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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 20-2/2

**“Radar Signal Processing”
(«Обработка РЛ сигналов»)**

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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 20-2/2

"Radar Signal Processing" («Обработка РЛ сигналов»)

Публикации в трудах конференций

"Copula based detection algorithm for MIMO ultrawideband noise radars"

In this paper statistical approach to synthesize algorithms for digital signal processing in UWB noise radar and sodar is used. Nonparametric copula based detection algorithms are suggested. Multiple input multiple output case is investigated. Monte-Carlo simulation for suggested algorithm is done. Experimental check is done on the basis of developed acoustic physical model which is used to build a noise sodar prototype. Developed algorithms can be used in noise radars for different applications. The use of the UWB noise signal provides a very high resolution both in speed and range. [C3603]

"Shape optimization of UWB dipole radiating required impulse for specific excitation impulse"

In any UWB application, it is crucial to ensure the minimal distortion of the transmitted impulses. On the other hand, some impulse generators do not produce required impulse shape suitable for the antenna excitation. This paper describes the optimization process of the antenna, which distorts/forms optimally the excitation impulse to the required and radiated impulse shapes. The particle swarm optimization method is used. [C3604]

"Over The Horizon Sky-Wave Radar: Simulation tool for Coordinate Registration method based on Sea-Land transitions identification"

We recently proposed a correlation method for the real time coordinate registration (CR) of the received echo by over the horizon sky wave radar (OTHRsw) based on a priori knowledge of the positions of the sea-land transitions within the radar coverage area. In this paper we present a software simulation tool developed to analyze the performance of the proposed CR method in different OTHR scenarios. The software tool simulates the monostatic OTH radar propagation using simplified ionospheric models and simplified models of surface clutter radar interactions. Simulation results assuming different surface clutter scenarios are presented and discussed. [C3605]

"Correction of propagation errors in Wide Area Multilateration systems"

Methods to estimate and correct slow time-variant position errors due to bad synchronization and propagation in Wide Area Multilateration Systems (WAM) are presented. The procedure does not use emitters at known locations. Instead it uses opportunity traffic emissions (from the aircraft present in coverage). The need for these methods came from the difficulty to install reference beacons that can be seen simultaneously by all WAM base stations. [C3606]

"Evaluation of beam-forming algorithms for automotive OFDM signal based radar"

In this paper the applicability of beam-forming algorithms in radar systems operating with OFDM signals is investigated. It is shown that beam-forming techniques can be directly applied to the output of an OFDM radar processor in order to calculate two-dimensional radar images in distance and azimuth. With a dedicated system model including a realistic road scenario propagation simulator, the performance of different algorithms in typical automotive radar scenarios is analyzed for 24 GHz ISM applications. [C3607]

"Forward scattering indicatrix of aircrafts and possibility of over-the-horizon surveillance"

The scattering indicatrices of targets in L and S bands for bi-static angles of (180plusmn55) degrees and a method of an aircraft beyond-the-horizon detection and estimation of its range and the cross velocity, when the aircraft crosses a propagation path, are discussed in the paper. [C3608]

"Characterization of a fiber-optic direct modulation analog link with chirp radar signals"

This paper describes the experimental investigations carried out to evaluate the behaviour of a fiber-optic direct

modulation analog link as a substitute of traditional transmission means, like coaxial cables or waveguides, for X-band chirp modulated radar signals. First of all, the link has been completely characterized, and the spurious frequency modulation has been measured in presence of pulsed signals. Afterwards, the link has been inserted in the receiver and transmitter chain of the Selex-Galileo LPI radar SPN-730 in order to perform a characterization of the performance degradation in terms of minimum detectable signal (MDS). The measurements have shown that for compression ratios and pulse widths typically used in a navigation/surveillance radar like SPN-730 the added frequency modulation does not affect significantly the performance of the system. [C3609]

"X-band MEMS technology for integrated Radar modules"

This paper reports on the potential of RF-MEMS technology to improve and miniaturize new functions in Radar front end and antenna modules. The insertion of new MEMS components and subsystems, using RF-MEMS switches, filters and phase shifters, in radar front end are reported in this article and their characterization results are discussed. [C3610]

"Aspects of spatial planning of radar sensor network for inland waterways surveillance"

Radar sensor network performance for inland water surveillance is dependent on spatial character of terrain. Terrain shape, elevations and all geographical object situated in the river zone are potential barriers for microwaves propagation and are main sources of radar shadows. Thus, some complicated geometry of terrain surface can cause difficulties during proper localisation of radar sensors, which should ensure in continuous way observation of all objects on the water surface. This paper presents spatial planning of radar sensor network in the aspect of terrain and waterway geometry. [C3611]

"A novel digital beam-forming concept for spaceborne reflector SAR Systems"

The trend in the conception of future spaceborne radar remote sensing is towards the use of digital beam-forming techniques. These systems will comprise multiple digital channels, where the analog-to-digital converter is moved closer to the antenna. This dispenses the need for analog beam steering and by this the use of transmit/receive modules for phase and amplitude control. Digital beam-forming will enable synthetic aperture radar (SAR) which overcomes the coverage and resolution limitations applicable to state-of-the-art systems. Moreover, new antenna architectures, such as reflectors, already implemented in communication satellites, are being reconsidered for SAR applications. This paper introduces a new digital beam-forming radar concept based on the combination of a reflector with a digital feed array. For a system example the SAR performance is estimated. Finally a novel digital signal processing approach, exploiting the signal properties of the transmitted waveform, is presented. [C3612]

"TBD netted radar system in presence of multi false alarms"

Track before detect (TBD) in netted radar system in the presence of multi false alarms is proposed and studied. The proposed structure uses TBD algorithm based on Polar Hough Transform (PHT). This algorithm improves the detection probability of moving target along a straight line in conditions of multi false alarm. The advantage of the proposed approach is the data unification in a net of asynchronously working radars with different accuracy characteristics and each radar varied observation sampling period. The obtained simulation results illustrate the high effectiveness of this detector in the presence of false alarms. We study the detection probability of TBD multiradar system as a function of SNR and the false alarm probability for different radar number. The study is performed through Monte-Carlo simulations in MATLAB computing environment. [C3613]

"Usage of electromagnetic fields of antropogenic irradiation sources for remote sensing of atmosphere"

Examined the possibility of usage of anthropogenic irradiation sources such as television centers, navigation artificial satellites for diagnosis of atmospheric processes (troposphere refraction, dangerous meteorological phenomenon). The methods of troposphere refraction estimation on UHF field propagation factor at over-the-horizon path using radio setting and raising of GPS system navigation satellites are proposed. [C3614]

"Full polarimetric time domain calibration for UWB Radar systems"

In this paper a full polarimetric calibration for Ultra-Wideband Radar systems is presented. The proposed calibration method is completely performed in the time domain. Conducting the UWB Radar calibration in the time domain has several advantages compared to classical frequency domain calibration procedures. First of all, the possibility to perform a lower number of measurements than in the classical frequency domain calibration,

and second that it is by far faster. A complete mathematical description by scattering and impulse response matrices is derived. Proper calibration targets and procedures are discussed and evaluated. [C3615]

"A correlation-based method for precise radar distance measurements in dispersive waveguides"

This contribution deals with guided radar distance measurements in the field of industrial tank level control. The aim is to achieve a submillimeter gauging accuracy even when conducting the measurement within a highly dispersive environment of large and thus overmoded cylindrical waveguides. Normally multimode propagation causes a decrease in measurement precision. Therefore, the effects of intermodal dispersion are fundamentally reviewed and based on these results, a correlation-based signal processing method is presented. The method is able to exploit the otherwise parasitic dispersion effects to enhance the measurement precision even in constellation with a simple waveguide transition or antenna, respectively. Measurement results in a frequency range of 8.5 to 10.5 GHz are provided for two different kinds of waveguide transitions proving the capability of the method. [C3616]

"Direction of arrival estimation using ESPRIT with sparse arrays"

In this paper we consider the problem of direction of arrival (DOA) estimation with a sparse linear array, characterized by several separated subarrays. The proposed ambiguity resolution algorithm based on the MUSIC algorithm or conventional beamformer improves previous disambiguation scheme. A new ESPRIT-based DOA estimator is obtained for linear subarray-based sparse array. Simulation results are included to show the performance of proposed estimator. [C3617]

"Ultra-wideband printed circular monopole antenna array"

In this paper, a printed monopole circular antenna array concept for use in the frequency 3.1 GHz-10.6 GHz is presented. The design uses the printed monopole disc antenna in a four-element array to produce high gain and to shape the radiation pattern while maintaining good match of the frequency range of interest. The four printed disc monopole antennas are fed using broadband T-junction power divider. The proposed concept has been verified by simulations and finally confirmed by measurement which verifies a -10-dB match bandwidth extending from 3.1 GHz-10.6 GHz and directive radiation pattern as well. [C3618]

"Analysing the elements of SAR polarimetry matrixes"

The various applications have been promised by the new generation of the spacecraft SAR data (i.e. Radarsat2 and TerraSAR-X), as the classification, the decomposition, and the modelling of the polarimetric synthetic aperture radar (SAR) data has been improved in recent years. This work is based on the fact that in order to extract the various patterns in distinctive field of studies, all the scattering matrix components are informative source of data. Different cross products of the complex scattering matrix channels (HH, HV, VH, and VV) that are involved in the phase and amplitude information are joined together to build instructive features. In the vector space, Fisher class separability algorithm will be tested, and the features with the best class separability, large distance between classes, and small within-class variances will be selected. As we measured the classification effectiveness of the individual features, we needed to choose a subset of the informative features from the nine originally available features. Finally, we combined all the educational information contents in order to classify desired images with the best overall accuracy. [C3619]

"Tracking of a move-stop-move target in clutter: A comparison among MM methods"

In this paper we compare three different sequential estimation algorithms for tracking a single move-stop-move target in clutter. Bayesian estimation algorithms are taken into account, with a special focus on particle filters (PF). The target can undergo three different motion modes: a stopped target mode, a constant velocity mode and a manoeuvre mode. We analyze a realistic car traffic scenario by considering not only additive Gaussian noise, but also detection probability less than unity and false measurements originated by clutter disturbance. The aim of this paper is to compare the so called PDA-MM-PF (probabilistic data association, multiple model, particle filter) and PDA-MM-APF (probabilistic data association, multiple model, auxiliary particle filter) to the well-established Kalmanbased PDA-IMM (probabilistic data association, interacting multiple model) tracking algorithm. Tracking filters ignore a priori information about the true clutter spatial density. Advantages and disadvantages of the proposed algorithms are illustrated and discussed through computer simulations. [C3620]

"GRIFO radar: new results of high-resolution modes for an expert avionic radar for fighters"

In the 90s, Galileo Avionica (GA Radar Systems Business Unit) has developed the GRIFO Radar, a multimode-multitrole pulse Doppler radar, devoted to occupy an important role in the family of the radar for weapon release.

In the last 15 years more than 400 units have been sold to five Air Forces, for more than 100,000 hours of operative flights. The need for the implementation of high-resolution modes, with seaborne targets identification for the Italian navy, pushed to the extension of the Grifo radar to high-resolution applications. With the new capability, making use of the deramp on receive technique, Grifo radar can now perform spot-SAR on ground patch as well as ISAR upon A/A and A/S target tracking ISAR. This paper describes the real-time results obtained during the last flight tests of the Grifo, newly upgraded with high-resolution modes, which were carried out in November and December 2008. [C3621]

"Application of the TRMC processing chain to SAR/ISAR imaging"

In this paper we present the application of a single algorithm (TRMC) for different radar imaging techniques (SAR/ISAR), since in both cases the aim of the processing is to compensate the unwanted effects of pure translational and rotational relative motion between radar and target. The proposed techniques for estimation and compensation of these two motion components are briefly discussed and their extensive application to real radar data for different classes of targets (ships, aircrafts, ground) is presented. Results show that the proposed processing is particularly effective in case of nonuniform rotation-rate during the Coherent Processing Time (CPT) considered for imaging. The low computational cost and the effectiveness of the proposed algorithms make them suitable and convenient for real-time applications even for compact and low-weight radar systems to be fitted onboard UAV or other airborne platforms. [C3622]

"Low-power transmitter for UWB Impulse Radio"

This paper proposes the use of pulsed UWB in the design of fully-integrated low-power radios for sensor node applications. A key-point is compliance with ETSI/FCC regulations on power spectral density, obtained through proper pulse selection and differential architecture. Instantaneous power consumption better than 6 mW and temperature stability may be possible using advanced 1.0 V 90 nm technology. Also temperature and process variation may be controlled by means of digital calibration techniques. [C3623]

"UWB Radar signal capture and analysis"

As radar designers produce ever wider systems there comes a point where the digitizers found in high dynamic range measurement systems, such as spectrum analyzers are not fast enough to capture the instantaneous bandwidth of the signals they are measuring. This paper is intended to enable designers working with signals of more than a couple hundred megahertz of instantaneous bandwidth (BW) to understand the measurement capabilities offered in today's high bandwidth, high sample rate oscilloscopes as they relate to modern radar signal capture and analysis. The discussion will include both the capture of the pulse characteristics as well as the chirp or coded information within the pulse. The techniques discussed, while framed around radar, are based in core acquisition and measurement technology building blocks making the discussion applicable to any ultra wideband technology. The paper will specifically discuss how to determine and control various aspects of dynamic range, capture time and signal fidelity through techniques of oversampling, filtering, under-sampling, memory segmentation and triggering. [C3624]

"Suppression of the ground clutter in airborne PCL radar using DPCA technique"

This paper presents the detailed discussion on displaced phase center antenna (DPCA) technique for ground clutter suppression in Passive Coherent Location Radar (PCL). The PCL radar is installed on a moving platform. The validity of theoretic analysis is proved by simulation. [C3625]

"SAR image compression based on wavelet packets and sub-band coding"

Synthetic aperture radar (SAR) is an imaging technique, which provides high-resolution images. The high resolution in the range direction is achieved by using large bandwidth signals and that in the azimuth direction is achieved by synthesizing a large aperture antenna using platform motion. The unique data collection geometry of SAR system requires that huge amounts of raw data be processed before obtaining a viewable image. Therefore, performing some form of compression on SAR raw data provides an attractive option for SAR systems. In this paper, we present a transform coding approach for SAR raw data compression. Due to presence of large dynamic range of frequency content in SAR raw data we propose the usage of wavelet packet transform. Experimental results of the proposed method provide significant improvement in SNR results over standard block adaptive quantization (BAQ) and JPEG2000 techniques. [C3626]

"LTCC-based ultra-wideband Linearly Tapered Slot Antenna design guidelines"

In this paper, the design of antipodal non-planar linearly tapered slot antenna (LTSA) designed in LTCC

technology with wide bandwidth operation for ultra-wideband applications and a practical design guideline of LTCC-based ultra wideband LTSA is presented. The LTCC-based ultra wideband LTSA characteristics are investigated and then compared to a compact antipodal LTCC-based Vivaldi design. Using microstrip feeding technique, the antenna return loss S_{11} stays below -10 dB from 9 GHz to 10.5 GHz. From simulation results, the LTCC-based ultra wideband LTSA design, optimized using HFSS, it is found that the LTCC-based LTSA antenna has a broad bandwidth of about 1.5 GHz which satisfies the ultra-wideband bandwidth requirement. The LTCC-based ultra wideband LTSA has an efficient end fire radiation pattern of more than 5 dB peak gain and a total chip area of 50times25 mm². Therefore this antenna can be used for a variety of ultra-wide band applications. [C3627]

"Reduction of range finding error in NRD guide pulse radar system at 60GHz"

A technique to reduce the range finding error in the NRD-guide pulse radar system was proposed for tank level sensor applications at 60 GHz. The considerable sensing error to be plusmn 15 cm, which was bigger than the theoretical one, was measured in the first range finding test. It was predicted that the measured error was due to clocks generated in a PLL embedded into an FPGA for the radar signal processing, so that a VCXO (voltage controlled crystal oscillator) with high stability performance was employed to overcome such difficulty. Based on the upgraded radar signal processing, we could successfully decrease the measured error to be within plusmn 2 cm. [C3628]

"Parametric differential SAR tomography of decorrelating volume scatterers"

Much interest is continuing to grow in advanced interferometric SAR methods for full 3D imaging, in particular of volumetric forest scatterers. Multibaseline SAR tomographic elevation beam forming i.e. spatial spectral estimation is a promising technique in this framework. In this paper, the important effect of temporal decorrelation during the repeat pass multibaseline acquisition is analyzed on superresolution (MUSIC) tomography with limited sparse data. Moreover, the ultimate achievable estimation performance of the volume height parameters is investigated by deriving the Cramer-Rao bound in the partially coherent scenario. Finally, new tomographic methods are proposed robust to temporal decorrelation phenomena, exploiting the advanced differential tomography concept which produces 'space-time' signatures of scattering dynamics in the SAR cell. To this aim, the 2D version of MUSIC, and a generalized MUSIC matched to non-line spectra, are applied to decouple the nuisance temporal signal histories in the spatial spectral estimation. First differential tomography results with real P-band forest data are presented. [C3629]

"Ambiguity function study for UMTS Passive Radar"

Passive Radar systems, also referred to as Passive Coherent Location systems (PCL), exploit reflections from illuminators of opportunity in order to detect and track objects. Over the last few years there has been an evolution of mobile networks towards the third generation radio wireless communications (3G) as UMTS (Universal Mobile Telecommunications System). The UMTS is the European standard for 3G wireless communication and it has been developed by 3gpp (3rd Generation Partnership Project). The downlink signal transmitted from the UMTS base-station (or Node B) presents interesting properties that induced us to verify the usability of the UMTS signal as opportunity signal for passive radar systems. In order to obtain some performance evaluations, we have studied the ambiguity function of UMTS signal through a Simulinkreg model based on the WCDMA library. The simulations have proven that the UMTS signal has good properties in term of range and Doppler resolution. In the last section the bistatic geometry effects on the ambiguity function has been studied. [C3630]

"Real-time software implementation of Passive Radar"

The paper presents a comparison of three different computing platforms for signal processing in Passive Coherent Location radar: general-purpose PC, Sony Play Station 3 and NVIDIA graphic card with CUDA technology. The radar under consideration was developed at Warsaw University of Technology, and it is called PaRaDe (Passive Radar Demonstrator). It utilizes commercial FM radio transmitters as illuminators of opportunity to detect and track airborne targets. In order to perform real-time processing, high computing power is needed. The aim of this paper was to investigate various solutions providing good performance at a reasonable price. [C3631]

"A flexible system simulator for antenna performance evaluation of radar level measurements"

In this contribution, a flexible radar system simulator is introduced emulating a widely used radar test range to efficiently evaluate the effects of antenna design in terms of monostatic radar operation for tank level measurements. Typically, prototypes of novel antenna designs are tested in a scenario consisting of distinct

reflectors, like e.g. trihedral corner reflectors. In order to accelerate and to cheapen the antenna design and verification process, the number of required hardware prototype setups needs to be reduced. Hence, a MATLAB-implemented hybrid simulator is set up including arbitrary 3D antenna pattern and full-wave reflector models, ray-based wave propagation as well as FMCW signal processing algorithms, thus providing the overall relationship between the characteristic antenna properties and the obtainable level distance accuracy. The simulated results are verified by measurements in a frequency range from 8.5 to 10.5 GHz. [C3632]

"SAR image compression based on piecewise linear mapping algorithm"

Block adaptive quantization (BAQ) algorithm is the most widely used technique for SAR raw data and image compression but in the practical applications it encounters problem when the input data carry saturation component. According to the characteristics of the synthetic aperture radar (SAR) data, the saturated component deteriorates the quantizer performance. In this paper we have devised an improved algorithm dealing with the saturated data. The experiment results show that this method does not change the compression ratio but improves the signal to noise ratio by an amount of more than 4 dB. This has been achieved by mapping the average signal magnitude with the standard deviation value of input and output signals. Based on the resultant curves it is certified that for linear part of the curve the scale factor assigned is a constant value and for non linear part a new algorithm is run giving optimum value of the threshold or the scale factor minimizing the mean square error (MSE) and maximizing the signal to noise ratio (SNR). [C3633]

"Estimation of radar observability of objects against background of sea clutter"

The method of estimation of radiolocation observability of marine objects and range of operation of radar station on requirement on non-Gaussian noise from sea is offered. The examples of estimation of observability of marine objects of different classes by different condition of the weather and uses of narrowband SMT Doppler system are given. [C3634]

"Evaluation of the tracking process in ground surveillance applications"

This paper discusses methods that are suitable for assessing the performance of target tracking algorithms. Emphasis is placed on applications involving ground moving targets detected by radar sensors, which are deployed on aerial platforms. Numerical examples are provided in relationship with an experimental ground moving target indicator (GMTI) tracker available at NC3A. [C3635]

"The effects of acquisition geometry on SAR images of natural scenes"

In this paper we present novel results regarding the modeling of the SAR imaging process of natural scenes. The proposed model represents the extension to the two-dimensional case of the model previously proposed by some of the authors for the case of a one-dimensional fractal profile. Assuming a fractional Brownian model (fBm) for the observed surface and under a small slope hypothesis, we evaluate here, in closed form, the power density spectrum of the corresponding radar image. The proposed model effectively accounts for the effect of finite sensor resolution and for the peculiarity of SAR acquisition geometry. A numerical setup is implemented, based on sound physical models, allowing, on one hand, the validation of the small slope model and, furthermore, the empirical study of the general slope case. [C3636]

"An Improved DRFM System Based on Digital Channelized Receiver"

An improved Digital Radio Frequency Memory (DRFM) system based on digital channelized receiver is stated, which employs digital channelized receiver to slow down the high speed input data flow, and uses Digital Up Converter (DUC) to generate digital intermediate frequency (IF) signal from digital baseband signal. This system can achieve broad instantaneous frequency coverage, reduce the demand for the memory capacity in DRFM system, and achieve real-time jamming information modulation in radar jamming applications. The common DRFM system is first discussed, then the realization structure for this improved DRFM is stated, the realization model of digital channelized receiver and high speed DUC are also proposed. [C3637]

"A Novel Deformable Model for Urban Vegetation Detection Using LiDAR Data"

This paper presents a new approach to creating variational level set model for vegetation detection combining 3D irregular point clouds and aerial image simultaneously acquired by LiDAR light scanning and imaging device. Firstly, a fundamental statistical level set framework is built which integrates texture information to improve the quality of vegetation detection. Then, several derived products directly or indirectly from LiDAR raw point cloud data, like DTM(digital terrain model,) nDSM(normalized digital surface model) and local roughness capable of describing 3D texture feature of vegetation, are used to construct a novel energy term in relation to height and

roughness of non-terrain objects, in order to make up the disadvantages caused by insufficient information only from remote sensing image. This model can well fuse spectral feature, height and roughness information of objects from different sensors. Experiments on pairs of LiDAR Aerial image and 3D point cloud data are carried out, and conclusions can be drawn that our model can effectively separate various vegetation categories including grass and tree in urban area from other land covers, including buildings, noises, ground etc., and alleviate various influences caused by occlusions or spectral inhomogeneity. [C3638]

"Design of Frequency-Hopping Waveforms Based on Ambiguity Function"

Integrated sidelobe level(ISL) criterion and the maximal sidelobe level(MSL) criterion are used to design frequency-hopping waveforms based on ambiguity functions respectively in this paper. Some simulation results are given and analyzed. The performance of the proposed algorithm is validated by numerical simulations. [C3639]

"Study on Blind Estimation of Weak DS-UWB Signals"

In this paper, the signal model and expression in time domain of DS-UWB signal are introduced, and an approach using eigen-analysis of correlation matrix for DS-UWB signal is proposed to blindly estimate the PN sequence and several parameters in low SNR DS-UWB signal. Compared with the previous methods, both synchronization and PN sequence estimation can be realized simultaneously by the approach in this paper. Based on the theoretic analysis, experimental results show that this approach is very effective in lower SNR. [C3640]

"Linear FM Signal Detection Performance from Discrete-Time Observations"

Detection performance of a complex linear FM signal from a finite number of noisy discrete-time observations is discussed. The computation method of spectrum peak SNR is given. The detector statistic based spectrum peak SNR is constructed and the probability density functions (PDF) of spectrum peak SNR under the 'noise-only' hypothesis and the 'noise-and-signal' hypothesis are examined respectively. Simulation results verify the analysis. [C3641]

"A Study of Land Subsidence by Radar Remote Sensing at Datong Jurassic & Carboniferous Period Coalfield"

At Datong coalfield, the heavy mining activities in its jurassic & carboniferous coal seams has caused very serious adverse effects to the local geological environment, such as soil avalanche, landslide, mud-rock flow, surface settlement, surface crack, surface gangue stack, surface deformations and subsidence. Moreover, as coal mining causes groundwater leakage, excessive groundwater exploitation has greatly intensified surface settlement in Datong City. The paper uses 8 cognominal ERS-1/2 SAR data frames obtained during 1992 to 2003 period, obtained 84 deformation fields. Of the 84 sites for preliminary interference, 44 sites belong to mining subsidence, 23 urban subsidences and 17 landslides. The total coverage area of deformation amounts to 1824.4 km², which is almost equivalent to the total area of the Datong coalfield. [C3642]

"An Improved Automatic Ship Detection Method in SAR Images"

This paper provides an improved automatic ship detection algorithm, which uses two-parameter CFAR algorithm based on Gauss-distribution to process the homogeneous imaging local area, and uses two-parameter CFAR algorithm based on K-distribution to process the heterogeneous imaging local area again. This improved algorithm keeps both the ability of traditional two-parameter CFAR algorithm' good features, such as small computation quantity, easy to implement and so on, and the detection accuracy in complex sea conditions at the same time. [C3643]

"Segment DPCA Motion Compensation for SAS"

The towfish motion error is analyzed in this paper first. It is shown that the motion error is range-variant in wide-swath SAS application. Displaced phase center algorithm (DPCA) used in synthetic aperture sonar (SAS) to estimate and compensate motion error is only suitable for compensation of range-invariant motion error, but the performance could be degraded in the case of range-variant motion error in wide-swath SAS application. A segment DPCA (SDPCA) to correct range dependent motion error is presented. Raw data of lake trial are used to verify the SDPCA algorithm. [C3644]

"Feature Extraction of 2D Radar Profile via Double-Sides 2DPCA for Target Recognition"

Target recognition based on 2D radar profile is a rising application of radar technology, because 2D radar profile can offer more structural information about targets. But the methods of feature extraction based on 2D radar profile are very scarce. In this paper, a new approach double-sides 2DPCA is presented. It is performed by using original image matrices directly, while PCA always needs image matrices to be transformed into 1D vector. Besides, it can reduce the dimension of image from two sides and obtain a feature image with a much smaller size, while traditional 2DPCA, mainly used in the area of face recognition, can only reduce the size of image from one side. This approach has excellent dimension reduction property. The experimental results show that double-sides 2DPCA is effective on feature extraction of 2D radar profile and in much smaller dimension level, it has better recognition performance than traditional 2DPCA. [C3645]

"Weak Signal Detection in Noisy Chaotic Time Series Using ORBFNN"

This paper considers the problem of detection of weak signal detection in noisy chaotic time series using an optimal radial basis function neural network (ORBFNN). Based on chaotic dynamic mechanism, using ORBFNN to establish the forecast model of chaotic time series. When noise exists, to determine the structure of an optimal RBF predictor, we propose a new technique called the cross-validated subspace method to estimate the optimum number of hidden units. Which is used to identify a suitable number of hidden units by detecting the dimension of the subspace spanned by the signal eigenvectors, the cross validation method is applied to prevent the problem of overfitting. The results of theoretical analysis and simulation indicate the effectiveness of the ORBFNN predictor. The infection degree of noise is evaluated in quantity in the end. Results show that the proposed ORBFNN predictor can provide a further improvement in signal detection performance. [C3646]

"Analysis on Effective SNR Loss of Space-Time Block Coded MIMO System with Channel Estimation Error"

Channel estimation error impacts the performance of practical orthogonal space-time block coded (OSTBC) MIMO system. The effective SNR loss is caused by the impact of imperfect channel knowledge. In this paper, we qualitatively analyze on the effective SNR loss, and derive a symbol error rate (SER) expression for PSK modulation scheme in MIMO Rayleigh channel with channel estimation error. However, theoretical analysis show that the sensitivity of MIMO system to channel estimation error increases as the number of receiver antennas increases. Simulation results are furnished to demonstrate the effectiveness of the proposed analysis. [C3647]

"Compensation Method of Acquisition for High Dynamic DSSS Signal"

According to the problem of acquisition error for high dynamic direct sequence spread spectrum signals, a new compensation method is presented to guarantee acquisition phase accuracy of PN code. In this method, the acquisition result of Doppler frequency is used to compensate acquisition phase of PN code based on processing time of acquisition and start-up time of tracking. Analysis and simulation results indicate that the principle of method is correct and the initialize precision for tracking can be ensured especially for high dynamic environment. [C3648]

"Chaff Jamming Recognition for Anti-Vessel End-Guidance Radars"

In order to solve the problem of chaff jamming recognition for end-guidance radar, average gray correlation degree (AGCD) is introduced here to analyze the difference of time-domain correlation characteristic between vessels' echo and clutter. A novel recognition method called position matching is presented making use of the difference of spatial position between vessels and chaff cloud. Finally, recognition method based on microDoppler effect is provided according to the difference of movement. Simulation experiment and theory study indicate the effectiveness of the three methods. [C3649]

"Oblique Projectors-Based Blind Source Separation Using Information Maximization Principle"

As a new research scope, blind signal separation (BSS) is attracting more and more interests. Independent component analysis (ICA) is an important solution to the problem of BSS, under the assumption conditions of ICA, a BSS algorithm using oblique projection operators is proposed in this paper. The autocorrelation matrix of mixing matrix is used to construct the objective function while the principle of information maximization is adopted to iterate and extract the component, and the mixing matrix can be obtained in a direct way. The description of the problem is demonstrated, and the detailed flow of the proposed method is listed. Simulation results show the suggested scheme is valid even when the weakest signal is less than -80 dB to others. [C3650]

"Design and Implementation of Portable Multi-Parameter Tele-Monitor Terminal Based on S3C2410a"

This paper introduces an implementation of portable multi-parameter tele-monitor terminal(PMTT). This terminal is reliable, portable, real-time and high cost-effective, which can tele-monitor many kinds of vital bio-signals and GPS signal through GPRS, such as electrocardiogram(ECG), blood pressure, oxygen saturation, blood glucose, body temperature, respiration and so on. The Samsung's S3C2410a is the core of the mutiparameter tele-monitor terminal's hardware platform. muC/OS-II is cut down, customized and ported into the embedded system, for which the monitor software based on muC/GUI is also developed. [C3651]

"Design and Implementation of GPS/DR/GPRS Integrated Position and Monitoring System for Vehicle"

The paper designs and implements positioning monitoring system for vehicle based on GPS/DR (Global Positioning System/dead reckoning) technology. It solves the deficiency that vehicle can not locate and monitor when GPS signal loses, and improves positioning accuracy. The system uses S3C2410A microprocessor as the core of the entire system modules. The designation of the whole system, hardware and software is given in this paper, and gives the way to solve time synchronization, alignment of the initial azimuth, calibration of installation error angle when the GPS/DR data fuses. [C3652]

"An Adaptive-Adaptive Beamforming Algorithm with Nulls Widening"

By constructing an extended interference covariance matrix and the auxiliary beamspace, an improved adaptive-adaptive array processing method is presented based on nulls widening in this paper. It resolves an issue that the adaptive-adaptive algorithm can't reject interference effectively when the perturbation or the rapid motion of jammers occurs, which improves robustness greatly. As a partially adaptive beamforming algorithm, it is more suitable for the practical engineering application. Computer simulations demonstrate the validity of the approach. [C3653]

"A Novel Method for Ship Detection Based on NSCT and ACO"

Ship detection is an important section of Synthetic Aperture Radar's marine applications. Through analyzing the distribution characteristics of ship targets and speckle, a novel ship detection method based on NSCT and ACO is proposed for SAR image processing. First, apply NSCT adaptive threshold method to de-noise the SAR images, then detect the edges by ACO, last ship targets can be precisely detected. Simulating results indicate that this method can not only pickup contour information of ship objects in complex speckle efficiently, but also keep ships structure well, show ideal antijamming competence, guarantee the detection accuracy. [C3654]

"Near field mm-wave imaging with multistatic sparse 2D-arrays"

A near field application of multistatic 2D sparse arrays designed based on an effective aperture concept is presented. Several test arrays which utilize this concept are introduced along with simulation and measurement results for near field operation at 100 GHz. High reduction in the needed number of transmit and receive modules is verified along with the drawbacks in the image quality. Good agreement between measurements and simulations is demonstrated. [C3655]

"Spectral modelling of airborne radar signal in presence of windshear phenomena"

In this paper, a parametric spectral model of the received signal from airborne Doppler weather radar in presence of windshear is proposed. This parametric model can be used for detection of windshear without the application of a clutter rejection pre-filter. The bimodal shape of the model has been defined as a superposition of clutter and windshear. Two parameters of the model are closely related to mean and variance of wind velocity associated to the windshear. The model performance analysis is done by comparing the proposed spectrum model to a simulated received signal spectrum. [C3656]

"A low cost Ultra-Wide-Band Pulse Radar in a guided wave gauging application"

This paper presents a low cost UWB-pulse-radar operating in the FCC 3.1 GHz-10.6 GHz band designed with standard RF-off-the-shelf components. The radar is based on the sequential sampling principle that will be briefly described. Special attention is paid on the pulse generation, where a coherent pulse oscillator in combination with a high speed switching circuitry is employed to gain pulse durations of 250 ps centered at 6 GHz. To demonstrate the resolution of the radar, a tank level scenario is presented allowing to detect liquid interfaces from 6.5 cm thickness. [C3657]

"W-band imaging of explosive substances"

This paper presents three-dimensional W-band images of some common explosives and substances that can be used to produce explosives. As an introduction, some information about the imaged materials (DUTs) is given. After a detailed description of the measurement setup, multiple views of the three dimensional image data are presented. Data features that could be used for detection of the explosives are proposed. At last, estimates of the thickness of the DUTs and the permittivity of the imaged substances are extracted from the image data. [C3658]

"DDV-novel Doppler-polarimetric technique for remote sensing of precipitation"

This paper presents results of Doppler-polarimetric radar signal modelling and real data processing that show correlation between Differential Doppler Velocity (DDV) and parameters of rain including rain microstructure and turbulence in rain. Reasonability to use DDV as one of informative parameters in recognition neural network system is checked. [C3659]

"Efficient fourier based algorithm development for airborne Moving Target Indication"

This paper shows how the signal model that is commonly used as a starting point in multi-channel space time adaptive processing (STAP) for airborne moving target indication (MTI) formally corresponds to a model that can be derived from a bi-static synthetic aperture radar (SAR) model extended for multiple channels. With the help of this generalisation one arrives at an operation that can be performed on the conventional airborne MTI STAP model. The result yields an orthogonal domain that allows for a design of one-dimensional clutter-rejecting algorithms. This should drastically decrease the computational demands in comparison with the high-performance two-dimensional algorithms described in the airborne MTI literature so far. [C3660]

"Multistatic Passive Coherent Location radar systems"

The use of signals of opportunity such as television or radio signals to detect and track targets has cyclically entered and left technology fashion. However, due to high constraints in the receiver design, and the signal processing implementation in real time, operational systems have appeared only recently. This paper presents a multistatic passive coherent location (PCL) system, where the signal, issued from several transmitters, is processed coherently by several receivers organized in a network configuration. An analysis of the signal processing operations is presented and an efficient hardware implementation is described. [C3661]

"Extended Small Perturbation Method and retrieval of natural surface parameters"

The extended Bragg (X-Bragg), or extended small perturbation method (X-SPM), has been recently introduced to widen the SPM range of validity in terms of surface roughness, and to account for cross-polarisation and depolarisation effects. This is obtained by modelling the scattering surface as composed by slightly rough randomly tilted facets. The facet random tilt causes a random variation of the local incidence angle and a random rotation of the local incidence plane around the line of sight, which in turn causes a random rotation of the facet scattering matrix. In, the random incident angle variation $\Delta\theta$ is ignored, and the incidence plane angle of rotation β is assumed to be uniformly distributed in an interval $(-\beta_1, \beta_1)$. In this paper, we remove both these simplifying assumptions, in order to assess their validity and to improve them. In particular, we derive more realistic distributions of β and $\Delta\theta$ by assuming that the facet slope (i.e., the slope of the large-scale surface roughness) is a Gaussian random variable, in agreement with both classical and fractal surface models. Finally, we show that, if the X-SPM is used, the same information about a bare soil surface that can be retrieved from the coherency matrix entropy and scattering angle (H, α) can be also retrieved from the co-pol and cross-pol ratios. [C3662]

"Convergence analysis of the iterative adaptive Kronecker receiver for MIMO radar applications"

We analyse an iterative adaptive multiple-input-multiple-output (MIMO) radar receiver in the situation where a K L -variate adaptive transmit-receive beamformer is structured as the Kronecker product of a K -variate (transmit) and an L -variate (receive) beamformer. We present results for the special case of two clutter propagation modes separated in elevation angle, where the direction-of-departure (DoD) of one mode and the direction-of-arrival (DoA) of the other mode coincide with that of a target. We introduce the analytical condition of convergence and signal-to-interference-plus-noise ratio (SINR) loss factor for a given training sample volume under a number of assumptions for a sample-matrix inversion (SMI)-based iterative algorithm, and demonstrate that the diagonally loaded SMI algorithm can provide significant improvement in the convergence rate of the iterative "Kronecker MIMO receiver". [C3663]

"Beam Pattern for Ultrawide-Band Impulse Signal of Linear Array in the Near Field"

The beam pattern of ultrawide-band (UWB) impulse array in the near field is discussed in this paper. The basic principle of beamforming of linear array in the near field for UWB pulse is presented. Computer plots of beam patterns, such as peak amplitude pattern, peak power pattern and energy pattern are presented. The UWB nearfield array beamforming results in a directivity beam pattern having a narrow mainlobe and practically no sidelobes. The influence of every parameters, such as array length, interelement spacing, number of array elements and time duration of the pulse, to the beam patterns of a linear array for UWB Gaussian pulse is analyzed, which is useful to design a practical system. The difference of the beam patterns steering different positions in the near field is analyzed as well. According to the results, improved beam width can be achieved by either increasing the array length or decreasing the time duration of the Gaussian pulse. A reduction of the restlobe level can be achieved by either decreasing the array length or increasing the number of the array elements. However, the restlobe level in the near field beam pattern is higher than that in the far field, and it increases as the range between the source and the array decreases, which is a disadvantage to suppress the noise and interference in the near field. [C3664]

"Machine learning in remote sensing data processing"

Remote sensing data processing deals with real-life applications with great societal values. For instance urban monitoring, fire detection or flood prediction from remotely sensed multispectral or radar images have a great impact on economical and environmental issues. To treat efficiently the acquired data and provide accurate products, remote sensing has evolved into a multidisciplinary field, where machine learning and signal processing algorithms play an important role nowadays. This paper serves as a survey of methods and applications, and reviews the latest methodological advances in machine learning for remote sensing data analysis. [C3665]

"DOA Estimation and Self-Calibration Algorithm for Y-Shaped Array in the Presence of Mutual Coupling"

A 2D DOA estimation algorithm in the presence of unknown mutual coupling for Y-shaped array based on MUSIC algorithm is presented and performance comparison among ULA, L-shaped array and Y-shaped array is analyzed. This algorithm can simultaneously estimate DOA of signals and coupling coefficients of antenna array without any calibration sources or iterative operations. It not only calibrates mutual coupling of the inner-subarrays, but also compensates for mutual coupling between subarrays. Compared with conventional self-calibration algorithm based on iterative alternating minimization technique, the proposed algorithm transforms joint estimation problem about DOA and mutual coupling coefficients into cascaded estimation problem, so as to avoid huge computation because of multi-dimensional search and global convergence problem due to iterative. Simulation results demonstrate that the performance of Y-shaped array is the best among three arrays and that the proposed self-calibration algorithm can achieve the high resolution under the condition of unknown coupling. [C3666]

"Maneuvering Target Tracking in the Case of Wakes"

An interacting multiple model probability data association method for tracking the wake target is presented. When the detections are fed to a tracking system like the probabilistic data association filter, the estimated track can be misled and sometimes lose the real target because of the wake. This problem becomes even more severe when the target performs maneuvering in the presence of wakes. To prevent this, we propose a probabilistic model of the wakes and deduce the new probability association coefficient, for the target's maneuvering, the interacting multiple model is applied. Simulation result shows, compared with the interacting multiple model probabilistic data association method, the new method could reduce the target loss effectively and retain low target loss ratio with augmenting measurement noise. [C3667]

"On apodization techniques for ultra-wideband SAR imaging"

Ultra-wideband (UWB) SAR imaging suffers from a number of inherent problems in which the apodization has not been investigated appropriately. This paper presents a discussion on apodization techniques and possibilities to apply these techniques to UWB SAR imaging. [C3668]

"Improved FMCW multi-port technique"

This paper describes an improved frequency modulated continuous wave (FMCW) multi-port technique, for short-range detection, intended to be used in low-cost automotive radar applications, at 77 GHz. The simultaneous range detection using two different detection procedures yields not just an increased accuracy and extended range capabilities, but a significant reduction of false alarm rate (FAR). CW mode provides increased solving capabilities in Doppler domain. [C3669]

"Properties of ambiguity functions for weighted pulse trains with Oppermann sequences"

In this paper, we consider properties of the auto-ambiguity and cross-ambiguity functions of weighted pulse trains with Oppermann sequences. Several properties are examined and proved which in turn allows for reducing the design space for optimization of a particular design. The insights gained from these properties are consolidated in a formal framework leading to procedures that can be used for a more structured waveform design. Numerical examples are provided to illustrate the relationship between sequence parameters and performance characteristics. [C3670]

"Experimental evaluation on UWB aggregation and coexistence"

A measurement campaign has been carried out in Japan to evaluate UWB technology for both aggregation characteristics and coexistence performance. Different from other previous studies, our evaluation is based on measurements with real devices. We examined both UWB low band and UWB high band, the latter has rarely been investigated by others. UWB aggregation results with real measurements are also rare. Both OFDM type and impulse type UWB were used in the measurements. Coexistence evaluations with several existing wireless systems were conducted. Main results of the measurements and evaluations are presented. [C3671]

"Adaptive waveform generator for radar systems"

Purpose of this paper is to present basic concepts and an automatic tool for the design of radar waveforms suitable for implementation in modern multifunctional or surveillance systems. [C3672]

"Ultra-wideband Frequency Modulated Continuous Wave synthetic aperture radar for Through-The-Wall localization"

In this paper we present the development and preliminary results of an ultra-wideband frequency modulated continuous wave (FMCW) through-the-wall (TTW) radar prototype built at ONERA in Toulouse, France. The radar operates between 0.5 and 8 GHz in three possible subbands: 0.5-2 GHz, 1-4 GHz or 2-8 GHz depending on the type of wall. The radar has been successfully tested in free space and trials with a cinder block wall are on going. [C3673]

"Effects of frequency-dependent attenuation on time delay estimation techniques applied to ground penetrating radar data"

In this paper, the effects of frequency-dependent attenuation on the performance of some time delay estimation techniques applied to ground penetrating radar (GPR) data are investigated. Being based on a complex power law of frequency for dielectric permittivity, the adopted signal model deviates from the damped exponential model and it is this mismatch that is likely to deteriorate the performance of the employed techniques. At first, we carry out a sensitivity study by determining the variations of the relative root mean square error of the time delay estimates as a function of the SNR and the quality factor Q for three algorithms, namely, root-MUSIC, ESPRIT and the matrix pencil method (MPM). These variations reveal a systematic error which is quantified by means of a first-order approximation and is found to be the ratio of the phase delay to the group delay. Then, this error is used to compensate for the bias introduced by the model mismatch with the aim of improving the estimates. [C3674]

"Design criteria for a Multifunction Phased Array Radar integrating weather and Air Traffic Control surveillance"

Cost reduction for transmit/receive modules makes phased array radar of potential interest to civilian users. An integrated target/weather surveillance at medium range, i.e. for terminal manoeuvre area in the frame of ATC and regional weather monitoring, is made possible by MPAR (multifunction phased array radar) techniques, allowing a single technology to satisfy different requirements. The main design criteria and tools are outlined, as well as the preliminary guidelines for a detailed system design, needed for a future cost/benefit analysis. The key techniques needed to achieve the required performance are (a) interleaving of functions by careful scheduling, (b) digital beam forming for target surveillance and (c) fast (electronic) scanning for the weather surveillance. Using these techniques it is possible to design an architecture in which the transmit/receive module (TRM) may operate with a rated low peak power, compatible with the low-cost requirement. [C3675]

"A comprehensive model for chaff characterization"

The paper is aimed at providing a unified behavioural model for the chaff which takes into account all its fundamental characteristics including the kinematical properties, the statistical properties and the non-stationary

behaviour. The aim is to reproduce the chaff behaviour with respect to all the relevant parameters in order to exploit such model in simulated environments, with respect to the radar and jamming domains. Such model is aimed at being representative for both naval as well as avionic situations. [C3676]

"Doppler Radar for planetary safe descent and landing"

This paper discusses some basic requirements for a Doppler Radar intended to provide critical measures to be used for safe descent and landing on planets. Some considerations are briefly developed in order to establish a preliminary design of such a radar. [C3677]

"A multistatic radar array for detecting wild animals during pasture mowing"

During pasture mowing in spring time, every year countless animals such as fawns are killed or severely injured. In addition to animal protection laws, this is a big problem for farmers due to botulism of the livestock. Many different strategies have been developed to either scar the fawns away or to detect them, for example by searching with a hunting dog. These methods are either ineffective or very time-consuming and therefore less applicable. In this paper, we present a detecting method which is based on microwave signals. This incoherent radar system uses antennas arranged as a matrix and a signal superposition principle. It detects the reflection signature of covered targets of a certain shape-e.g. metals or objects with high water content. The low computing power needed allows a large area to be scanned within a short time. Since this radar system is almost completely insensitive to vertical movement of the extension arm, it can be mounted on a fast driving vehicle. [C3678]

"A class of Cramer-Rao optimal estimators for analysis of clutter"

Fisher information matrix can be seen as the metric of a Riemannian manifold, Fisher-Rao metric. As such it can be evolved through Ricci flow. For the case of the estimation of two parameters, the two dimensional manifold is also conformal. In this case we show that the Cramer-Rao bound is saturated as a scalar function always exists that is also a solution of Liouville equation. This implies that in order to have an optimal estimation of parameters one have to solve this equation. This result can be extended in higher dimensions when the Fisher information matrix can be cast into a similar form as for the two-dimensional case and the estimator vector admits a potential field. Applications of this result are wide-ranging going from tracking to control theory and clutter analysis. We present an example for the analysis of sea clutter data. [C3679]

"Candidate scatterometer concepts for the Post-EPS mission"

Post EUMETSAT Polar System (Post-EPS) is the next generation meteorological polar satellites system of EUMETSAT, a joint ESA-EUMETSAT development programme currently in phase 0, to replace MetOp system in the 2018-2020 time frame. Post-EPS is a mandatory programme addressing the need to continue EPS to provide, first of all, observations for operational meteorology and climate monitoring, and in addition, environmental services covering ocean, atmosphere, land and biosphere, and natural disasters. According to these objectives, the Scatterometry (SCA) mission has to provide ocean surface wind vectors, which are an important input to global and regional Numerical Weather Prediction (NWP) and also models of the ocean surface waves. The SCA instrument is conceived with the objectives of ensuring continuity of past spaceborne scatterometer missions. Their heritages (ASCAT, SeaWinds, etc.) have been fully exploited in SCA design and has directly led to the identification of the SCA candidate concepts. The direct comparison of the performance for past scatterometry missions and the SCA requirements shows that SCA performance would be in line with the ASCAT radiometric performance, while significantly exceeding ASCAT in terms of geometric parameters (horizontal resolution and accuracy). This paper presents the preliminary instrument concepts that have been investigated during the on-going phase 0 study. [C3680]

"Improvement of target resolution in azimuth by LMMSE technique"

Azimuth target separation is of crucial importance in many applications of radar. The azimuth resolution is determined by the antenna beamwidth. However, in practice, standard signal processing techniques require the distance between targets to be more than one resolution cell. This can prove inadequate for several relevant applications. In this paper the problem of improving the azimuth resolution for rotating surveillance radar is addressed. A data model for the case is described and a novel application of the linear minimum mean square error (LMMSE) processing technique is evaluated. The antenna pattern used is obtained from real measurements and the received signal is synthesized to produce target profiles with spacing smaller and larger than the resolution cell. Results show the capabilities of this technique of separating targets in azimuth spaced closer or further than one azimuth resolution cell. The processing scheme shows a large improvement in the resolution capability with respect to standard techniques. [C3681]

"Monitoring of St. Sophia Cathedral interior using Ka-band Ground Based Noise Waveform SAR"

This work is devoted to measurement of shifts inside an old Cathedral using a Ka-band ground based noise waveform SAR (GB NW-SAR). Design of this SAR is based upon synthetic aperture antennas and noise radar technology. The system is intended for small shifts measurement at large objects using differential interferometry technique and it can be used for detection of pre-catastrophic changes. In current experiments, GB NW-SAR was used in monostatic regime with CW signals. Resolution of the GB NW-SAR was ~ 30 cm both in range and azimuth. The SAR has been placed inside the St. Sophia Cathedral in Kiev and used for shifts detection in sealing of the building covered with ancient frescos and mosaics. Precision of shifts measurements up to 0.1 mm has been shown. Influences of reflections inside the building have been analyzed. High stability of the object of interest has been shown. [C3682]

"MIMO radar target localization by using Doppler shift measurement"

A new method for target localization in MIMO radar is proposed. Localization of a moving, non-maneuvering target is possible by using Doppler-shift measurements and angle information in MIMO radar systems. This is a nonlinear problem and it must be solved for a grid search strategy. If the received frequencies and the angles between the target and the transmitter and the target and the receiver are known, we can search space grid by grid for desired (x, y) coordinates to find the position of the target in 2D space. [C3683]

"Azimuth Pre-Processing in Real Time imaging of UWB SAR"

Large data volume owing to the long aperture of UWB SAR is one of the main difficulties in real-time UWB SAR imaging. Azimuth pre-processing (AzPP) can reduce the data volume, which make real-time imaging of UWB SAR become possible. In this paper, we analyze the AzPP characteristics in UWB SAR, and design the lowpass FIR filter under Chebyshev method. Then a parallel structure of AzPP based on TS201 is proposed. The computational cost and storage are also analyzed. Finally, the imaging result processed with the parallel flow is presented. [C3684]

"Range sidelobes reduction filters for WiFi-based passive bistatic radar"

In this paper the feasibility of a WiFi transmissions based passive bistatic radar is analysed. The auto-correlation function of this waveform of opportunity is characterized with reference to typical signals broadcasted by a 802.11 access point and it is shown to yield a high sidelobe level which strongly limits the useful dynamic range. Proper weighting networks are proposed to cope with this limitations based on the knowledge of the expected value of the signal autocorrelation function. The performance of the proposed technique is evaluated against simulated data generated according to the 802.11 Standards. Moreover the preliminary results are presented against a real data set collected by an experimental setup. The proposed approach is shown to yield a significant improvement of the peak to sidelobe ratio thus making the considered waveform more attractive for passive local area surveillance. [C3685]

"Tuneable optoelectronic oscillator based on a Frequency Shifter"

The Opto Electronic Oscillator proves a lower phase noise with respect to the classic quartz based oscillators. In this paper we describe an experimental setup of a microwave optoelectronic oscillator operating in the radar band based on a novel optical component, the Frequency Shifter, and operating on a dual frequency (SSB) modulation scheme. We have theoretically modelled and experimentally measured our novel approach and compared it with the common Mach Zehnder based oscillator. [C3686]

"Investigation of optimal array configurations for full azimuth scan HF skywave radars"

The design of planar arrays providing full azimuthal scanning coverage for skywave radar applications is considered in this work. The main objective is to simultaneously achieve a given beamwidth in any scanning direction and a given peak SLL in a specified subdomain of the visible region, while minimizing the number of required radiating elements. The capability of certain deterministic aperiodic arrays with substantially rotationally symmetric distributions of elements to comply with the full scan requirement while allowing the suppression of grating lobes is shown to be similar to that of random arrays. [C3687]

"A survey of differential SAR interferometry for surface displacement monitoring"

Differential synthetic aperture radar interferometry (DInSAR) is a well-established technique, able to measure very small movements of the terrain over time. It is used for the monitoring of subsidence, volcanoes, landslides

and soil instability, for the measurement of soil deformations caused by earthquakes, and for the measurement of glacier movement velocity. This paper is the summary of a workshop presentation in which the basic theory of the DInSAR technique is presented, the main implementation approaches are illustrated from an "historical" perspective, and some applications are described. [C3688]

"ORFEUS project: the surface GPR system"

A surface based GPR system for locating buried pipes and cables suitable for deployment in urban areas is under development within the ORFEUS (Optimized Radar for Finding Every Utility in the Street) project. Innovative technical solutions allow significant inherent limitations of conventional radar systems to be overcome. [C3689]

"Specific Emitter Identification: Analysis on real radar signal data"

This paper focuses on the specific emitter identification (SEI) technique applied to electronic support measure (ESM) systems. The main idea is to analyze the radar pulses and characterize those by extracting features that should be different for each radar. In the paper, feature extraction algorithms are used to characterize the radar pulses: a measurement campaign has been conducted to acquire real radar pulses from different radar modes and radar signals. The applicability of the feature extraction procedure has been analyzed for different case studies to obtain a complete picture of the results achievable with the different radar signals. [C3690]

"Sub-Array Processing for parameters estimate of embedded conducting cylinders"

A hybrid electromagnetic-statistic approach for the detection and localization of buried perfectly-conducting circular cylinders is presented. The data used for simulating the scenario are produced by using the cylindrical wave approach (CWA) method. The inverse scattering problem is treated by means of a statistical detection technique. In particular, by the use of a SAP (sub-array processing) structure, it is possible to apply several algorithms of direction of arrival (DOA) estimation. By triangulating the DOAs, a set of crossings, condensed around the expected object locations, is obtained. To process the crossing pattern, we develop a statistical model for the crossings distribution, and employ hypothesis testing procedures to identify a collection of small windows containing targets. By defining a suitable threshold from a desired false alarm rate, and dividing the region in small windows it is possible to ascribe each window to the ground or to an object. [C3691]

"The synergy of SAR polarimetry and interferometry for forest parameters retrieval"

In this paper we deal with the combination of SAR polarimetry and SAR interferometry to estimate bio-physical parameters, in particular the height of vegetated areas. We show a preliminary inversion approach that uses the polarimetric and interferometric (POLINSAR) coherence phase to estimate forest height. The POLINSAR degree of coherence is first optimized to identify the ground and top-canopy height, and then corrected for the wave penetration and terrain slope. We use a coherent POLINSAR scattering model to estimate the correction parameters. ALOS-PALSAR data are used to illustrate the results. [C3692]

"Dual-polarized X-band radar detection and estimation of hydrometeor microphysical parameters"

An original hydrometeor classification technique (BRAHC), based on the Bayesian theory, coupled with a variational final-value (VarFV) path-attenuation correction and water content estimation techniques at S- and X-bands, is developed. The main feature of this combined approach is the capability to deal with hydrometeor heterogeneity along each radar ray in a physically-consistent way. Using SPOL and XPOL radar data collected during the IHOP campaign in 2002, a comparison between the results obtained at the 2 different frequency bands is discussed, showing some potentials and limitations of the X-band radar precipitation retrieval. The latter are mainly related to the reduced detectability of the precipitation signal in presence of strong path attenuation through the storm cores. [C3693]

"Time frame selection for High PRF Pulsed Doppler radar ISAR image formation"

Inverse Synthetic Aperture Radar is a signal processing technique used to obtain high resolution images of targets. In ISAR imaging high cross-range resolution is obtained by exploiting the radar to target relative motion. The radar target kinematic affects the data grid spacing and shape in the Fourier domain (acquisition surface). When the grid is rectangular with equally spaced points, the ISAR image is focussed and it has predictable resolution properties. The object of this paper is to investigate the relationships between the acquisition surface and both the resolution and defocusing properties of the ISAR image given the radar-target kinematic. A distortion parameter that depends on the kinematic properties is defined and compared to image focus quality indicators. Simulation results are also shown considering a complex target model. [C3694]

"SAPPHIRE: a novel building mapping radar"

Through-the-wall radar is available for single walls, providing range, direction, and motion information of moving subjects, often requiring a close position to the wall. No proven technology exists yet that allows mapping of building structures in a covert way. At TNO an innovative concept to synthesize a 3D map of a building with a stand-off, through-the-wall radar is being developed: SAPPHIRE. [C3695]

"Closed form localization algorithms for mode S wide area multilateration"

Multilateration (MLAT) is an increasingly important location and identification system for surface traffic surveillance, is in use in large airports such as London-Heathrow, Frankfurt/Main and Rome-Fiumicino. Target location can be extended to approach and terminal area surveillance (wide area multilateration, WAM), with a system coverage to some hundred kilometers around the airport. Practically used MLAT systems exploit signals transmitted by aircraft equipped with SSR (or ADS-B) transponders for target location. Multilateration algorithms locate targets using hyperbolic time difference of arrival (TDOA) techniques. Under the special conditions imposed by the geometry in the WAM case, high-performance algorithms are required for targets far outside the polygon enclosing the receiver stations. This paper presents algorithms formulated in TOA (time of arrival) representation directly, without resorting to the TDOA. Their performance is compared with other present-day algorithms that are mostly formulated in terms of TDOA. [C3696]

"Space-time clutter rejection using the APES method"

A new method to reject ground clutter using the amplitude and phase estimation (APES) method is proposed in this paper. The theoretical approach is followed by the application of this method on the rejection of such an interference in the frame of a bistatic passive radar using digital video broadcasting-terrestrial (DVB-T) transmitters. [C3697]

"A comprehensive analysis on detection performances of LPI signals filtering strategies"

This paper focuses on the detection performances achievable in the presence of Low Probability of Intercept (LPI) radar signals. It well known that the radar community is widely investigating LPI waveforms to reduce the Range Advance Factor (RAF) obtainable with Electronic Support Measure (ESM) systems. Several filtering strategies for LPI signals processing are already available in open literature, but a formal analysis on different detection strategies and a comparison on the detection probability has not yet carried out. In this paper we propose several detectors, using different signal filtering algorithms and different detection strategies. Moreover a comprehensive analysis for all the proposed receivers is carried out for different LPI waveform, also in comparison with the classical Fast Fourier Transform (FFT) filtering, widely adopted by current ESM systems. [C3698]

"On the trade-off between mainlobe width and peak sidelobe level of mismatched pulse compression filters for linear chirp waveforms"

In the work of the authors (2007), they introduced a technique for generating mismatched pulse compression filters for linear frequency chirp signals. The technique minimizes the sum of the pulse compression sidelobes in an L_p -norm sense. It was shown that constant, extremely low sidelobe levels (better than 60 dB) can be achieved for minimal mismatch loss but with some broadening of the compression peak. This paper investigates the tradeoff between the sidelobe level and the mainlobe width for mismatched filters designed using L_p -norm techniques. [C3699]

"Integrated 79GHz UWB automotive radar front-end based on Hi-Mission MCM-D silicon platform"

A highly integrated silicon platform (Hi-Mission) for high frequency applications is introduced. This platform utilizes heterogeneous MCM-D technology with integrated passive devices together with silicon and GaAs MMIC technology developed for the automotive UWB radar (SRR) frequency band from 77-81 GHz. Developments are described in the area of MCM-D process development, MMIC, integrated phased array antenna, module design and assembly process development. The demonstrator is composed of two test vehicles designed for conducted and radiated measurements respectively. Test results are presented at the component and module level. [C3700]

"Sparse linear array design for a short range imaging radar"

This paper presents the design of an active short range imaging system in the Ka-band (26.6-40 GHz). The sensor is a multistatic linear array which is moved perpendicular to the array dimension for the purpose of 3D

imaging. By sequentially switching on the transmitters and simultaneous reception of the scattered field by each receiver, a fast sampling of the 2D aperture plane is achieved. To reduce the number of parallel receive channels, a thinned array on the base of sparse periodic arrays (SPA) was developed. Due to non focussing antenna elements, numerical reconstruction algorithms, for near field conditions, have to be applied for a high lateral resolution. First simulation results verify the imaging quality of this concept and the functionality of the proposed reconstruction algorithm. [C3701]

"Multi-sensor rotation motion estimation for distributed ISAR target imaging"

The use of multiple radar systems, carried by a set of air platforms flying in formation, has been demonstrated to be able to provide ISAR images of rotating surface targets with increased cross-range resolution, up to the number of considered platforms or even higher. The achievement of the desired cross-range resolution improvement from distributed ISAR data requires the knowledge of the target motion characteristics in order to correctly focus the multi-sensor ISAR image. To accomplish this task a new estimation technique, based on the maximum likelihood criterion, of the target rotation motion from the distributed ISAR data is here proposed. A complete simulated performance analysis is provided showing the improvement arising with respect to conventional (single sensor) techniques. Moreover examples of application to live ISAR data are provided showing the effectiveness of the proposed approach. [C3702]

"Merging frequency agile OFDM waveforms and Compressive Sensing into a novel radar concept"

Compressive sensing (CS) is a new tool that intends to estimate the original information by means of convex optimization, using just a few measurements. In radar this original information consists of the range-Doppler map of the observed scene. The method allows undersampling since the band-limitedness of the waveform is no longer the limiting criterion, which turns to be the sparsity of the scene. Essentially, this article opens new prospects for radar waveforms by focusing on the orthogonal frequency division multiplexing (OFDM) signal in comparison with chirps, and shows how the concept of agility fits in a natural way with CS as a processing tool. Examples with conventional matched filtering support fair comparisons. The scenario of a 1D range profile sparsely filled with bright spots or point targets is investigated. [C3703]

"Linear Sampling Method for time-lapse qualitative through-the-wall imaging"

The development of effective diagnostic tools for fast and non-invasive through-the-wall imaging (TWI) is an important topic, also motivated by the increasing public concern on security issues. In this framework, the main challenges are the detection of targets located on the other side of a wall and the monitoring of their motion. To pursue these aims, we propose an imaging strategy based on the linear sampling method (LSM), a computationally effective tool to determine the targets' morphology from multiview, multistatic and monochromatic data. In particular, by relying on the physical interpretation of LSM, we give its formulation for TWI and propose its use for motion tracking purposes by means of a simple post-processing strategy. A numerical example is given to assess the performances of the approach. [C3704]

"Lateral velocity estimation using an FMCW radar"

This paper addresses the estimation of the lateral velocity using a Frequency-Modulated Continuous-Wave (FMCW) radar. Usually lateral velocity estimation is performed by evaluating the range information during multiple sweeps by means of a tracking algorithm. Another approach is to use the Doppler frequency shift during one chirp of an FMCW waveform in conjunction with the instantaneous aspect angle of the target. But all these algorithms ignore the phase information between nearby chirps. In this contribution an estimator based on the phasing between adjacent sweeps is presented using contrast optimization in combination with the discrete polynomial-phase transform in order to reduce the computational demands of the proposed estimator. This approach makes it suitable for real-time implementation with state of the art technology. [C3705]

"A procedure for effective receiver positioning in multistatic passive radar"

Multistatic passive radar systems offer many advantages in terms of coverage and sensitivity of the positioning accuracy with respect to the single bistatic passive radar. However the performance of such a system is largely dependent on the geometry. Its design has to deal with the additional complexity of selecting both the optimum transmitters among the ones available and the optimum receiver position. In this paper we identify the set of constraints for the relative positions of transmitters and receivers, in order to guarantee the continuous monitoring of an assigned target path. Then, we focus on the specific case of a multistatic passive radar based on two transmitters of opportunity and a single receiver. For this case, we devise an optimised approach to select the two transmitters among the available transmitters choose the receiver location. [C3706]

"Detection of objects inside water exploiting the Brillouin precursors"

In a dispersive medium, the appearance of the steady-state part of the signal is preceded by oscillations known as precursors. This is due to the interrelated effects of phase dispersion and frequency dependent attenuation. The propagation properties of the precursors are different from the steady-state part of the pulse which makes them suitable for many applications. An example of these interesting properties is the non-exponential attenuation rate of the Brillouin precursor inside a Debye medium. Exploiting this property, it is suggested that an input pulse consisting of two mutually delayed Brillouin precursors would be an optimal excitation in terms of the attenuation inside triply distilled water. Evidently, this optimized pulse is promising for remote sensing applications, aimed at detecting objects inside lossy dispersive media such as moist soil and water. In such cases, the optimized pulse can overcome the high loss of the medium and contribute to the detection of objects further inside the dispersive medium. In this paper, Finite-Difference Time-Domain (FDTD) simulations are employed to evaluate the usefulness of the optimized pulse for remote sensing applications, by modeling its scattering from objects inside water. [C3707]

"Status, results and perspectives of the Italian Earth Observation SAR COSMO-SkyMed"

COSMO-SkyMed is a Dual-Use program, devoted to produce both civilian and military applications, and as such, it is required to have a fast response time, to manage conflicts and to optimize resources. This paper provides a description of the current COSMO-SkyMed unique in-orbit performances, functionalities and Dual-Use design, implementation and operations, comparing them with other RADAR remote sensing Systems. In this context examples and potentialities of the data already acquired and catalogued are given and discussed. Following that the paper summarizes: 1) The lesson learnt and the needs evolution up to now collected from the Scientific, Technological and User Communities, also through the experiments performed in the frame of the current utilization phase; 2) The evolution that is planned for the 2nd generation of the COSMO-SkyMed System to provide the involved Civilian and Defence Communities with adequate imagery capabilities and global performance. In particular are discussed: 3) The new/improved architectures and technologies necessary in the Space as in the Ground Segments to provide new/improved operative modes, performances, applications, interoperability and modularity features, life-cycle costs, et cetera; 4) The implementation plan of the necessary technical improvements; 5) The COSMO-SkyMed 2nd Generation development and deployment plan. [C3708]

"Welcome to EuRAD 2009"

It is my pleasure, as conference chairman, to welcome you to the 6th European Radar Conference (EuRAD 2009) being held in Roma as part of the European Microwave Week (EuMW). EuRAD started six years ago thanks to a wonderful idea of our Dutch colleagues and friends from IRCTR and Delft University and in particular to the determination of prof. Leonard Ligthart. Since then, EuRAD has grown into one of the largest European and worldwide recognised radar events, both in terms of quality (guaranteed by a rigorous, peer review of a substantial abstract) and of quantity: in fact, the number of proposed contributions has steadily increased during six years. This year, in spite of the present international financial crisis, we have received 189 submissions to this conference, with more than 18% increase with respect to the very successful EuRAD 2008 edition. EuRAD submissions are now about 15% of the whole EuMW, making this conference the second largest of the EuMW and with an increase of its duration of more than two full days. The accepted papers are organised into twelve oral sessions plus four Focused Sessions and one common session EuMC/EuRAD (summing up to eighty-three podium presentations), complemented by a poster session. Moreover, five invited papers of wide interest are presented in the Opening and Closing sessions. This year, I feel that the strong reduction in the number of parallel sessions will enhance the benefit for the attendees. The programme covers a wide range of radar topics including Radar Subsystems and Technology, Signal Processing, Design and Evaluation, Systems and Applications; two focused sessions are dedicated to Space Radars and their Environmental Remote Sensing applications, one to Space-Time Adaptive Processing and one to Passive Radar, while the common session with EuMC is dedicated to through-the wall radar imaging. In addition to that, the programme includes other "hot" topics such as ultra wide band radar, multilateration-, interception/analysis of radar signals, new radar waveforms and OFDM radar, sea and OTH radar, phased arrays and more, with a wide and updated overview on the most recent advances in radar technology and applications. [C3709]

"Recent advances in waveforms for radar, including those with communication capability"

New scalable and flexible waveforms offer a great number of new opportunities for object- or environment-tailored signal processing. The paper will discuss two classes of such flexible waveforms, i.e. single carrier waveforms with orthogonal modulations and multiple carrier coded waveforms. These waveforms may for instance be used for the benefit of scalable resolution, fast unambiguous Doppler assessment, two-channel code-orthogonality supporting to measure the full back scatter matrix in radar polarimetry, and message transfer

in a network by radar. [C3710]

"Future radars procurement for the Italian Ministry of Defense"

The Italian ministry of defense (IT-MoD) is working together with NATO (North Atlantic treaty organization) allied countries in order to improve the radar sensors and the identification systems, so as to better protect the air space, the war fighters and to reduce fratricide fire. In particular, TELEDIFE has now in progress significant procurement actions of radar and identification systems with state-of-the-art technology taking into account that the IT-MoD has the requirement to make available to the Italian ministry of communications the S band frequencies necessary for the Wi-Max/ Broadband Wireless Access systems. [C3711]

"The TanDEM-X mission: Overview and interferometric performance"

TanDEM-X (TerraSAR-X add-on for Digital Elevation Measurement) is an innovative spaceborne X-band earth observation mission that will be launched in October 2009. This paper gives an overview of the TanDEM-X mission concept, summarizes the basic products and illustrates the achievable performance. In more detail the effect of quantization on the interferometric performance is discussed. Finally new imaging techniques are outlined. [C3712]

"Design and implementation of a chaotic oscillator for UWB"

Chaotic oscillators can generate wide-band signals and the spectrum characteristics of the signals are not changed by switching the output power of the oscillators. If communication systems could be implemented using a chaotic oscillator, the communication system need not a local oscillator, a mixer, IF amp. And so forth which are needed in conventional transceivers. Therefore the configuration of the communication system using a chaotic oscillator can be simple. The system has the characteristics of low-power consumption. In this paper we design and implement a chaotic oscillator for UWB applications. And the test results of the implemented chaotic oscillator for UWB systems are presented. The implemented chaotic oscillator has -8.11 dBm of the output power within 500 MHz channel bandwidth at 3.4 GHz of the center frequency and has about 470 MHz of -10 dB bandwidth. [C3713]

"EuMW 2008 Amsterdam Prizes"

{no data available} [C3714]

"Real-time tracking of transceiver-free objects for homeland security"

The increasing demand in homeland security speeds up the development of innovative and non-invasive systems to localize and track moving objects in complex environments. In this paper the real-time localization of transceiver-free targets is addressed by means of learning by example methodology that exploits the received signal strength indicator available at the nodes of a wireless sensor network as input data. This approach uses neither dedicated sensors nor active devices put on the target to localize both idle and moving objects. The definition of a customized classifier during an offline training procedure enables the real-time generation of a probability map of presence by processing the output of the support vector machine. Some selected experimental results validate the effectiveness of the proposed methodology applied in real scenarios. [C3715]

"Advances in radar systems by SELEX Sistemi Integrati: Today and towards the future"

SELEX Sistemi Integrati is now watching toward the future to reinforce its leadership in the state of the art of radar systems. The strong position in the market has been achieved by delivering top radar performance in many fields of application and it has been based on the capability to manage the proper technology insertion in its radar systems. For each radar product the Company has identified its own key technology components and has planned its development and insertion to take the right advantage from a well established radar knowledge. The same winning approach is now followed for the next generation of SELEX-SI radar systems. In the paper it will be shown how the Company has developed technology and radar systems together in the past, how it is delivering up to date solutions now and how it is preparing the new generation of radar systems by investing again in technology. In this field the focus will be on the new multifunction/multirole radar applications and on the technological capabilities that SELEX-SI is developing by taking advantage of its Research and Development facilities. [C3716]

"Mixed SSR sources separation exploiting sparsity: a geometrical approach"

The aim of this work is to discriminate and separate overlapped downlink SSR signals received by a

multilateration (MLAT) station in a crowded environment. As a typical MLAT receiver station is equipped with an omni directional antenna, the probability of multiple receptions increases as a function of the traffic density. The proposed algorithm is conceived for a multi channel receiver with garbled signals discrimination/separation capabilities. Taking advantage of the sparsity characteristics of the MLAT signals (Mode S) our approach faces the problem under a geometrical outline. [C3717]

"SELEX Sistemi Integrati new active G-Band radar family"

KRONOS is a multi-role G-band medium range radar with an active solid state full phased array antenna that can be easily and fully integrated in a multi-layered defence system. It is designed by SELEX Sistemi Integrati on the basis of its well proven experience in advanced Multifunctional radar systems, such as the shipborne EMPAR, and takes advantage from the solid state technology developed in SELEX-SI for G Band MMIC T/R modules. Two versions are available: naval version, intended for use on naval ships starting from 400 tons, land version, completely contained in a fully autonomous standard 20-ft ISO container. The multifunctional architecture and the state of the art technology used make KRONOS able to comply with the following missions: Gap Filler o Point Defence, Air Surveillance and tracking, Sea Surveillance and tracking, Littoral Warfare, Gunfire Support. In this paper the KRONOS features will be detailed in terms of implemented technical and technological solutions and related advantages in surveillance, tracking and other functionalities required for a Combat System.. [C3718]

"Monopulse and coherent integration: performance and waveforms"

Purpose of the paper is the description of a technique dedicated to the recovery of monopulse performance loss in phased array radars (PAR) using both Low PRF Waveforms and High PRF Waveforms (here in after LPRF and HPRF respectively). [C3719]

"PicoSAR- an advanced lightweight SAR system"

PicoSAR is an ultra-lightweight SAR based on active array antenna technology. The complete system, including waveform generation, 2-channel receiver, inertial measurement unit, real-time signal processing and motion compensation is housed in a compact unit weighing less than 10 kg which can be easily installed in a wide range of aircraft. The system delivers excellent performance, with ranges in excess of 20 km and resolutions down to below 0.3 m. The paper describes the key technologies of the system and shows examples of system performance. [C3720]

"A new approach for DVB-T Cross-Ambiguity Function evaluation"

In this paper the use of Digital Video Broadcasting-Terrestrial (DVB-T) signals as waveform of opportunity for Passive Bistatic Radar (PBR) is addressed. A new approach for DVB-T Cross-Ambiguity Function (CAF) evaluation is proposed, which exploits a linear filter based on the knowledge of the expected value of the ambiguity function. The proposed approach is able to remove the unwanted deterministic peaks in the CAF due to specific features of the DVB-T signal, as guard intervals and pilots. The performance of the conceived filter is evaluated against simulated data and compared to other existing approaches. It is shown to yield more robust performance in terms of CAF improvement with reduced computational load and system complexity. [C3721]

"X-band T/R module in state-of-the-art GaN technology"

In this paper a first iteration X-band T/R module based on a GaN-HEMT MMIC Front-End chip-set, comprising a power amplifier, robust low-noise amplifier and power switch will be presented. Even though ultimate T/R module performance cannot be achieved with current GaN-HEMT technological maturity the impact that this technology can have at systems level in terms of performance/cost trade-off will be illustrated by means of a preliminary innovative module architecture which foresees the elimination of more traditional T/R module components such as ferrite circulator and limiter for front-end signal routing and protection. [C3722]

"An extremely compact dielectric resonator antenna for space-limited UWB wireless communication devices"

An extremely compact ultrawideband (UWB) dielectric resonator antenna is presented for potential use in compact UWB wireless communication devices. The antenna consists of a dielectric resonator of relatively high permittivity attached to a thin dielectric segment of relatively low permittivity, positioned on a ground plane. The current version is fed by a coaxial probe although other feeding methods are possible. The use of two dielectrics and multiple resonance modes have helped this design to cover the entire FCC UWB band (3.1-10.6 GHz, 1:3.4 or 109.5% bandwidth) in a very small volume. The antenna size has been further reduced, without compromising

the bandwidth, by removing about half of the dielectric volume and applying a metal coating on one side of the dielectrics. [C3723]

"Passive Space-Surface Bistatic SAR for local area monitoring: Primary feasibility study"

This paper presents a new topology for a sub-class of bistatic SAR, called Space-Surface Bistatic SAR (SS-BSAR). This new topology comprises Global Navigation Satellite Systems (GNSS) as transmitters of opportunity and a stationary receiver on the ground. It is shown that such a system is promising for local area monitoring, and its very basic radar performance (power budget, resolution) is assessed. [C3724]

"Application of time to digital converter in I-UWB positioning system receiver"

The paper contains a description of an I-UWB receiver intended for a vehicle positioning system developed within the SAFESPOT project. The receiver design is based on a commercially available time to digital converter. The paper deals with details of receiver implementation. It discusses the most important issues connected with converter application. Results of receiver measurements and their analysis are also included. [C3725]

"Comparison of UWB SAR and MIMO-based short-range imaging radars"

This paper compares and analyzes the imaging capability of two ultra-wideband radar systems which are based on synthetic aperture and sparse planar array respectively. The systems comprise the same 3.1-10.6 GHz antennas and video-impulse electronics. The SAR uses a transmit-receive antenna pair installed on 2D mechanical scanner, while the array represents an multiple input multiple output (MIMO) structure with four transmit and sixteen receive antennas. In both systems digital beamforming is applied to the acquired data. The comparison bases on measurements conducted for the same scenarios. [C3726]

"Design of 2-D FIR fan filters for wideband beamforming and interference suppression"

This paper presents a method of designing 2-D FIR fan filters for wideband beamforming with interference wave suppression used in mobile communication and also acoustic signal processing. Wideband beamforming network generally consists of sensor array, tapped-delay line (TDL) and adaptive fan filter coefficients to extract target wideband signal, however most of fan filters do not suppress interference waves at the same time. In this paper, we develop an optimum design method of 2-D FIR fan filters that enable both desired signal extraction and interference suppression by employing temporal-domain representation of the combined error function and its partial differentiations. Performance of the proposed method is evaluated through some computer simulation. [C3727]

"A fully integrated 77GHz FMCW radar transmitter using a fractional-N frequency synthesizer"

A single chip transmitter for automotive FMCW radar application is implemented in 0.18 μm SiGe BiCMOS technology. The frequency synthesizer driving a 77 GHz VCO is based on a fractional-N PLL embedding a programmable divider operating at 10 GHz. A 28 bit sigma delta modulator associated to a digital controller enables a versatile generation of FMCW modulation with a resolution of 3 Hz and a linearity of 1%. The measured phase noise is -75 dBc/Hz at 100 kHz offset from a 77 GHz carrier and output power is 18 dBm. [C3728]

"A study on the accurate estimation of the number of weak coherent signals"

Estimation of the number of incident signals (NIS) is an important problem for array signal processing, such as direction-of-arrival (DOA) estimation. A method for estimating the number of signals without eigendecomposition (MENSE) is superior to algorithms based on the spatial smoothing preprocessing (SSP) and the Akaike information criterion (AIC). The advantages of the MENSE can be achieved by employing the Hankel correlation matrices which can suppress the correlation between the incident coherent signals and the influence of noise. In this paper, we propose a new metric based on the multiplicity criterion to improve the accuracy of the MENSE. Computer simulation results show that the proposed method is superior to the MENSE and the SSP-AIC methods in an environment arriving closely spaced coherent signals. [C3729]

"A ray tracing based method for coarse coordinate registration in HF skywave OTH radar"

Over-the-horizon (OTH) radars use the refractive properties of high-frequency radiowave propagation through the ionosphere for wide-area surveillance at long ranges. Target detection is accomplished by tracking returns in slant range, Doppler and azimuth. Moreover OTH radar performances are affected by several types of frequency dependent factors, mainly due to propagation and ionospheric absorption, but also related to the background

noise. Coordinate registration (CR) is the process of localizing the target by converting the slant coordinates R_g into ground coordinates R_g for all the frequencies used in transmission. The CR method here presented is based on a ray tracing algorithm which provides the ground range distance reached with a specific transmission frequency and elevation angle. The ray tracing approach here adopted uses an electronic density profile estimated by using the latest revision (2007) of IRI (International Reference Ionosphere) model. Errors in the estimated down-range ionospheric parameters introduce as a consequence a degradation of target localization accuracy. The goal of this work is that to show a technique to determine the coordinate registration by jointly using ray tracing and Breit and Tuve theorem. [C3730]

"Multi-frame data fusion techniques for ATR of ship targets from multiple ISAR images"

This paper deals with the topic of Automatic Target Recognition (ATR) of Non Cooperative Targets. Specifically the focus is on the ATR of ships from multiple ISAR images. An investigation on different techniques for the fusion of the information provided by multiple image frames is presented. The techniques exploit the principles of multi-feature based ATR and apply them to the case of availability of several images. The recognition process makes use of a wire-frame models library which undergoes a step of candidate models selection before feeding the target model declaration step. Both cases of centralized and decentralized data fusion techniques are considered. The performance of the proposed techniques is investigated in depth by means of simulated data. Moreover the paper provides a comparison of the results of the proposed techniques when applied to live ISAR images of ship targets. [C3731]

"Radio proximity Doppler sensor with high K dielectric materials"

One of the most important trend in electronic devices manufacturing is miniaturisation. Among other techniques used to decrease the physical dimensions of microwave devices one is to employ materials with high permittivity, providing that the dimension of the device is proportional to the wavelength in the material, which is square effective permittivity times less than the wavelengths in free space. The paper shortly presents the manufacturing process to obtain a high permittivity ZST ($(\text{Zr}_{0.8}, \text{Sn}_{0.2})\text{TiO}_4$) material used to build a dielectric resonator oscillator, which is used as a proximity Doppler sensor. Computed and experimental results as well as the procedure to measure the parameters of the Doppler sensor are presented. The sensor described in the paper may be considered as a short range radar device. [C3732]

"Spatial-Smoothing-like Processing of array steering vectors for high resolution DOA estimation"

This paper proposes spatial smoothing preprocessing (SSP)-like definition of the virtual array steering vector used in array mapping design process. Accuracy of direction-of-arrival (DOA) estimation is often deteriorated when incident signals are strongly cross-correlated, and SSP has been developed to reduce such signal correlation and then to accurately estimate DOAs of those signals. Application of SSP is limited to the array configuration where parallel shift of subarrays are considerable, like uniform linear array (ULA) or uniform rectangular array (URA). On the other hand, array interpolation processing is necessary to apply SSP to uniform circular array (UCA) which could provide DOA estimation in all azimuth angles with identical accuracy. This paper proposes a novel definition of the virtual steering vector as SSP-like form in array interpolation, and also the same concept is applied to element space (ES)-root-MUSIC. [C3733]

"Compact wideband downconverter module for Electronic Warfare applications"

Analysis and design of a compact wideband downconverter module for EW applications are presented in this paper. Architectural and circuit solutions trade-offs are described and related to the module's electrical and mechanical requirements and the key components characteristics. RF chain simulations and their comparison with measurements of the manufactured module are finally illustrated. [C3734]

"Comparing non-ideal ultra-wideband transmission for European and FCC regulation"

The performance of UWB transmission can be degraded by non-ideal frontend components. In literature, there exist only few contributions about non-ideal impulse radio transmission, and they are based on the FCC regulation. Non-ideal system considerations for the European regulation are however missing. This paper uses a detailed system model based on measurement data and compares the achievable performance when analogue filters for the European and the FCC regulation are included. The results show that a loss of signal-to-noise ratio due non-ideal filters and bandwidth limitations is very critical at small distances. Filter optimization is hence necessary to improve the system performance. [C3735]

"Validation of a smart antenna prototype: Model and experiments"

In this paper, the architecture of a smart antenna prototype is described and its functionality assessed. The system prototype is composed by an 8-elements linear array of dipoles with a finite reflecting plane and the adaptive behavior is obtained modifying a set of array weights with electronically-driven vector modulators. In order to real-time react to complex interference scenarios, the system is controlled by a software control module based on a particle swarm optimizer. To demonstrate the feasibility and the effectiveness of the proposed implementation, a set of representative results concerned with realistic interference scenarios is reported and discussed. [C3736]

"Fast detection of moving targets by focusing in multi-channel Ultra-wideband SAR"

Long processing time and, in certain cases, restricted ability to detect moving targets are seen as the shortcomings of the moving target detection by focusing technique. The detection ability reduces significantly when Normalized Relative Speeds (NRS) with respect to the speed of the platform are approximated or equal to one. This paper propose solutions for such problems. Local Backprojection (LBP) replaces Global Backprojection (GBP) in the focusing approach of the detection method to save the processing time and a space-time processing technique, namely Displaced Phase Center Antenna (DPCA) is used to pre-process multi-channel SAR data to strengthen detection ability. Simulation results demonstrates a fast- and reliable detection achieved with these proposals. [C3737]

"32-cm wavelength radar mapping of the Moon"

We present our effort for producing a high-resolution 32-cm wavelength synthetic aperture radar map of the Moon using ground based measurements with the EISCAT UHF radar. We discuss coding, decoding, Doppler north-south ambiguity mitigation, focusing, and clock error mitigation. We also show preliminary results from a test measurement. [C3738]

"Eclipsing loss and HPRF selection for airborne radar"

Radar operating in High pulse repetition frequency (HPRF) suffers eclipsing loss because of high duty cycle. Multi PRF systems are able to reduce eclipsing loss but proper selections of PRF's are necessary to minimize Eclipsing loss as low as possible with the given specification (duty cycle, range, maximum relative velocity of target, etc). Proposed algorithm for selection of multi-HPRF's try to fill eclipse region in eclipsing cycle, i.e. target is unoccluded by at least one PRF in the eclipsing cycle. By proper PRF switching, set of these PRF's gives almost zero eclipsing loss. [C3739]

"De-ghosting of tomographic images in a radar network with sparse angular sampling"

Taking into account sparsity of the reflectivity function of several radar targets of interest, efficient low-complexity automatic target recognition (ATR) systems can be designed. A low-dimensional 2D spatial model, where information on the radar target signature is compressed, can be estimated using high range resolution (HRR) data from a sparse system of view angles. Incoherent tomographic processing of HRR data from a distributed surveillance system, made up of several radar nodes, is studied in this paper. A sparse angular sampling scheme is proposed, which exploits diversity due to both the distributed radar system and the target motion. The novelty is in the exploitation of this locally dense, but otherwise sparse set of viewing angles of the targets, obtained using a sparse network of radars. The de-ghosting efficiency of such a sampling scheme is demonstrated geometrically. This results in identification of minimal information resources for unambiguous estimation of a 2D target model, useful for radar target classification. [C3740]

"Ultra-wideband testbed for 6.0-8.5 GHz ranging and low data rate communication"

In this paper we present ULANDreg testbed that consists of two European mask compliant impulse radio ultra-wideband (IR-UWB) transceivers with low data rate and medium range for data communication and distance measurement. The transmitter uses time hopping spread spectrum codes to reduce the peak to average ratio in the power spectral density and the receiver is based on a filter bank. The hardware/software partitioning of the receiver provides the testbed with the necessary flexibility. Therefore new ranging algorithms can be tested quickly in real time in order to improve the distance measurements. The ranging protocol performs the distance calculation with four-way exchange of the frame even when there is not a common timing reference between transceivers. The algorithms demodulate data and estimate relative time of arrival (RTOA) in a line of sight (LOS) and non-LOS (NLOS) framework. Finally, distance measurement results are presented showing the functionality of the testbed. [C3741]

"Angle Estimation with Automatic Pairing for Bistatic MIMO Radar"

In this paper, a new joint direction of departure (DOD) and direction of arrival (DOA) estimation method is presented for bistatic multiple input multiple output (MIMO) radar. Because all the diagonal elements of the transmitting and receiving invariance matrices are located on the unit circle of the complex plane, we construct a complex matrix so that the DOD and DOA pairing is given automatically by the real and imaginary parts of its complex eigenvalues. Thus this method can be applied under any condition of target distribution, which does not suffer from incorrect pairing problem as existing methods in literature. Simulation results show that the new method provides satisfactory performances but with drastically reduced computations compared with previous work. [C3742]

"Survey on spiked models and their application to wireless communications"

In this talk, we will discuss some problems related to cooperative spectrum sensing, and show how random matrix theory can help to address them. We will propose a simple test for frequency band sensing in wireless networks. The test is based on the analysis of the ratio of the extreme eigenvalues related to the gain matrix of the channel. The novelty relies in the fact that the test does not require the knowledge of the noise statistics. Large random matrix results allow us to build the threshold for the test, and also to study its type II error. This in particular enables us to compare this test with a different although popular test already proposed in the literature. We will show that our test is uniformly more powerful. [C3743]

"Cooperation at the network level"

Cooperative Techniques in Wireless Networking have been developed mostly at the physical layer and are based on the notion of relaying and space-time codes. However, it is possible to also use the idea of cooperation at the MAC and Network layers in very simple ways that provide further performance improvements. We focus on the objective of stable throughput region which requires that delays are finite when packet arrivals are random and demonstrate how simple relaying can increase the region of arrival rates that can be accommodated with finite delays. The reasons for the improvement are subtle and suggest far-reaching possibilities regarding "stable capacity regions". Also, we consider another form of cooperative routing for the case of sensor networks and again demonstrate how cooperation can be thought of in a much broader sense than the one that has prevailed until now. [C3744]

"Title page"

The following topics are dealt with: speech enhancement; routing; scheduling; UWB; wireless transmission; network performance; distributed video coding; compression; source coding; string generation; information organization; decision support; transport protocol; OFDM; WiMax system; MIMO; circuit design; modulation; signal processing; image processing; sensor data processing; computer architecture; cognitive radio; array signal processing; biomedical signal processing; query processing; video processing; peer-to-peer network; distributed system; grid system; agent-based system; parallel processing; performance analysis; wireless LAN; relay communication; cooperative communication; radar localization; and target localization. [C3745]

"Lifting the curse of dimensionality: a random matrix-theoretic approach"

The ubiquity of inexpensive sensors implies that we can measure vector-valued data of ever increasing dimension. But the number of independent measurements of the data vector is limited so the sample covariance matrix is usually singular. The traditional remedy for singularity is diagonal loading-the addition of a small identity matrix to make the covariance estimate invertible. An alternative to diagonal loading is to reduce the dimension of the data vectors to be smaller than the number of independent observations through an ensemble of isotropically random (Haar measure) unitary matrices. For every member of the unitary ensemble, the shortened data vectors yield a statistically meaningful, invertible covariance estimate from which we can compute an estimate for the ultimate desired quantity. The final step is to take the expectation of this estimate with respect to the unitary ensemble. For a class of applications that includes adaptive spectral estimation, the design of a linear estimator, and supervised learning the random matrix approach results in an estimate for the inverse covariance matrix which preserves the eigenvectors of the sample covariance matrix, but alters the eigenvalues in a nontrivial manner. A closed-form expression for the expectation over the unitary ensemble eludes us, but we have obtained a tractable asymptotic expression. Preliminary numerical results indicate considerable promise for this approach. [C3746]

"Bistatic radar system using radio signals of geostationary satellites for hydrometeors parameters determination"

Bistatic systems offer an opportunity to install a transmitter, where they have no influence on a human being and environment and allow receiving signals in some advantageous positions. In this paper geostationary signals are

proposed as probing ones. Primary purposes of the system are to determine hydrometeors parameters and to diagnose hazardous occurrences, such as: showers, hail formations, lightnings, turbulences, etc. [C3747]

"Digital microwave antenna arrays design for radar purposes"

The problems of designing of modern digital antenna arrays are considered. A basic module of a digital antenna array and possibilities of upgrading of existing transmit-receive modules of active implemented phased arrays are considered. [C3748]

"Analysis of interference re-reflections in MIMO radar at multiplicative processing"

The mathematical model of influence of rereflections is presented for a small range radar with a step frequency modulation signal and for a spatially multi-channel antenna system of MIMO type. Presence and level of interferential marks in the system alarm function are analyzed for a multiplicative algorithm of processing for all pairs of transmitter-receiver elements. [C3749]

"Operation principle of intro-pulse autodyne FM SRR"

This paper shows the functional circuit of short-range radar (SRR) with pulse modulation and FM. Time diagrams of such SRR output signals are also presented. The modulation pulse parameters and gating parameters, their interposition in time are defined in the synchronization unit. At the same unit, the synchronization of pulse modulation processes and FM is provided. The radiation reflected from a target inside of each radio pulse causes the amplitude and frequency variations due to the autodyne effect as well as the bias voltage variations after time T later on the beginning of the radio pulse formation. The amplitude variations are usually extracted by means of the additional (external) detector, but the bias voltage variations in the oscillator supply circuit. [C3750]

"Radar sensor for remote control of track occupancy and railway cars speed"

The results of development of low cost radar sensors for remote control of track occupancy and railway cars' speed over the territory of hump yards under heavy weather conditions are presented. The radar sensor feature is application of autodyne transmitting-receiving module for linear frequency modulation and digital systems for forming sounding signal and spectral processing of received signals. Sensor is equipped with the systems of remote control and transmission of radar and service information to the control point. [C3751]

"Upper bounds on processing loss for wideband, long-CPI space-time adaptive processing"

The combination of synthetic aperture radar (SAR) and space-time adaptive processing (STAP) for moving target indication (MTI) radar applications allows the use of long, potentially sparse arrays, wide bandwidths, and long coherent processing intervals (CPIs), all of which enable detection of a greater variety of targets than is possible with traditional systems. In this paper, upper bounds on the signal-to-interference-plus-noise (SINR) loss are derived for post-SAR processing in the presence of three types of impairments: internal clutter motion, volumetric clutter, and antenna backlobes. These bounds are important for both the design and assessment of this type of MTI system, as impairments such as these can influence the entire system architecture. [C3752]

"On the analysis of peak-to-average power ratio of Wavelet Packet Modulation"

Wavelet Packet Modulation (WPM) is a novel multicarrier modulation technique and a promising alternative to the well established OFDM. A major drawback of multicarrier systems is their high peak-to-average power ratio (PAPR). In this paper, we study the PAPR performances of WPM systems. The novelty of the work is in the investigation of the stochastic of the WPM signals and influence of the waveshapes properties on their PAPR performances. Several well-known wavelets such as Daubechies, Symlets, Coiflets, Discrete Meyer and biorthogonal wavelet are applied. The results of this research show how these wavelet-based systems cope with PAPR. [C3753]

"Sub-nanosecond pulse generator for through-the-wall radar application"

This paper presents a sub-nanosecond pulse generator intended for a transmitter of through-the-wall surveillance radar. The basis of the generator is a step recovery diode, which is used to sharpen the slow rise time edge of an input driving waveform. A unique pulse shaping technique is then applied to form an ultra-wideband Gaussian pulse. A simple transistor switching circuit was used to drive this Gaussian pulser, which transforms a TTL trigger signal to a driving pulse with the timing and amplitude parameters required by the step recovery diode. The maximum pulse repetition frequency of the generator is 20 MHz. High amplitude pulses are advantageous for obtaining a good radar range, especially when penetrating thick lossy walls. In order to

increase the output power of the transmitter, the outputs of two identical generators were connected in parallel. The measurement results are presented, which show waveforms of the generated Gaussian pulses approximately 180 ps in width and over 32 V in amplitude. [C3754]

"LiDAR-guided analysis of airborne hyperspectral data"

This paper describes a new framework to the collection and fusion of multisensor airborne LiDAR and hyperspectral data. We describe a data fusion philosophy that provides a spatially precise positioning of hyperspectral data based on discrete first and last return LiDAR data. Three dimensional objects defined by the LiDAR data are then used to sample optimal spectra for subsequent analysis. The sampled spectra retain their positioning metadata and so can be mapped back into geographic space for further analysis. While the paper presents this philosophy within the context of a species classification, other analytical analysis can be performed. [C3755]

"Investigating the use of GPU-accelerated nodes for SAR image formation"

The computation of an electromagnetic reflectivity image from a set of radar returns is a computationally intensive process. Therefore, the use of high performance computing is required to form images from radar signals in a short time frame. This paper explores the use of distributed memory cluster computers and accelerator technologies such as GPUs for radar signal analysis applications, particularly backprojection image formation. We obtain good results with the use of GPUs and compare their performance in terms of execution time with distributed memory cluster computers. When using a configuration with 4 GPU-accelerated nodes, we achieve speedups up to 3.45x for different input and output data size combinations. [C3756]

"Study of amplitude fluctuation spectrum of geostationary satellite signals"

The possibility for using geostationary satellite signals to determine hydrometeors parameters has been examined. The method description and experimental results from the analysis of main forms of hydrometeors such as clouds, rain- and snow-falls are presented. The conclusions about the environmental safety and possibility of extensive use of the method have been made. This method is applicable to warning of different hazardous events. [C3757]

"Subsurface object detection using UWB Ground Penetrating Radar"

Ultra wideband (UWB) ground penetrating radar (GPR) has been widely used in the detection of buried unexploded ordnance (UXO), particularly for small and/or shallow objects. Detecting subsurface objects from a weak reflection signal against strong clutter from GPR data is an important problem. A detection method which employs principal component analysis (PCA) and digital image processing techniques is proposed in this paper for clutter reduction in underground object location. The proposed method can robustly indicate not only the regular hyperbolas but also the perturbed slant lines as a result of buried objects. Experimental data collected using an UWB GPR system is used to demonstrate that the proposed methods are effective in reducing clutter and detecting subsurface targets. [C3758]

"High order statistic receiver applied to UWB radar"

To enhance road safety, many studies have been carried out on on-board collision avoidance system. The goal of these systems is to keep the vehicle at a safe distance from any obstacle in front of it. This paper deals with study of a collision avoidance system based on radar techniques which employs a new technology called ultra wide band (UWB). The exploit of this technology for the radar makes it possible to have a very good precision and a capacity to detect several obstacles at the same time and even to make the difference between them thanks to their signature and all that with low powers so low energy consumption. This paper presents a detection method of road obstacles using high order statistics (H.O.S.). The main advantage in this application is to decrease the noise effect and to enhance the detection performances comparing to the classical correlation. [C3759]

"A study on application of wavelets and filter banks for Cognitive Radio spectrum estimation"

Spectrum sensing is important in cognitive radio (CR). Accuracy and speed of estimation are keys to select appropriate spectrum sensing technique. Conventional spectrum estimation techniques based on short time Fourier transform suffer from familiar problems such as low frequency resolution, large variance of estimated power and large side lobes. In this article, the possibility of employing wavelet packet decomposition for new spectrum sensing is investigated. In order to investigate the performance of the proposed approach, four types of sources (transmitters) are used, namely partial band, single tone, multi tone and swept tone. To simulate the

temporal dynamics in CR, a special kind of source called swept tone source is devised. The novelty of this work relates to the development of wavelet packet decomposition using filter bank approach as a new spectrum sensing tool recommended for CR. The results of this study show that the wavelet based spectral estimation is a promising technique for CR applications. [C3760]

"High-resolution spectrum estimation for non-coherent source location using the multi-frequency virtual correlation matrix"

We explain how multiple frequencies can be used to extend the capabilities of the spectrum estimation method for high-resolution location of multiple non-coherent point sources. The techniques covered in this paper are MULTiple Signal Classification (MUSIC), Autoregressive (AR) spectrum estimation and Capon minimum variance spectrum estimation. Our approach uses coarray equivalence to construct a virtual correlation matrix with larger size than the correlation matrix that is directly obtainable from the physical array. The larger dimension of the virtual correlation matrix allows for more point sources to be resolved when the spectrum estimation methods are applied. This method will prove to be useful in situations where the number of antenna elements must be limited, but there are many sources. [C3761]

"A 60GHz LC-VCO module using flip-chip on a laminate substrate"

For emerging mm-wave consumer applications such as high data-rate wireless communications at 60GHz and car radar at 76-81GHz, it is important to investigate the impact of module assembly on IC performance. Flip-chip is a promising candidate to meet requirements like low reflections, low insertion loss and low costs for mm-wave applications. This paper addresses the design, modeling and evaluation results of a 60GHz LC-VCO module using flip-chip. The impact of the substrate on on-chip CPW transmission lines and spiral inductors is studied based on the performance of a 60GHz LC-VCO. Since the inductor is part of the VCO resonator, a remarkable 10% increase in oscillation frequency occurs due to the nearby top-metal layer of the substrate. The IC is realized in a 0.25μm SiGe BiCMOS process. The 0.44mm thick substrate offers four copper signal layers. [C3762]

"Reconstruction of physiological signatures from synthetic biomedical ultra-wideband signals"

To understand the reflection signals generated by probing the human thorax with an ultra-wideband radar, an analytical model is derived. This model considers ideal antennas and propagation in a closely approximated stratified arrangement of the thorax. It also accounts for the dispersive behavior of the dielectric properties of the different biological tissues. To model physiological processes intra-thoracic layer variations mimicking myocardial deformation and respiration are mimicked. The reconstruction of these displacements are compared with reference signals for the ideal case. By incorporation of measured antenna transfer functions an approximation towards real conditions was investigated. [C3763]

"Highly integrated and solderless LTCC based C-Band T/R Module"

This paper describes a C-Band T/R Module (TRM) developed by Thales Alenia Space Italia as element of the Electronic Front-End (EFE) for Synthetic Aperture Radar (SAR) antenna developed for Sentinel-1 Program under the responsibility of the European Commission and the European Space Agency in the frame of the Global Monitoring for Environment and Security (GMES). TRM includes Power and Low Noise amplification as well as phase and amplitude control in order to realize different radiation patterns in active antenna in TX operation and processing of received signal in RX operation. A calibration path and a temperature sensor are also implemented inside the module. The above mentioned functions are implemented using MMIC technology. In particular the phase / amplitude control is implemented through an highly integrated solution (Core-Chip) inside the TRM. In transmission mode the TRM is able to provide an output power in excess of +42 dBm (15.85 W) whereas in receiving mode a gain in excess of +41.3 dB with +3.5 dB associated Noise Figure has been measured. HPA and Driver MMIC have been manufactured with PPH25X process from UMS whereas LNA and LLA have been developed using PH25 UMS process. The integrated Core-Chip has been manufactured using the ED02H OMMIC process. The full TRM has been realized in ISP (Integrated Substrate Package) technology based on Low Temperature Cofired Ceramic (LTCC) substrate to improve integration factor and have a reduction of the overall size. [C3764]

"Microwave tomography for GPR diagnostics of reinforced concrete"

In recent years, innovative strategies such as inverse-scattering or data fusion have been suggested for the processing of GPR datasets in complex scenarios. In this framework, high-resolution concrete inspections are a challenge regarding the treatment of radar data because of the size of the datasets and the complex structures involved. In addition, the achievable depth of inspection is in many cases restricted to unacceptable limits

because of the material properties of concrete and the "masking effect" of the upper layers of rebar. Thus, the application of innovative approaches to high-resolution concrete data seems to suggest itself. In this framework, this work deals with the processing of a high-resolution, dataset acquired on a concrete retaining wall via an inverse scattering technique. In particular, we show how the adoption of a strategy based on signal processing techniques and an inverse scattering approach is able to provide the mapping of the two layers of rebar. [C3765]

"Highly integrated and solderless LTCC based C-band T/R module"

This paper describes a C-Band T/R Module (TRM) developed by Thales Alenia Space Italia as element of the electronic front-end (EFE) for synthetic aperture radar (SAR) antenna developed for Sentinel-1 Program under the responsibility of the European Commission and the European Space Agency in the frame of the global monitoring for environment and security (GMES). TRM includes power and low noise amplification as well as phase and amplitude control in order to realize different radiation patterns in active antenna in TX operation and processing of received signal in RX operation. A calibration path and a temperature sensor are also implemented inside the module. The above mentioned functions are implemented using MMIC technology. In particular the phase/amplitude control is implemented through an highly integrated solution (core-chip) inside the TRM. In transmission mode the TRM is able to provide an output power in excess of +42 dBm (15.85 W) whereas in receiving mode a gain in excess of +41.3 dB with +3.5 dB associated noise figure has been measured. HPA and Driver MMIC have been manufactured with PPH25X process from UMS whereas LNA and LLA have been developed using PH25 UMS process. The integrated core-chip has been manufactured using the ED02H OMMIC process. The full TRM has been realized in ISP (integrated substrate package) technology based on low temperature cofired ceramic (LTCC) substrate to improve integration factor and have a reduction of the overall size. [C3766]

"Waveform diversity in distributed radar"

The desire to anticipate actions before they occur is a goal within the military. Cognitive sensor and communications systems along with distributed radar systems are key enablers to meet this need. Close in sensing examples are provided showing the value of waveform diversity in distributed radar. The use of waveform diversity presents a challenge to the electromagnetic compatibility (EMC) community. [C3767]

"Estimating temporal multipath via spatial selectivity: Building environmental knowledge into waveform design for radar-embedded communications"

We consider the problem of embedding a communications signal into the backscatter induced at an RF tag/transponder by pulsed radar illumination given the competing constraints of high data rate and low probability of intercept (LPI). In this work spatial selectivity is addressed as a means to provide lower intercept probability without sacrificing data rate or receiver error performance. Here spatial selectivity is achieved by incorporating the forward scatter (i.e. multipath) effects between the radar and tag into the information-bearing embedded communication waveform intended for reception at the radar. The multipath is incorporated via a time reversal framework thereby enabling spatial focusing which inhibits interception by an eavesdropper. The focus of this paper is upon the accurate estimation of the multipath given that prior knowledge of the transmitted radar waveform may not be available. [C3768]

"Packaging technologies for highly integrated 77 GHz automotive radar sensors"

The availability of SiGe with transit frequencies exceeding 200 GHz enables highly integrated and cost effective 77 GHz radar sensors for automotive applications. A major challenge for future radar generations is the development of an appropriate packaging technology. We propose a system in package approach (SIP) utilizing a SMD package without external 77 GHz connections. Beamforming is possible with dielectric lenses permitting the use of this modular concept in different automotive applications. [C3769]

"CW radar based vital signs detection"

This paper sets up to discuss further development of continuous wave (CW) radar based living bodies' vital signs detection methods. The paper summarizes experimental results obtained with proposed CW radar configurations for vital signs detection and ranging. [C3770]

"A multi-channel Rx for 76.5GHz automotive radar applications with 55dB IF channel-to-channel isolation"

A multi-channel RX for automotive radar applications at 76.5 GHz is presented. The chip uses a LO input signal at 38.25 GHz which is multiplied on chip. The single-ended IF outputs show a noise density of -143 dBm/Hz at

100 kHz with a typical conversion gain of 18 dB. The large signal IF channel-to-channel isolation is > 55 dB. The 14 mm² chip consumes 520 mA from +3.3 V supply in a 200 GHz fT_{SiGe} BiCMOS process. [C3771]

"Title page"

The following topics are dealt with: radioengineering research; microwave amplifiers; oscillator; receive devices; solid state devices; CAD/CAM; O-type microwave devices; DRO microwave devices; M-type devices; gyrodevices; wireless access networks; telecommunication systems; information technologies; antenna arrays; antenna elements; passive devices; microstrip devices; SHF-devices; semiconductor materials technology; microwave microscopy; nanotechnology; nanomaterials; nanoelectronics; quantum devices; very high power microwave electronics; chaotic oscillations; chaos generators; microwave devices measurement; microwave signals measurement; technological processes control; nondestructive testing; ecological applications; medical applications; radioastronomy; atmosphere research; remote sensing; and radar systems theory. [C3772]

"Reduced-rank STAP algorithm for adaptive radar based on basis-functions approximation"

In this paper, we develop a novel reduced-rank space-time adaptive processing (STAP) algorithm based on adaptive basis function approximation (ABFA) for airborne radar applications. The proposed algorithm employs the well-known framework of the side-lobe canceller (SLC) structure and consists of selected sets of basis functions that perform dimensionality reduction and an adaptive reduced-rank filter. Compared with previously reported reduced-rank techniques, the proposed scheme works on an instantaneous basis, selecting the best suited set of basis functions at each instant to minimize the squared error. Furthermore, we derive a recursive least squares (RLS) algorithm for efficiently implementing the proposed ABFA scheme and compare the computational complexity with existing algorithms. Simulations for a clutter-plus-jamming suppression application show that the proposed STAP algorithm outperforms the state-of-the-art reduced-rank schemes in convergence speed and tracking performance at significantly lower complexity. [C3773]

"Estimation of SAR signals compression time using different processing methods"

The investigation included computing experiments of processing of phantom, laboratory and real radioholograms using direct convolution, fast convolution and harmonic analysis. It was found that the processing time was determined not only by the number of operations, but also by the technique of program realization, and it had to be taken into account while determining the requirements to both on-board and groundbased computing systems. [C3774]

"Game-theoretical synthesis of antijamming system of nonlinear radiolocation"

The results of a research of immunity of systems of nonlinear radar with the application of mathematical apparatus of games theory are presented. The optimal game algorithms of a behavior of nonlinear radiolocation under the interference attack with different characteristics are found. [C3775]

"Registration of LiDAR data through stable surface matching"

The accuracy of final LiDAR points on ground depends on various factors including GPS/IMU position and orientation, laser range and scan angle measurements. As a result, the adjacent overlapping swaths or flight strips fail to match with each other. Surface matching is a common procedure used to relatively register the LiDAR data and reduce the mismatch between the overlapping strips. However, in case of smooth topography with fewer features, classical registration algorithms render poor results. This paper presents a modified registration technique for the optimal relative registration of LiDAR data over a flat terrain with fewer features. In this method, the feature samples used in the algorithm are selected depending on their geometric stability. The points from overlapping strips are matched through iteratively closest point (ICP) method based on minimizing point to plane normal distance. [C3776]

"Wireless interrogation techniques for a passive pressure micro-sensor using an EM transducer"

In this communication, the new and latest results relative to an original passive electromagnetic micro-sensor for wireless pressure monitoring application are presented. This micro-sensor uses the electromagnetic transduction principle. The sensing element is a flexible high resistivity silicon membrane located above a coplanar quarter-wavelength resonator operating in Ka-band. From the measurement of the resonant frequency the pressure applied on the membrane can be derived. This completely passive and wireless pressure telemetry micro-sensor has been designed, fabricated and characterized, thereby eliminating the need for contact, signal processing circuits, or power supplies to be contained within the sensor. Measurement results under real working conditions, obtained from a specific RF/pressure bench are reported and reveal a very good sensitivity of 370 MHz/bar in

Ka-band. Moreover, for the first time, we propose to use a frequency-Modulated Continuous-Wave (FMCW) radar system for the remote determination of the pressure data via the electromagnetic micro-sensor. This attractive concept of radar interrogated micro-sensor based on electromagnetic transducer is discussed and illustrated. [C3777]

"Ultra-wideband frequency modulated continuous wave synthetic aperture radar for through-the-wall localization"

In this paper we present the development and preliminary results of an ultra-wideband frequency modulated continuous wave (FMCW) through-the-wall (TTW) radar prototype built at ONERA in Toulouse, France. The radar operates between 0.5 and 8 GHz in three possible subbands: 0.5-2 GHz, 1-4 GHz or 2-8 GHz depending on the type of wall. The radar has been successfully tested in free space and trials with a cinder block wall are on going. [C3778]

"Identification of sand dredges in Yangtze River based on ASAR remote sensing data"

This paper wants to explore a key technique of identifying and locating the sand exploitation ships using ASAR images. Chenglingji of Yangtze River is selected as the research region. One software module was developed with the IDL (Interactive Data Language) which is a facing matrix, simple visual language. This paper researches on some key techniques based on ASAR images such as filtering and noise reduction, the process of image based on morphology, edge detection, region growth, extraction of ship's shape feature and so on. Comparing with the field monitoring results, this method can achieve 80%-90% accurateness. [C3779]

"A 60GHz LC-VCO module using flip-chip on a laminate substrate"

For emerging mm-wave consumer applications such as high data-rate wireless communications at 60 GHz and car radar at 76-81 GHz, it is important to investigate the impact of module assembly on IC performance. Flip-chip is a promising candidate to meet requirements like low reflections, low insertion loss and low costs for mm-wave applications. This paper addresses the design, modeling and evaluation results of a 60 GHz LC-VCO module using flip-chip. The impact of the substrate on on-chip CPW transmission lines and spiral inductors is studied based on the performance of a 60 GHz LC-VCO. Since the inductor is part of the VCO resonator, a remarkable 10% increase in oscillation frequency occurs due to the nearby top-metal layer of the substrate. The IC is realized in a 0.25 μm SiGe BiCMOS process. The 0.44 mm thick substrate offers four copper signal layers. [C3780]

"Design of binary sequences and matrices for space applications"

In this paper, we present a new iterative algorithm for designing binary sequences with good properties in terms of aperiodic autocorrelation function. The algorithm has a low complexity, growing linearly with the sequence length, and allows improvements with respect to best known sequences, especially for large lengths. First, we show its application to the design of long markers for frame synchronization. In particular, new markers with length 128 and 192 bits are generated and evaluated, showing consistent improvements with respect to current markers used by CCSDS Recommendation for turbo code synchronization at very low SNR. Then, the proposed technique is applied to the design of binary arrays with small values of peak side lobes, as required by various communication and signal processing applications, including radar. [C3781]

"Localization in 3D environments using differential, evolution"

It is necessary to determine the robot's pose to localize a mobile robot in a known environment. If there is no information about the initial location, we are talking about global localization. In our previous work we solved this problem in a two-dimensional environment with an algorithm known as Evolutive Localization Filter (ELF). Based on evolutionary computation concepts, the proposed algorithm searches stochastically along the state space for the robot's best pose estimate. In this paper we have improved our method designing an algorithm with new features, called ELF-3D, that uses three-dimensional sensorial information. The resulting global localization module has been tested in a simulated indoor environment. The most important improvement obtained is the accuracy of the method, allowing to apply it in manipulation tasks. [C3782]

"Imaging of behind the wall targets using wideband beamforming with compressive sensing"

Through-the-wall radar imaging (TWRI) is a versatile application which demands the collection and processing a large number of data, both along the spatial and frequency dimensions. Compressive sensing (CS) is an attractive approach for reducing the number of data samples, without a significant degradation of the original image that is generated using the full array aperture and frequency band. In this paper, we apply CS technique

to TWRI using well known Fourier-like matrices. The proposed method applies CS independently to the data samples of the radar returns of each antenna location. It then incorporates the results into the delay-and-sum beam-forming to provide a through-the-wall radar image. Simulation results show that the proposed method can provide a high-quality radar image using less than 20% of the data samples. [C3783]

"Single channel all digital direction finding system"

Direction finding system can be utilized in radar, in sonar in order to find the Direction Of Arrival (DOA) of signal of interest for the purpose of positioning sources. Conventional direction finding system employs multi-antenna elements or by single switched antenna followed by digital or analogue receivers and a digital signal processing block. We propose in this paper, a robust single channel direction finding system devoted to radar or sonar. The proposed solution is based on a switched antenna associated to a special all digital receiver architecture that allows us to digitalize directly RF signals with low sampling frequency. The proposed system takes advantages of single antenna element instead of multiple antenna ones, of all digital receivers in terms of digital signal processing and of low-cost of implementation thanks to its low sampling frequency. The novel architecture is modelled and simulated for the test of its performance through the DOA estimate of signal of interest by employing a super-resolution algorithm. [C3784]

"The Central DOA Estimation Algorithm for Multiple Coherently Distributed Sources"

We consider the problem of estimating the central direction of arrival (DOA) of multiple coherently distributed sources. This problem is encountered due to the presence of local scatters in the vicinity of a transmitter or due to signals propagating through a random inhomogeneous medium. Since the integral steering vector of coherently distributed source can be deduced to be a Schur-Hadamard product comprised of point source steering vector and a real vector, a rotational eigenstructure is showed to exist accurately for two identical closely spaced subarrays. And then the central DOA can be obtained analytically without any peak-finding searching, which significantly reduces the computational complexity. In addition, the proposed algorithm needs little prior knowledge about angular signal intensity. The simulation results illustrate the better performance of the proposed method. [C3785]

"Close range impulse radio beamformers"

Beamforming electromagnetic waves, especially at close range, is challenging. Extremely accurate control of phase/timing is required. In this work we present a digital programmable delay-line suited for transmission beamforming using multiple senders. Back-gate tuning of inverter delays are measured to give relative temporal tuning in the range of 1.1 ps. [C3786]

"Target detection metrics and tracking for UWB radar sensor networks"

A radar sensor network (RSN) is a wireless network system, typically composed of one transmitting (TX) node and several receiving (RX) nodes, aimed at detecting and tracking an intruder (target) moving within a given surveillance area. In this paper, RSNs based on impulse radio ultra-wideband (UWB) are investigated. In the considered system, at each scanning each RX node calculates a soft image of the surveillance area based on the target-scattered UWB pulses. All images are then transferred to a fusion node where the decision about target presence or absence is taken. Optimum decision metrics and likelihood tests are developed, together with approximated metrics reducing the complexity of the detection block. Moreover, it is illustrated how the soft images produced by the RX nodes may be effectively exploited by tracking algorithms relying on Bayesian filters. [C3787]

"Ultra compact filters for ultra-wideband (UWB) applications using multilayer ring resonators"

Novel compact ultra-wideband (UWB) bandpass filters are proposed. It is based on multilayer ring resonators (MRR). The ring is applied to any loop shape. The filter has a simple structure for fabrication and the design technique can be adapted in order to realize both narrowband and ultra-wideband filters. With the MRR, filters of bandwidths in excess of 10 GHz while enjoying a wide stop-band can be designed. The fractional bandwidth of more than 143% and a group delay of less than 0.2 ns are achieved with this class of filters. Also, in this class of filters, it is easy to place the attenuation poles in order to fit a requirement. Due to its small circuit size (around 2 mm in each dimension), this filter can be used in hybrid integration with small UWB, WLAN and radar devices. Since the filter is located within two ground planes, no radiation affects its characteristics. Two types of the proposed UWB filters were fabricated and the measurement verified the theory and simulation. [C3788]

"Radar and data communication fusion with UWB-OFDM software-defined system"

This paper describes the architecture, testing methodology and experimental results of the software-defined ultra-wideband system built at Miami University. To achieve broadband data communication capability, spectrum-efficient OFDM method of modulation was chosen. The radar functionality using the same OFDM-coded pulses was implemented as well, and tested in short-range experiments. The system operates in X-band with a total transmit bandwidth of 1 GHz. Range resolution of 0.30 meters and data communication capability at approximately 57 Mb/s were established and the system was shown to be able to operate in either mode without any hardware adjustments. This concept may prove extremely useful in high-resolution radar sensor network scenarios. [C3789]

"Order-adaptive frequency trackers for direct-to-Earth Mars communications"

During the entry, descent and landing phase (EDL) of the missions to Mars, the spacecraft's high dynamics imprints severe Doppler swings on the signals transmitted via the direct-to-Earth (DTE) channel. In order to recover the data that record the mission status from the received signal, a reliable estimate of the Doppler profile is required. We extend previous work by developing order-adaptive schemes that enforce frequency continuity and improve tracking performance and, as a result, the overall frequency mean-square error as well. [C3790]

"Design and Implementation of a Weak Signal Detecting System Based on LabWindows"

Detecting weak periodic signals is widely used in radar, communication, sonar, earthquake and industrial measurement. Generally, the weak signal detection needs special equipments, such as phase sensitive detector and demodulation module, and requires the user to operate and process the receiving data. The article designs and implements a weak signal detecting system, which can detect high frequency near-field signal automatically using universal test equipments and without users' intervention. Furthermore its effect is demonstrated by detecting a periodic weak signal radiated from certain electronic equipment. The detecting system designed in this article can detect a signal of only several microvolts in a range of twenty centimeters. [C3791]

"Mobile Assisted Language Learning in a Developing Country Context"

Mobile learning has significant potential to be very influential in developing countries. Because of its ubiquitous nature and comparatively low cost, the mobile phone system appears to be the most practical way of delivering m-learning for the foreseeable future. Mobile learning with its any time/place/pace learning will conveniently accommodate different modes of language learning for different groups of learners. In this study, three different educational environments have been utilised for Iranian language learners. Government employees received continuous refreshment of their language skills in a non-formal mode using a combination of mobile Web and short messaging. Two mobile games have been designed, which served as a platform for exercises, assignments and self-study in combination with schools and higher education. These games have shown that they can motivate the learners using an informal setting. Learners develop their knowledge whilst they perform in a pleasant virtual world in order to achieve the goals proposed. The paper concludes that using m-learning within the informal framework of learning provides a ubiquitous tool that can powerfully help adult learners and students in Iran during their continuous lifelong learning. [C3792]

"Accumulating a Personalised Ubiquitous Learning Platform for Enhancing the Third Level Educational Experience"

This paper describes a personalised, single-supported mobile learning environment for University College Dublin that aims to provide efficient learning content delivery and promote constructivist learning anywhere, anytime to third level students. The system will offer accessibility via desktop computer and mobile devices; interactive tool; personalised interface; reusability of learning objects; recommendation of available educational resources and similar peers. [C3793]

"Approach for Name Ambiguity Problem Using a Multiple-Layer Clustering"

Name ambiguity refers to the problem of attributing a publication to a proper author. This is a common issue in digital library. It is a difficult problem as the same author's name may be written in different ways and different authors may share the same name. In this paper, we examine a multiple-layer clustering approach which is based on a limited amount of associated information with each publication. It combines the Package-Merge algorithm, pattern-matching extraction methods, as well as a fuzzy logic rule based concept. This experimental study uses the DBLP collection as a case study, and the three attributes used are email addresses, the co-authorship relationship and paper title similarity. Our experiments show that this approach can distinguish authors and classify papers on the test dataset more accurately than the previous studies. [C3794]

"Emerging Trends in Persistent Surveillance Information Fusion"

Recent data collections in video and signals collection such as Electro-optical/Infrared video, synthetic aperture radar (SAR), and Hyperspectral (HSI) data afford persistent surveillance. As the rate of the imagery (or other products such as 3D terrain modeling) becomes available, there is a greater need for data exploitation to support and augment user needs for situational awareness. The presentation will focus on (a) emerging technologies, (b) tools and processing needs for the user, and (c) developments for persistent surveillance performance analysis. Standard methods of image processing and imagery collection have been accelerated based on the availability of emerging products such as Unmanned Aerial Vehicles (UAV) technology, traffic monitoring systems, and security products. Each of these systems require coordination over varying resolutions, distributed networks, and graphical interfaces. The sensor coordination in the system network enables surveillance over persistent coverage. Persistent surveillance implies that the information processed is to report the results to a user. Surveillance systems can report situational awareness results of target tracks and identifications, anomalies, and target behaviors. Focus should be placed not only on the processing, but include an interactive user to control the collections, determine priorities for the video processing, and support exploration analysis. Image processing, especially video, requires novel techniques to direct collections, process varying targets in complicated terrains, and efforts to evaluate the success. Evaluation includes assessing the performance over varying operation conditions (i.e. sensors, targets, and environments) to include obscurations, compression, and non-continuous data streams. Persistent surveillance coverage requires new techniques in image exploitation to include: (1) fusion with signals and database intelligence, (2) contextual modeling, and (3) tools for user interactive analysis. [C3795]

"Attention Manipulation for Naval Tactical Picture Compilation"

This paper discusses and evaluates an agent model that is able to manipulate the visual attention of a human, in order to support naval crew. The agent model consists of four submodels, including a model to reason about a subject's attention. The model was evaluated based on a practical case study which was formally analysed and verified using automated checking tools. Results show how a human subject's attention is manipulated by adjusting luminance, based on assessment of the subject's attention. These first evaluations of the agent show a positive effect. [C3796]

"Cross-ambiguity function of weighted pulse trains with Oppermann sequences"

The design of integrated radar and communication systems may be based on sets of polyphase sequences such as Oppermann sequences. In this paper, we derive an analytical expression for the cross-ambiguity function of weighted pulse trains with Oppermann sequences. Further, the auto-ambiguity function is deduced from this as a special case. Numerical examples are provided to illustrate the relationship between sequence parameters and performance characteristics. [C3797]

"Traffic Density Estimation with On-line SVM Classifier"

Information on the vehicular traffic density in an intelligent transport system (ITS) is presently obtained mainly through loop detectors (LD), traffic radars and surveillance cameras. However, the difficulties and cost of installing loop detectors and traffic radars tend to be significant. Currently, a more advanced method of circumventing this is to develop a sort of virtual loop detector (VLD) by using video content understanding technology to simulate behavior of a loop detector and to further estimate the traffic flow from a surveillance camera. Such a virtual loop detector that requires supervised training with human intervention for its setup. Difficulties also arise when attempting to obtain a reliable and real-time VLD under different illumination, weather conditions and static shadows. In this paper, we study the effectiveness of texture features in describing the traffic density, and propose a real-time VLD based on on-line SVM classifier and a background modeling technique (OSVM-BG) to estimate the traffic density information probabilistically and automatically. The system uses feedback from background modeling to train and update its SVM kernel to self-adapt to various lighting environments. Experimental results show that the system outperforms an existing algorithm and achieves an average accuracy of 89.43% under various illumination changes, weather conditions and especially changing static shadows in daytime. [C3798]

"Adaptive MIMO radar detection in non-Gaussian and heterogeneous clutter considering fluctuating targets"

Previously, the Generalized Likelihood Ratio Test-Linear Quadratic (GLRT-LQ) has been extended to the Multiple-Input Multiple-Output (MIMO) case where all transmit-receive subarrays are considered jointly as a system such that only one detection threshold is used. The new MIMO detector is Constant False Alarm Rate (CFAR) with respect to the clutter power fluctuations. In this paper, the adaptive version of this detector is

considered, as well as a fluctuating target model similar to that of the Swerling Target. The degradation of the detection performance due to the estimation of the covariance matrix and the fluctuation of the target is studied through simulations for both the well-known Optimum Gaussian Detector (OGD) and the new MIMO detector under Gaussian and non-Gaussian clutter. [C3799]

"Ultra-wideband rules in Canada and worldwide"

Canada introduced its domestic UWB rules in March 2009. Issue-1 of Radio Standards Specifications RSS-220 established provisions for the introduction and use of short-range UWB devices on a licence-exempt no-interference no-protection basis. This speech presents the Canadian UWB rules, and outlines similarities and differences with those of other countries (e.g.; US, Europe) and ITU-R recommendations. [C3800]

"Location-aware wireless networks"

The availability of positional information is of great importance in numerous commercial, health-care, public safety, and military applications. The coming years will see the emergence of high-definition location-aware (HDLA) networks with sub-meter accuracy, minimal infrastructure, and robustness in harsh environments. We propose to realize this ambitious goal using cooperative peer-to-peer algorithms. This talk will present a brief technical overview of our recent activities with particular emphasis on cooperative localization in wideband wireless networks from three points of view: fundamental performance bounds, cooperative algorithms, and experimentation. Fundamental bounds serve as performance benchmarks and as guidelines for network design. Cooperative algorithms will be designed to approach these bounds, resulting in dramatic performance improvements over traditional techniques. Experimentation will be used to determine important attributes of physical environments; these realistic models are necessary to obtain accurate bounds, to develop robust algorithms, and to validate their performance in harsh environment. [C3801]

"Challenges and opportunities in ultra-wideband antenna-array transceivers for imaging"

This paper discusses challenges in the monolithic realization of ultra-wideband (UWB) antenna-array transceivers for radar and imaging. A power-consumption comparison between an all-digital signal-processing approach and approaches that exploit analog pre-processing is provided. Architectures for the implementation of integrated, UWB, antenna-array transceivers for radar and imaging are then discussed. [C3802]

"On the significance of UWB wireless technology for industrial users"

While emerging ultra-wideband wireless technology is widely expected to play an important role in consumer products, its significance to industrial users may be even greater. UWBs role as an enabling technology for high speed data links that can operate in noisy environments, low power wireless sensor and building automation networks, and ground penetrating radar and through wall imaging will almost certainly change industrial users' perceptions of how wireless technology can be used to meet important business needs. In this presentation, we consider these needs in detail and the possible role of UWB technology in satisfying them. [C3803]

"A novel UWB radar 2-D imaging method with a small number of antennas for simple-shaped targets with arbitrary motion"

The study of UWB (ultra wide-band) pulse radar has attracted great interest in a variety of applications including surveillance systems. The high-speed SEABED (shape estimation algorithm based on BST and the extraction of directly scattered waves) imaging algorithm, is a promising candidate for the application of UWB pulse radar in fields that require real-time operation. However, since the SEABED algorithm uses signals received at multiple locations, it can only be used in systems with either array antennas or a mechanically-scanned antenna. Such systems are inevitably costly and unrealistic for applications such as surveillance. To overcome this problem, a revised SEABED algorithm was developed, which relies on the motion of the target instead of scanning an antenna. This imaging method works with only a pair of fixed antennas, even for a target with unknown shape and motion. The method cannot, however, be applied to arbitrary motion, because it assumes that the target is located on a straight line parallel to the baseline of the pair of antennas. In this paper, we extend the revised SEABED algorithm so that an accurate imaging can be achieved when applied to arbitrary target motion. [C3804]

"Close range hyperspectral and lidar data integration for geological outcrop analysis"

The use of spatial data collection techniques in geology has increased significantly in recent years, with methods such as laser scanning (lidar) becoming popular. However, the remote mapping of rock properties within the geological outcrops remains a major challenge. This study develops a workflow for combining and utilising ground based hyperspectral and laser scanning data. This workflow is presented for two case studies, each with

different geological settings and mineral composition. Multiple hyperspectral and lidar scans were acquired to gain both spectral and geometric data. Mixture Tuned Matched Filtering was utilised to extract and map geological features from the spectral images, resulting in thematic images. This combination of geometrically accurate lidar data and spectral mapping of lithology has significant implications for the improved collection of geological data. [C3805]

"Hyperspectral data analysis of nitrogen fertilization effects on winter wheat using spectrometer in North China Plain"

This article presents results from hyperspectral analysis for winter wheat (*Triticum Aestivum* L.) in the North China Plain during a research study in 2006. In the first part the focus was set on canopy spectral reflectance during the vegetation period under different N supplies. Four different experiments with variable N-inputs and winter wheat cultivars were set up in the study area of Huimin County, Shandong Province. Spectral reflectance data and agronomic data like biomass, plant height, N-uptake and LAI were collected at different phenological stages. In the second part of the study a spectral and agronomic library was set up. For this purpose, spectral reflectance was related to agronomic parameters. The results indicated significant difference in spectra characteristics, cultivars and N-inputs. Vegetation indices like NDVI, HNDVI, RVI, HVI, OSAVI and MCARI2 had the best performance in estimating agronomic parameters among the vegetation indices evaluated. [C3806]

"Design and application of dielectrically scaled double-ridged horn antennas for biomedical UWB radar applications"

Ultra-wideband sensing begins to play an important role in biomedical diagnostic systems. Promising and relevant applications include remotely monitored vital functions as well as the characterization of tissues and organs. The acquisition of such physiological signatures requires small and radiation-efficient antennas, designed for ultra-wideband frequency operation. We have developed physically small and adjustable double-ridged horn antennas with which we could demonstrate the specific advantages of miniaturized, dielectrically matched sensor elements in a direct mode compared to remote sensor applications. As a logical consequence of these results, we have considered to replace the lossy high-permittivity liquid by low-loss high-permittivity solid ceramic material to improve the degree of miniaturization and the radiation efficiency further. Some unexpected peculiarities related to this approach are discussed. [C3807]

"Multimodal biomedical sensing applying ultra-wideband electromagnetic excitation: Ultra-wideband sounding of the human myocardium from different radiographic standard positions and simultaneous high resolution electrocardiography"

To understand how myocardial mechanic is rendered by reflected and post-processed ultra-wideband radar signals, we have executed the simultaneous acquisition of radar signals with a high-resolution electrocardiogram. The ultra-wideband illumination was done from several radiographic standard positions to monitor selected superficial myocardial areas during the cyclic physiological myocardial deformation in three different respiratory states. From our findings we could conclude, that UWB radar can serve as a navigator technique for high and ultra-high field magnetic resonance imaging and can be beneficial preserving the high resolution capability of this imaging modality. [C3808]

"Photonic generation and envelope detection of millimeter-wave ultra-wideband impulse-radio employing Mach-Zehnder modulators"

The photonic generation of millimeter-wave impulse-radio ultra-wideband (UWB) signals is proposed and experimentally demonstrated. Impulse-radio UWB monocycles at 16.85 GHz with 5 GHz bandwidth and bearing data at 1.244 Gbit/s are generated. The frequency up-conversion is performed by a Mach-Zehnder electro-optical modulator (MZM) and the monocycle shaping is achieved after photodetection based on an amplifier with polarity-inverted outputs and further delay. The technique is suitable for simultaneous vehicular short-range radar and communications in the 24 GHz band and communications in other bands. Adequate photonic reception stage employing a MZM is also proposed and demonstrated achieving good quality. [C3809]

"A Bayesian approach to respiration rate estimation via pulse-based ultra-wideband signals"

In this paper, theoretical limits on estimation of respiration rates via pulse-based ultra-wideband (UWB) signals are studied in the presence of prior information about respiration related signal parameters. First, a generalized Cramer-Rao lower bound (G-CRLB) expression is derived, and then simplified versions of the bound are obtained for sinusoidal displacement functions. In addition to the derivation of the theoretical limits, a two-step suboptimal estimator based on matched filter (correlation) processing and maximum a posteriori probability

(MAP) estimation is proposed. It is shown that the proposed estimator performs very closely to the theoretical limits under certain conditions. Simulation results are presented to investigate the theoretical results. [C3810]

"An MHT algorithm for UWB radar-based multiple human target tracking"

This paper presents a multiple hypothesis tracking (MHT) framework for tracking the ranges and velocities of a variable number of moving human targets via a mono-static ultra-wideband (UWB) radar. The multi-target tracking (MTT) problem for UWB radar-based human target tracking differs from traditional applications because of the multitude of observations (multipath scattering) per target in each scan, due to the short spatial extent of the transmitted UWB signal pulse width. We develop an MHT framework for UWB radar-based multiple human target tracking that extends a previously studied human tracking algorithm. We present experimental results in which a monostatic UWB radar tracks both individual and multiple human targets, even with changing numbers of targets across radar scans. [C3811]

"A feasibility study on aortic pressure estimation using UWB radar"

Microwave radar based techniques have been proposed for medical applications such as heart beat and respiration monitoring, and for breast cancer detection. This paper investigates the feasibility of using microwave radar techniques to estimate aorta diameter variations. A survey of relevant medical literature shows that the aorta diameter variations can be used to estimate aortic compliance, pulse pressure and mean pressure. [C3812]

"A 2 pJ/bit pulsed ILO UWB transmitter at 60 GHz in 65-nm CMOS-SOI"

The paper describes a 2 pJ/bit transmitter with 1.5 Gbps data rate with Pulsed Injected Local Oscillator (p-ILO) and 0 dBm peak output power that 0.16 mm² active area in 65-nm CMOS-SOI. Input digital pulses modulate the oscillator at 60 GHz from On to Off state. The occupation bandwidth is 7 GHz for a 300 ps modulating pulses. This millimeter wave output frequency oscillation is locked to one of the numerous harmonic components of the pulse generator synthesized around 60 GHz, which permits to obtain a stable pulse to pulse phase condition. Thanks to this very non linear injection using pulses switching, a super high order N harmonic injection is obtained. With a 500 MHz input pulse data rate ($N = 60 \text{ GHz} = 500 \text{ MHz} = 120$) the phase noise is -92 dBc/Hz at 100 KHz which is very close to the theoretical $20 \log(N)$ dB increasing phase noise. The peak conversion efficiency is more than 18 % and the maximum peak output power is 7 dBm. Output pulse waveform and phases are coherent with input modulated pulses, which make this transmitter suitable for Automotive Radar, Giga bit WLAN, Wireless Sensor Networks and localization. [C3813]

"Impulse based range-gated UWB wireless transceiver IC in 90nm CMOS for medical sensing applications and communications"

This paper presents a new impulse based ultra-wide band (UWB) transceiver system designed in 90 nm CMOS technology for UWB medical radar sensing and communication applications. The design is targeting for human heart motion detection and short range data communications. The transmitter is composed of a simple on-off keying (OOK) modulated impulse generator and a variable gain-controlled amplifier (VGA) at the transmitter. The generated pulse width can be adjusted. The receiver operating in the radar mode is composed of a simple low noise amplifier, a mixer, and an analog-to-digital converter operating in the radar mode. The range gate control design allows the receiver gather maximum power reflection from the objects within the expected range and minimizes the noise. The proposed impulse based UWB transceiver works under a 1.2 V power supply and the transmitter provides an output transmitting pulses of 300 mV to 50 Ω load. The fully integrated UWB transceiver occupies a core area of 0.3 mm². The transceiver works in UWB band of 3.1-6 GHz and consumes an average power of 5.32 mW and 12.69 mW for simulations of radar sensing and communications, respectively. [C3814]

"Feature based indoor mapping using a bat-type UWB radar"

A system for building a feature-based map of an unknown indoor environment is proposed. We consider emergency scenarios where smoke and dust block the vision so that camera-based systems and laser range finders are not operable. In this kind of situation, ultra-wideband (UWB) radar is a good alternative. We use a bat-type UWB radar system composed of one transmitter and two receivers arranged in a fixed linear array. Time-of-flight measurements are taken between the transmitter and the receivers. The environment is reconstructed from impulse responses by extracting information on different features like walls, edges and corners. These features can be used as landmarks to navigate. The solution we present works by dividing the problem into three different parts and solving them: Tracking of the bat pose and localization of already detected landmarks; data association to single out measurements originating from the detected landmarks; and detection of new landmarks from the remaining measurements. By combining solutions to these three subtasks, a

computationally cheap, precise algorithm for feature-based indoor mapping is obtained. Tests using real life data were performed to confirm the feasibility of the approach. [C3815]

"A linear quadratic optimization based TOA estimation scheme for IR-UWB systems"

This paper proposes an energy detection based time of arrival (TOA) estimation scheme for impulse radio ultra-wideband (IR-UWB) systems. The proposed scheme is composed of two stages in performing the TOA estimation: initial signal acquisition (ISA) and fine timing estimation (FTE). In the ISA stage, a linear quadrature optimization based weighting scheme is proposed to coarsely capture the arrival of the IR-UWB signals. Capitalizing on the acquisition of the IR-UWB signal in a relatively wide time range, this paper develops in the FTE stage a double-threshold based search back method tailored for locating the leading edge of the IR-UWB signal. Simulation results illustrate that the linear quadrature optimization based algorithm can effectively seize the arrival of the UWB signals and the double-threshold strategy significantly improves the TOA estimation accuracy in terms of mean absolute error (MAE) performance. [C3816]

"A simplified modeling of ultrawideband antenna time-domain analysis"

A simplified modeling of time-domain analysis for ultrawideband (UWB) antennas is proposed in this paper. Compared with the conventional model consisted of a pair of antennas, only one antenna is required for the analysis of UWB antenna time-domain characteristics in the proposed model. The same time-domain pulse response can be obtained from the two models, while the overall dimension of the proposed model is only a half of the former one. As a result, the time for simulation can be greatly reduced. The validity of the proposed model is discussed and proved by five typical compact UWB antennas. [C3817]

"Automotive active safety & comfort functions using radar"

Increase of safety and comfort is a main objective of car manufacturers as well as of their suppliers and a substantial distinguishing feature in the international competition. Active safety systems as well as driver assistance systems are becoming more and more important. They help to recognize dangerous situations at an early stage, and thus, help to avoid accidents or at least to reduce the accident severity, especially within the permanently increasing traffic density. Radar sensors play a decisive roll for the environment perception. After an introduction to the evolution of automotive systems, commonly implemented functions using radar will be discussed. Finally, as an example, the arrangement of the radar sensors in the new Mercedes-Benz E-Class and their role in the adjacent environment perception system-as a part of the safety and comfort functions-will be outlined. [C3818]

"Hybrid numerical scattering field analysis embedded into simulations of complex radio based systems-Examples, capabilities and limitations"

Navigation, radar and communication systems rely on radio signals. Objects in the vicinity of these systems can create distortions. This paper describes the advanced system simulation by the integrated scattering analysis by numerical methods and the adapted system signal processing. The simulation procedure and the criteria for a suitable method are described. Practical cases are outlined. [C3819]

"Calculation and Analysis of Typical Coastal Low-Tide Marks Based on Lidar Data"

Coastal Zone is the current research hotspot. But it is difficult to accurately designate the inter-tidal coastal zone because the low-tide mark is underwater for a long time and difficult to be established. Light Detection and Ranging (Lidar) can quickly, directly and accurately detect elevation information of real surface and ground; The high-resolution aerial image synchronously accessed with Lidar can notably present characteristics of, so it is convenient for accurately locating and extracting features; we can acquire the average tide difference of coastal zone according to years of tidal information. With the support of geographic information system and remote sensing technology, this paper establishes a model for extracting the low-tide mark based on Lidar data and the high-resolution aerial image simultaneous received. The main contents of the model are: (1) Extract the average high-tide mark and water-mark from the high-resolution aerial image in ArcGIS; (2) Generate DEM using Lidar data, and then derive gradients from the generated DEM. (3) Calculate the average tide difference according to tidal information. Finally, based on the above three parameters, reckon the projected average low-tide mark position. [C3820]

"A New Type of Automatic Ship Detection Method"

A new type of automatic ship detection algorithm is proposed in this paper. By determining whether the local area is heterogeneous, simplex two-parameter CFAR algorithm based on Gauss-distribution or both two-

parameter CFAR algorithm based on Gauss-distribution and two-parameter CFAR verification algorithm based on K-distribution are used to detect targets. This new type of algorithm keeps both the ability of traditional two-parameter CFAR algorithm' good features, such as small computation quantity, easy to implement and so on, and the detection accuracy in complex sea conditions at the same time. [C3821]

"The Properties and Stability Analysis of an Integrate-and-Fire Model"

In this paper, a simplified integrate-and-fire (IF) neural network is introduced. This network possesses lateral interactions of the shunting inhibitory type only; hence, it is also called shunting inhibitory cellular neural network. Its derivation and biophysical interpretation are presented in this article, along with a stability analysis of its dynamics. In particular, it is shown that the IF model is bounded input bounded output stable dynamical system. Two indices of firing variability are evaluated, which are the ratio of the variance to the mean for the number of action potentials evoked by a constant and a random stimulus respectively, and the rate coefficient of variation of the interspike interval (ISI) distribution (standard deviation / mean ISI). [C3822]

"Performance Evaluation of IMS-Based Push-to-Talk Service over Multiple Wireless Access Networks"

This paper evaluates the performance of IMS-Based PoC service over three typical wireless access environment, such as GPRS, UMTS/WCDMA and WLAN/802.11. The contributions of this paper are: developing a NS2-based simulation platform with multiple wireless access environments which can be taken as a general platform for study; proposing a series-connected M/M/1 queuing model to simulate the call processing delay of IMS entities; simulating and analyzing the call establishment delay of PoC sessions over GPRS, UMTS/WCDMA and WLAN. The simulation results can conduct the deployment of the real PoC system and evaluate the feasibility of performance optimization schemes for both network and services. [C3823]

"Research on Binary Complementary Sequence Pair Set and Its Construction Methods"

A new perfect discrete signal-complementary binary sequence pair set is presented under aperiodic correlation condition. Several construction methods of it are proposed. Based on these techniques, a great many binary complementary sequence pair sets can be synthesized. It extended the selected scope of perfect discrete signals, and feasible for practical engineering applications such as multi-user signals. [C3824]

"Research on Target Damage Assessment Based on SAR Images"

SAR images not only have the characteristics of all-way and all-weather but also provide target information which is different from visible and infrared sensors. Meanwhile, evaluation of damage effect for military targets is undoubtedly crucial in information warfare. Unfortunately, exact and timely evaluation in most cases is still unavailable. The paper researches on evaluation of damage effect for battlefield targets (especially for large or medium-sized buildings, villages and town) in the SAR images. A Gauss-Markov model is taken for wavelet-based SAR image despeckling so that the following process of image segmentation is more accurate. A damage assessment method is presented based on the gray co-occurrence matrix. Experiments on SAR images obtained by homemade SAR shows the method proposed in the paper is effective. [C3825]

"Effect of Non-Appropriate Sampling on Radar Detection Algorithm"

Many detection algorithms for received radar signals are based on Fast Fourier Transform (FFT) processing. The detection scheme for radar signals is affected by the prior knowledge of the Power Spectral Density (PSD), which is affected by non appropriate sampling. A performance comparison of two detectors based on frequency domain and changing place of sample namely periodogram and quadratic detectors, is presented, and analytic evaluation of the performance of these detectors supported by computer simulation is conducted. When the desired frequency is not in a bin of the discrete PSD, one standard technique to recover the peak is to add zeros (zero-fill). The performance measure utilized in this work is the Receiver Operating Characteristic (ROC), which measures the probability of detection with the probability of false alarm at different values of Signal to Noise Ratio (SNR). It is obvious that the performance will be degraded if there are estimation errors. [C3826]

"Novel Fast Subspace Decomposition Using Lanczos Recursion"

In this paper a new form of the initial vector is presented, and it is proved that in the context of space-time white noise the Krylov subspace composed of the initial vector and the covariance matrix of the observed signal is equivalent to the signal subspace, therefore the fast estimation of signal subspace can be performed only by computing the basis of the Krylov subspace with Lanczos recursions. By numerical simulation, it is clear that the method presented in this paper can perform the fast subspace decomposition efficiently and effectively. [C3827]

"Performance Analysis of the Eigen-Space Projection Beamformer Based on Operator Approach"

In this paper, we propose a new approach resulting in an expression for the probability density function (PDF) of the normalized conditioned signal-to-interference-plus-noise ratio for the eigen-space projection beamformer for antenna arrays of arbitrary geometry. The analysis method is based on the first order perturbation expansion of the projection operator. This technique takes advantage of the algebraic simplicity of the perturbation analysis of linear operators. The probability density is derived from the asymptotic properties of the sample covariance matrix estimated from finite samples. It is shown that, unlike the SMI beamformer, the probability density function depends on the interference-plus-noise covariance matrix when the interference-to-noise ratio is not high enough. Computer simulation shows the correctness of the method. [C3828]

"Analysis of Track Long-Wave Irregularity with Fractional Fourier Transform"

As a generalization of classical Fourier Transformation (FT), the fractional Fourier transform (FrFT) outperforms many analysis techniques with its higher time-frequency resolution, but it is quite new to be employed into the track irregularity signal processing. In this paper, we simulate the data of the high-speed train's track, according to the data from the real test of the high-speed train on the railway. The FrFT has been investigated for the analysis of track long-wave irregularity, and some other typical methods are also used to analyze the data to estimate the track irregularity signal, including Fourier transform (FT) and short time Fourier transform (STFT). The results show that FrFT is more effective to detect track long-wave irregularity signal than traditional methods. [C3829]

"Research on Generalized Pseudorandom Punctured Binary Array Pairs Theory"

A new periodic correlation discrete signal named generalized pseudorandom punctured binary array pairs is presented along with the transformation properties and combinatorial limited conditions. Based on these properties many generalized pseudorandom punctured binary array pairs with small volume were searched out. The folding construction method between generalized pseudorandom punctured binary array pairs and pseudorandom punctured binary sequence pairs is presented. The searched results show that it have high energy efficiency and exist in large space, and feasible for engineering applications as synchronization code. [C3830]

"Implementation of MMSE Receivers Based on Diagonal Loading Method in Multipath Rayleigh Fading Channels"

This letter focuses on the implementation of MMSE receiver in multipath Rayleigh fading channels, we present a new linear multiuser receiver with multipath combining, which can optimize the output signal-to-interference ratio (SIR) through diagonal loading method to implement MMSE detection. We obtain closed-form expressions for the SIR-optimized diagonal loading estimate. When the channel coefficient changes, the linear operator update of the new receiver can be implemented only by adjusting the diagonal loading quantity, which doesn't involve the matrix inverse computing. We show that the new receiver is equivalent to the conventional MMSE receiver, but the former is easier to be implemented than the latter on fading channel. [C3831]

"Target Detection in SAR Image Based-on Wavelet Transform and Fractal Feature"

This paper introduces a small target detection algorithm combined with wavelet transform and high-order fractal feature for SAR image. The new algorithm is composed of three steps: (1) decompose the original image using wavelet transform and (2) extract the wavelet coefficients in low frequency and calculate its high-order fractal parameter to judge the target region, and (3) inverse wavelet transform to obtain the result image. Results are presented for two fractal methods (high-order fractal feature and fitting error). Our analyses show that the effect of using high-order fractal feature is better than fitting error. Based on the experiment result available to us, the small target is detected exactly from the SAR image. [C3832]

"A FMCW Radar Acquisition and Process System Based on LabVIEW"

This paper presents a acquisition and process system for frequency modulation continuous wave (FMCW) radar. The procedure is designed by LabVIEW7.0. The system adopts FMCW radar sensor and high-quality data acquisition card. The intermediate frequency (IF) signal of the FMCW radar can be collected in time. The intermediate frequency, distance and velocity forward vehicle can be calculated by an improved algorithm. It can give the alarm when the collision danger is predicted, and it can assist the driver to brake control, thus some collision accidents will be avoided. The design method of the system and test data are given simultaneously. The effectiveness of the designed system is verified by some real tests. [C3833]

"Time Delay Estimation Based on the Fractional Fourier Transform in the Passive System"

The time delay estimation between two signals in the passive system has been an important issue. In this paper, we propose a new time delay estimator based on the delay property of the fractional Fourier transform (FRFT). It is suitable for chirp signals in the passive system. The time delay is evaluated in the fractional Fourier domain by measuring the time differential between the time delays obtained from the two peak values of the fractional spectra of the received signals. Simulation results show that the proposed time delay method performs better than the conventional cross correlation approach at low signal-to-noise (SNR). [C3834]

"Modulation Recognition of Multi-Signals Via Multi-Resolution Approach"

A modulation recognition method based on multi-resolution analysis for time-frequency overlapped multi-signals is proposed. These signals include wireless communication signals, RADAR signals and satellites signals in single channel. The algorithm extracts the characteristic points of mixed signal by the multi-resolution analysis firstly, and then separates them through polynomial curve fitting, finally, estimates the parameters for each signal, respectively. This method is able to estimating the number of mixed signal components, calculating their symbol rates, also recognizing their modulation types from few sampling data. The method doesn't need any prior information, and has much more adaptability and robustness. Computer simulations have verified its validity and practicability to the engineering for the first time. [C3835]

"A New Parameter Estimation Method of Linear Frequency Modulation Signal"

This paper introduces the method of high-order ambiguity function (HAF) which is the basic method for estimating the parameters of PPS, and discusses the parameters of estimation error, the cumulative errors when estimating the low order parameters, and the influence from the different between the start of the receiving signal and the real, which are due to the correlation operation. Then aimed at the above limitations, it puts forward a new parameter estimation method of Linear Frequency Modulation (LFM) signal. This method dose's need correlation operation, so it has better effect. Finally, the simulation experiments verify the validity of the algorithm. [C3836]

"A Kind of Signal Processing Method for the Polarization Phased Array Radar"

This paper discusses a kind of polarization phased array radar system and its signal processing method. The polarization signal processing technology is introduced to improve the detection performance and anti-jamming ability of the radars. In order to achieve the performance of low probability of intercept (LPI) for the transmitted signal, the linear frequency modulation (LFM) is adopted inside each pulse and the frequency coded technology is adopted among pulses. The radar system can received the scatted signal of the target through dual polarization channels simultaneously and the polarization information of the target scatted signal can be obtained. In signal processing, the polarization parameter estimation and polarization detection technology are used. The basic structure of the polarization phased array radar is introduced, and the specific LFM pulse compression and polarization detection method are discussed. The analysis results in this paper can provide a reference for the design of the polarization phased array radar. [C3837]

"An Improved Histogram Method for Calculating Extrinsic Information Transfer Functions"

To remedy the defect of the current available methods used to calculate the Extrinsic Information Transfer (EXIT) Function; we propose an improved histogram method in this paper. It adopts an optimal histogram, which adjusts the bin width adaptively, to estimate the distribution of the LLR data. The optimal Probability Distribution Function (PDF) of the LLR data, in the sense of the integrated mean squared error (IMSE), is then estimated and from which the accurate EXIT function can be obtained. The proposed improved histogram method not only breaks through the application limitation of the algebraic average method, but also avoids the manual choosing of bin width in the original histogram method which does not guarantee the optimum. The simulation results show that the proposed method can get accurate EXIT function for different decoders, which provides a solid basis for the analysis and optimal design of the iterative processing system. [C3838]

"A Heterogeneity-Based Ship Detection Algorithm for SAR Imagery"

Ship and wake detection from the SAR imagery have been studied for long time. In several situations, ship wake is not available for some reasons, such as sea status, the incidence angle of radar, and so on. Fortunately, ship always imaged in the radar image. In this paper a heterogeneity-based algorithm to detect ship in the open ocean is proposed. Firstly, a heterogeneity test is locally performed to detect the candidate target in the original image, and then a global optimal threshold is selected according to Renyi entropy to get rid of the false object.

Thirdly, the segments of the same object for the noise present are merged according to its minimum distance to get the accurate position and number of the ships. Several real SAR images demonstrate its efficiency. [C3839]

"Wideband Sonar Signal Design for Moving Target Parameter Estimation"

The signal waveform design of wideband high frequency sonar is proposed. Using the ridge slope invariability property of wideband HFM signal, moving target parameter estimation is discussed. Real time results are presented and show the prospect of wideband HFM signals in underwater signal processing applications. [C3840]

"Application of UKF Algorithm for Target Tracking in DTV-Based Passive Radar"

In this paper the geometry of DTV-based passive radar is studied, with the form of the ambiguity function (AF) of the system given to get TDOA and Doppler parameters, and the state and measurement models established. Then the unscented Kalman filter (UKF) method with TDOA/Doppler measurements is presented for target tracking. The simulation results show that the proposed algorithm can effectively locate and track target, and has better location and velocity estimation accuracy compared with EKF method. [C3841]

"Physical Constraints of High Resolution Acoustic Imaging in the 50 Hz-15 kHz Frequency Range"

Identification and spatial detection of low frequency airborne sound sources, 50 Hz 15 kHz, both generative and reflective, is not a clear cut task. The purpose of this paper is to give an overview of the physics and related mathematics that govern and acoustic imaging system. Most of the theory is borrowed from optics and is now applied to the field of acoustics. The paper highlights the relationship between wavelength and effective aperture. Other important issues addressed are field depth and resolving power, i.e. the point spread function. Chromatic aberration, spectral aberration, due to refraction is also discussed. The last issue is the comparison of a mirror/lens approach vs. a microphone array approach. Finally the paper concludes with a discussion of two applications. First it looks at architectural acoustics and second at a low frequency acoustic radar/sonar application. [C3842]

"Water Objects Extraction from Polarimetric SAR Imagery Based on Sequential Nonlinear Filtering and Independent Component Analysis"

A new method is proposed for speckle noise suppression and water objects extracting from synthetic aperture radar (SAR) imagery based on sequential nonlinear filtering and independent component analysis. The distribution of SAR image data with multiplicative speckle noise is non-Gaussian and its parameters are unknown. Logarithmic quantification is utilized to transform multiplicative speckle noise to independent additive noise. Speckle noise and image data are separated from multi-polarimetric imagery, and the components with the least speckle index are chosen as the object component automatically by means of ICA while the specific distribution of SAR imagery is unnecessary. Water objects are extracted from the separated object component imagery based on sequential nonlinear filtering according to their lightness and region shape features. The experimental results using ENVISAT ASAR polarimetric imagery show that the proposed method can extract water objects rapidly and accurately. [C3843]

"Computationally Efficient DOA Estimation for MIMO Radar"

A computationally efficient direction-of-arrival (DOA) estimation algorithm is proposed for the multiple-input multiple-output (MIMO) radar with uniform linear array (ULA). In the proposed algorithm, the ULA structure is exploited to greatly reduce the array vector dimension, which results in a significant decrease in computational complexity. The effectiveness of the algorithm is verified by simulations. [C3844]

"An Efficient SAR Processor Based on GPU via CUDA"

A novel and efficient Synthetic Aperture Radar (SAR) processor is introduced in this paper. This new processor is implemented on the Graphics Processing Unit (GPU). GPU is traditionally used for graphics rendering, but in recent years, it has rapidly evolved as a highly-parallel processor with tremendous computation capability and ultra-high memory bandwidth. The algorithm of the new SAR processor is developed via Compute Unified Device Architecture (CUDA) which is a popular GPU programming environment. The imaging results of the simulated data show that the resolution and the peak sidelobe ratio of this processor agree with the theoretical values. The time of processing on the actual data shows that this processor is more than 18 times as fast as quad-core CPU-based processor using OpenMP. The high efficiency of this GPU-based processor provides a promising way to solve the complicated problems of high resolution SAR systems. [C3845]

"An Array Pattern Synthesis Method with the Constraint of Weight Amplitude Dynamic Range"

An improved pattern synthesis algorithm based on optimization theory is proposed. The non-convex problem of array pattern synthesis with a dynamic range constraint in amplitude is converted to two convex formulations for optimization, and the amplitude of the optimal weight is confined to a certain dynamic range. The proposed method provides the optimal tradeoff among the mainlobe pattern, the sidelobe level and the dynamic range in weight amplitude, which has many advantages, such as flexible design, high accuracy and good convergence. The validity of method is demonstrated by the result of the simulate data. [C3846]

"Array Optimization for MIMO Radar by Genetic Algorithms"

In this paper, technique for the array optimization of multiple-input multiple-output (MIMO) radar is investigated. The primacy focus of this study is improved two-way pattern performance of MIMO radar. Genetic algorithms (GA) is applied to the array optimization in order to reduce the peaks of side lobes (PSL) by acting on the elements positions. By using the property that the two-way pattern of MIMO radar equals to the product of the transmitting and receiving beam patterns, the computational complexity of algorithms in this paper is significantly decreased. For MIMO radar system with separate transmitting and receiving arrays, and both of them are composed of 25-element with an overall aperture of 50λ (λ being the wavelength), the two-way pattern obtained in this paper with PSL do not exceed -28.65 dB, which meets the requirement of project applications. [C3847]

"Space Tracking System and Its Key Technological Analyses"

This article expounds space tracking's working theory its constructure, space object photoelectric detecting technology's characters, analyses the analytics formula of photoelectric position sensitive detector under the absolute reversal of biasing and weak signal circumstances and the tracking error signal's distilling method, the key technological questions in space tracking, it gives space capturing N tracking processing system's adopting tracking methods in carrying all-field capturing and tracking. [C3848]

"A New Method for Estimating the Number of Targets from Radar Returns"

This paper introduced linear frequency modulation (LFM) waveforms and proposed a new method based on the Wigner transformation and Hough transformation, the new method was used to estimate the number of targets contained in the LFM radar returns. At last we got the simulation result through experiments. The simulation results show that as long as the waveforms meet the certain conditions, the number of targets contained in the LFM radar returns can be estimated exactly by the new method, whose algorithm is simple and easy to implement in works, so it has good technical expansibility, so it could not only be applied to the field of military, but also the field of civil. [C3849]

"An Algorithm for ISAR Ship Imaging Based on S-Distribution"

Under the sea wave, ship target experiences three-dimensional rotations and its echo Doppler frequency changes complexly. In order to improve the quality of ship image, a new algorithm based on S-distribution is proposed. The instantaneous ISAR image can be obtained by calculating the S-distribution of each range bin. In comparison with the classical time frequency distribution, S-distribution produces high concentration at the instantaneous frequency for arbitrary signals, its cross-term interference can be easily removed by recursive method, and its calculation is effective. The simulation results demonstrate the effectiveness of this imaging method. [C3850]

"Real Time Speckle Filter by Cellular Neural Network"

The present of speckle noise affects the exploitation of useful information in images, especially, in the ultrasound and SAR image. It is desirable to remove speckle noise in real time processing without damaging the image features. In this paper, we propose a new method to suppress the speckle noise in realtime by using cellular neural network (CNN) technology. Section 2, CNN and cellular neural network universal machine (CNN-UM) will be briefly introduced, which are the optimized technology for real time image processing applications. Section 3, a few mathematical models of anisotropic diffusion methods for reducing speckle noise on the SAR images will be surveyed and analyzed. In section 4, is also the main part, presented how to design a speckle denoising filter to eliminate the speckle noise and enhance the image features by converting the conventional denoising algorithm to templates, that make CNN chip understandable and processes as a real-time speckle reducing filter. The experiment's results are given in section 5 and some conclusions and future works are summarized in the last section. [C3851]

"Cramer-Rao Low Bound of Radar Tracking by Exploiting the Correlativities of Multi-Dimension Resolution Cells"

Because of the characteristics of radar signal, the echo energy from one target contributes to several adjacent delay-Doppler resolution cells after matched filtering, so that the amplitudes of these cells are correlated; There is a similar situation when the target is illuminated by several overlapped beams, thus there are correlativities among the delay-Doppler cells obtained by these beams. Nevertheless, traditional processing makes little use of the correlativities. It's feasible to utilize these correlativities in tracking to improve the estimation performances. In this paper, the correlativities are first modeled statistically and then the potential benefits in tracking are evaluated by Cramer-Rao Low Bound (CRLB). The tracking CRLBs are compared with that of traditional tracking scheme, and the simulation results show that the improvement to tracking performances is marked. [C3852]

"Two atypical methods for ship RCS measurement with the laser and the acoustic wave technique"

Nowadays, the measurement methods for ship radar cross section (RCS) are of many kinds, but the traditional ones exist some shortages. In view of this situation, this paper mainly presents two atypical methods for ship RCS measurements, which are respectively based on the laser and the acoustic wave technology. Using scaled theory to test the target, both of the two methods can to some certain extent make up the deficiencies of the typical ones. The former method gradually trends from theory to experiment, while the latter has formed a test system. The proposed atypical methods make a significance to the measurement of ship RCS, whether in theory or in project practice. [C3853]

"Feature Extraction of Radar Emitter Harmonic Power Constraint Based on Nonlinear Characters of the Amplifier"

In radar countermeasures systems, because each emitter has its own electromagnetic properties inside its transmitted signal, the specific emitter can be identified using received radar signals. Traditionally, the specific emitter identification (SEI) depends on analyzing the time-frequency structure within the usage band. In this paper, a new SEI feature extraction approach based on autocorrelation analysis is proposed. To characterize the nonlinearity of the amplifier in the transmitter, the harmonic power constraint characteristic of the output signal of the amplifier is analyzed, and a power series model is applied to describe the output signal. For different amplifiers, harmonic power constraint properties are different. We present the autocorrelation analysis method to estimate each harmonic power spectrum and extract harmonic power ratio signature features from output signal of the amplifier. The validity of the proposed method is confirmed by simulation experiments. [C3854]

"The Design and Implementation of a RSSI-Based Localization System"

Existing localization algorithms in Wireless Sensor Network (WSN) can be divided into two categories: range-based and range-free. Most of the range-based localization algorithms proposed made use of the Received Signal Strength Indication (RSSI) to make an estimation of the distance between transmitter and receiver. Based on our experiments, there is no relationship between RSSI and distance in indoor situations. But the outdoor experiments show that RSSI is closely related with distance, direction of antenna, the height of nodes above the ground and obstructions. The Gaussian model by curve fitting the average RSSI value with distance resulted the formulation that can be used to compute the distance between unknown node and its neighboring nodes. Then, by applying Trilateration method, a localization system was implemented. This system are specially designed for outdoor without obstructions, tiny variance of physical conditions and all sensor nodes should be placed 2 meters higher than playground. Finally, some errors were analyzed in detail and corresponding proposals were given. [C3855]

"Modeling of Complex Radar Target for High-Resolution Synthetic Aperture Radar Image Simulation Based on GRECO"

The electromagnetic scattering models of complex radar targets, e.g. aircrafts, vehicles etc, are of great significance to Automatic Target Recognition (ATR) of Synthetic Aperture Radar (SAR) imagery. Based on the Graphical Electromagnetic Computing (GRECO) technique, a novel implementation method of complex radar target modeling for the simulation of high-resolution SAR image is proposed. The three-dimensional (3-D) scattering modeling of the complex radar targets is founded on the basis of GRECO. Furthermore, high-resolution SAR image simulation is implemented through echo simulation and image formation procedure with the 3D scatting data generated by using GRECO. Computer simulation results of an aircraft target are provided, with high-resolution millimeter wave SAR system parameters, which illustrate the radar image characteristics such as foreshortening, layover as well as shadowing. The datasets of simulated SAR images with different elevation and azimuth angles are presented, verifying the effectiveness of the method of the paper. The

simulated high-resolution SAR images could be applied in ATR research as the input source data. [C3856]

"Detection of Weak Signal in Chaotic Clutter Using Advanced LS-SVM Regression"

In this study, detection of small target in chaotic clutter with unknown dynamics is presented. We achieve this in four steps: (i) by using db3 wavelet decomposition of the signals, (ii) using Takens delay embedding theorem and least-squares support vector machine (LS-SVM) prediction, including increase the symmetric constraint and improve the kernel function, (iii) wavelet reconstruction, (iv) separation the weak signals from the prediction error. Efficiency of the new approach is evaluated by computing the root mean square error (RMSE) and signal-noise-ratio (SNR) of the estimation. Lorenz attractor and the data from the McMaster IPIX radar sea clutter database will be used in the simulation. It is demonstrated in the simulation that compared with conventional RBF neural network LS-SVM regression prediction method; this approach has stronger generalization ability and better accuracy. [C3857]

"Performance Analysis of Non Coherent CFAR Detection Based on Goodness-of-Fit Tests in Different Clutter Environments"

Non-coherent detection using multiple pulses is very useful in radar detection, especially in the case that the phase information of return pulses is unavailable. This paper addresses the performance of non-coherent CFAR detection based on goodness-of-fit (GoF) tests compared with non-coherent CFAR integrator (NCCI) in different clutter environments by simulation experiments, when the assumed and actual clutter distributions are same and different respectively. The results show that the GoF CFAR detector outperforms the NCCI in very spiky Weibull, lognormal as well as K clutter with enough integrated pulses, even when the assumed and actual clutter distributions are different. The CFAR loss of the GoF CFAR detector due to the estimation of unknown distribution parameters has also been shown in this paper. [C3858]

"Design and Experiments of Photon Counting Imaging Test Platform"

The photon counting avalanche photodiode (APD) imaging test platform is put up according to the semi-classical theory of photoelectric detection which the classical statistical fluctuation of the light field is combined with the fluctuation of the interaction between light and matter. A mathematical model between APD photon counting frequency's expectation and input gray levels is set up. With changes of scene gray, the photon number of reflective radiation is bigger; photon counting frequency expectation of the corresponding sampling points will be greater. A black white stripe image is scanned at 10-3lx low light level (LLL) illumination. In accordance with the established mathematical model and the scanning mechanism, the photon counting output appearing as one-dimensional time-domain will be represented as two-dimensional image information. [C3859]

"Extracting Residential Area Information from Dual-SAR Image Based on Object-Oriented Technique"

Quick and accurate extracting residential area information has important practical significance to plantation protection, city planning, and reasonable land use. Hence the paper introduces an innovative method about extracting residential area from dual polarization SAR image. First of All, create area object using region grow algorithm, secondly select residential area samples artificially and compute average covariance matrix of each type, then extract residential area objects based on Wishart distance. According to the above theory, design the corresponding procedure, and do experiment on dual polarization SAR image of a region, the result indicates that the method for residential area information extraction has higher precision, less calculations, faster speed than the existing ones. [C3860]

"A Modified Dynamic Programming Approach for Dim Target Detection and Tracking"

Dynamic Programming (DP) algorithm based Track Before Detect (TBD) is an efficient approach to detect the dim moving target. However, the big computational burden is the disadvantage of DP algorithm, which restricts its applications in many fields, such as radar detection where the real-time processing is a necessary requirement. A modified DP algorithm has been developed in this paper. The main idea of this algorithm is that a low threshold is applied to the measurement frame before DP processing. Its computational requirements and detection performance are analyzed and compared with traditional DP. Simulation results show that it can produce an order-of-magnitude reduction in computational demand with only about 1 dB detection performance loss. And more processing reduction can also be achieved, consequently, with more performance loss. Thus, this algorithm offers an approach of tradeoff between computational reduction and performance loss in DP processing. And by this kind of tradeoff, the real-time DP processing can be realized with acceptable performance loss in many fields. [C3861]

"Application of Radar Signal Processing System Based on DSP in the VTS"

Radar signal processing system is an important part of vessel traffic services. In order to overcome the shortcomings of traditional analog video system, this paper proposes a design solution for digital radar signal processing system based on DSP and a new method that is a constant false alarm rate algorithm based on wavelet transform. This method can suppress the interference of sea clutter without impairing the target resolution. Experimental results demonstrate this system can increase the detection accuracy and reduce the false alarm rate. Furthermore, the tracking performance can be improved. Radar signal processing system based on DSP plays an important role in the vessel traffic services. [C3862]

"Space Relative Navigation Filter Based On-Board Radar Observation"

The absolute attitude error of chaser vehicle is always neglected in observation equation of space relative navigation filter when chaser satellite on-board radar using as the measurement sensor. But the attitude error could affect relative navigation filter precision in fact. The new observation equation, which contains the absolute attitude error of chaser vehicle, is constructed. And the plan, using equivalent measurement error as attitude error, is put forward. The simulations show that the filter precision of relative position and velocity descend when attitude error is big, and the precision is improved when attitude equivalent error is introduced to filter. The plan of attitude equivalent error is proved to be feasible. [C3863]

"Sorting Radar Emitter Signal Based on Wpt6 and Cr1"

Sorting rate of common method is not high and it is sensitive to the signal noise ratio (SNR), in order to solve these problems, a novel sorting algorithm for radar emitter is proposed. The Wpt6 and Cr1 is extracted firstly and used as the sorting basis when the unknown radar emitter signal is received, then the radar emitter sorting is realized by the Kohonen neural network. Simulation result shows that this new method can get higher correct rate than traditional method. [C3864]

"Error-Resistant Adaptive Filtering for INS/SAR Integrated Navigation System"

This paper presents a new error-resistant adaptive filtering algorithm for INS/SAR (Inertial Navigation System / Synthetic Aperture Radar) integrated navigation system. This algorithm adopts the principle of error-resistant estimation to adaptively process measurement information. The experimental results demonstrate that the performance of the proposed error-resistant adaptive filtering algorithm can significantly improve the performance of INS/SAR integrated navigation system. [C3865]

"Study of Side Lobes Suppression for Using Pulse Compression in Weather Radar"

In this paper, low range time side lobes for pulse compression in weather radar can be achieved by an integrated scheme using non-linear FM, tapering transmission waveform, mismatched windowed filter. The simulation process to search optimum realization scheme is presented to make sure least enlargement of main lobe pulse-width while mitigating energy of side lobes. The result of simulation indicates that side lobes can be less than 60 dB while main lobe width will not surpass 0.66 μ s. In the end, the implement of the scheme is designed for realization. [C3866]

"Multiscale Orientation and Recognition for Permanent Scatterers"

How to effectively detect and identify permanent scatterers (PS) from SAR images is one of the crucial procedures in PS interferometric system. In this paper, a new method of PS detection is presented by using the wavelet multi-scale product and wavelet modulus maxima according to the PS targets' features and the characteristics of speckle noise in SAR image. This paper analyzed the theory of wavelet multi-scale product and wavelet modulus maxima and its suitability for identifying PS points respectively. Using 4 SAR images over Nanjin from satellites ENVISAT of European Space Agency, both of the methods have been validated for PS detection. The testing results show that both the two algorithm can identify PS from SAR images effectively and reliably. Of which the method using wavelet modulus maxima has stronger anti-noise ability. [C3867]

"Iterative adaptive Kronecker receiver for MIMO over-the-horizon radar"

We introduce an iterative adaptive multiple-input-multiple-output (MIMO) radar receiver that is useful when the KL-variate adaptive transmit-receive beamformer is structured as the Kronecker product of a K-variate transmit and an L-variate receive beamformer. We consider the case of two clutter propagation modes with different elevation angles, and where the direction-of-departure (DoD) of one mode and the direction-of-arrival (DoA) of the other mode coincide with that of a target. For an example simulation scenario, we demonstrate that our

iterative adaptive Kronecker receiver achieves high performance. [C3868]

"Detection of spatially extended objects in clutter"

Range-spread Doppler-spread signals in interference are readily discernable via the application of classical algorithms and architectures presented by Van Trees [1], and more recently by Kay [2] and others. However, when these returns emanate from stationary objects, the generalized inner product (GIP) offers a unique tool for detection and discrimination processing. This paper offers insight into how the GIP may be applied to optimize the detection of spatially extended fixed objects in clutter. [C3869]

"Virtual performance evaluation of automotive radar concepts in realistic traffic environments"

In this paper a simulation approach is presented, that allows for virtually investigating the performance of automotive radar systems regarding different system parameters. This is achieved by combining dedicated simulation models for the radar transmitter and receiver with a deterministic propagation simulator based on ray tracing. This approach is in particular suitable for investigating the capabilities of beamforming algorithms in radar systems with multiple antenna receivers. The configuration of the developed tool is explained in detail and the performance of different array configurations for classic digital beamforming and the MUSIC algorithm is evaluated. [C3870]

"Synthesis of narrowband differentiators with a piecewise-polynomial impulse response with parallel-branch structures"

A synthesis method is proposed for linear-phase narrowband FIR differentiators. This method is based on two computationally efficient recursive structures to synthesize linear-phase narrowband FIR filters with a piecewise-polynomial impulse response proposed by Saramaki and Mitra. The efficiency of these structures is based on implementing the overall transfer function as a parallel connection of a few branches of the form $G(z)F(z)$, where each $F(z)$ requires no real multipliers. Such $F(z)$ s by thorough derivation for both structures were proposed by Lehto, Saramaki and Vainio. This paper proposes the synthesis method of linear-phase narrowband FIR filters with an antisymmetrical piecewise-polynomial impulse response for differentiators. The arithmetic complexity of the proposed method is based on the number of branches and the polynomial degree. An example is included, illustrating the benefits of the proposed filters, in terms of a reduced number of unknowns in the optimization and implementation. [C3871]

"Application and Research of Data Acquisition Technology Based on GPRS"

Data acquisition technology based on long distance wireless network is one of the hot research problems of data acquisition technology at the present time. This paper applies data acquisition technology based on GPRS to automatic collection of noise data, designs encapsulation format of data. Data collection terminal accesses to network through GPRS to upload noise data to database of remote server and display terminal gains noise data through network and real-time outputs with the form of broken line. This system has been successfully applied to environment acoustic GIS management system of Wuhan and provides a new method for environmental planning, monitoring, decision support and scientific evaluation, and it has very important reference value for environmental monitoring. [C3872]

"The Data Processing Flow and Algorithms Study of Acquiring DEMs Using Interferometric SAR"

In this paper, we present a practical InSAR data processing flow and analyze the key techniques such as the method to select appropriate interferometric SAR data, coregistration, flat earth phase removal and noise altering of the interferogram, phase unwrapping, conversion from phase to height, geocoding and precise baseline estimation with a special pair of SAR SLC images. [C3873]

"Monitoring Land Subsidence in Suzhou City Using D-InSAR Technique"

This paper mainly discusses how to monitor the land subsidence in Suzhou city using differential interferometric synthetic aperture SAR (D-InSAR) technique. It firstly introduces the principle and data processing flowchart of D-InSAR. Then it carries out test and gets the land subsidence in Suzhou city using two pass D-InSAR technique. At last, it analyzes some problems which influence the application of D-InSAR in monitoring the urban land subsidence in detail. [C3874]

"Passive Coherent Radar Tracking Algorithm Based on Particle Filter and Multiple TDOA Measurements"

In passive coherent radar tracking using external illuminator as transmitters, the traditional extended Kalman filter (EKF) is adopted frequently, but the tracking performance is affected seriously by the glint noise in practice. To solve this problem, a novel passive coherent radar tracking method is proposed based on particle filter (PF) and only time difference of arrival (TDOA) measurements. This new approach obtain measurements from multiple TDOA locating model, and then by using particle filter to track target, which avoid the error caused by EKF linearization, and reduce the measurements error resulted from glint noise, so it can improve the tracking precision. The simulation results show that the performance of the proposed method is superior to that of the EKF algorithm not only in Gaussian but also in glint noise environment. The experiment based on real data demonstrates the validity and feasibility of the new method. [C3875]

"Modeling and Simulation of Single-Look Complex Images for Distributed Satelliteborne Interferometric Synthetic Aperture Radar"

The significance of modeling and simulating the single-look complex (SLC) images for the distributed satellite borne interferometric synthetic aperture radar (DS-InSAR) system is addressed. Moreover, the simulation modeling for the DS-InSAR SLC images is presented in details, including the geometric model and the radar signal model. Furthermore, an implementation method for DS-InSAR SLC images simulation is proposed, which has the advantage of lower computation loads and higher efficiency compared with the traditional simulation methods. The intensity images and phase interferograms can consequently be generated from the simulated SLC SAR images. Computer simulation results are numerous presented, with the simple conic scenario and the digital elevation model (DEM) of natural terrain. It is straight forward that the simulation results demonstrate the effectiveness of the modeling and simulation method presented in this paper. [C3876]

"A Robust Estimation Method of Interferometric Phase Based on Weighted Subspace Fitting"

Interferogram estimate method based on the weight subspace fitting is presented through the subspace fitting of measured signal subspace and the subspace spanned by compound steering vectors. The proposed method can improve the performance of interferogram estimate, using the forward-backward average processing method to decorrelate the signals. The processing results from real data of InSAR show that the performance of proposed method is better and robust than the subspace projecting method's. [C3877]

"Detection of Chirp Signal by Combination of Kurtosis Detection and Filtering in Fractional Fourier Domain"

The chirp signal has been used widely in radar signals. As a useful signal processing technique, the fractional Fourier transform (FRFT) is a way to concentrate the energy of a chirp signal. Therefore, the FRFT presents a potentially effective technique for detection of chirp signals. Compared with the common Wigner-Vill distribution (WVD) algorithm, the FRFT is a linear operator, and will not be influenced by cross-terms even if multiple components exist. Moreover, to solve the problem whereby weak components of the signal are shadowed by the sidelobes of strong ones, a new method of combination of kurtosis detection and filtering in fractional Fourier domain is proposed. In this way strong components and weak ones can be detected iteratively. The effectiveness of this combined method has been tested through simulation. [C3878]

"Radar Signal Environment Simulation Based on Quadrature Multiple Waveform Synthesis Method"

The principle of multiple quadrature waveform synthesis (MQWS) is introduced, which is based on the theory of quadrature modulation. Its adaptability to pulse signals is analyzed. Combined with pre-saved waveform data, this method can be used in radar signal environment simulation and it can simplify the requirement for the hardware implementation with general-purpose and flexibility characters. The realization experiments show that it can fulfill the signal's simulation of various radar types. [C3879]

"A Variational Approach for Bias Correction and Boundary Delineation of SAR Image with Intensity Inhomogeneity"

This paper presents a variational approach for bias correction and boundary delineation of synthetic aperture radar (SAR) images with intensity inhomogeneity. The bias fields in SAR images might have a negative impact on boundary delineation. Our approach is implemented by two steps within a unified framework of energy minimization. First we propose a deviation correction method in which no physical parameter is needed. Then we conduct an improved geodesic active contour model using the tensor voting method to delineate boundaries. The advantage of combining the geodesic active contour model and the tensor voting method is that the active contour is more sensitive to weak boundaries. [C3880]

"Investigation of Electromagnetic Radiation from High Power Weather Radar"

In this paper, we devote to investigate the electromagnetic (EM) radiation characteristics and radiation intensity of high power weather radar once extensively. We compare our field measurement with international specifications and an operating early-warning radar case study also made a contribution to those who are interested in the healthy effect of high power EM radiation. The measured data is much lower than the recommended specifications announced by EPA and ICNIRP. It shows that no direct evidence can prove that radiation may cause harms to human beings. [C3881]

"Improved Background Prediction Algorithm for IR Small Targets Detection"

For detection problem of infrared dim small targets in complex background, an adaptive filtering algorithm based on the improved M-estimation is put forward to suppress background clutter. In the proposed algorithm, target pixels and observed noise form the mixed interference of background estimation. In order to better estimate the background, the proposed algorithm introduces the correction factor to reduce the influence of target pixels and introduces the forget factor to entreat the non-homogeneous backgrounds. The experimental results to real images show that the proposed algorithm can better suppress background and preserve target information than the commonly-used median filtering algorithm and the LMS filtering algorithm. As a result, the proposed algorithm can detect effectively IR small targets in complex background. [C3882]

"Feature Extraction and Recognition of Landmine"

As a new detecting landmine method, Ground Penetrating Radar (GPR) is introduced into the field of detecting buried landmine. In order to improve the detection accuracy, A approach based on the Support Vector Machine (SVMs) is presented in the paper. The Support Vector Machines (SVMs) has solved the inevitable partial minimum problem and overcome the disadvantage which the traditional neural network cannot avoid, especially, it is suitable for the high dimension data space and sample less situations, it is used to extract feature vector and recognize landmine. In order to improve the accuracy of detection landmine, WP (wave packet)-based preprocessing algorithm is used to clutter reducing and the genetic algorithms (Gas) is used in the feature selection. The experiment result shows the feasibility and advantage of the presented algorithm. [C3883]

"Auto-Registration of SAR and Optical Images Based on Priority Strategy"

The registration of synthetic aperture radar (SAR) and optical images is the critical precondition for image fusion and image analysis, since SAR and optical imaging have complementary effects. However, the traditional algorithms do not often meet the actual demands when a large distortion, the combination of translation, a big rotation and a great scale change, exists between SAR and optical images. This paper presents the factors result in failing registration with a large distortion and devise a novel method based on priority strategy in which rotate and scale are used as priority factor. Experiment results show that the priority strategy proposed registers SAR and optical images with a large distortion automatically and high-precision. [C3884]

"Signal Processing Algorithm of Spaceborne SIMO HF-SAR for Three-Dimensional Topside Ionosphere Exploration"

Ionosphere exploration is very important to improve the performance of space information systems, e.g. satellite navigation. A novel of spaceborne nadir-looking single input and multiple output (SIMO) HF-SAR is investigated, which has the capability to generate three-dimensional radar image for the topside ionospheric irregularities. The three-dimensional radar echo signal modeling is developed. The image formation algorithm for the antenna array typed SIMO HF-SAR system is proposed, based on modification of extend chirp scaling (ECS) algorithm. Computer simulation results illustrate the feasibility of new radar system and the validation of the signal processing algorithm. It has very good potential to be applied to the new generation ionospheric explorer developed in the future. [C3885]

"Generalized Variational Optimization Analysis for Improving Scatterometer Surface Wind Field"

In order to improve the wind field retrieval from microwave scatterometer, we firstly used SeaWinds Data Processor (SDP) model produced by KNMI to retrieve sea-surface wind from near real time data of SeaWinds which aboard on QuikSCAT in middle wind speed. Then we proposed generalized variational optimization analysis method to adjust the wind field, and the structure of the wind field was further improved. This paper offered a new idea for improving wind field retrieval from microwave scatterometer data. [C3886]

"A New Method of Multi-Component Source Signal Coding"

The usage of system bandwidth is restricted when coding multi-component linear frequency modulation (LFM) source signals that used in multi-beam systems, and the multicomponent echo signal will exist serious time-frequency superposition if the frequency bands of the signal components are overlapped. For solving these problems, a new multi-component LFM source signal coding technique based on fractional Fourier transform (FrFT) is analyzed in this paper. Using the predominant performance of FrFT when processing LFM signals, the theoretical position that LFM signal distributed in the fractional Fourier domain (u domain) and the coding theory of multi-component LFM source signals is proposed, so the utilization ratio of the system band is improved and we can extract or separate the signal components by band-pass filter in the u domain easily. The noise immunity of FrFT is also presented along with the simulation results. The method proposed in this paper provides a new and effective path to code multi-component LFM source signals. [C3887]

"A New LiDAR Filtering Method Based on Multi-Layer Two-Class Segmentation"

There are two kinds of filtering methods for airborne LiDAR, one is discrete point cloud based; the other is two-dimension depth images based; the basic idea of which is applying image processing approaches into image segmentation. That is, firstly conversing discrete point cloud data into the two-dimension depth image, and then using various methods of image processing and segmenting out the ground points. In this paper, a new LiDAR filtering method based on multi-layer two-class segmentation is put forward. The main idea is that generating three-dimension digital surface model (DSM) from raw LiDAR point cloud data and obtaining the main feature-type number N firstly. Secondly, using the global threshold segmentation method for two-class incomplete classification, namely high-lighting the main feature category, and using the average pixel value of the outlying regions of the main feature to replace the main features region and generating a new two-dimension depth image. Finally repeating the procedures above for the times of the main feature-type number N and acquiring DEM with most of features filtered. This approach is easy-doing and very useful for some large-scale engineering construction, such as the highway designation. Take the plain areas for an example, some beneficial suggestions are given. [C3888]

"Weather Radar Data Compression Based on Zerotree Wavelet Algorithm"

Wavelet based image compression is getting popular due to its promising compaction properties at low bit-rate. Zerotree wavelet image coding scheme efficiently exploits multi-level redundancy presented in transformed data to minimize coding bit. In this paper, a novel compression algorithm for weather radar data based on zerotree coding is presented. Considering the dependence of radar data, an efficient pre-processing algorithm of the data is given first and the redundancy of the data is efficiently reduced. Then an advanced embedded zerotree wavelet encoding algorithm is presented which uses context-based adaptive arithmetic coding to improve its performance. Experimental results show that for weather radar data, the proposed algorithm achieves good PSNR even in very low bit rate. [C3889]

"Design and Analysis of a Compact Terahertz Signal Generator for Military Communications"

Future radar and military communication systems need powerful signal generators with much higher frequencies. In this paper, results of the theoretical and numerical simulation studies of a MW-class, large diameter terahertz wave generator are presented. The device consists of a miniaturized foillless diode as well as an oversized rectangular slow wave structure (SWS) which could support surface wave and provide a strong beam-wave coupling. With the method of particle-in-cell simulation, we investigated the operating characteristics of a prototype 0.22 THz signal generator. It is found that the steady-state, singlemode operation in overmoded demonstration could be realized by the property of surface wave, and its operation in the first Brillion region demonstrates that the device performs as a forward wave oscillator, which would be employed in military applications. [C3890]

"Denoising of SAR Images Based on Wavelet Packet"

The SAR remote sensing images are interfered by noises during the detection and transmission, a method based on wavelet packet and level dependent adaptive threshold is proposed in this paper. By using this method, the SAR images can be decomposed in a more elaborate method compared to the traditional wavelet transform, and the noises in the SAR images are eliminated by the adaptive threshold method. The experiment results show that this method can reduce the noises efficiently. The PSNR and the subjective vision of the results have better performances than the result of traditional wavelet transform method. [C3891]

"A Sidelobe-Constraint Direct Data Domain Least Square Algorithm"

We present a modified direct data domain least square (D3LS) algorithm here to decrease the sidelobe level of a beampattern when the D3LS is used in non-stationary noisy circumstance . The proposed algorithm first

determines the mainlobe region and preset the highest sidelobe level, then a sidelobe constraint is set on the beamforming algorithm to have a beam pattern with sidelobe level not higher than the preset value. A distortional uniformly linear array (ULA) with 23 sensors is used in simulation. It is shown by the simulation that the proposed algorithm can decrease the sidelobe level effectively and can reduce the effect for beampattern introduced by the disturbing errors. [C3892]

"Despeckling SAR Images Using Bayes-Shrink in Bandelet Domain"

Synthetic aperture radar (SAR) images are inherently affected by multiplicative speckle noise, which is due to the coherent nature of scattering phenomena. This paper presents a despeckling method for SAR images based on adaptive bandelets thresholding. This threshold is derived in a Bayesian framework. The proposed threshold is simple and closed form, and it is applied to adaptive bandelets coefficients to achieve more satisfying results. The performances of adaptive bandelets Bayes-shrink soft-thresholding and wavelet thresholding for despeckling SAR images are compared through an experiment. Experiment results clearly demonstrated the capability of the proposed scheme in SAR image speckle reduction especially for SAR images possessing detailed textures. [C3893]

"Multiscale Markov Random Field Method for SAR Image Segmentation"

In this paper, a multiscale Markov random field method for segmentation of the synthetic aperture radar (SAR) images is proposed. A classifier which inherits the strongpoint of the Markov random field (MRF) and the multiscale autoregressive (MAR) model is designed. The MAR models are utilized to extract the multiscale feature of SAR image, which is used to train the MRF with the proposed algorithm, and then the SAR images is segmented by the trained random field. The experimental result demonstrates the effectiveness and efficiency of the proposed method. [C3894]

"Decoupling DOA Estimation Algorithm for Rectangle Array"

A new decoupling algorithm is proposed to estimate DOA of rectangle array with mutual coupling. The new algorithm can jointly estimate signal source direction and coupling parameters of array. This algorithm transforms joint problem into cascade problem and gets the parameters by one dimension spectrum peak value searching, which avoids multidimensional nonlinear searching of multi-parameters joint estimation. The simulation results validate the good performance of the proposed algorithm. [C3895]

"Introduction"

{no data available} [C3896]

"Evolution of the military munitions RF environment"

With the increase in joint and combined operations, the decrease in the military spectrum and the increase use of mobile communication, the specified RF environment over the years has evolved especially in respect to the effect on ordnance safety. The presentation identifies these changes and some of the incidents that have triggered reviews since 1964 to the present day with the publication of the NATO AECTP 258 February 2009. It will provide the rationale that nations have used to determine their RF environment and how a worst case approach was formulated. [C3897]

"TAS and wind estimation from radar data"

Accurate wind magnitude and direction estimation is essential for aircraft trajectory prediction. For instance, based on these data, one may compute entry and exit times from a sector or detect potential conflict between aircraft. Since the flight path has to be computed and updated on real time for such applications, wind information has to be available in real time too. The wind data which are currently available through meteorological service broadcast suffer from small measurement rate with respect to location and time. In this paper, a new wind estimation method based on radar track measures is proposed. When on board true air speed measures are available, a linear model is developed for which a Kalman filter is used to produce high quality wind estimate. When only aircraft position measures are available, an observability analysis shows that wind may be estimated only if trajectories have one or two turns depending of the number of aircraft located in a given area. Based on this observability conditions, closed forms of the wind has been developed for the one and two aircraft cases. By this mean, each aircraft can be seen as a wind sensor when it is turning. After performing evaluations in realistic frameworks, our approach is able to estimate the wind vectors accurately. Based on those local wind estimates, a global space-time wind field estimation using vector splines is interpolated in order to produce wind maps in the area of interest. The underline model for wind field computation is Shallow-Water,

which assumes geostrophic wind. The accuracy of this wind map is dependent of the number wind estimates in a given zone. Further improvements to the estimation can be made by correlating with meteorological measurements. [C3898]

"An Analytical method for calculating the limitation of beam scanning in Uniform Linear Array (ULA)"

The limitation of beam scanning in a uniform linear array (ULA) is determined as a maximum range of scanning; within that the sidelobe of the pattern still not be exceed the certain level. There are some calculations for this purpose by numeric method; these are convenient for some practical applications. This paper presents a new approach to calculate the above limitation by analytical method. The simple analytical formula is obtained and the comparison of derived results by two methods is presented. [C3899]

"Statistical MIMO radar under non-Gaussian target scattering"

We consider a multiple-input multiple-output (MIMO) detection problem with M widely-spaced transmit antennas and L widely-spaced receive antennas, and we optimize the signal waveforms transmitted by each source node. Two figures of merit are investigated for space-time code optimization under a semi-definite rank constraint and a received signal-to-clutter ratio constraint: (1) the lower Chernoff bound (LCB) to the detection probability for fixed probability of false alarm, and (2) the mutual information (MI) between the observations and the target scattering matrix. If the scattering distribution possesses some properties of exchangeability and unitary invariance, we show that MI-optimal and LCB-optimal space-time coding admit a simple closed-form solution. As an application, the detection of a compound-Gaussian target is examined. The robustness of code design under Gaussian scattering is also investigated. [C3900]

"Methodology for the empirical analysis of the scattering signals from a wind turbine"

This study proposes a field data-based methodology to characterize the scattered signals from wind turbines. The method is based on the scattering pattern of the wind turbine, empirically obtained from the estimation of the channel impulse response, which allows the accurate estimation of the amplitude and the time variation of the scattered signals. The analysis of the Channel Impulse Response at different situations, such as the rotation speed, the orientation of the turbine or the elevation and azimuth angles of the receiver location, will allow the proper characterization of this phenomenon, and therefore, the development of an empirical model for the estimation of the potential interference of wind farms. [C3901]

"Difference pattern synthesis using a particle swarm optimizer"

In this paper a simple feeding network is proposed for monopulse radar systems with small number of elements. Mutual coupling effects are included in case of difference pattern. Optimization in the presence of mutual coupling is proposed based on particle swarm optimizer (PSO). A bandwidth comparison is presented between two sets of excitations (weights). It is shown that the weights obtained by the PSO technique were less frequency sensitive as compared to the conventional weights based on the Bayliss distribution. [C3902]

"A new DOA estimation method for uncorrelated and coherent sources under nonstationary noise fields"

A new direction of arrival (DOA) estimation method is proposed for uncorrelated and coherent sources under unknown nonstationary noise fields. The uncorrelated sources and coherent sources are resolved separately. In this way the output data of the array are used repeatedly, and more sources can be estimated. Compared with the conventional methods, the new method can resolved more sources using the same number of sensors. At the same time, the nonstationary noise can be translated into white noise, so the effect of the nonstationary noise is eliminated. Computer simulation results verify the correctness and effectiveness of the proposed method. [C3903]

"Moving train imaging by ground-based Ka-band radar"

Ground moving trains have been imaged by many airborne and spaceborne SAR systems, but seldom imaged by ground-based radar system. In this paper, we introduce our experiment on moving train imaging by a ground-based Ka-band radar system with 1 GHz bandwidth. The 1 GHz bandwidth is realized by synthesizing 10 subpulses in frequency-jumped burst (FJB). High-resolution SAR images for a moving train were obtained and the electromagnetic scattering characteristics were analyzed. Radar images show that at different aspect angle, the strong scattering centers are different and may changeable. [C3904]

"On the value of information within a collaborative decision making framework for airport departure operations"

As airport surface surveillance technologies develop, aircraft ground position information becomes more easily available and accurate. The value of these technologies, and more particularly the value of surface surveillance information, can be derived from the operational enhancements they provide within Air Traffic operations. This article provides a better understanding of the value of surface surveillance systems within tomorrow's collaborative framework, where departures, and more specifically push-back times, will be collaboratively optimized. It quantifies analytically the potential benefits yielded by providing surveillance information to the agent which is entrusted with tactically optimizing push-back and taxi clearances under nominal conditions. This work proposes a novel approach to the valuation of surveillance information. A stochastic model of surface operations is developed and calibrated to emulate departure surface operations at LaGuardia Airport. Two levels of information are examined within a tactically optimized Collaborative Decision Making framework. For each level, emissions and number of taxiing aircraft are analyzed in order to determine the value of surveillance information. Safety benefits, however, are not considered in this paper. It was estimated that surface surveillance information could improve optimization of departure operations, by reducing emissions and the number of taxiing aircraft by 5.7%, without impacting the runway utilization rate. [C3905]

"Assessing tactical alert function accuracy performance"

An effective test program for the evaluation of the performance of the short term conflict alert (STCA) function must consider the definition of the test scenario, assessment metrics, and alert classification rules. This paper discusses test issues encountered using a realistic scenario based on live data. The paper describes a method to obtain systematic and automated measurements of nuisance rate, missed rate, and alert response time for a realistic traffic scenario. Based on experience using live data, the concept of a valid alert is introduced to deal with an alert that is not associated with an actual conflict nor considered to be a nuisance alert (e.g., an alert issued prior to an aircraft maneuver that avoids loss of separation). To classify alerts as nuisance or valid, and to check timeliness of alerts associated with a conflict, the approach relies on the comparison of the alerts declared by the system with those that would be expected from Γ, B_i truth data Γ, B_i projected forward in time (linear predictor)-truth data defined as the actual aircraft paths. Detailed alert classification rules addressing issues encountered in performance testing with realistic scenario data are described. Approaches to obtaining a representation of Γ, B_i truth data Γ, B_i are referenced. The method of using a test predictor operating on truth data in association with alert classification rules was used in performance evaluation of, and problem identification related to, the tactical alert function in the en route automation modernization (ERAM) system and for studies of the common automated radar terminal system (Common ARTS). Aspects of the performance measurement approach described herein may be applicable to the development of accuracy requirements of future systems. [C3906]

"Convective weather avoidance with uncertain weather forecasts"

This paper describes simulations of an automated planning system that routes flights around airspace impacted by forecasted convective weather. If the system predicts that a flight will enter a weather-impacted airspace within a predefined time horizon, it generates a new route. Because the forecasts are uncertain, the system periodically generates, using updates of the weather forecasts and radar tracks, new reroutes. The simulations included convective weather in the northeastern quadrant of the United States over a 24-hr period. Multiple simulations investigated the system performance as the planning horizon and planning frequency varied. As the planning horizon and frequency increased, the system successfully routed more traffic around weather but with more route changes. For a planning horizon of 20 to 120 minutes and a planning frequency of four cycles per hour, the reroutes increased flight time by 3.3% and avoided 79% of the weather-impacted airspaces that were detected. Most flights required one to three reroutes to pass by a weather-impacted airspace, while the worst case flights required six reroutes. [C3907]

"Result from evaluation of 4D trajectory management with contract-of-objectives"

Contract-of-Objectives (CoO) is designed in the context of trajectory-based Air Traffic Management (ATM), using mutually agreed objectives between Air Traffic Control (ATC), airlines and airports. This paper provides an overview of the foreseen validation of CoO and discusses the results of the first Human-in-the-Loop (HIL) evaluation of the concept of operations using CoO between Air Traffic Controllers (ATCos). This HIL real time evaluation is carried out in October 2008 in SkyGuide premises in Geneva, Switzerland. Measurements on system performance (i.e., Safety, Efficiency, and Capacity) as well as Human performances (i.e., workload, Situation Awareness, and acceptability) were collected and analyzed. Results show that ATCos are positive with the concept of operations, and they do agree on the principle of flying what were Γ, B_i planned, agreed and

negotiated, but on the planning phase as opposed to first come, first served. Results of the evaluations also show that CoO can be applied to 2008 and 2020 traffic level in Europe without any impact on System Safety. [C3908]

"Analysis and causality of airport surface delays"

A prototype departure advisor is under development at the Sensis Corporation, with support from the New York State Energy Research and Development Authority (NYSERDA). The prototype is being developed based on operations data at John F. Kennedy International (JFK) Airport, and depends on surface surveillance data (ramp area, movement area), flight plans, and traffic flow constraints. The prototype will provide recommended departure pushback times for airline ramp managers, and will deliver departure sequences to the movement area in an improved order. Use of the prototype will reduce taxi-out times, fuel burned, and emissions, and improve efficiency of departure runway use. Measurement of the location, duration, and cause of holding on the airport surface by taxiing aircraft is an important part of demonstrating potential benefits from a departure advisor (e.g., reduction in excess fuel burn) and also helps with the development of the prototype itself. As mentioned above, one outcome of the prototype is improved departure sequences, with optimized groups of departures bounded by successive arrivals. Hold categories and algorithms for detection and classification have been developed for arrivals and departures taxiing on the airport surface. Hold categories and algorithms depend on having high-quality surveillance data. Some hold classifications require gate-area surveillance data, such as is available at JFK. The arrival hold categories are: arrival held short of crossing runway and arrival held waiting for departure to clear ramp alleyway. Departure hold categories are: departure queue hold, departure runway pre-roll hold, hold at gate, hold at pushback, and hold at movement area/ramp area ?spot.? Hold categories not specific to operation type (e.g., arrival) are: operation held behind arrival holding short of crossing runway, operation held to merge with or follow taxiing traffic, and operation held to yield to crossing traffic. This paper presents results from the application of the holding algorithms. For example, the material presents statistics on the holding of arrivals short of an active departure runway. Also, examples of departure queue statistics (maximum departure queue depth vs. service time, fraction of time spent in a held position while in departure queue) will be presented. This work extends the state-of-the-art for detection and quantification of aircraft taxi delays on the airport surface by providing some causal attribution (e.g., blocked ramp alleyway). Causality is important to business cases made to support adoption of airport automation technology by an air navigation service provider (ANSP), airline, or airport authority. [C3909]

"CDA with RTA in a mixed environment"

Procedures for continuous descent approach (CDA) and optimized profile descents (OPD) are being fielded to allow aircraft to approach moderately dense terminal areas while flying efficient, near-idle descent trajectories that save fuel, and reduce emissions and noise. However, CDA operations can have a negative impact on the airspace throughput and controller workload. Air traffic management automation systems are being developed and fielded to assist controllers in handling more aircraft and larger airspace per controller. Many of these systems are time-based and built to predict the aircraft trajectories as accurately as possible. Three technologies that can assist ATM automation systems in enabling CDA operations in dense terminal areas while maintaining or increasing airspace throughput and safety: controller pilot data-link communications (CPDLC), automatic dependent surveillance contract, extended projected profile (ADS-C EPP), required time-of-arrival control (RTA). Initial trials using RTA capability have shown some challenges in integrating RTA and non-RTA aircraft due to the structural shape of the speed profile strategy (how the speeds are chosen in different flight segments), and the automatic speed adjustments made by the RTA algorithm in response to observed trajectory error. Both of these issues can reduce the relative spacing between aircraft in trail. This paper presents an operational concept for how the RTA capability can enable the use of CDA procedures in high density traffic in a mixed equipage environment, either with or without the use of digital data link. [C3910]

"Enabling advanced continuous descent approaches-Results of the European project optimal"

This paper describes the development, implementation and validation of an extension module to a 4D capable Flight Management System to enable environmentally efficient CDA techniques in a future operational environment. It briefly explains an operational concept that will allow optimized CDA in high density traffic situations and demonstrates that with the developed FMS functions an optimized CDA can be flown in 4D so that a given RTA can be met with high accuracy. Flight trials with DLR's test aircraft ATTAS, a modified VFW 614 and with DLR's Advanced Flight Management System onboard, proved a highly accurate predictability of 4D optimized CDA trajectories. The work has been carried out within the OPTIMAL project, a European 6th Framework Program research project (2004-2008) which develops innovative procedures for the approach and landing phases of aircraft and rotorcraft. The objective is to minimize environmental impact and increase airport capacity while improving operational safety. [C3911]

"Analysis of divergences from area navigation departure routes at DFW airport"

The next generation air transportation system (NextGen) calls for the extensive use of trajectory management for aircraft to achieve precision flight paths. To understand, develop, and model systems that support these NextGen operations, especially in the terminal area, NASA is looking at today's precision operations to gain insight into the expected behavior. This paper documents characteristics of aircraft that are both on and vectored from routes in the execution of area navigation (RNAV) precision departures to support precision modeling and provide for NextGen super density operations research. Dallas/Fort Worth International Airport (DFW) was selected for this case study as these kinds of precise departure procedures have been in daily use there for years. One-third of DFW RNAV departures encounter some form of vectoring away from the defined RNAV routes. The majority of these, about one-quarter of the departures, are given direct routings that bypass fixes on the route and shorten the distance flown within the terminal radar approach control (TRACON). These divergences primarily result from controllers taking advantage of opportunities in the airborne traffic, similar to direct-to routing in enroute airspace, and are not the result of departure sequencing or avoiding loss of separation. During the planning of the RNAV procedures, some of this vectoring was expected and even encouraged, but the number of aircraft so affected has grown over time. Pilots and air traffic controllers use the precision navigation capability required for the RNAV departure procedures to bypass portions of the routes. While this is applicable to DFW alone, it is a reminder that the human elements in the system frequently find new and innovative uses for elements of the procedures, or the technology behind them. The numbers of aircraft vectored in the course of RNAV departure operations is comparable to those departing with reduced spacing, the main benefit of the original RNAV implementation. The data presented here demonstrate the flexibility of the procedures as currently used. [C3912]

"Visual assistance to support late merging operations in 4D trajectory-based arrival management"

Within the German Aerospace Center (DLR) project FAGI (Future Air Ground Integration), new operational concepts and automation support systems for fuel- and noise-efficient arrival management are being developed. An essential element of the FAGI concept is a modified airspace and route structure, featuring the late merging of different arrival routes to support user-preferred flight profiles such as Continuous Descent Approaches (CDA). The present paper studies aircraft ghosting solutions on the radar display as a potential means to support controllers with merging different streams of aircraft with sufficient precision. In addition to a technical presentation of different ghosting principles, the results of two human in the loop studies are reported. Using objective and subjective data on performance, workload, situation awareness, and eye-tracking analysis, the benefits, trade-offs and acceptance of the visual assistance functions are discussed. [C3913]

"Frequency diverse array: Simulation and design"

In this paper, the radiation characteristics of frequency diversity array are concerned. With a set of CW signals of different frequencies transmitted simultaneously from the array, the transient field is examined by electromagnetic field simulation software. A periodically scanning beam is observed and the scanning speed is shown to be related to the frequency increment between two neighboring elements. Based on electromagnetic field simulation results, a low cost frequency diverse array is designed. 4 PLL frequency synthesizers sharing the same reference signal generate the desired signals. The output frequencies can be easily configured and flexibly changed by 16 bit parallel programming. [C3914]

"Real-time propagation forecasting for Earth-space communication"

The use of frequencies in excess of 20 GHz for Earth-space communications is significantly impaired by the effects of the weather phenomena in the troposphere. The main contributing factor is attenuation due to rainfall but at higher frequencies (Q- and V-band 40/50 GHz) cloud attenuation can also be significant. Although small fades can be overcome by adapting the physical layer through changes to modulation, coding scheme and through power control, fades can be so deep that the link is lost. Knowledge of these conditions can help schedule and manage network resources and help reduce interference. This paper discusses the use of propagation models allied to numerical weather prediction and weather radar data to produce real-time and forecast prediction of fades. These can be used to both design and drive instantaneous fade-mitigation techniques. [C3915]

"Electronically tunable liquid crystal based Salisbury screen microwave absorber"

In this paper we describe the design, manufacture and performance of an electrically thin (0.15 Г,Ві) dynamically adaptive Salisbury screen absorber. The structure is backed by a high impedance surface which is constructed on a 250 Г,Віm thick liquid crystal substrate. The shift in the resonant frequency of the radar absorber is

obtained by exploiting the voltage dependent anisotropic property of nematic state liquid crystals. Simulated results show that the reflection minimum is tunable over a 2.3% bandwidth and the reflectivity is below -10 dB in the frequency range 8.8-10.05 GHz (13%). Numerical predictions for normal incidence operation are shown to be in close agreement with experimental results when bias voltages are applied in the range 0 V to 20 V. [C3916]

"Towards HF metamaterials"

Surface waves are a key point for high frequency radars. Our global objective is to improve or avoid their excitation depending on whether we operate surface wave radars or sky wave radars. This paper deals with suppression of surface wave for high frequency sky wave radar. We aim to develop periodic sub-wavelength structures like metamaterial ones. Indeed, considering HF wavelength, we have the opportunity to build objects with reasonable size and relatively poor accuracy constraints. We present first results of our studies. [C3917]

"The optimal search for multifunction phased array radar"

Multifunction phased array radars have the potential of directing the electromagnetic radar beam without mechanically adjusting the antenna. Furthermore, the beam can be redirected instantaneously towards any location in space. Instantaneous, adaptive beam pointing enables the combination of functions such as tracking, surveillance, and weapon guidance each of which requires access to a shared antenna. Therefore, there is the need to optimize radar resource allocation adaptively according to dynamically changing environments. In this paper, the optimal search is investigated based on the search performance and quantified radar load. Therefore, the overall probability of detection is evaluated to calculate the average probability of track initiation. A novel algorithm for adaptive optimal search is presented and analyzed through simulations. [C3918]

"Multi-modal image registration for localization in Titan's atmosphere"

We study the problem of localizing a balloon in the atmosphere of Saturn's moon Titan by registering onboard imagery with orbital imagery. This is critical for both autonomous navigation purposes and acquisition and sampling of scientifically interesting sites. Because of Titan's atmospheric opacity, we require the ability to match combinations of visible, infrared (IR) and synthetic aperture radar (SAR) images. For both localization and direct use as a multi-modal data product for science analysis, match results must be sub-pixel accurate. We demonstrate the feasibility of matching orbital SAR data to visible and IR imagery and outline a framework for using this data as a navigation product. We demonstrate a technique to compensate for local distortions to enable accurate data registration in spite of differences in sensor return and imaging geometry. Finally, we show match results using both terrestrial imagery and the limited amount of available Titan data acquired by the Cassini orbiter and Huygens probe. [C3919]

"A new and practical formulation of bistatic Inverse Synthetic Aperture Radar imaging and verification of the formulation using numerical examples"

A compact formulation of bistatic inverse synthetic aperture radar (ISAR) imaging is provided and presented through numerical simulation of various perfect scatterers. The imaging formulation is derived for small-angle and small-bandwidth conventions. After completing the formulation, its relationship to monostatic set-up is examined and discussed. To validate the algorithm, the images of point target models are then simulated and presented for different bistatic geometries. It is shown that for a range of bistatic angle, the imaging algorithm successfully works and has the advantage of reduced bandwidth over the monostatic case at the cost of worse resolution. [C3920]

"Shifted frequency internal equivalence 2D application"

Scattering problem is analyzed in a large frequency band by a new method, using Shifted Frequency Internal Equivalence (SFIE). The accuracy of the method is investigated by comparing the results of Method Of Moments (MoM) solutions and the result of the solution by SFIE. The field distribution in the 2D structures and the far field Radar Cross Section (RCS) values are calculated. As a result of the study, the benefit of the application of SFIE is analyzed and usage of the method is detailed. The application of the SFIE to multi-frequency EM scattering and its performance are presented. [C3921]

"Sb-based n- and p-channel HFETs for high-speed, low-power applications"

Heterostructure field-effect transistors (HFETs) composed of antimonide-based compound semiconductor (ABCS) materials have intrinsic performance advantages due to the attractive electron and hole transport properties, narrow bandgaps, low ohmic contact resistances, and unique band-lineup design flexibility within this material system. These advantages can be particularly exploited in applications where high-speed operation and low-

power consumption are essential, which include large-scale activearray space-based radar, communications, imaging, sensing, and high-data-rate transmission. In this talk, recent advances at our laboratory in the design, material growth, device performance, and oxidation stability of Sb-based nand p-channel HFETs will be presented. [C3922]

"Sub-aperture method for the wide-bandwidth wide-angle inverse synthetic aperture radar imaging"

In this paper, a method for obtaining focused inverse synthetic aperture radar (ISAR) images of targets based on the radar backscattering measurements taken over wide bands and wide angles. The proposed method divides wide angle and wide frequency band into small aperture bands in the spatial frequency or Fourier domain. This set-up makes it possible to use fast calculation of ISAR images for every sub-aperture data set as in the case of standard ISAR case of small-bandwidth and small-angle. The details of the method are presented and numerical examples are given for the validation the method. The electromagnetic scattering estimation from the target is calculated via a hybrid simulator that uses both the physical optics and the shooting & bouncing ray concepts. [C3923]

"Left-handed microstrip delay line implemented by complementary split ring resonators (CSRRs)"

Left-handed microstrip delay lines implemented by Complementary Split Ring Resonators (CSRRs) have been designed, fabricated and tested. The measured results reveal that the left-handed microstrip CSRRs can realize much longer delay in time as compared to conventional transmission lines for the same lengths. In this paper, for the length of 96 mm, a 12-cell CSRRs can provide the highest delay approximately 16 ns, whereas a conventional line can only offer the delay of only 6 ns with the length of 48 mm. The much needed delay properties with compact size of the lines will lead to their application in phase array radar systems. [C3924]

"Towards a better excitation of the surface wave: Electromagnetic field on the sea surface"

HF radar and communication systems take advantage of surface wave propagation at the interface of the sea to overcome the radioelectric horizon limitation. The paper reviews electromagnetic fields excited by a vertical electric dipole over both a flat and a spherical Earth in order to focus on the surface wave. In a first time, classical Norton and Zenneck results are discussed and compared with a modal decomposition technique for a plane interface. Secondly, the field on a spherical Earth is considered. Fock formulation is applied in the last part of this communication. Even if the expressions of these fields are not similar, the results are in good agreement. This make the way for analytic isolation of surface wave contribution whatever the antenna design. [C3925]

"X-band waveguide array with a wide scanning angle"

In this paper a sixteen elements antenna array with wide scanning angle is presented. Characteristics of the optimized individual radiator integrated in the antenna array are determined. Beam steering for the phase shifts 0° , 90° and 150° are demonstrated for the antenna prototype. [C3926]

"Loop-loaded printed dipole array design for a dual-band radar application"

A loop-loaded printed dipole (LLPD) antenna array is introduced for a dual-band radar application operating at 3.0/5.5 GHz bands. A pair of loops is placed on or underneath the dipole aperture, providing dual-band operation without deteriorating the gain performance. It is numerically demonstrated that the proposed arrays offer almost 15% impedance bandwidths at designated frequencies. The full-wave analyses of the LLPD designs have been carried out using CST Microwave Studio, and cross-comparisons are provided using Ansoft HFSS. [C3927]

"A methodology for calculating the interference of wind farm on weather radar"

Wind turbines may degrade the quality of the hydro-meteorological data obtained by weather radars. This degradation is difficult to estimate, and it is necessary to develop a procedure to obtain accurate results of the reflectivity values from the wind turbines and the affected area. This contribution outlines a methodology to estimate the clutter generated by a specific wind farm on a weather radar. The methodology is based on the estimation of the RCS of each wind turbine of the wind farm, and includes the filtering and data processing stages of the weather radar. The proposed method has been applied to a specific case. [C3928]

"Numerical and experimental analysis of metallic plate near-field RCS at oblique incidence and applications to radar systems"

An analysis of the near-field radar cross section of a metallic plate at oblique incident angle is presented using

physical optics integration. This analysis is validated by experimental results obtained in an anechoic chamber. Furthermore, the results show that by using multiple receiving antennas, one can increase the angular range of radar systems and reduce the standard deviation of the target response. This work has potential applications in automotive collision warning/avoidance radar systems. [C3929]

"Effect of target conductivity on plasmonic cloak"

In this paper, effect of target conductivity on plasmonic cloak performance is investigated. The target considered here is a conducting/semiconducting sphere, enclosed in a plasmonic cloak designed for PEC sphere. Structure was modelled and simulated in HFSS. Bistatic and monostatic RCS for cloaked and uncloaked structure was evaluated for various values of target conductivities. High reduction in both monostatic and bistatic RCS was observed even for conductivity value as low as 0.01Sm^{-1} . [C3930]

"Dual-polarized stacked C-band antenna element with novel hairpin-type contactless stripline to stripline transition in multilayer integrated structure for SAR applications"

Stacked dual-polarized antenna element for SAR applications is presented. The antenna element operates in C-band having 8% bandwidth. In order to achieve high isolation between ports generating orthogonal polarization orthogonal placement of two coupling slots has been applied. To provide additional isolation between vertical and horizontal polarizations the feeding lines generating orthogonal polarizations have been placed on different layers of multilayer stripline structure. Contactless hairpin-type band-pass transition between adjacent stripline layers has been designed and applied within the antenna feeding network to eliminate via interconnections and possible excitation of leaky modes. The measured results of the manufactured antenna element are in good agreement with the calculated ones. [C3931]

"Mathematical analysis of true time delay for optical beam steering in laser radar"

Optical beam steering is very essential for efficient and faster imaging of the environment using radars for both commercial and defensive purposes. Very often this is implemented in mechanical domain, which leads to numerous shortcomings like limited lifetime, electro-magnetic effects etc. To get continuous beam angle control, we use electro-optic effect. In the electro-optic waveguide approach, 1D linear arrays of electro-optic curved, variable length waveguides were harnessed for beam steering. For fusion of microwave and optical domains proper down and up conversion is essential. Here a true time delay is implemented and unique optical splitter is also designed. In addition optimization of electrode has been proven here with brief study of different noise effects. [C3932]

"Design of no-hit-zone frequency-hopping sequence sets with optimal Hamming autocorrelation"

No-hit-zone frequency-hopping sequence (NHZ-FHS) is a core element for quasi-synchronous frequency-hopping multiple access (QS-FHMA) systems. In this paper we construct new optimal NHZ-FHS sets with respect to the bound by Ye and Fan by interleaving techniques. We first give three constructions for optimal NHZ-FHS sets of length $2N$ for any positive integer N , $\Gamma, \text{Bi } 3$ according to whether the size of NHZ is even or odd. We also construct optimal NHZ-FHS sets of length kN for any positive integers k and N with $2 \leq k < N$ by generalizing one of the proposed constructions for NHZ-FHS sets of length $2N$. All the FHSs from our constructions are non-repeating FHSs which are optimal with respect to the Lempel-Greenberger bound. Since the NHZ size and set size can be freely selected in our constructions, they may be applied to various situations in QS-FHMA systems. [C3933]

"Maximum directivity beamformer for spherical-aperture microphones"

Spherical microphone arrays have been recently studied for sound analysis and beamforming. These arrays have the advantage of spherical symmetry facilitating three-dimensional analysis. Performance of microphone arrays at the high-frequency range is typically limited by aliasing, which is a result of the spatial sampling process. A potential approach to avoid spatial aliasing is by using continuous sensors, in which spatial sampling is not required. This paper presents an optimal beamforming technique for the spherical-aperture microphone, which is based on a continuous sensor. The proposed beamforming technique is used to compute the optimal real-valued aperture weighting function. Real-valued aperture weighting functions are required to ensure the realizability of the sensor. [C3934]

"Constructions of quadriphase Z-complementary sequences"

Aperiodic quadriphase Z-complementary sets (QZCS), which include the conventional complementary sets as special cases, are introduced. It is shown that, aperiodic quadriphase Z-complementary pairs are normally better

than binary ones of the same length in terms of the number of Z-complementary pairs, and maximum zero correlation zone (Z_{\max}). The new notions of elementary transformations on quadriphase sequences and elementary operations on QZCS are brought forward. In particular, new methods for analyzing the relations among the formulas relative to QZCS and for describing aperiodic Z-complementary sets are proposed. Improved constructions of QZCS and their mates are given. [C3935]

"Lower bounds on the periodic partial correlations of frequency hopping sequences with partial low hit zone"

In order to evaluate the goodness of frequency hopping sequence design, the periodic Hamming correlation function is used as an important measure. Usually, the length of correlation window is shorter than the period of the chosen frequency hopping sequence, so the study of the periodic partial Hamming correlation of frequency hopping sequence is particularly important. In this paper, the periodic partial Hamming correlation lower bounds for frequency hopping sequences with partial low hit zone, with respect to the size of the frequency slot set, the length of correlation window, the family size, the partial low hit zone, the maximum periodic partial Hamming autocorrelation and the maximum periodic partial Hamming crosscorrelation are established. It is shown that the new bound include the known Lempel-Greenberger bound, Peng-Fan bound and Eun-Jin-Hong-Song bound for the conventional frequency hopping sequences as special cases. [C3936]

"Underwater target detection from multi-platform sonar imagery using multi-channel coherence analysis"

This paper introduces a new target detection method for multiple disparate sonar platforms. The detection method is based upon multi-channel coherence analysis (MCA) framework which allows one to optimally decompose the multichannel data to analyze their linear dependence or coherence. This decomposition then allows one to extract MCA features which can be used to discriminate between two hypotheses, one corresponding to the presence of a target and one without, through the use of the log-likelihood ratio. Test results of the proposed detection system were applied to a data set of underwater side-scan sonar imagery provided by the Naval Surface Warfare Center (NSWC), Panama City. This database contains data from 4 disparate sonar systems, namely one high frequency (HF) sonar and three broadband (BB) sonars coregistered over the same area on the sea floor. Test results illustrate the effectiveness of the proposed multi-platform detection system in terms of probability of detection, false alarm rate, and receiver operating characteristic (ROC) curves. [C3937]

"Effects of overlaid navigational information on seascape on ship crew performance"

Many of marine accidents cause by the perception error during navigation watch. We developed a new navigation support system which expected to decrease cognitive workload of officer of the watch. The support system can project marine radar information onto head up display combiner which is placed on a compass. An experiment was carried out in order to evaluate the effectiveness of the support system. Seventeen subjects participated in the experiment who is asked to navigate vessel at PC-based ship bridge simulator. Eye fixation duration for under navigation task was measured as index for efficiency of the support system. As a result of this experiment, the statistical significance could not be found. However, there has been shown to be tendency towards extend the fixation duration for navigation watch with the support system as increase collision risk. [C3938]

"Precise positioning with wireless sensor nodes: Monitoring natural hazards in all terrains"

Prediction, assessment, and mitigation of surface-affecting natural hazard processes such as landslides, avalanches, earthquakes, and floods call upon geoscientists to rapidly deploy instruments and accurately characterize these earth processes, often with little lead time and under dangerous working conditions. Affected areas may have heavy tree canopies, or high atmospheric dust loads (volcanic eruptions), precluding the use of traditional location techniques like Global Positioning System (GPS). The proliferation of inexpensive radio systems provides a technology that has the potential to redefine the approach to rapid characterization of hazardous earth processes. The research effort described in this paper developed and demonstrated an inexpensive, cooperative radar-like technology for precise distance measurement between intelligent radio nodes. [C3939]

"Automated cable detection in sonar imagery"

The classical paradigm of line and curve detection in images, as prescribed by the Hough transform, breaks down in cluttered and noisy imagery. In this paper we present an "upgraded" and ultimately more robust

approach to line detection in images. The classical approach to line detection in imagery is low-pass filtering, followed by edge detection, followed by the application of the Hough transform. Peaks in the Hough transform correspond to straight line segments in the image. In our approach we replace low pass filtering by anisotropic diffusion; we replace edge detection by phase analysis of frequency components; and finally, lines corresponding to peaks in the Hough transform are statistically analyzed to reveal the most prominent and likely line segments (especially if the line thickness is known a priori) in the context of sampling distributions. The technique is demonstrated on real and synthetic aperture sonar (SAS) imagery. [C3940]

"Image segmentation using minimum cross-entropy thresholding"

Entropy-based image thresholding is an important concept in the area of image processing. Pal (1996) proposed a minimum cross-entropy thresholding method based on Gaussian distribution. Our new method is derived from Pal method that segment images using minimum cross-entropy thresholding based on Gamma distribution and can handle bi-modal and multimodal images. Our method is tested by using Synthetic Aperture Radar (SAR) images and it gives reliable results for bimodal and multimodal images. [C3941]

"A new approach based on particle filter for target tracking with glint noise"

In radar target tracking application, the observation noise is usually non-Gaussian, which is also referred to as glint noise. The performances of conventional trackers degrade severely in the presence of glint noise. An improved particle filter, Markov chain Monte Carlo iterated extended Kalman particle filter (MCMC-IEKPF), is applied to this problem. The tracking performance of the filter is evaluated and compared to the particle filter (PF) and the Markov chain Monte Carlo particle filter (MCMC-PF) via simulations. It is shown that the MCMC-IEKPF has better tracking performance. [C3942]

"Path loss revisited using computer simulation"

In this paper, we propose a computer simulation model for the study of the large-scale effects on narrowband wireless transmission systems. The development of the path loss model is based on the ray tracing technique. This study concentrates on the first-order scattering effects, namely each multipath signal is a two-hop signal that involves a single scattering object. The first hop is directed toward the scatterer from the transmitter; and the second hop goes from the scatterer to the receiver. For each hop the signal is described using a two-ray model accounting for wave propagation along the direct path and along the ground-reflected path. The simulation results are consistent with the empirical models that are derived from measurements, including the Hata model and the Lee model. More importantly, two key observations are made: First, the path loss is affected by the number of scattering objects, their radar cross sections, and the ground reflection. Second, coherent multipath signals can cause the path-loss exponent falling below 2, which corresponds to free-space propagation. [C3943]

"Evaluation of marine simulator training based on heart rate variability"

Mental workload is useful for evaluating performance of a ship's navigator: a captain, a duty officer, and a pilot. The heart rate variability (R-R interval), the nasal temperature and the salivary amylase predict well based on pre-experiments; however, most of the research tests a professional's skill. The evaluation does not test a cadet's skill yet. In this paper, we evaluate a cadet's R-R interval as he guides a ship from a narrow channel to open sea, and consider simulator training effects. The experiment is carried out using a ship bridge simulator, not a real ship. We show the R-R interval is a good index for the evaluation of marine simulator training. [C3944]

"3D building reconstruction from LiDAR data"

Airborne LiDAR data can be used to create 3D terrain models useful in augmented or virtual reality in which real-world landscapes are incorporated. Automatic generation of 3D models of man-made structures such as buildings is essential for creating these detailed models. We present a method that builds a 3D mesh, segments the triangles, and forms planar facets that correspond to a roof structure of a target building. We illustrate our method with real-world data sets. [C3945]

"Impact of increased spatio-temporal radar data resolution on forecaster wind assessments"

This study examines the impact of increased spatio-temporal resolution weather radar data on the judgment accuracy and warning decisions of forecasters. In a static part-task setting, weather forecasters were provided with high resolution radar data in addition to conventional radar data and asked to forecast ground level winds two to five minutes into the future. When given these additional data, subjects significantly increased wind speed assessments, decreased absolute error, increased confidence ratings, and changed the number of affirmative

warning decisions. [C3946]

"Approximate expression for long length huffman sequence"

Huffman sequence has impulsive autocorrelation function and is applicable to radar and communications. This paper describes approximate expression for the sequence and considers sequence values. The sequence spectrum is expanded to polynomial groups related to approximate sequences. The first-order approximate sequence with real value is similar to a real-valued orthogonal periodic sequence with phase parameters $\{0, \pi\}$. The maximum absolute value of the Huffman sequence is estimated on the basis of the maximum absolute value of the first-order approximate sequence. [C3947]

"Construction of binary sequence pairs with two-level periodic autocorrelation function"

Based on the equivalent relationship between binary sequence pairs with two-level periodic autocorrelation function (BSPT) and difference set pairs (DSP), several families of BSPT including perfect binary sequence pairs are constructed by recursively constructing DSP on the integer ring. [C3948]

"A novel quantum evolutionary algorithm for quadratic Knapsack problem"

The Quadratic Knapsack Problem (QKP) deals with maximizing a quadratic objective function subject to given constraints on the capacity of the Knapsack. We assume all coefficients to be non-negative and all variables to be binary. Solution to QKP generalizes the problem of finding whether a graph contains a clique of given size. We propose in this paper a Novel Quantum Evolutionary Algorithm (NQEA) for QKPs. These algorithms are general enough and can be used for similar subsection of problems. We report in this paper solutions which lie in less than 1% of the optimal solutions. We also show that our algorithm is scalable to much larger problem sizes and is capable of exploiting the search space to its maximum. [C3949]

"Viewpoint independent vehicle speed estimation from uncalibrated traffic surveillance cameras"

We present here a prototype of an algorithm for vehicle speed estimation. Different from previous approaches, our algorithm requires no road markers and fewer manual calibrations. Based on specific projection rules, we find a relation between the in-camera coordinate and the real world coordinate. A non-linear regression is employed to estimate the model parameters. This model enables us to estimate the real world position of the vehicles directly from a video sequence taken by a surveillance camera. The algorithm shows its ability to produce accurate estimations in our experiments. [C3950]

"Stride rate in radar micro-doppler images"

We extract gait information from the radar micro-Doppler signals generated by human motion. We demonstrate the extraction of information associated with gait, especially the stride rate, from simulated and measured radar data. We describe micro-Doppler algorithms used for the extraction of stride rate, the radar sensors used for the measurements, and detail the gait features that can be extracted. We make measurements of human subjects in realistic outdoor clutter backgrounds. These features help identify subjects in a scene. We gather ground truth using video to validate the radar data. We conclude that although we can extract gait features like stride rate from radar data, more features need to be extracted before reliable identification or classification can be determined. [C3951]

"Analysis of downlink aircraft parameters monitored by SSR mode S in ENRI"

In order to prepare for future deployment of SSR (secondary surveillance radar) mode S with DAPs (downlink aircraft parameters) function in Japan, ENRI (Electronic Navigation Research Institute) has started research and development of new SSR mode S. DAPs function enables ground station to obtain aircraft information such as selected altitude, rollangle, magnetic heading and so on. When DAPs function is employed as a means of ATC (air traffic control), reliability of DAPs data is critically important. The purpose of this paper is to compare DAPs data with original FMS (flight management system) source data to validate radar system function and to test the reliability of DAPs data. This time, we picked up B737-800 and B747-400 and selected aircraft parameters in GICB (Ground Initiated Comm-B) 40, 50 and 60 as an analysis target of DAPs data. These are known as Mode S EHS (enhanced surveillance) which becomes mandatory in the part of Europe. In this paper, we first describe our experimental mode S system with DAPs function. Then, DAPs data have been compared with the data stored in aircraft flight recorder. As a result, we presented that the values of DAPs agreed with those of airborne stored data except in a few parameters. [C3952]

"Integrated RNAV procedure design: City-pair analysis"

Potential benefits of area navigation (RNAV) to operating costs, airspace capacity, and environmental impact are well known. Unfortunately, several real-world RNAV implementations have underperformed benefits expectations. Integrated procedure design seeks to capitalize on the benefits of RNAV and mitigate some of the effects that reduce benefit. This paper focuses on integrating upstream and downstream constraints into procedure design to achieve this goal. It explains a general methodology for combining techniques, such as diverging departures and Q-routes during route development. The method considers net capacity impact from one or more procedure revisions, using an origin-to-destination view. Some procedure modifications specifically considered include runway efficiency changes, additional egress points, and RNAV-based Q-routes. We present a specific case study with the method and show how it can account for mixed equipage, variable aircraft weight categories, and downstream route merging. [C3953]

"Marine vessel height detection and display system at Logan International Airport"

This paper describes a high resolution dual radar system designed to detect and track tall ships in Boston Harbor and to report this information to air traffic controllers. The system consists of a conventional X-band marine radar for tracking ships and a narrow beam, W-band radar system used to scan ships to determine their height. The system provides coverage of ships within a 10,000-ft wide surveillance zone in the Boston Harbor Channel centered on the approach to Runway 4R/22L. The system provides controllers with a visual display of ship position, height and time of entry and exit into and out of the runway protection zone. The system also provides audible alerts whenever ships exceed allowable height limits. This paper describes the radar system, height measurement methodology, display features and operational utility. Example data demonstrate ship height measurement accuracy of approximately 10-ft at 1 nm range. [C3954]

"Results of validation of SSR mode S interrogator identifier code coordination"

Secondary surveillance radar (SSR) mode S is an air traffic control radar system with improved surveillance and datalink capability. In SSR mode S system, each mode S ground station (GS) has interrogator identifier (II) code. II code is set in interrogation and signals. It makes possible transponders identify the source site of interrogation and GS distinguish the destination of reply. International Civil Aviation Organization (ICAO) standard prepares 4 bits space in interrogation and reply for II code. Fifteen II codes are available for GS. As the number of SSR mode S GS increases, SSR operator is not able to assign II codes without conflicts between neighboring GS. This problem is called II code shortage problem. If the same II code is assigned to neighboring GS that have overlapping coverage, GS is not able to achieve continuous aircraft surveillance in overlapping area. To overcome the problem, GS is required to have II code coordination function. To prepare for the II code shortage problem in Japan, Electronic Navigation Research Institute (ENRI) developed SSR mode S with II code coordination function and conducted validation of fundamental functions in 2008. In this paper, we mention II code coordination technique, experimental system and experiments. Then we show the results of validation. [C3955]

"Colorado WAM separations standards targets of opportunity and flight test analysis"

The Federal Aviation Administration (FAA) Surveillance and Broadcast Services (SBS) Program Office and the Colorado Department of Transportation are implementing Wide Area Multilateration (WAM) in Non-Radar Airspace (NRA) to improve air traffic services at and around routes and fixes that support operations at Hayden/Yampa Valley (HDN), Craig-Moffat (CAG), Steamboat Springs/Bob Adams Field (SBS), and Garfield County Regional-Rifle (RIL) airports. In particular, the lack of comprehensive radar surveillance at and below 10,000 ft. in these regions requires controllers to use procedural separation standards for the Instrument Flight Rules (IFR) arriving/departing aircraft. While this is a safe means of providing service, it is inefficient for current traffic and especially for expected demand growth. Wide Area Multilateration is a distributed surveillance technology that utilizes a constellation of ground stations to provide surveillance coverage within a defined region. This technology makes use of signals transmitted from Air Traffic Control Radio Beacon System (ATCRBS) (Modes A and C) and Mode S transponders, in response to interrogations. The Mode S transponders also provide the squitter message once per second. The implementation, certification, and commissioning of WAM would enable air traffic controllers to apply more efficient separation standards for aircraft operating in the affected airspaces. For this operational environment, with WAM as the surveillance technology, the FAA seeks to achieve 5 NMI lateral/longitudinal separations. This paper describes the technical results from the data modeling, controlled flight test, and targets of opportunity analysis for the WAM sensor constellations near HDN and RIL to support separation standards within the Host Computer System (HCS) automation platform environment at Denver Center (ZDV). Comparative analysis was conducted between WAM and Secondary. U.S. Government work not protected by U.S. Copyright. Surveillance-Radar (SSR) to evaluate and validate WAM performance to support separation services. [C3956]

"Evaluation of separation performance with ADS-B at the Louisville key site"

The Federal Aviation Administration's (FAA) surveillance and broadcast services (SBS) program office is implementing a ground infrastructure that supports the automatic dependent surveillance-broadcast (ADS-B) data service. One of the main applications of this new surveillance service will be to support air traffic control (ATC) separation procedures that are performed exclusively with radar surveillance today. As part of the initial activities to assess the system, the ADS-B data is being incorporated into four different automation platforms in four different key sites. The first key site to integrate ADS-B data is the Louisville Terminal Radar Approach Control (TRACON) which uses common automated radar terminal system (Common ARTS) to process and display radar data to controllers today. The Louisville Common ARTS has been augmented to accept ADS-B data and display aircraft using system track positions that are calculated from a variety of surveillance inputs, including multiple radars and ADS-B. As part of the SBS evaluation, a working group was created that worked specifically to evaluate the end-end performance in terminal separation applications of the ADS-B avionics, ADS-B surveillance service on the ground, and the updated Common ARTS software. The evaluation used a comparative approach with current monopulse secondary surveillance radar (MSSR) systems as a baseline; if the new system performed as good or better than MSSR systems in separation applications, then the system was acceptable for operation. This paper summarizes some of the efforts of that SBS working group to evaluate the operational performance in Louisville, including the metrics, assumptions made, scenarios developed for evaluation, and results from simulation, analysis of targets of opportunity (TOO), and controlled flight testing.

[C3957]

"Addressing challenges for GIG interoperability of manned and unmanned platforms"

Affordably enabling the benefits of the Global Information Grid (GIG) for enhanced mission capabilities and effectiveness requires key decision coordination in Community of Interest (COI) for Manned and Unmanned Platforms. Network based information sharing requires coordination in data presentation, representation, level of sensor integration, communication link connectivity, and communication link interoperability. Data presentation coordination needs to address operator interface flexibility for Web and third-party applications. Data representation must address the need to share a Common Operational Picture (COP) with both legacy derived data and emerging GIG content in addition to recognizing emerging unmanned standards. Effective use of GIG connected sensors requires proper balance in data exchange of both raw sensor data static and processed track representations. Communication link connectivity considerations need to include transition from point-to-point, to relay, to ad hoc information exchanges. Finally, radio and datalink interoperability needs to be achieved well before the final capability applications are integrated. Lockheed Martin Systems Integration (LMSI) has been engaged in tri-service platform programs exploring the GIG insertion at all of these levels for both manned and unmanned platforms. In this paper, GIG insertion for the Multi-Mission Helicopter (MMH) and its mission partner unmanned vehicles are presented. Incremental insertion of Link 16 and the ship sensor data link have already demonstrated coordinated COI information exchange benefits. From this baseline, future insertion analysis is presented with regard to requirements, interface, and architecture to enable further GIG migration with effective staging.

[C3958]

"Evaluating eLORAN as a backup for surveillance and navigation: A comparative cost analysis"

Over the past five years, there have been multiple studies related to backing up the Global Positioning System (GPS). The studies have mostly focused on technical and operational issues and often assumed a performance requirement that eliminated conventional ground-based navigation aids as a solution. This paper is focused on Enhanced Long Range Navigation System (eLORAN) as a backup for cooperative surveillance and area navigation (but not precision approach) and it is directed at the business case. The authors examined a scenario where conventional ground-based navigation aids are the backup for GPS and where a limited set of secondary radars is a backup for Automatic Dependent Surveillance-Broadcast (ADS-B). This scenario was compared with a case where eLORAN is a backup for GPS, both for navigation and ADS-B positioning, and no ground-based navigation aids or secondary radars exist, with the exception of some Instrument Landing Systems (ILSs) at major airports. Several versions of the eLORAN scenario were examined, varying the year in which eLORAN becomes the backup and when equipage begins in aircraft. In addition, sensitivity analyses were run by varying the costs of the ground-based systems and the avionics. The results indicate that strictly from a cost avoidance perspective, the savings of eliminating Secondary Surveillance Radars (SSRs), Very High Frequency Omnidirectional Range (VORs), and Distance Measuring Equipment (DMEs) are smaller than the aggregate costs associated with maintaining eLORAN and the avionics costs to the users. This result is quite robust with respect to variations in the ground and avionics costs. However, if the requirement for a more robust backup than that provided by VORs, DME, and secondary radar can be made, then the case for eLORAN could be made on those grounds. Thus, the question of eLORAN as a backup rests with a better understanding of future requirements and not with cost avoidance.

[C3959]

"Detecting airport surface movement events using ground surveillance"

The availability of high-quality multi-sensor surveillance for the airport enables new forms of surface movement analysis. The Airport Surface Detection Equipment, Model X (ASDE-X) system provides precise time-stamped position and velocity reports associated with aircraft identification codes, as required for its primary mission of improving situation awareness in the air traffic control (ATC) tower. Many additional trajectory properties can be estimated from the same source. ASDE-X has no requirements for estimating and reporting acceleration in real time. However, the ability to estimate acceleration improves the ability to detect maneuvers. For the purpose of this paper, a maneuver is defined to be any acceleration of sufficient magnitude and duration to affect operational decisions. The focus of this paper is on the feasibility of estimating acceleration as part of non-real-time analysis, the ability to relate those acceleration estimates to maneuver recognition, and the operational applications of such a capability. Deeper understanding of surface activity can be obtained by re-processing surveillance data for precise trajectory reconstruction. Changes in velocity, including starts, turns, and stops, are particularly significant for operational analysis; the timing of such events in relation to airport geometry and the movement of other traffic can indicate the reasons for the observed behavior. For example, slowing can be explained by the need to yield to converging traffic at an intersection, and stopping can be explained by proximity to a hold line or joining the end of a queue. This paper shows results on the sensitivity and precision with which these surface movement events can be detected and measured. In addition, examples of the potential use of these events in studies of operational efficiency and safety will be given. Particular examples include relating speed changes to fuel use and emissions metrics, and relating acceleration from a stop to the recognition of runway entry and start of take-off roll. [C3960]

"New architecture for improving performance in embedded training system using embedded virtual avionics"

T-50's embedded training system (ETS) has been developed by Korea Aerospace Industries, Ltd. (KAI) using the embedded virtual avionics (EVA). KAI ETS contains several functions of simulation for the air-to-air and air-to-ground combat training. In the architecture of KAI ETS, the target/threat database is the main component of the ETS. Virtual sensors, equipments, and weapons can share the data of target/threat from one source, virtual target/ threat database. EVA data messages for embedded training are transmitted to mission computer (MC) via MIL-STD-1553B card. The interface between the EVA card and MIL-STD-1553B card is used for the TCP/IP communication mechanism over Ethernet. The interface between the MIL-STD-1553B card and MC is 1Mbps command/response multiplexer data buses. The EVA data which is composed of total 6 messages is each transmitted only after MIL-STD-1553B card status request and successful initialization handshake procedure occurs. Although the previous designed KAI ETS has been showed a good performance, it still leaves room for improvement. This paper proposes a new architecture for improving performance in KAI ETS. In the proposed architecture, EVA card is directly connected to MC not via MIL-STD-1553B card. The interface between the MC and EVA is point-to-point UDP/IP communication. Data messages such as weapons launches, terrain maps, radar and electronic warfare, and virtual threats are integrated. The proposed integrated message structure is not needed the checksum process. System integration test results show that the proposed architecture is improved up to 9.1 times compared with the conventional architecture. Therefore, it shows to achieve reliable transmission to the real-time constraints, required by military applications. Also, the proposed architecture can implement low-cost ETS compared with the KAI ETS architecture because MIL-STD-1553B card is removed. [C3961]

"Analysis and design of multifunction radar task schedulers based on queue"

Inside the set of systems that constitute the avionics, the radar on board is one of the principal systems, both for the commercial and the military aircraft. For a few years ago, the technologies of electronic exploration arrays are used in the radar design, and specially, in the combat fighters, where the detection and tracking of multiple targets is a fundamental requirement. In this type of environments, it is required to use multifunction radar, MFAR (Multi-Function Array Radar), which joins inside the same system, and simultaneously, so much the classic functions of tracking and surveillance, as all the functions related to the communication, countermeasures, calibration, etc. Thus, the functions are implemented according to specific tasks. The principal ones are: surveillance, tracking, confirmation of false alarm, backscanning, reacquisition and communications plane-missile. Therefore, it is required to work with, specialized subsystems inside the radar. They are called task schedulers. The task scheduler is a key element of the radar, since it does the planning and distribution of energy and time resources to be shared and used by all tasks. This paper analyzes the features of the task schedulers based on tasks queues. Radar time is divided in time intervals that are called scheduling intervals. They allow realizing the task scheduling in a flexible and automatic way, planning individually each interval. Therefore, the task scheduler constitutes, for every scheduling interval, the corresponding queue or queues with the tasks planned to execute in that interval. Then, the tasks that are going to execute are selected from those tasks queues. Therefore, the

scheduler includes and applies two scheduling policies: the policy for the constitution of the tasks queues, and the policy of scheduling, which is applied for planning every scheduling interval. Several schedulers have been designed and studied, and it has been made a comparative analysis of different performed schedulers. The tests and experiments have been done by means of system software simulation. Finally a suitable set of radar characteristics has been selected to evaluate the behavior of the task scheduler working. [C3962]

"Moving multi-object tracking algorithm based on wavelet clustering and frame difference"

The paper presents an approach to motion objects tracking by combining parallel wavelet clustering with frame difference, which satisfies certain requirements of rapid moving objects detection. By utilizing multi-resolution property of wavelet clustering analysis based on adjacent frame difference results, we can identify arbitrary shape moving objects at different degree of accuracy. Experiment results show that good accuracy of proposed algorithm can be obtained at speeds close to real-time. Applications in real world are also presented which further demonstrated the efficiency and effectiveness of the proposed method. [C3963]

"Quality of reported NACP in surveillance and broadcast services systems"

The Surveillance and Broadcast Services System (SBSS) is tasked in part with fusing NAS radar surveillance data with ADS-B data in order to provide (1) Validated ADS-B reports to ATC, and (2) a complete picture of ADS-B equipped and non-equipped aircraft to participating Traffic Information Services-Broadcast (TIS-B) clients. In order to support these functions, the multi-sensor tracker (MST) within the SBS system must translate the ADS-B avionics reported NACP to a measurement covariance in order to complete the IMM-Kalman fusion process. It is important that the reported NACP, within the confines of the NACP construct, provide an accurate assessment of the position quality contained in the respective ADS-B report with respect to the reported time of applicability. This paper assesses NACP jitter position quality through analysis of more than one million ADS-B reports recently collected in the SBSS network. Characterizations are made for each NACP number for which there are sufficient data, and distinctions are made in characterizing NACP quality between UAT, 1090 ES (DO-260) and 1090 ES (DO-260A). [C3964]

"A hardware in the loop facility for testing multisensor sense and avoid systems"

The Italian Aerospace Research Centre and the Department of Aerospace Engineering at University of Naples have been involved in a project for the development of an obstacle detection and tracking suite for autonomous collision avoidance of unmanned aerial systems. In this framework, a flight prototype of an autonomous obstacle detect sense and avoid system has been designed and realized. It is installed onboard a very light aircraft named FLARE. The system is based on multiple-sensor data integration and it includes several components, such as a Ka-band pulsed radar, four electro optical sensors and two processing units. A hierarchical sensor configuration has been chosen in which the radar is the main sensor while EO cameras are the auxiliary ones to increase accuracy and data rate. In order to maximize the outcome of flight tests, an indoor facility for hardware-in-the-loop tests has been developed. The indoor facility includes processing units dedicated to simulate aircraft and intruder dynamics that are provided as input to sensors. The radar is replaced by a simulator, while the real visible camera unit is used. Flight images are displayed on a LCD screen. The facility permits to test multiple critical flight configurations and different sensors combinations. Moreover, the availability of a well assessed simulator allows the research team to support several activities such as: i) tuning of the data fusion techniques (i.e. tracking based on Kalman filtering); ii) system performance validation for a wide range of scenarios; iii) evaluation of alternative architectures that are difficult to be reproduced during flights. Some results of hardware-in-the-loop tracking tests based on flight data are briefly summarized and expected flight performance of the electro-optical system as auxiliary sensor is discussed. [C3965]

"Fusion of airborne radar and FLIR sensors for runway incursion detection"

Objects on the runway are a leading cause of accidents to landing aircraft. A recent study by RTI for NASA investigated the detection of those objects from the aircraft using sensors commonly found on commercial aircraft: infrared cameras and weather radar. Attention was given to sensor enhancements that would improve the probability of detection, followed by the development of detection routines for each sensor. Finally a fusion process was developed based on a tracking system. A laboratory-based demonstration fusion system has been developed for the detection of runway incursions. This system uses FLIR data recorded from an aircraft on approach including long-wave and short-wave infrared video, aircraft navigation data from NASA flight tests, and simulated radar data based on the flight test parameters. The radar data are obtained from an updated NASA/RTI-developed Airborne Doppler Weather Radar Simulation (ADWRS) program. This paper describes the fusion process and presents initial results of system performance under clear weather night conditions. We show how the FLIR processor effectively extracts targets of opportunity from the infrared imagery. The LWIR provides

good target detection capabilities at night when out-the-window visibility is limited to lighted objects. The performance of the fusion algorithm is discussed, showing how it effectively removed false alarms from the FLIR and radar data. The fusion process successfully tracked targets of opportunity and classified them accurately according to the incursion hazard they represented. [C3966]

"Effects of synthetic and enhanced vision technologies for lunar landings"

Eight pilots participated as test subjects in a fixed-based simulation experiment to evaluate advanced vision display technologies such as enhanced vision (EV) and synthetic vision (SV) for providing terrain imagery on flight displays in a lunar lander vehicle. Subjects were asked to fly 20 approaches to the Apollo 15 lunar landing site with four different display concepts-Baseline (symbology only with no terrain imagery), EV only (terrain imagery from forward looking infrared, or FLIR, and light detection and ranging, or LIDAR, sensors), SV only (terrain imagery from onboard database), and fused EV and SV concepts. As expected, manual landing performance was excellent (within a meter of landing site center) and not affected by the inclusion of EV or SV terrain imagery on the Lunar Lander flight displays. Subjective ratings revealed significant situation awareness improvements with the concepts employing EV and/or SV terrain imagery compared to the baseline condition that had no terrain imagery. In addition, display concepts employing EV imagery (compared to the SV and baseline concepts which had none) were significantly better for pilot detection of intentional but unannounced navigation failures since this imagery provided an intuitive and obvious visual methodology to monitor the validity of the navigation solution. [C3967]

"Intelligent hazard avoidance system"

Weather hazards cause about 70% of flight delays and 21% of accidents in National Airspace System. Modern airborne weather radars enable pilots to detect and assess the severity of surrounding weather hazards in real-time. Military aircraft equipped with tactical data links can receive information about pop-up tactical threats, such as surface-to-air missiles, that can put the safety of the aircraft in jeopardy. Currently, pilots need to mentally combine hazard information received from various sources to determine whether these hazards will endanger the safety of the aircraft and warrant an avoidance maneuver. If an avoidance maneuver is required, pilots also need to decide what necessary maneuvers should be performed to avoid these potential hazards as well as terrain and surrounding traffic. Finally, the proposed avoidance maneuver in the form of a modified flight plan may need the approval of air traffic controllers before it can be executed. Upon approval, the modified flight plan may be manually loaded into flight management system to become the active flight plan. Since the current approach for hazard assessment and avoidance imposes a heavy burden on pilot workload, this paper presents an intelligent hazard avoidance system that automates the process of hazard avoidance by using state-of-the-art decision aid algorithms and an open architecture for avionics integration. The performance of the proposed system is also discussed in the paper. [C3968]

"Simple landing distance measurement with circular mark between aircraft and runway"

Description herein is a system for simple distance measurement between an aircraft and circular mark in landing runway. The system includes an altimeter and a camera installed on the aircraft, and a circular mark placed on a landing runway. The camera on the aircraft must be oriented toward in front of the aircraft, and configured to detect the shape of the circular mark in image data and a flight control computer configured to calculate the angle between the aircraft and the ground, the ground range between the aircraft and the circular mark, and the slant range between the aircraft and the circular mark with the altitude information measured by the altimeter installed on aircraft. Accuracy of CDGPS used conventionally and proposed system is compared in analysis section, result shows proposed system has better performance if it uses high accuracy altimeter. [C3969]

"Analysis on the tracking performance of active radar seeker under the condition of coherent interference"

The principle of the active radar seeker coherent interference was analyzed, and the mathematical expression of orientation error angle under the condition of coherent interference was established. Then the two interference sources phase difference and the signals amplitude ratio which impact the orientation error angle were simulation analyzed, it obtained that when the two interference sources phase difference is at 180° , the orientation error angle can reach the maximum. Then the coherent interference signal model was established, and the track performance of active monopulse radar seeker under the condition of coherent interference was simulation. The simulation result shown that coherent interference can effectively increase the directional error angle and the smallest distance between target and missile, when the two interference sources transmission power ratio non-linear increasing, the orientation error angle and the smallest distance between target and missile increasing greatly, that is the interference effect significantly. [C3970]

"Combining Multiple SVM Classifiers for Radar Emitter Recognition"

Radar emitter recognition is of great importance in modern ELINT and ESM systems. The conventional methods for emitter recognition usually use one classifier. For specific emitter recognition, there are slight differences between the feature vectors from radars with the same type. So the recognition result of single classifier is unreliable and instable. In this paper we propose a new combining method of multiple SVM Classifiers based on Dempster-Shaffer theory. We use a new training scheme to increase the uncertainty of single classifiers by classes' combination of the training data. This training scheme is not only accords with the character of specific radar emitter recognition, but also exerts the function of D-S theory. The simulation experiments on actual pulses of six radars with the same type verify the correctness and validity of this method, which can enhance the recognition rate and decrease the reject rate. [C3971]

"Design and implementation of an ultra-high speed data acquisition system for HRRATI"

Data acquisition system (DAS) is a fundamental functional part in every radar application, especially when used for high range resolution radar system. This paper presents a high speed and reliable DAS of a high range resolution radar used for acquiring traffic flow information (HRRATI). The system uses high performance field programmable gate array (FPGA) to cope with the data transformed by the high speed 8-bits analog-to-digital converter (ADC08D500), which performs digitization of the dual channels radar echo signals with sampling rate at 500 MHz. The signal bandwidth up to 180 MHz in each channel, then the system preprocesses all the data onboard in real time. In view of the broad bandwidth of the signal and high sampling rate, clock jitter, signal integrity and EMI/EMC issues assume great importance and pose a great challenge to the printed circuit board (PCB) design. This paper gives a thorough investigation of such problems. Finally, clock jitter and ENOB test experiment results show that the DAS is capable of sampling the radar signal effectively. [C3972]

"Passive multitarget tracking using transmitters of opportunity"

Passive Coherent Location (PCL), which uses commercial signals (e.g., FM broadcast, digital TV) as illuminators of opportunity, is an emerging technology in air defense systems. The advantages of PCL are low cost, low vulnerability to electronic counter measures, early detection of stealthy targets and low-altitude detection. However, limitations of PCL include lack of control over illuminators, limited observability and poor detection due to low Signal-to-Noise Ratio (SNR). This leads to high clutter with low probability of detection of target of interest. In this paper, multiple target tracking algorithms for PCL systems are analyzed to handle low probability of detection and high nonlinearity in the measurement model due to high measurement error. The converted measurement Kalman filter, unscented Kalman filter and particle filter based PHD filter are implemented and compared for PCL radar systems. The feasibility of using transmitters of opportunity for tracking airborne targets is shown on simulated and real data sets. [C3973]

"Tracking and Positioning Maneuvering Target with Low Thrust Acceleration"

The uncertainty of thrust acceleration will cause enormous error to model and track the accelerated motion of maneuvered target during orbit transfer process. An on-line minimum-variance estimator was developed for thrust acceleration applied to orbit transfer using discrete-time radar measurements. The mass-flow-rate of propellant was selected as a state variant, which was estimated by employing an integral state model and Extended Kalman filter. The variation equations for the measurement vector to mass-flow rate have been established to linearize the discrete-time measurement equations. The algorithm has applied successfully to maneuver process in commanding satellite into Geo-stationary orbit and lunar insertion orbit. The results show the algorithm developed here can monitor and determine whether engine works well or failure precisely and quickly during orbit transfer process. [C3974]

"Sense-Through-Wall Channel Modeling Using UWB Noise Radar"

Sensing-through-wall will benefit various applications such as emergence rescues and military operations. In order to add more signal processing functionality, it is vital to understand the characterization of sense-through-wall channel. In this paper, we propose a statistical channel model on a basis of real experimental data using UWB noise radar. We employ CLEAN algorithm to obtain the multipath channel impulse response (CIR) and observe that the channel amplitude at each path can be accurately characterized as T location-scale distribution. We also analyze that the multipath contributions arrive at the receiver are grouped into clusters. The time of arrival of clusters can be modeled as a Poisson arrival process, while within each cluster, subsequent multipath contributions or rays also arrive according to a Poisson process. However, these arrival rates are much smaller than those of indoor UWB channels. [C3975]

"Evaluation of an ultra-high speed non-uniformly working ADC with parallel structure in the software radar system"

In the ultra high-speed sampled ADC system with time-interleaved structure of the software radar, the input signal is sampled non-uniformly because of the sampling-time offset and gain difference of ADC, which product the distortion of the signals, digital spectrum. In this paper, the digital spectrum of the signal sampled non-uniformly is synthetically researched by this ADC with sampling-time offset and gain difference, and derived its digital spectrum representation. A detailed spectrum analysis of the non-uniformly sampled sinusoid is presented to obtain the signal-to-noise ratio. The results of computer simulation that verify the correction of the theory are given. The result provides the useful reference to select the indexes of the software radar system using the ADC with Parallel Structure. [C3976]

"Performance Analysis of Distributed Fuzzy CA-CFAR Detector in Pearson Distributed Clutter"

In order to improve the radar's detection performance under Pearson distributed background clutter, the problem of designing CA-CFAR detector based on fuzzy logic is studied in this paper. A kind of distributed fuzzy CA-CFAR detection scheme including two detectors is proposed here. Two detectors compute the values of the membership function to the false alarm space from the samples of the reference cells, in the fusion centre two values are combined according to four kinds of fuzzy fusion rule to produce a global member function to estimate the background clutter power for decision. The simulation results indicate that the fuzzy CA-CFAR detector based on algebraic sum fusion rule provides more robust detection performance than conventional distributed CA CFAR based on AND or OR logic. [C3977]

"A Novel Approach for Angle Measuring Improvement in Monopulse Tracking"

This paper presents a novel approach for angle measuring improvement based on Adaptive Moving Target Indicator(AMTI) and Capon algorithm. Rain clutter has a nonzero Doppler shift in spectrum domain. In monopulse radar system, the clutter reduces radar's tracking ability by means of decreasing the measuring accuracy in Doppler spectrum. The classical Moving Target Indicator (MTI) and Fast Fourier Transform (FFT) method doesn't meet the exacting tracking needs. In order to suppress rain clutter, we choose the Adaptive MTI for obtaining the best mean Improvement Factor (IF). Moreover, Capon approach is used to enhance the measuring accuracy in this article. Compared with the classical MTI and FFT, the AMTI and Capon based algorithm shows better resolution quality. Then it improves the angle measuring precision. Numerical simulation experiments prove the validity of the new method. [C3978]

"An image restoration method for reducing the de-correlation effects in InSARad"

The interferometric synthetic aperture radiometer (InSARad) is a microwave imaging instrument with the large field of view (FOV) and high spatial resolution using synthetic aperture technique. However, its performance suffers the de-correlation effects. A space variant degradation image restoration method based on coordinate transformation to alleviate the de-correlation effects is presented, and its validation is demonstrated by simulation. [C3979]

"Improvement of classification accuracy integrating C- and X-band synthetic aperture radar data"

Remote sensing for the monitoring of agricultural crops has been widely used in the past. Synthetic aperture radar (SAR) system, for its characteristics of all-weather, all-day image obtain capacity, is an attractive source of information for agriculture crop classification applications, particularly in regions where cloud cover is a problem. The accuracy with which crops can be classified is dependent on a range of sensor properties, including the SAR operating configuration. This paper focuses on the effect of integrating C- and X-band SAR data on the improvement of classification accuracy. The study was carried out on Yucheng Ecological Experimental Station (China). Radarsat-2 and TerraSAR-X data were acquired, and during the satellite overpass, the ground investigation was implemented. Support vector machine classifier was used to classify the image based on the backscattering coefficients and texture features. The classification was conducted separately on Radarsat-2, TerraSAR-X and the integrating of the two. The performance of single band SAR was not acceptly good, but the integrating of the two had a great increase on classification accuracy (more than 10%). With different frequency we would get more information about the earth surface. Integrating of multiband of SAR data was a dependable way to improve classification accuracy. [C3980]

"A design of high-range resolution radar signal synthesizer"

In this paper, we briefly analyze characteristics of linear frequency modulation (LFM) signal, stepped frequency signal and stepped chirp signal which are employed as high-range resolution radar signals. Then we propose a

design of frequency synthesizer based on a new direct digital frequency synthesizer (DDS) which clock frequency is up to 3.2 GHz. The frequency synthesizer can generate three kinds of high-range resolution radar signals, which output bandwidth is up to 1.6 GHz. Through up-conversion, the frequency synthesizer can be used in many wave bands. [C3981]

"Comparisons of ISAR Time-frequency imaging methods"

Time-frequency imaging methods include many base functions, it is hoped that the best can be applied in two dimensional imaging. A experimental radar system is designed. STFT, WVD Harr and morlet wavelet transforms are simulated and compared, which shows WVD has the best quality of the ISAR images. [C3982]

"Near-field imaging of one-dimensional aperture synthesis radiometers"

For synthetic aperture radiometers under far-field (FF) condition, the relationship between the visibility and the brightness temperature is a Fourier Transform. However, it is no longer valid when synthetic aperture radiometers are applied at short distances. A novel method based on a reference position for near-field (NF) imaging of one-dimensional aperture synthesis radiometers (ASR) is proposed. By subtracting the phase of NF visibility samples of a point source at the reference position from the phase of NF visibility samples of the imaged scene, the relation between the brightness temperature and the NF visibility can be represented by another form of Fourier Transform. Then direct DFT inversion algorithm is applied. Simulations and NF experimental results demonstrate the validity of the method for both point and extended sources. The method can be used not only in those applications at NF region of ASR, but also indoor performances test of spaceborne ASR. [C3983]

"Study of ELF electromagnetic fields from a submerged horizontal electric dipole positioned in a sea of finite depth"

Formulas for extremely low frequency (ELF) electromagnetic fields generated in a sea of finite depth by a submerged horizontal electric dipole (HED) are derived based on an air-water-seafloor three-layer model. Field components in seawater are computed using numerical integration technique and Euler's transform. The effects of frequency, sea depth, seabed conductivity and depth of submerged transmitting HED on the electromagnetic field distribution in a sea are studied, and substantive results are obtained. [C3984]

"ADBF at subarray level using a generalized sidelobe canceller"

ADBF is one of crucial techniques for phased array radar, which generally contains thousands of element. It usually adopts subarray configuration and can get only digital outputs of subarrays. Direct subarray weighting(DSW) configuration based on linearly constrained minimum-variance(LCMV) is an effective solution for ADBF, while the performance degrades in the presence of array imperfections such as amplitude and phase errors. Generalized sidelobe canceller(GSLC) is insensitive to those errors and can implement a wide variety of linearly constrained adaptive array processors with simple hardware differencing amplifiers. This paper studies an implementation method at subarray level for GSLC and compares the performance of GSLC to that of DSW in the cases of errors and no errors. Simulation results demonstrate that the proposed method is effective even when DSW lose beam shape in the presence of array imperfections. [C3985]

"New beamformer for coherent signal reception in the presence of uncorrelated interferences"

In this paper, a new beamformer is proposed for coherent signal reception with the assumption that the directions-of-arrival (DOA's) of the uncorrelated interferers are available. Here, the composite vector of the coherent sources is first estimated based on the use of a transformation matrix to eliminate the uncorrelated interferers. Then the optimum beamforming is performed based on the estimated composite vector and the eigenstructure of the array correlation matrix. Experimental results show that the proposed beamformer achieves the optimum performance and rapidly converges. [C3986]

"Monopulse characteristic based on full digital weighting for phased array radar at subarray level"

Subarray configuration is usually adopted in phased array radar where monopulse is used to detect the target angle by using sum and difference beam. While analog (Taylor and Bayliss taper) weighting is usually used to suppress the sidelobes of sum and difference beam. This paper presents an approach for phased array radar at subarray level based on full digital weighting at subarray level, therefore it is reduced for the hardware cost and complexity greatly compared to conventional analog weighting at element level, and it takes full advantage of the flexibility of digital processing. Simulation results indicate that the monopulse characteristics obtained by full digital weighting at subarray level quite approximate to that obtained by conventional analog weighting at element

level. [C3987]

"A Novel Method for Sorting Radar Emitter Signal Based on the Bispectrum"

In this paper, a novel sorting algorithm for radar emitter signal is proposed. The bispectrum of received signal is extracted, and it is predigested to two dimensions characteristic. A rectangle pulse sequence and triangle pulse sequence are constructed, then the resemblance coefficient of two dimensions characteristic with rectangle pulse sequence and triangle pulse sequence are gained, and they are used as the sorting parameters. For the bispectrum of different signal is distinguishing and it is not sensitive to SNR, the resemblance coefficient is divisible and steady, the advantage of this new method is validated by simulation results, and the highest sorting rate is 100% when the SNR is 10 dB. [C3988]

"The FDTD Modeling of GPR for Tunnel Inspection"

Ground-penetrating radar is an important tool non-destructive testing for buildings and transportation systems. However, ground-penetrating radar signals is extremely complex and is easily influenced by many factors, which lead the interpretation of radar data to be very complex and often with a certain error. The accurately interpretation of radar data need workers have some special experience, such experience is often get through the acquisition of a large number of data and their predecessor's scholarly papers. Based on the finite-difference timedomain method, the forward modeling of GPR signal provides the reference for the interpretation of ground penetrating radar data in tunnel lining inspection, so that the reliability of detection can be improved. [C3989]

"Active Learning Artificial Neural Networks Ensemble for HF Ground Wave Radar Sea Clutter Predicting"

Based on chaotic characteristic of high frequency ground-wave radar (HFGWR) sea clutter, a new adaptive artificial neural networks ensemble method for sea clutter predicting is presented in this paper. In phase space reconstructed, when one sea clutter sample is to be predicted, some artificial neural networks are choosed adaptively by evaluating their performance and error correlation in neighborhood of the sample, and outputs of these artificial neural networks are combining dynamically as the result of prediction for the sample. The adaptive artificial neural networks ensemble method is designed to improve precision of sea clutter predicting, and server sea clutter modeling in HF ground wave radar objects detecting. In order to improve the adaptive ability of the ensemble method and reduce computational complexity, the corresponding active learning algorithm is designed. Result of testing the sea clutter predicting method on practical echo data of HFGWR for objects detecting shows precision of sea clutter predicting and generalization ability can be impoved effectively by the adaptive artificial neural networks ensemble method. [C3990]

"Coherent spectrum synthesis of frequency-stepped chirp signal"

Stepped frequency radar signal has been widely used for its high range resolution and low instantaneous bandwidth. Frequency-stepped chirp signal is a useful waveform which can decrease the frequency step number while the synthesized bandwidth remains unchanged. The spectrum synthesis method based on coherent addition is introduced to avoid the range ambiguity or "ghost" images caused by the conventional IFFT processing. In order to avoid the amplitude ripples caused by the superposition of the sub-spectrum boundaries, a spectrum synthesis method based on stitching without superposition is introduced and analyzed in detail. Besides, this method is more computational effective compared with the coherent addition method. Analysis and simulation results show that the stitching without superposition method can get a more desirable high resolution range profile than the coherent addition method and can be easily applied for its computational efficiency. [C3991]

"Research on Some Key Technologies of Features Extraction from LIDAR Data in Coastal Zone"

Coastline, tidal flat is a significant and sensitive regional type for perfecting China's geographical information database, rapid and accurate survey toward it and postprocessing Lidar data effectively are the main survey work. This paper omnibearingly proposed separation methods of main planimetric feature in coastline and tidal flat area, from Lidar points. Vegetation, soil and water-body would be extracted through integrating spectral information, laser reflection rate, return intensity, especially, the characteristic of double return signals introduced for the extraction of water-body points. It can bring reference significance for research of coastline, tidal flat zone and promote the development of airborne Lidar in China. [C3992]

"Long-Term Integration Algorithm and System Design Using the Stepped-Frequency Signal"

A novel algorithm of multi-burst stepped-frequency signal co-processing are proposed, from which the high

resolution in both range and velocity profile of moving targets can be achieved. A fast keystone transform is presented to remove the range migration between the bursts causing by the long-term integration, which is of efficiency to implementation. A real-time signal processing system is designed to process multiburst stepped-frequency signal in real-time and employ velocity compensation algorithm based on keystone transform. [C3993]

"Real-Time Detection Performance of Airborne Pulse Doppler Radar"

This paper quantitatively describes the detection performance of the airborne pulse Doppler Radar (PDR) in Integrated Electromagnetic Environment (IEE). It is significant to benefit the aircraft in anti-jamming, which is a necessary condition to fight for the information dominance in the air combat. It discusses how to construct a real-time detection model framework of the airborne PDR, and models the noise, clutter and active jamming to simulate the effects in a real IEE. The model may precisely exhibit the detection performance with all kinds of jamming modes. Its real-time ability completely meets the limit of the step time (500 ms) in the HLA federation. [C3994]

"A Novel Waveform Scheduling Method"

One of the important issues for cognitive radar is how to optimally decide or select the radar waveform for the next transmission based on the observation of past radar returns. In this paper, with the stochastic dynamic programming model of waveform scheduling, the optimal algorithm of waveform scheduling is proposed. In order to solve the problem that we can not compute the exact value function under some circumstances, we step forward in time using an approximation of the value function from the previous iteration. The simulation results testify validity of our algorithm. [C3995]

"Embedded Advance Collision Warning System: Vehicle Images Ranging System Based on Machine Vision"

EACWS (Embedded Advance Collision Warning System) is an important part of ITS (Intelligence Transportation System). It is mainly based on monocular vision algorithms, and high-speed DSP processor, real-time to complete front vehicle distance detection, and send out early warning signals to ensure driving safety. [C3996]

"Research about Sounding Atmosphere Based on GNSS Radio Occultation"

Tracking of the radio signals broadcast by the Global Navigation Satellite System (GNSS) satellites as they are occulted from a GNSS receiver by the Earth's atmosphere can provide high resolution vertical profiles of atmospheric refractivity, temperature and water vapour. The phenomenon is regarded as Sounding Atmosphere based on GNSS Radio Occultation (GNSS RO). Compared to traditional radiosonde and radar probing, the GNSS RO is a powerful tool for atmospheric sounding, which have many traits such as no calibration, all-weather, almost uniform global coverage, high precision and vertical resolution. In this paper, investigative actuality which we make use of GNSS RO technique get atmosphere parameters like temperature, air pressure and humidity is introduced. At the same time, development direction of GNSS RO in the weather domain is put forward; undoubtedly, it will boost up use of GNSS RO technique for global climate. [C3997]

"A Novel Characteristic for Sorting Radar Emitter Signal"

Sorting rate of current methods is not high and too sensitive to the signal noise ratio (SNR), in order to solve this problem, a novel characteristic for sorting radar emitter signal is proposed. The ambiguity function of received signal is extracted and predigested to two-dimension characteristic. A rectangle pulse sequence and triangle pulse sequence are constructed, then the resemblance coefficient of two dimensions characteristic with rectangle pulse sequence and triangle pulse sequence are gained, and they are used as the sorting parameters. For ambiguity function of different signal is distinguishing and not sensitive to SNR, the resemblance coefficients are divisible and steady. The advantage of this new method is validated by simulation result, and the lowest sorting rate is 90% at SNR = 10 dB. [C3998]

"Discrete Chaotic Synchronization and Secure Communication Design"

In recent years, secure communication is becoming one of the researching hotspots in information safety. Some problems of chaotic synchronization and its application in communication are studied on the bases of the theory of nonlinear dynamics. It is a mode of correspondence, which transmits the desired information in the channel by means of encrypting, and then decrypts them at the receiving end. Chaos encryption is to encrypt the plaintexts and utilize random-like characteristics of chaos signal to secure the real-time communication. This paper bases on nonlinear dynamics theory and starts from stability theory of dynamic system. In addition, it adopts logistic mapping of discrete chaotic system and uses modular operation to design the synchronization and secure

communication. This design is easily realization and has stronger anti-interference ability, and then the secure capacity of secure communication system is nice. [C3999]

"Fast Scanning LIDAR For Safe Landing On Planets"

Landing on the moon, Mars or other planets safely is of great significance for the success of space exploration. Compared with the previous cameras and human vision to look for a safe landing area, LIDAR can quickly detect the undesired zone with gravels, craters, scarps and other dangerous features. A type of laser scanner, which is designed by Shanghai Institute of Technical Physics of the Chinese Academy of Sciences (SITP) for safe landing on planets, is introduced. The single laser beam is expanded to linear beams through a cylindrical lens and the scanning direction is controlled by two-dimensional tilt mirrors. The reflected laser beams gather at avalanche diode detectors of the focal plane of telescope. The signal of every cell is processed individually and the planetary surface can be achieved by the fast two-dimensional scanning. At present, the designed linear array LIDAR is under prototype development, this paper describes its principle, and detection capability of single cell LIDAR for dangerous terrain. [C4000]

"The Design and Implementation of Real-Time Automatic Vehicle Detection and Counting System"

This paper designed and implemented with Visual C++ a software video stream processing system to realize the real-time automatic vehicle speed detection and vehicle number counting. Based on geometric optics, we first present a simplified method to accurately map the coordinates in image domain into real-world domain. The second part is focused on the vehicle detection in digital image frames in video stream. We tested this system on a laptop powered by an Intel Centrino-2 (1.2 GHZ) CPU and 1GB RAM. The processing speed is 18.0 frames/second. Experiment also shows the system is able to simultaneously perform vehicle speed detection and vehicle number counting over multiple lanes. The detected vehicle speed's average error is 2.3 km/hour and counting accuracy achieves 97.8% (2298 among 2340 vehicles) for a video clip of 42 minutes. [C4001]

"Research on Simulation of Radar Return from Extended Target"

Simulation of radar return from targets is an important part of radar system simulation and it is developing fast these years. Although there are already many mature theories on simulation of radar return from targets, these theories mainly aim at point targets and often simply describe an extended target as synthesis of many point targets. There is little theory to describe detailed methods of how to judge the position of extended targets compared to the beam of radar and how to divide extended targets into point targets and synthesize radar returns from them. This thesis found the methods, described them in detail and proved them with simulation. Using these methods, we can simulate radar return of extended targets more veraciously and provide more reliable data for analysis, designation and test of radar systems. [C4002]

"SAR Image Denoising Based on Orthogonal Bandelet with Context-Model and GCV-Threshold"

A novel approach to synthetic aperture radar (SAR) image denoising is presented in this paper, which is based on the second generation bandelet with contextual model and multi-level generalized cross validation (GCV) threshold. Orthogonal bandelet, a multiresolution geometry analysis tool, uses an adaptive segmentation and a local geometric flow suited to capture the anisotropic regularity of edge structures and then provide an optimal representation of noisy SAR image. The contextual model is used to compute contextual values of bandelet coefficients and GCV rule is used to get optimal threshold for contextual values on each scale. Experimental results using real SAR image demonstrate that the method can remove the speckle noise efficiently and preserve edge of image better. [C4003]

"Application of Pseudo-Random Sequence in Lidar Ranging"

A way of laser ranging was proposed based on autocorrelation property of pseudo-random sequence. The hardware platform of laser ranging was designed and the plan of echo-signal's recognition was given in which the bit width and the period of pseudo-random sequence were detected. The delaying time of the echo signal was also determined according to the auto-correlation properties of pseudo-random sequence. The influences of the coherent accumulation gain and the error bits of the echo signal on the accuracy of laser ranging were analyzed later. The simulation results show that the coherent accumulation gain can improve the signal to noise rate (SNR) and error bits must be less than 13 in 31-bit pseudo-random sequence. [C4004]

"Irradiation Jamming to Inverse Synthetic Aperture Radar"

Based on the transmitting and receiving paths among radar and target and jammer, irradiation jamming method is proposed. Path model and signal model of the irradiation jamming are set up. Then parameters, like the

maximum number of ghost targets and the effective jamming to signal ratio, are analyzed. The simulation result shows that many target signals can be detected by radar match filtering and inverse synthetic aperture radar processing in down range profile and 2-D image, including real target, jammer and targets with the same character as the real target. [C4005]

"A Novel Contrast Enhancement Algorithm for Infrared Laser Images"

A conventional piecewise linear grey transformation based self-adaptive contrast enhancement algorithm is proposed for infrared laser images, in which the image pixel value histogram is divided into three parts: background and noise area, targets area, and uninterested area. The targets parts are highlighted, while the background and noise parts and the uninterested parts are restrained. A comprehensive qualitative and quantitative image enhancement performance evaluation is presented to verify the proposed theory and algorithm validity, efficiency and reasonability. The experimental results indicate that the proposed algorithm can greatly improve the global and local contrast for both near infrared images and far infrared laser images while efficiently reducing noise in the infrared laser images, and the visual quality of enhanced image is obviously better than the enhancement of the traditional histogram equalization, double plateaus histogram equalization algorithm, etc. [C4006]

"Design of dual-channel circuit of P-band instantaneous polarization radar"

First of all, the detection theory of the instantaneous polarization radar is introduced. The overall structure of dual-channel circuit has been designed. The principle part of RF system consists of antenna arrays and the dual-channel receiving and transmitting circuit. Si4133 chip used as the core design of the high stability, fully coherent frequency synthesizer as instantaneous polarization radar's frequency source. Then the structural design of inverters pieces is discussed, clear frequency convert program is reasonable. ADEX-10L devices use to produce high vibration isolation mixers. The dual-channel receiver components focuses on the development of voltage-controlled gain amplifier based on the AD8367 chip, and the amplitude-frequency characteristics, phase frequency characteristics and dual-channel consistency were tested. The introduction of the automatic power balance technology to ensure that the two-channel transmitter power balance. [C4007]

"RCS simulation of spacecraft based on orbital dynamics"

A method for RCS simulation of spacecrafts is developed. The Keplerian orbit and its perturbations are discussed before a simulated trajectory is given. Based on orbital dynamics and Euler's transformation, the attitudes of spacecraft are determined and the incident wave angle is calculated. Then, a 3D model of spacecraft is constructed for RCS calculation through physical optics (PO) method. The simulation results demonstrate good estimates of RCS for spin-stabilized spacecrafts. The method also shows efficiency of RCS simulation which can be used for further research on EM reflectivity of in-orbit spacecrafts. [C4008]

"Development of RCS simulation software for electrically large complex cavities based on the secondary development of UG"

A shooting and bouncing ray (SBR) based software is developed by the secondary development of Unigraphics (UG). The core algorithm of ray tracing is based on the optimized non-uniform rational B-splines (NURBS) curve-surface intersection algorithm built in UG, which results in very high accuracy of ray path tracing without meshing, thus keeping the accuracy of the original cavity model. It is also efficient even if work with a complex cavities because of avoiding of shielding process. Both geometry modeling of cavity and its scattering simulation are integrated into a uniform platform, which forms an easy-using integrative and universal environment for electromagnetic modeling of complex cavities. In this paper, the developed software for complex cavity scattering modeling has been introduced with some numerical results to demonstrate the accuracy and efficiency. [C4009]

"Simulation and analysis of a planar array antenna integrated with FSS"

This paper investigates the application of symmetrical two-layer FSSs to a planar array antenna to reduce its backward RCS. The symmetrical two-layer FSSs is based on the band-pass FSS design. A planar array antenna covered with FSSs is designed and constructed. The simulated results show that at working frequency the backward RCS of antenna array with FSS has dramatically reduced than that of the common antenna array. [C4010]

"Enabling GSM/GPRS/EDGE EVM testing on low cost multi-site testers"

The key motivation for this work is to enable the use of low cost multi-site testers that exhibit both high transmit test stability and high throughput suitable for massive production of a 2/2.75G GSM/EDGE multi-mode cellular

single-chip radio. Due to stringent performance compliance test requirements, transmitter (TX) testing consumes more time on expensive automated test equipment (ATE) and therefore it is critical to develop cost efficient multi-site test schemes, which can exploit parallelism to achieve production testing cost goals. This paper illustrates our low-cost self-contained test methods for both GSM phase trajectory error (PTE) and EDGE TX error vector magnitude (EVM) testing in a TX. We compare our test results with those of the R&S vector signal analyzer (VSA) to demonstrate the achieved test accuracy. Current production solutions allow us to simultaneously test and process up to eight devices using multi-site hardware with eight ATE RF receiver cores. Through scaling and careful hardware/software co-design we are able to realize a sixteen site solution using a combination of serial capture and parallel processing scheme. [C4011]

"EM Scattering model for Targets from the sea surface with breaking waves"

The problem of targets from the sea surface with breaking waves is investigated by using a new model. This model is developed which extends the range of validity of Anderson's result. A general expression for the radar cross section is obtained taking into account the influence of whitecaps by breaking waves. Therefore, using this model, we can obtain the more exact results about target information. [C4012]

"Optimization schemes for scattering of periodic structures"

Combining conventional radar absorbing material with periodic patch array structures, say frequency selective surface (FSS) type absorbers, have more freedom of degrees and so can be designed to be more efficient than the conventional radar absorbing material. In this paper, three optimization schemes such as parallel particle swarm optimization (PPSO), binary-coded genetic algorithm (BGA) and decimal-coded genetic algorithm (DGA) are investigated in the design of FSS type absorber. The goal functions are set up based on spectral moment method. Efficiency of three optimization schemes are compared each other. Numerical results showed that PPSO has a much better convergence than DGA and BGA. [C4013]

"Discrimination of low-flying vehicle from ground moving targets using multi-path"

The detection of low-flying vehicle by a pulse-Doppler radar is seriously interfered by ground moving targets, for that they have similar Doppler frequency. In multi-path environment, TDOA and DDOA of the low-flying vehicle direct reflection and its multi-path image have some constraint relationship, while this property is not possessed by ground moving target. By taking advantage of this property, a novel approach of discriminating low-flying vehicle from ground moving targets is proposed, which involves the technique of high resolution spectrum estimation. This idea is approved by theoretical analysis and simulation testing, and some applicable system conditions are also discussed. [C4014]

"A millimeter wave circular polarized microstrip antenna based on linear polarized subarrays"

A millimeter wave circular polarized microstrip antenna based on linear polarized subarrays is presented in this paper. The subarrays provide orthogonal vertical linear polarized component and horizontal linear polarized component. LHCP and RHCP waves can be obtained by configuring amplitudes and phases of the feeds. This microstrip antenna has relatively simple feed structure. In this microstrip circular polarized antenna, the ratio primary polarization to cross polarization change coincident with angle Γ, B_i . The cross polarization of this antenna is less than -15 dB in $\Gamma, B \pm 2\Gamma, B^\circ$. The axial ratio is better than 3 dB in $\Gamma, B \pm 2\Gamma, B^\circ$ beam width. [C4015]

"Design new ultrawide-band planar metal-plate monopole antenna by FDTD method"

A new square ultrawide-band planar metal-plate monopole antenna is proposed, which is analyzed by the Finite Difference Time Domain Method (FDTD), the results of FDTD are essentially agreement with experimental results. The monopole antenna proposed shows a very wide impedance bandwidth of about 10.24 GHz (about 1.36~11.6 GHz, bandwidth ratio about $8.53\Gamma \cdot 1$), the proposed antenna has properties of simple structure, ultrawide-band, easier to feed and low cross-polarization level, which make it very promising for application in the UWB systems. [C4016]

"High-precision direction finding of RADAR emitter signals based on space-borne sparse L-array"

Satellite recognition is increasingly important in modern wars, and relative techniques have been the hotspot to study. Due to the limitation of virtual load, the space-borne arrays are commonly chosen to be sparse ones. Thus, analysis of the direction finding ability to the ground emitters is particularly important. Estimation to ground emitters of space-borne sparse L-array is provided, and the simulation results obtained prove such arrays are good at high-precision direction finding. [C4017]

"Doppler compensation algorithm based on pseudorandom sequence"

Because binary phase-coded signal is sensitive to Doppler frequency, a new compensation algorithm is introduced in this paper. The returns can be cancelled through the algorithm which takes advantages of the property that neighboring returns have almost equal Doppler frequency. The algorithm is based on pseudorandom sequence (m-sequence) and can well meet the needs of low intercept possibility characteristics. It only focuses on signal processing therefore it is easy to be applied in typical full-wave radar. Theoretically, through the algorithm any number of moving targets and any Doppler frequency can be compensated accurately. [C4018]

"Design of a circularly polarized 848 patch antenna array using a new series-parallel Feed"

In this article, A novel 64-element high-gain circularly polarized patch antenna array in the a-band is presented. Sequential rotation technique is employed here and the patches are excited by a new series-parallel feed power distribution network with microstrip transmission lines to improve the antenna performance. The results achieved show that the microstrip antenna array provides a minimum peak gain of 24.4 dBi at the center frequency 29 GHz. The input return loss less than -10 dB bandwidth of the array is about 12.2, and the 3 dB axial ratio bandwidth is achieved as 5.9. The proposed a-band circularly polarized antenna array has the advantages of low-cost, less weight, compact construction and easy to be integrated with F/microwave active circuits, and allows a good prospect of application in the phased array radar and satellite communication systems. [C4019]

"Evaluation on anti-jamming efficiency of coherent sidelobe cancellation"

It is addressed that the anti-jamming efficiency of CSLC coherent sidelobe cancellation could not be only evaluated by C Cancellation ratio, but also by the detection range change between before and after CSLC. According to orthogonal principle, by introducing the correlation coefficient between the main and auxiliary jamming signal, it could be simplified to calculate the C of CSLC. The mathematical models of C of the single and double CSLC are set up considered the receiver noise, and the static simulations are made. The results indicated that the jamming signal could be canceled to the noise level by single CSLC when the jamming signals of main and auxiliary channel are cohered completely, but the jamming signals level will be higher than the noise level when the channels are not cohered completely and jammer-to-noise ratio is high. The CSLC has a strong anti-jamming performance for cover noise jamming. [C4020]

"Efficient RCS estimation of 2-dimensional cylinder with random holes"

In this paper, we propose an efficient method to estimate the radar cross section (RCS) mean and variance of a 2-D cylinder with random holes. This model has been applied extensively in microwave engineering, e.g., frequency selective surface (FSS). Firstly, we develop a deterministic RCS solver based on nodal Discontinuous Galerkin Finite Element Method (DG-FEM). Then, we quantify the RCS mean and variance of a 2-D cylinder with random holes based on the stochastic collocation method. We use the Gauss-Patterson quadrature formula to solve the resulting stochastic equation. Numerical results show how the RCS in scattering is affected by the uncertainty in shape of the object. [C4021]

"An algorithm of acquiring terrain slope based on interferogram"

By analyzing mapping geometry of interferometric synthetic aperture radar, the relation between terrain slope and interferogram is explained. Then an approach which can acquire terrain slope using interferogram is presented. Results using airborne InSAR system data show validity of our algorithm. The algorithm avoids phase unwrapping and absolute phase calibration which are usually computational burden for traditional processing method. And the algorithm will play an important role in project of responding to nature disaster real-time. [C4022]

"Tolerance analysis of coupling slot of waveguide slot array"

The tolerance of coupling slots is a major factor to determine the performance of the waveguide slot array. Consequently, it is significant to discuss the effects of coupling slots tolerance on the slot array performance. In this paper, the effects of slot dimensions on the resonance frequency are analyzed at first. Secondly, the effects of equal-area bulletheaded slot on the resonance frequency is analyzed, and the modified expression of bulletheaded slot's machining length is presented. The numerical results are useful for the design and processing of high performance slot array. [C4023]

"Design of high-speed T/R module of P-band instantaneous polarization radar system"

High-speed T/R converter is developed in this paper by using the combination of the circulator, the limiter and the RF switch technology. The super low noise receiving technology is realized through reducing the transmission loss and improving the gain of LNA. Experiments have proved that the T/R component's power tolerance in this paper is more than 100 W, and that the blind distance caused by it is less than 800 meters.

[C4024]

"RCS calculation of conducting targets in strong random media for E-wave polarization"

This paper discusses the effect of strong random medium on the behaviour of RCS of conducting targets. A comparison with free space case is considered with E-wave incidence. [C4025]

"Characteristic of EM-wave anomalous propagation in marine evaporation duct"

Based on the atmospheric modified refractivity, the difference between the evaporation duct and the standard atmosphere is analyzed. The propagation path and the transmission loss of the EM waves are calculated respectively by ray-tracing technique and Fourier split-step method of the parabolic equation in standard atmosphere and evaporation duct. The simulation results show that evaporation duct can trap some radio rays to extend the propagation distance of EM wave and result in the appearance of radar blind zone. The characteristic of the EM wave anomalous propagation in marine evaporation duct can help to improve the radar over-the-horizon detection performance. [C4026]

"Design of beam steering system in phased array based on DSP"

Phased array radar attracts more and more attention and has application in many fields because of its prominent capability. The performance of phased array radar is badly restricted by the beam steering system. This paper proposed a beam steering system based on DSP, aim at high speed and high precision in calculation, using the subarray modularization and the distributed-centralized operation obtain the balance of speed and precision in calculation. Simulation testify the respond time of this beam steering system less than 100 ГВіs, error of the beam steering code is much less than phase quantization error, accord the request of design in speed and precision. [C4027]

"Design of remote locomotive real-time monitoring system based on GPRS"

For the sake of locomotive running safely and predicting potential fault of locomotive. This paper introduces a method of data transfer based on GPRS, achieving locomotive information collection, remote transfer and real-time display. Using database technique, actualizing locomotive information storage and fault analysis for technician predicting locomotive fault and eliminating fault in time. It is important to the safe running of locomotive and reducing maintenance costs. [C4028]

"A broadband waveguide-to-coaxial transition"

The tapered narrow side waveguide is applied into the waveguide-to-coaxial transition to obtain a wider band. The simulated results testify that this structure is useful to make good impedance matching. [C4029]

"Reconfigurable antennas in cognitive radio that can think for themselves?"

This paper discusses the use of reconfigurable antennas in cognitive radio. Most of the emphasis on cognitive radio so far has been in the area of spectral estimation and signal classification. In this paper we show that once a cognitive device manages to learn the RF environment (cognition part), from past observations and decisions using machine learning techniques, we can use the collected data to train reconfigurable antennas to adapt to any change in the RF environment. [C4030]

"Transponder with undersampling method"

A transponder can encode the signal transmitted by synthetic aperture radar (SAR). The reflected signal from the encoding transponder to SAR can be imaged with the background clutters suppressed. One type of encoding transponder inverts the chirp slope of a linear frequency modulation (LFM) signal transmitted by the SAR. Two methods exist by which the transponder can invert the chirp slope of a LFM signal from the SAR: the analog mixing method and the digital undersampling method. I put forth the latter method in this paper as being the superior approach. I have applied this method in the design of a RadarSat-1 SAR transponder. [C4031]

"FM interference suppression for PRC-CW radar based on adaptive STFT"

The influence of FM interference on correlation detection performance of the pseudo random code continuous wave (PRC-CW) radar is analyzed. It is found that the correlation output deteriorates greatly when the FM interference power exceeds the anti-jamming limitation of the radar. A new method is proposed based on adaptive STFT and time-varying filtering for FM interference suppression. The instantaneous phase of interference is firstly estimated utilizing adaptive STFT and the estimated phase error is decreased by means of recursive correcting. A time-varying filter based on the estimated instantaneous phase is set up to excise the interference. The echo signals corrupted by two types of interference including linear FM (LFM) and sinusoidal FM (SFM) forms under different signal-to-jamming ratio (SJR) situations are simulated. It is shown that the method can effectively suppress the FM interference and improve the performance of target detection significantly. [C4032]

"Performance analysis of self-calibration algorithm for Y-shaped array in the presence of mutual coupling"

A self-calibration algorithm for Y-shaped array (SAY) is presented in the presence of mutual coupling. It utilizes special mutual coupling characteristics of Y-shaped array to decouple the azimuth (AZ)/elevation (EL) and mutual coupling coefficients of antenna array so that two kinds of parameter estimations can be realized without any calibration sources. Different from conventional self-calibration algorithm based on iterative alternating minimization technique, the proposed algorithm firstly estimates DOA by searching spectrum peak, and then estimates mutual coupling coefficients so as to avoid huge computation and global convergence problem. This literature puts emphasis on the performance analysis of new proposed algorithm. Simulation results illustrate that the proposed self-calibration algorithm has the advantages of better numerical stability and less computation load. Besides, it possesses a better performance when SNR is larger than 20 dB and the number of snapshots is larger than 150. [C4033]

"Research on the scattering coefficient measurement method based on LFM CW"

This paper researches the scattering coefficient (Γ_{Bi0}) measurement method based on LFM CW radar. The measurement mechanism of the relative calibration measurement method is introduced. Barrier effect and different window functions' effect on the measurement precision is analyzed by simulation when processing the IF signal of the LFM CW radar digitally. An appropriate window function and the length of FFT is selected according to the requirement of measurement precision of the calibration object. The actual RCS of multiple scatters whose theoretical value is already known is obtained by simulation with the relative calibration method. The simulation results verify the scientificity and efficiency of the measurement method. Finally this method is applied to Γ_{Bi0} measurement of a crown. [C4034]

"Scattering of arbitrary direction Gaussian Beam from bisphere"

Based on the local approximate form of the beam shape coefficients and the coordinate rotary theory of the vector sphere wave functions, the expansion form of the field of the Gaussian beam in terms of the vector sphere wave functions at arbitrary coordinate system is obtained. The scattering of arbitrary direction Gaussian Beam from bisphere is investigated according to generation Mie theory (GMM). Numerical results on the radar cross section and its change characteristic at different incident angle are analyzed. Some results are compared with the result gained by business software CST. [C4035]

"An optimization procedure for signature reconstruction of near-field targets"

In this paper, a target reconstruction procedure is proposed for simulating the near-field signatures of a complex target with high fidelity. The target model is composed of trihedral corner reflectors and different radar targets can be represented by combinations of trihedral corner reflectors without manufacture of either full-size or scaled target models. The near-field target is initially reconstructed based on the synthetic radar image. An optimization procedure is proposed to improve the performance of such target model. Simulation results show that the aspect-variant scattering characteristics of the target model maintain good agreements with that of the true target. [C4036]

"An improved hybrid technique for computing the RCS of dihedral corner reflector with a protrusion"

For the EM scattering problems of electrically large dihedral corner reflector with electrically small protrusion, the traditional MoM-PO hybrid method cannot efficiently consider the complex multi-reflection effects among the PO regions. Based on the classical MoM-PO method, an improved hybrid method is presented to calculate the multi-reflection contribution in the PO region efficiently by introducing the method of SBR based on RDN notion that avoids the complex iterative procedure. Simulation results agree with the numerical results very well. [C4037]

"A fast efficient technique for solving monotonic RCS using the SVD method"

In this paper, we apply multi-layer singular value decomposition (SVD) technology to the traditional characteristic basis function method (CBFM), then construct a series angle and polarization independent orthonormal characteristic basis functions (CBFs). By different linear combination of these orthonormal basic functions, we can get the surface current distributing of PEC object of any direction illuminating waves, and then we can obtain monotonic RCS. This article also combines physics optics (PO) method and dynamic storage binary tree technique, and it can reduce memory requirements and CPU-time. Numerical results show the correctness and effectiveness of this method. [C4038]

"RCS calculation of complex targets shielded with plasma based on visual GRECO method"

Based on the assumption that plasma medium is cold, unmagnetized, collisional and inhomogeneous, a radar cross section (RCS) calculation model for complex targets shielded with plasma is presented. In high frequency region, the plasma that defilading a target can be treated as layered media. In each layer, the plasma is equivalent to a uniform dielectric. Physics optics (PO), ray-tracing method and Wentzel-Kramer-Brillouin (WKB) method are applied to calculate the backscattering field, which is implemented by visual graphical electromagnetic computing (GRECO) platform. Numerical results illustrate that shielding the targets with plasma is a valid way to reduce the RCS of targets. This conclusion has a broad prospect for plasma stealth and anti stealth. [C4039]

"Equivalent dipole-moment method for electromagnetic scattering by dielectric bodies"

This paper presents an efficient method for the generation of MoM matrix based on the equivalent dipole-moment method for electromagnetic scattering by dielectric bodies. Based on the RWG basis function, the surface of the dielectric object is discretized into several triangular patches. Each RWG common edge element containing two triangular patches is regarded as a pair. The impedance matrix elements are calculated by conventional MoM when the pair of triangular patches of source point are not so far away from the field point, otherwise the electric and magnetic surface currents on the pair of triangular patches of source point can be equivalence as electric and magnetic dipole-moment, respectively, and all the rest impedance matrix elements are calculated by the equivalent dipole-moment method. Considering the boundary condition and PMCHW equation, the formula of impedance matrix elements is expressed. The equivalent dipole-moment method avoids the double integrals of the gradient of Green function and speeds up the forming of MoM matrix significantly. Numerical results show that it has less computation cost and high accuracy compared with MoM. [C4040]

"Application of grid-cell combination in 2D-FDTD modeling of ELF propagation and Schumann resonances of the earth"

In this paper, we have introduced a basic two-dimensional finite difference time-domain (2D-FDTD) method with TM and TE modes, and developed a model of antipodal extremely low frequency (ELF) wave propagation on the Schumann resonances (SR) of the earth. We have used an advanced algorithm, which is combining the grid-cells approaching to the certain pole points, and have improved the numerical stability and efficiency compared with those of the original basic algorithm. [C4041]

"Segmental analyse and numerical verification on radar scattering characteristics of reentry capsule"

During the reentering process, the RCS of the reentry capsule of Shenzhou spacecraft changed violently because of plasma sheath and wake. The change in turn affected the ground-based telemetry radar. Based on the actual measured data of C-band radar, this article analyzed the mechanism of the sudden increase and reduction of RCS of the reentry capsule and demonstrated the theory in WKB method. [C4042]

"Wavelet-based pulse design for UWB vehicular radar"

UWB vehicular radar has the potential to be a powerful tool in improving vehicle safety. The Gaussian monocycle pulse, commonly used in the UWB vehicular radar system, can not satisfy the bandwidth constraints. So a new pulse shape based on wavelet is presented, which selects factors of Morlet wavelet to meet the FCC spectral mask by searching the peak frequency which lies in bandwidth between 22 and 29 GHz. Contrasted to the traditional method, the algorithm changes the searching method from two dimensional random variables to one dimensional random variable. Simulation results show that the method can generate pulse shapes which comply with FCC regulation. [C4043]

"Sentinel 1-the future GMES C-band SAR mission"

The ESA Sentinels constitute the first series of operational satellites responding to the Earth Observation needs of the EU-ESA Global Monitoring for Environment and Security (GMES) programme. The GMES space component relies on existing and planned space assets as well as on new complementary developments by ESA. This paper describes the Sentinel-1 mission, an imaging synthetic aperture radar (SAR) satellite constellation at C-band. It provides an overview of the mission requirements, its applications and the technical concept for the system. [C4044]

"Reviewers"

{no data available} [C4045]

"EuMA Awards"

{no data available} [C4046]

"High power broadband ferrite circulator for air traffic surveillance radar"

Signal routing at watts and kilowatt levels is primarily handled by using waveguide or stripline structures containing magnetised ferrite materials. Current radar applications require the design of high power circulators with increased bandwidth and reduced insertion loss. A technique called *mode segregation* is used to select a bias field region above ferrimagnetic resonance, which avoids low-field loss, resonance damping and high power nonlinear loss to achieve optimal power/bandwidth and temperature stability. A finite element magnetostatic/microwave procedure is used to implement this technique for the differential phase shift section of a 4 port circulator to be used in air traffic control surveillance. The magnetostatic solver calculates the D.C state of the ferrite prior to calculating the microwave solution for this low loss mode of operation. This study dictates that the differential phase shift is reduced and larger magnetic bias fields are required. The circulator phase shifting section has an operating bandwidth from 9.6-10.4 GHz, handles peak power of 0.60 MW, and 1.8 KW average power above ferrimagnetic resonance. Minimum 20 dB isolation with insertion loss less than 0.2 db over the operating frequency band was achieved. Calculations agree well with the experimental data. [C4047]

"Target's range migration compensation in passive radar"

Ideally the processing gain in passive radar is $PG=BT$. Where B is the bandwidth and T is the integration time. So by increasing T the target detectability will also increase. But practically, when we deal with moving targets, increasing T will result in a problem: target migration from its range cell that in turn results in decreased processing gain. In this paper we have suggested a method, by which we can compensate target's migration, while keeping the computational load low. [C4048]

"Circularly tapered antipodal Vivaldi antenna for array-based ultra-wideband near-field imaging"

In this paper, the design of a low profile circularly tapered antipodal Vivaldi antenna for array-based UWB nearfield imaging is presented. The antenna with the dimensions of 45×48.5 mm achieves satisfactory impedance matching and radiation performance across the frequency band from 2.7 to 26 GHz. The proposed antenna exhibits consistent UWB characteristics over a wide angle, which is crucial for near-field imaging applications. [C4049]

"A concept for infrastructure independent localization and augmented reality visualization of RFID tags"

In this paper we present a multi sensor concept for localization and augmented-reality visualization of backscatter RFID tags. The sensor data of a camera and a RFID FMCW reader system are combined based on a synthetic aperture radar principle. The system enables the localization of tagged goods without the use of any installed infrastructure. We integrate a FMCW RFID reader and a camera system into a handheld device. While the handheld device is moved around, radar measurements as well as images of the surrounding area are taken at a number of locations. Thus, a synthetic aperture is generated and the position of the tags is calculated based on a SAR localization algorithm. Based on the imagery of the camera the user receives an augmented visual impression of where to find the RFID transponders. [C4050]

"Simulation, measurement and validation of amplitude and phase matching performance between transmitter and receiver subsystems in dual-channel high-resolution polarimetric radar"

Stringent requirements for the matching performance between the channels of high-resolution multi-channel

radar for superb target detection and classification capabilities have to be met. This paper focuses on the investigation on the amplitude and phase matching performance between two transmitters and two receivers in a dual-channel polarimetric agile radar system. The system will be used to estimate all elements of the polarization-dependent backscattering matrix simultaneously in 3 meters resolution cells. The paper presents breakthroughs in designing such complex radar systems based on very up to date methods used for system level simulations, for measurements and for cross-validation between simulations and measurements. The measurement results of the developed transmitters and receivers demonstrate the validity of our design approach for obtaining the needed matching performance between transmitters and receivers in such a dual-channel radar system. [C4051]

"Comparison of different migration techniques for UWB short-range imaging"

In this paper, experimental investigation has been performed in order to compare the performance of different migration algorithms for short-range imaging. These algorithms include diffraction stack, Kirchhoff migration, and range migration algorithm (FK migration). Their resolution, beam pattern, ability for shape reconstruction, and computational complexity are compared and analyzed. The data processing schemes are described and illustrated using both numerical simulation and measurement data set. The resulting comparison provides guideline in terms of choosing suitable image processing method for practical applications. [C4052]

"Uniplanar ultra-wideband pulse generators"

This paper presents uniplanar ultra-wideband (UWB) pulse generators producing full-band as well as dual-band UWB pulses. New uniplanar UWB bandpass filters have been designed by using coplanar waveguide and the filters are cascaded with the Gaussian pulse generator to reshape the pulses as defined by the US Federal Communication Commission (FCC). Experimental results show that the generated pulses satisfy the FCC mask. [C4053]

"Properties of moment estimators for the K-distribution"

The K-distribution is an important probability distribution to describe radar reflectivity of clutter in SAR images. One of the main tasks is to find reliable estimates of the two parameters that determine the K-distribution. In this paper the derivations of different moment estimators for both parameters are shown. For each of these estimators, the linear expansion is calculated. With this expansion it can be demonstrated, that the moment estimator converges in probability to the true parameter value, and that the order of convergence of the estimator is equal to that of the maximum likelihood estimator. [C4054]

"The end of indexes"

{no data available} [C4055]

"Conference Committees"

{no data available} [C4056]

"EuRAD 2009 brief author index"

{no data available} [C4057]

"Welcome from the President of the European Microwave Association"

I am privileged to welcome you to the 12th European Microwave Week (EuMW), an initiative of the European Microwave Association (EuMA). The EuMA, a non-profit international organisation based in Belgium, is open to general membership of all microwave engineers from all over the world. The General Assembly, the highest governing body of the Association, gathers representatives from European countries, and also from North America, Asia Pacific and North Africa and the Middle East. If you are not a EuMA member yet, I encourage you to join. Among other benefits, such as discounted fees for attending the EuMW and EuMA-sponsored conferences, you will have free on-line access to the International Journal on Microwave and Wireless Technologies, a recent joint initiative of the EuMA with Cambridge University Press. [C4058]

"Message from the Incoming President of the European Microwave Association"

Having two welcome addresses in the President's column is an exception and may even prevent some from reading further. Hence, as the president-elect, I will keep my message short. [C4059]

"EuRAD 2009 detailed author index"

{no data available} [C4060]

"Welcome to the 12th European Microwave Week 2009"

European Microwave Week 2009 continues the series of successful microwave events with its 12th Conference and Exhibition Week. From September 28th through October 2nd 2009 the event will be held, for the first time, in the wonderful city of Rome. EuMW has grown significantly over the years and is now the premier European event in the field of microwaves. [C4061]

"Synthesizer concepts for FMCW based locatable wireless sensor nodes"

Local positioning systems significantly enhance the value of wireless sensor networks (WSN). This paper first motivates the use of WSN with exemplary application scenarios. Afterwards it shortly addresses the basics of frequency modulated continuous wave (FMCW) systems. Several common synthesizer concepts for FMCW radars are shown. The paper focuses on a novel integrated synthesizer for localization using frequency modulated continuous wave (FMCW) radar. The synthesizer is based on a fractional-n phase-locked loop (PLL) architecture. All components of the PLL are carefully designed with respect to their performance and power consumption. The complete synthesizer was manufactured in a 0.18 μm SiGe BiCMOS process from IBM, and it draws only 39 mA from the supply. It achieves a phase noise better than -113 dBc/Hz and has a silicon area of 1.15 mm². Due to its high integration level and its optimized design, the synthesizer achieves low power consumption and low phase noise that makes it suitable for precise localization in mobile sensor nodes. Localization measurements in indoor environments with multipath propagation showed mean distance errors about 13 cm. [C4062]

"Multi-target tracking for merged measurements of automotive narrow-band radar sensors"

In this paper, the conventional JPDA (joint probabilistic data association for merged measurements) algorithm for modelling merged observations, is applied to the automotive environment. As every sensor has limited resolution, the JPDA should be used instead of the JPDA algorithm, which does not model the effects of measurement merging. As the JPDA algorithm is more complicated, these effects are normally neglected for most sensors with good resolution capability. In this paper a new automotive prototypical multi-beam monopulse narrow-band FMCW radar sensor is used. While this sensor has good detection accuracy, it has only limited resolution capability. For this sensor, measurement merging leads to wrong target estimations when not modelled correctly in the multi-target tracking process. While the JPDA algorithm has already been developed for this case, it can not be applied directly, as it does not model the diminished measurement accuracy when more than one measurement is in the same resolution cell. When using a gating procedure with standard measurement accuracy, the merged measurements will not be associated to the corresponding targets. This motivates the usage of a modified gating method which will be presented in this paper. To reduce the computational demands of the algorithm, a clustering technique for the modified gating procedure is shown. The modified algorithm is tested with real sensor data. The JPDA algorithm and the JPDA algorithm are both applied to a challenging measurement merging scenario and the results of these algorithms are compared. [C4063]

"Multi-channel lidar processing for lane detection and estimation"

Lane recognition is a function which is needed for a variety of driver assistance systems. For example lane departure warning and lane keeping rely on information provided by a lane estimation algorithm. One important step of the lane estimation procedure is the extraction of measurements or detections which can be used to estimate the shape of the road or lane. These detections are generated by white lane markers or the road border itself. Lane estimation has for many years been under heavy development using a gray scale camera. Passive camera based systems can be degraded on its performance under certain circumstances, e.g. at dynamic changes of ambient brightness. The fusion with an active sensor can here increase the robustness of these systems significantly. In this paper an approach is presented to detect lane marks using an active light detection and ranging device (lidar). It can be shown that high reflective lane marks can be reliably detected. A polar lane detector grid is used to combine the distance and intensity measurement channel of the lidar sensor. [C4064]

"Feature-Based Probabilistic Data Association (FBPDA) for visual multi-target detection and tracking under occlusions and split and merge effects"

Uncertainties in the sensor data such as measurement noise, false detections caused by clutter, as well as

merged, split, incomplete or missed detections due to a sensor malfunction or occlusions (both due to the limited sensor field of view and objects in the scene) make multi-target tracking a very complicated task. Thus one of the big challenges is track management and correct data association between detections and tracks. In this contribution we present an algorithm for visual detection and tracking of multiple extended targets under occlusions and split and merge effects. Unlike most of the state-of-the-art approaches we utilize low-level information integrating it in a unified approach based on a threshold-free probabilistic conception. The introduced scheme makes it possible to utilize information about composition of the measurements gained through tracking of dedicated feature points in the image and resolves data association ambiguities in a soft decision using a globally optimal probabilistic data association approach. Beside existence evolution consideration we also exploit the spatial and temporal relationship between stably tracked points and tracked objects, which along with observability analysis, allows us for reconstruction of compatible measurements and thus correct track update even in cases of splits, merges and partial occlusions of the tracked targets. [C4065]

"Exploiting LIDAR-based features on pedestrian detection in urban scenarios"

Reliable detection and classification of vulnerable road users constitute a critical issue on safety/protection systems for intelligent vehicles driving in urban zones. In this subject, most of the perception systems have LIDAR and/or radar as primary detection modules and vision-based systems for object classification. This work, on the other hand, presents a valuable analysis of pedestrian detection in urban scenario using exclusively LIDAR-based features. The aim is to explore how much information can be extracted from LIDAR sensors for pedestrian detection. Moreover, this study will be useful to compose multi-sensor based pedestrian detection systems using not only LIDAR but also vision sensors. Experimental results using our data set and a detailed classification performance analysis are presented, with comparisons among various classification techniques. [C4066]

"A multi sensor system to evaluate driving behavior in curves"

Road constructions are supposed to have a direct effect on drivers behavior and thus on road safety. For example, the alignment will affect whether a curve is likely cut or not. This paper proposes a method which allows to record and to evaluate the driving behavior of road users with a little interactive effort. This is made possible by, first, an easy to install and nearly invisible multi sensor hardware to record data, and, second, as well an easy to use analysis program for offline analysis of the data. [C4067]

"Vehicle recognition and TTC estimation at night based on spotlight pairing"

Forward Collision Warning (FCW) together with Lane Departure Warning (LDW) and Electronic Stability Control (ESC) can highly contribute to a safer traffic environment. Therefore those three systems will be supported by the US NCAP (New Car Assessment Program) until the end of 2009 and rewarded in the new active safety rating. LDW and ESC are already on the market whereas development on the first vision-based FCW systems is still ongoing and enforced. This paper will give a short overview on common approaches in vehicle recognition and focus on nighttime conditions. Based on existing head- and taillight detection algorithms for Adaptive Headlamp Control (AHC) a novel vehicle detection algorithm is presented. The main challenge hereby is the accurate pairing of detected vehicle spots. The developed system also contains rough distance estimation and a robust Time-To-Collision (TTC) calculation. Sequences in various traffic conditions with hand-labeled vehicles serve as an evaluation set for the vehicle detection performance. Ground truth for TTC is available by radar sensor data. The system proves to be robust in various near-collision situations. [C4068]

"Time to contact estimation using interest points"

This paper presents a novel approach to obtain reliable and robust time-to-contact estimates from a monocular moving camera observing various obstacles. The algorithm utilizes interest points to measure the relative scale change of an obstacle and applies robust estimation techniques to combine the different measurements into one of three possible motion models. These include a model with constant distance, with constant velocity and with constant acceleration. An interacting multiple model framework is used to select the appropriate model and finally to estimate the time-to-contact with the observed obstacle. The algorithm presented is evaluated utilizing a large set of recorded video sequences with radar ground truth. Due to its field of application the entire algorithm is designed to use as little computation time as possible and is thus realtime capable. [C4069]

"Advanced occupancy grid techniques for lidar based object detection and tracking"

The robust and reliable detection of objects in the surrounding of a vehicle is an important prerequisite for collision avoidance and collision mitigation systems. In this paper, an ego-motion compensated tracking approach is presented which uses extended occupancy grid methods for both detection and tracking of objects

observed by lidar. The approach is able to estimate the velocity and direction of moving objects as well as to distinguish between moving and stationary objects. Additionally, an approach for drastically reducing the computational effort is presented. [C4070]

"Maximum-likelihood speed estimation using vehicle-induced magnetic signatures"

Modern traffic management systems require accurate vehicle detection, speed estimates, and link travel times for congestion detection, traveler information, ramp metering, optimization of traffic signal timing, and planning. Current speed estimation methods report speeds that are averaged over at least 30 seconds. This is necessary in some cases because the estimates tend to be noisy or in other cases because the algorithms are not intended to deliver individual vehicle speeds. This paper develops an algorithm based on communication theory and compares the results to conventional algorithms. The maximum-likelihood algorithm proposed in this paper provides significantly improved speed estimates that can be used to produce histograms of vehicle speeds instead of the speed averages currently available. [C4071]

"Coupling sensors to UHF RFID tags"

Coupling sensor signals to existing UHF RFID tags enables low volume applications without incurring the additional cost of developing a custom integrated circuit. The feasibility of this approach is demonstrated using the radar cross section as the metric in both simulations and experiments. [C4072]

"A robust position estimation algorithm for a local positioning measurement system"

Precise position estimation has always been a challenging but highly requested task in many technical problems. The time-difference of arrival (TDOA) based local position measurement system LPM uses the well-known Bancroft algorithm, which computes a closed-form solution to the non-linear range measurement equations. A critical issue of this computation method is that outliers in the measurements will decrease the quality of the position estimate significantly. In this contribution a least median of squares (LMS) algorithm for position estimation is developed which delivers an appropriate position estimate even if the raw data contain corrupted measurements. [C4073]

"An ultra wideband positioning system enhanced by a short multipath mitigation technique"

In this paper an approach for high precision local positioning radar using an ultra wideband technique is presented. The concept is based on the standard FMCW (frequency modulated continuous wave) radar principle combined with short pulses to fulfill the emission limits given by the official regulatory authorities. In this way, a high accuracy in dense multipath indoor environments can be achieved, ideally suited for 1D, 2D and 3D localization. A prototype was built which operates at a center frequency of 7.5 GHz utilizing a bandwidth of 1 GHz. With the setup presented in this paper the distance between two wireless units can be measured achieving a standard deviation down to 6 mm. Additionally, we studied the effects of short multipath propagation and present simulation results for an applicable mitigation technique. [C4074]

"Detection technology for trapped and buried people"

In this contribution we discuss the first results of a running project¹, I-LOV, within the German national research program for civil security funded by the German Federal Ministry of Education and Research (BMBF) concerning improved time efficiency and reliable novel detection systems for search and rescue. Classical detection technology covers borescopes and geophones in combination with K-9 units for search and rescue missions in ruins, detritus and cones of debris. An improved and time efficient approach for search of vital signs can be realised with UWB (ultra wide band) radar systems, where a very short wide band pulse is transmitted, or with continuous wave (CW) radar systems for measuring movements like respiration. An improvement of CW with a frequency modulation (FM) leads to FMCW radar systems allowing measuring the distance to targets, i.e. buried people. The search for people carrying electronic RF-devices can be assisted with pulse radar systems. Frequency filters of such devices can be exposed to a radar pulse near the filters' resonance frequency and an echo can be detected enabling the localization of a device and probably of the owner, too. [C4075]

"An overview of wireless local positioning system configurations"

Over the last years tremendous improvements of wireless positioning systems have been achieved. System accuracy has improved drastically and maturity changed from hand-soldered lab demonstrators to commercial products. In parallel applications moved from small, experimental installations to coverage of complete sites. Consequently the research focus shifts away from the positioning core technology to system aspects. Critical issues now are simultaneous handling of a large amount of mobile units like tags or vehicles with acceptable

update rate, coverage of large areas requiring multiple cells and cell-handover, quick exchange of positioning data and fusion with other local information. This paper reviews the most common approaches to wireless positioning from the system perspective. Requirements on the infrastructure are pointed out, the communication effort is analyzed, energy consumption of the mobile unit is evaluated and feasibility of sensor fusion with other available information is investigated. [C4076]

"Vision-based railroad track extraction using dynamic programming"

Most of the common driver assistant systems for detection of obstacles work on unstructured environments. These environments generally include many non-planar surfaces which pose a big challenge for vision systems. Similar problems exist for railroad environments which often contain complex shapes and surfaces like hills and vegetation along railroad tracks. In railroad transportation, the main task of a train driver is to carefully focus on the track. Therefore the field of view of a train driver must contain the space between two rails in front of the train and the near lateral area (left and right side) of these rails. In this paper, we present an algorithm to extract the train course and railroad track space in front of the train using dynamic programming in railroad environments. We use dynamic programming to compute the optimal path which gives the minimum cost to extract the railroad track space. The proposed algorithm extracts the left and right rails using dynamic programming simultaneously. Our method does not need any static calibration process. For this purpose, a camera system was installed in front of a locomotive. Experimental results show the effectiveness of the algorithm. [C4077]

"Out-of-sequence measurement processing for an automotive pre-crash application"

In this paper, the merits of incorporating out-of-sequence measurements (OOSM) into a Pre-Crash application are investigated. When an imminent front crash is detected by the Pre-Crash system, the algorithm activates a reversible seat belt tightening system. This paper points out that simple buffering is not applicable in most time critical applications such as Pre-Crash. It is crucial to have sufficiently accurate tracking information without any buffering delays, especially in urban traffic scenarios. Furthermore, the existing OOSM algorithm from Bar-Shalom [1] for the 1-step-lag case is extended to support Joint Probabilistic Data Association (JPDA). A comprehensive evaluation on simulated as well as on real sensor data is presented. [C4078]

"Design of a linear non-uniform antenna array for a 77-GHz MIMO FMCW radar"

In this paper the design and the implementation of a linear, non-uniform antenna array for a 77-GHz MIMO FMCW system that allows for the estimation of both the distance and the angular position of a target are presented. The goal is to achieve a good trade-off between the main beam width and the side lobe level. The non-uniform spacing in addition with the MIMO principle offers a superior performance compared to a classical uniform half-wavelength antenna array with an equal number of elements. However the design becomes more complicated and can not be tackled using analytical methods. Starting with elementary array factor considerations the design is approached using brute force, stepwise brute force, and particle swarm optimization. The particle swarm optimized array was also implemented. Simulation results and measurements are presented and discussed. [C4079]

"Wireless sensing applications in the mining and minerals industry"

This paper discusses and outlines applications of wireless sensing technology in the mining and minerals industry to provide enhanced assistance to mining machines. Three major applications can be performed by radar systems, such as surface profiling, positioning and collision avoidance. Radar sensors offer significant advantages compared to laser and ultrasonic in tough environments like rain, dust, fog and snow. The information received from the sensors can be used to increase the automation level and to advance the safety in the mine plus furthermore increase the turnover of mining companies. Underground communication systems and machine diagnostics are also discussed in this paper. Several applications were determined as highly feasible and are now completed respectively in the implementation stage. The authors are giving an insight into the experimental results, the implementation and an outlook of further use for this technology. [C4080]

"Performance analysis of resonance based radar target recognition with different excitation bandwidth using the E-Pulse technique"

Under different excitation bandwidth, the number of the resonant modes that will be excited from the radar target will be different. As a result, different numbers of resonant modes will be involved in the target recognition process and the performance of target recognition may also be affected. The objective of this paper is to study how the variations of the excitation bandwidth that may affect the performance of resonance based target recognition. In particular, the E-Pulse technique is chosen and numerical examples of two stick model aircrafts

will be used to investigate this problem. [C4081]

"Enhanced system architecture for rugged wide band data transmission"

In this paper, an enhanced architecture for wide band data transfer based on a true differential modulation is presented, showing extremely high resistance against dispersion and fading due to multi-path propagation. The proposed system operates well with minor frequency stabilizing requirements and is characterized by a low part count. Since the modulation is based on the phase difference between two propagating modes, spread spectrum techniques are easily implemented. Experimental results of a transmission over a distance of 45 m with a single carrier frequency using noise to spread the spectrum are presented for a data rates of up to 25 MBit/s. Furthermore, the system is resistant against Doppler shifts and small banded jamming, so that it can be used to improve data transfer rates in mobile systems. [C4082]

"A statistical approach to assess randomly rough surfaces in imaging radars"

In this paper, a statistical approach to evaluate randomly rough surfaces (RRS) in an inverse scattering problem is presented. Whereas in these investigations the roughness criterions possess random variables, the use of deterministic techniques such as the target decomposition (TD) can not be useful by itself as a tool of analysis. In these conditions, a statistical approach is essentially required to evaluate the target parameters. The goal of this study is the estimation of the polarimetric signatures, such as the scattering mechanism α and the entropy H , via a novel approach including the combination of TD and a new statistical model. To validate our work, SAR data sets, provided by the European Space Agency (ESA), are analyzed and compared with the simulation results. [C4083]

"Passive short range X-band frequency doubling transponder"

Various radar methods exist to identify and distinguish stationary and moving objects. Well known methods include synthetic aperture radar (SAR), millimetre-wave real aperture radar (RAR) and interferometric synthetic aperture radar (IFSAR) systems. In specific cases, one is interested to recognize a unique signal from objects. For example, in search and rescue operation radars, unique signals are identified from the Search and Rescue Transponder (SART) that is attached to the object of interest. However, unwanted clutter echoes can severely limit the detectability of the target. Clutter can be caused by obstacles, rain and surface reflections, is unpredictable and it cannot be easily removed. This paper presents the development of a low-cost, passive X-band transponder using frequency doubling to eliminate the problem of clutter. The passive transponder comprises of two rectangular patch antennas, a bandpass filter and a passive frequency doubler. Theoretical calculations show that such a passive transponder is able to operate at a range of about 1 km away from the radar. [C4084]

"LPI Radar detection: SNR performances for a dual channel Cross-Correlation based ESM Receiver"

Detection of low probability of intercept (LPI) radar signal is an important issue for an electronic support measure (ESM) receiver. In the present work a LPI radar signal is assumed to be phase modulated by a code. The ESM receiver does not have any knowledge of the modulating code and carrier frequency of the LPI radar signal; it can only make general assumptions about the occupied bandwidth. The lack of knowledge of the modulating code strongly constrains the maximum obtainable signal to noise ratio (SNR) by a typical ESM receiver. This paper presents a receiver architecture which allows an improvement of the achievable SNR: the proposed architecture combines in an optimized way a uniform filter bank with the cross-correlation technique: the idea is to use coherent processing on both channels of a dual receiver and then integrate the cross product in order to recover all the energy of the LPI signal. However, since the same signal received is used to demodulate it, nonlinear effects arise and the resultant SNR has to be elaborated. Theoretical SNR performances, derived for a generic case, will be compared with simulations carried out with realistic phase modulated LPI signals. Measurements done on new generation Elettronica SpA (ELT) digital receiver based ESM shall be finally compared with both theoretical and simulation results. [C4085]

"Analysis of common-mode resonances in arrays of connected dipoles and possible solutions"

A prototype array of dual polarized connected dipoles has been manufactured. The feed structure is composed by two orthogonal 8 times 8 elements for each polarization (128). The operational frequency ranges from 6 to 9 GHz (40% relative bandwidth). Preliminary measurements highlighted the presence of unpredicted common-mode resonances excited in the vertical feeding lines. An analysis of the common-mode excitation is carried out and exit strategies for a design of a resonance-free connected array are presented. [C4086]

"Quasi-simultaneous measurements of scattering matrix elements in polarimetric radar with continuous waveforms providing high-level isolation in radar channels"

This paper presents a new type of sounding signals for polarimetric FM-CW radar and corresponding de-ramping technique for processing, which provide the possibility for simultaneous measurement of all backscattering matrix elements and have high-level isolation between branches of the polarimetric receiver. The radar transmitter forms sounding signal, which has orthogonally-polarized components with orthogonal waveforms. The radar receiver is splitting orthogonally-polarized components of the scattered signals in two parallel receiver channels. Every such channel includes two parallel independent branches, which use wave-form orthogonality of the orthogonally-polarized components of sounding signal to split further signal components for simultaneous estimation of all four complex elements of the polarization backscattering matrix of radar object. The isolation between pairs of such branches in one receiver channel strongly depends on the time interval when scattered signals with orthogonal waveforms occupy the same frequency band. In this paper we propose to use a pair of LFM-signals as orthogonally-polarized components of the sounding radar signal. Both have the same form but are shifted in time relatively to each other. Our analysis shows that such time shift between the components of sounding signal prevent the frequency overlap between polarimetric components of scattered signal. As result, standard de-ramping processing technique can be used in the receiver, providing high level isolation between receiver's branches that simultaneously estimate all elements of the radar target backscattering matrix. [C4087]

"Monitoring subsurface target changes based on cross-polarized wideband scattering"

In the context of resonance based radar target recognition, most work is done based on the co-polarized transient target signature excited by linearly polarized excitation. In this paper, the possibility of target recognition based on a cross-polarized wideband transient signature is investigated. Numerical examples of monitoring subsurface target-depth changes demonstrate that the cross-polarized transient target signature can also be applied to these applications. In addition, for the first time, the possibility of applying the e-pulse technique together with cross-polarized target signature for monitoring geometrical changes of subsurface target is also investigated. [C4088]

"Microwave radar sensors for active defense systems"

Modern anti-armor missiles represent enormous threat for any military vehicle. Simple hand-held missiles are able to penetrate 300 mm, more sophisticated missiles up to 1000 mm of the best steel armors. Active defense methods seem to be promising ways how to face this problem. Systems of active defense are based on sensors able to detect and measure approaching threat missile and generate signals that activate a suitable counter-measure. The paper describes several different designed radar sensors tested in active defense configurations. This concerns narrowband sector sensor, Idquomicrowave curtainrdquo and a new wideband sensor with a distance measurement capability. All practical tests were performed using real missiles at army shooting ranges. [C4089]

"Integrated clutter cancellation and high-resolution imaging of moving targets in Multi-channel SAR"

An integrated clutter cancellation and moving targets focusing scheme is presented for multichannel SAR (M-SAR) systems. The integration between the two processing steps is made feasible by performing the clutter cancellation processing in the Doppler frequency domain, and performing the moving target focusing by means of a bank of chirp scaling algorithms (CSA). The integration results efficient from a computational point of view, since the azimuth FFT is common to both the clutter cancellation and the focusing processing. The clutter cancellation step allows to achieve sub-clutter moving targets visibility. The bank of CSA filters, each one matched to a different along-track target velocity component allows to produce a high-resolution image of the target itself. The effectiveness of the proposed technique is shown with reference to a sample M-SAR dataset obtained from a SAREX-92 image. [C4090]

"Influence of UTD singularities on the quality of millimetre-wave images"

For the purpose of MMW-imaging different setups can be considered. When active sensorics are applied the synthetic aperture radar (SAR) concept is often used, since real apertures would require large dimensions in order to obtain the required resolutions. The resulting images show different characteristics, depending on shape and position of the synthetic aperture. The UTD-theory is suitable to consider the different scattering contributions of an object separately. In order to obtain a reconstruction result similar to an optical image the acquisition of the specular reflections seems to be important. Different imaging setups are evaluated with respect to the resulting images of objects that can be modeled using UTD-theory. [C4091]

"Direction of arrival sensor calibration based on ADS-B airborne position telegrams"

This paper investigates the suitability of ADS-B airborne position messages for calibrating a direction of arrival (DOA) sensor for Secondary Surveillance Radar (SSR) signals at runtime. An ad hoc system is thereby utilized to receive, automatically select and process a statistically relevant number of ADS-B replies. It is experimentally shown that ADS-B transponders can provide a suitable calibration signal within some limitations. [C4092]

"RBX (band X SAR): Analysis and calibration of Tx/Rx modules"

This paper describes the design and simulation of the transmitter and receiver module, a part of the advanced prototype X band, linear frequency modulated (LFM), synthetic radar aperture (SAR) being developed at INTA's Radar Laboratory (RBX). The system includes onboard calibration, which allows measurement of the effects of the sensor's components. [C4093]

"Statistical analysis of sea clutter spikes"

In this work a set of coherent and polarimetric sea clutter data is analyzed with a special interest for sea-spikes. Using three sea-spikes defining parameters, the spike amplitude, the minimum spike width and the minimum interval between spikes, it is possible to positively identify the spiking events from the background. This work shows a sample of results from a statistical and spectral analysis of a set of sea-spikes selected from the radar returns, focusing on their Doppler properties, the spike duration and the temporal interval between spikes. [C4094]

"A high sensibility wideband millimeter wave receiver for imaging concealed objects application"

A high sensibility wideband millimeter wave receiver operating in Ka band on the background of imaging concealed objects is presented. The zero-bias direct detecting millimeter receiver achieves an effective bandwidth 9.2 GHz and NF <3.8 dB which can receive like noise signals that are typical for passive mm-wave imaging. The fundamentals of the system are described. The principle of operation, performance of the receiver and supporting measured data are described. Examples of images built with this receiver using a mechanically scanned system are presented proving its applicability for detecting concealed objects needs. [C4095]

"A coherence improvement technique for coherent change detection in SAR interferometry"

This paper presents the new method to improve the coherence between the synthetic aperture radar (SAR) images for coherent change detection (CCD) by removing the fringe rate which is determined by the terrain topography and the interferometric baseline. This method performs without the information on the terrain topography and the flight path measured by the instruments such as the inertial navigation system (INS). The proposed method can successfully reveal the car track that is unnoticeable on the airborne SAR amplitude images of the 10 cm resolution. [C4096]

"Overview of future evolution of spaceborne altimetry missions, techniques and technologies"

Operational oceanography is of high importance for scientific, commercial, security and defence applications. This paper addresses the main required improvements for next space altimetry systems and gives an overview of advanced concepts that aim at giving satisfaction to these challenging objectives. [C4097]

"Space Based Radar technology evolution"

This paper assess future trends for Space Based Imaging Radars, identifying the critical technologies for their realisation. Possible implementation of critical technological elements, such as multichannel receivers, wideband signal generators, high throughput processors, are discussed. [C4098]

"Basics and first experiments demonstrating isolation improvements in the agile polarimetric FM-CW radar-PARSAX"

The article describes the IRCTR PARSAX radar system, the fully polarimetric FM-CW radar with dualorthogonal sounding signals, which has the possibility to measure all elements of the radar targets polarization scattering matrix simultaneously, in one sweep. [C4099]

"RADARSAT-2: Main features and near real-time applications"

The advanced characteristics of the RADARSAT-2 SAR satellite are briefly described and the main features of the Science and Operational Applications Research for RADARSAT-2 Program (SOAR) are outlined. Two case

studies are then taken into account, which have been developed in the framework of SOAR project 1488, a vine observing experiment and a flooding monitoring one. [C4100]

"A comparative study of radar scattering from linear and nonlinear sea surfaces"

In this paper, the linear and nonlinear sea surfaces are constructed to comparatively study the radar scattering characteristics of the two surfaces, using the first-order small slope approximate (SSA) method to calculate the normalized radar cross section (NRCS). Simulation results demonstrate that the nonlinear surfaces have sharper wave crests and shallower troughs than those of the corresponding linear surfaces and the average bistatic NRCS calculated from nonlinear surfaces is larger than the relevant linear surface result except for the scattering angles near the specular direction. In particular, the nonlinear surface backscattering coefficient has larger mean value and associated standard deviation than its linear surface counterpart, and this discrepancy grows bigger as the incident angle increases. [C4101]

"Hadamard speckle contrast reduction for imaging system: Comprehension and evaluation"

Coherent imaging systems always suffer from speckle phenomenon, which blurs the image, and therefore making the information extraction quite difficult. Hadamard speckle contrast reduction (SCR) is considered to be effective to deal with this problem in optics. In this paper, we explore the working principle and effectiveness of this approach, from mathematical deduction to system simulation, and from optics to millimetre wave frequencies, so as to understand why it works and how well it can perform. We show that the effectiveness of Hadamard SCR is linked to the texture of the objects' surface. The investigated cases are in the region of both millimetre wave frequencies and optics, but it should be clear that it is a wave-oriented discussion and therefore the problem should be considered in terms of electrical size, beyond the limitation of working frequencies. [C4102]

"300-MHz-frequency-band impulse-radio receiver architecture with all-digital compensation for clock jitter and frequency variation"

An impulse-radio receiver architecture for the 300-MHz frequency band is presented. Digital signal processing (DSP), which compensates cycle-to-cycle jitter and frequency drift of transmitter clock, is performed in a FPGA DSP board. Owing to the process, the detection range for transmitted packets is considerably enlarged, which improves the communication range between a transmitter and receiver. A prototype wireless sensor node was developed with a fabricated IC. This sensor node, driven by a passive mechanical vibration sensor, senses the opening and closing motion of the door. The estimated lifetime of the transmitter is over ten years with a coin-sized battery. [C4103]

"Multi-channel landmine detection radar signal processing using blind deconvolution"

Landmine detection using multichannel radar poses many signal processing challenges, but the main issue lies with the variability of the propagation characteristics of the soil. These affect the spatial signature of the mine and require adaptive signal processing algorithms to optimise the performance. Investigation of various spatial deconvolution techniques has shown that blind deconvolution offers best image reconstruction compared with Wiener, Lucy and regular deconvolution. This paper describes the application of these processing techniques to multi-channel radar data. [C4104]

"Computer simulation of the RF system effects on a millimeter-wave Doppler radar for human vital-signal estimation"

A detailed modeling and analysis for the effect of the RF system on the human vital-signal estimation by a 60-GHz millimeter-wave Doppler radar has been developed. The simulation scheme uses the root-MUSIC algorithm to calculate the frequency error ratios of the estimated heartbeat and breathing signals by the radar detection system. From the simulation results, it is found that root-MUSIC method is robust to analyze the effects of phase noise on the frequency estimation of the detected heartbeat and breathing signals. The simulation result will be very useful for the RF system design specifications for the millimeter-wave Doppler radar. [C4105]

"EuRAD 2009 abstract cards"

{no data available} [C4106]

"Book of abstracts"

{no data available} [C4107]

"The dual frequency X and Ku band SAR for the Earth Explorer mission"

Earth Explorer is an ESA Program aimed to provide an important contribution for the understanding of the Earth System. Earth Explorer missions form the science and research element of ESA's Living Planet Program and focus on the observation of atmosphere, biosphere, hydrosphere and cryosphere. In this context, the CoReH2O mission was conceived in order to characterize snow cover spatial distribution and its relevant properties: snow depth, Snow Water Equivalent (SWE), sea ice and glacier features. Electromagnetic properties of the geophysical parameters of interest, and the need to retrieve them accurately on a wide geographical scale, envision the mission around a Synthetic Aperture Radar (SAR) providing the key features of wide coverage, IdquoSimultaneous Dual Polarisation on Receiverdquo capability, IdquoSimultaneous Dual Bandrdquo (Ku-X) capability. [C4108]

"DOA estimation of coherent waves for 77GHZ automotive radar with three receiving antennas"

This paper proposes a novel scheme suitable for mm-wave automotive radars to estimate the direction-of-arrivals (DOAs) of coherent waves with only three receiving antennas. Reflected waves completely correlated from two targets can be resolved with calibrated 3-channel array antenna by using only one snapshot data. The resolution capability can be further improved with the use of multiple snapshot data. A 77 GHz prototype radar mounted on a vehicle successfully measured the directions of two stationary targets in real time computation. [C4109]

"Comparison of Maximum Likelihood and Generalized Monopulse DOA estimation techniques on SOSTAR-X GMTI-STAP data"

The maximum likelihood (ML) angle estimator is widely considered the Idquooptimumdquo angle estimator, particularly in presence of adaptive digital beam forming (ADBF). A number of papers in literature suggest several solutions to implement the bi-dimensional Doppler-azimuth angle ML estimation in a cost-efficient manner. Nickel demonstrated that the generalized monopulse technique can be derived from the ML technique just as a first order Taylor approximation of the ML estimator, at a minor implementation cost. This paper compares the results obtained by implementing the ML and the generalized monopulse techniques on the GMTI-STAP data gathered during the SOSTAR-X flight trials. [C4110]

"Comparison between Pseudomeasurement and DD2 filters in exoatmospheric Ballistic Missile engagement"

This paper deals with the problem of exoatmospheric tracking of a Ballistic Missile (BM) from an interceptor (or pursuer) moving towards the ballistic target. During the terminal guidance phase of the engagement, the on-board seeker provides noisy measurements of range, azimuth, elevation and range rate (or Doppler). Using the available seeker observations, the position and the velocity of the target can be estimated by a nonlinear tracking filter. Filter initialization is realized by means of a ground radar that tracks the ballistic target until the first measurement from the seeker becomes available. Then a proportional navigation guidance law is applied in order to guide the path of the interceptor towards the intercept point of the pursuer and the BM. The performance of the interceptor missile guidance system is influenced by the seeker and the autopilot dynamics that, in this paper, are both modeled with single lag transfer functions. Effects of different kinds of nonlinearities (i.e. saturation of lateral acceleration and saturations at the seeker) in the guidance loop are considered as well. The Extended Kalman Filter (EKF) has probably been the most widely used estimation technique for this complex nonlinear filtering problem. Nevertheless it is known that the EKF, which is based on a first order Taylor approximation of the equation of motion and/or the measurement equation, has a bias in its estimate and could in addition have convergence problems; both of these drawbacks are due to the underlying approximations. In this paper two filters are compared for the problem of tracking a BM during its exoatmospheric portion of flight: the Pseudomeasurement filter and the second order divided-difference filter (DD2 filter). A full three-dimensional engagement scenario has been simulated to assess the performance of the two considered estimation techniques and to determine the miss distance accurately. The simulation results show that both filters have adequate performance for the proposed problem. [C4111]

"Genetic Algorithms for PRI ambiguity resolution in Passive Emitter Tracking"

Passive emitter tracking (PET) is an accurate technique to localize an emitter through time difference of arrival (TDOA) multilateration by a network of sensors. It suffers from pulse repetition interval (PRI) ambiguity when two successive pulses are closer than the distance between the receivers. The problem can be undertaken by minimizing an error function (X^2), and ambiguity can be solved by using coarse direction of arrival (DOA) information; but X^2 becomes a very complex function of position for low PRI (airborne radars). Traditional

approaches to solve ambiguity can be time consuming. An alternative approach is presented which exploits the characteristics of genetic algorithms (GA), suitable for the optimization of particularly complex functions. This technique becomes more efficient than the standard methods for low PRI. [C4112]

"STAP developments in Thales"

Space-time adaptive processing (STAP) has been shown to provide significant improvements in many different application areas. Though similar in principle, those applications exhibit specificities, related for example to the characteristics of the antenna arrays and to the statistical properties of the involved signals. In this communication, different examples of applications of space-time adaptive processing (STAP), currently being studied or developed in Thales, are reviewed, and some areas for future research are outlined. The following applications are considered (without exhaustivity): airborne surveillance radars, airborne combat radars, radio communications, satellite navigation, and underwater sonar systems. [C4113]

"A peak power reduction scheme for wireless body area networks using UWB-IR"

In this paper a peak power reduction scheme by pulse repetition for ultra-wide band (UWB) impulse radio (IR) scheme is experimentally examined for obtaining interference immunity to RF sensitive systems such as medical devices. The effectiveness of the scheme is shown in terms of an improvement of bit error rate (BER) performance. [C4114]

"3D X-Band tactical acquisition radar (X-TAR 3D)"

The present paper deals with the Rheinmetall Italia 3D X-Band Search radar (X-TAR 3D) technology and applications. Aim of the paper is to illustrate the advanced technology and technique adopted for the development of the radar itself and the presentation of the main results obtained by recordings of real target data. [C4115]

"Millimetre wave radar applications to airport surface movement control and foreign object detection"

In the recent years, increase in air traffic volume has demanded for new and more stringent safety requirements over the entire gate-to-gate air traffic control regions. In particular, for what concerns airport ground surveillance, congested traffic in parking areas (APRON) ask for new generation of radar sensors having very high resolution during low visibility to discriminate between vehicles and aircrafts, and very high sensitivity to detect small dangerous objects like for instance a baggage. After Concorde accident occurred in Paris Charles de Gaulle airport, 25th July 2000, the capability to detect very small objects is became very important on the runway to improve as much as possible the safety during the taking off and landing operations. In addition, after the 11th of September 2001 tragic events, new airport security needs are driving the ground surveillance system requirements by demanding for new type of radar sensors able to be used against new emerging threats like perimeter intruders (i.e. persons, cars, boats,...) . An advanced millimetre wave radar for all three functions, airport surface movements control, foreign object detection (FOD) and perimeter intruders detection (PID), has been developed by Rheinmetall Italia SpA. This radar, named SMART, will be presented in this paper with particular emphasis to some technological aspects inside the antenna assembly and the transmitter unit. [C4116]

"GSM passive radar for medium range surveillance"

This paper presents a passive radar system using GSM as illuminator of opportunity. The new feature is the used high performance uniform linear antenna (ULA) for extracting both the reference and the echo signal in a software defined radar. The signal processing steps used by the proposed scheme are detailed and the feasibility of the whole system is proved by measurements. [C4117]

"Cloud profiling radar on earthcare satellite"

The design and current status of EarthCARE/CPR are described in this report. Basic design of CPR will be confirmed in this year, and engineering model development and testing will be done this year and the next year. In parallel with the development activity of CPR, algorithm development activity is in progress. The data from CPR is expected to contribute to reveal the detailed information of clouds and to the studies on global warming. It is also expected the continuation of cloud observation from CloudSat data that was launched in 2006[4]. [C4118]

"Estimation of rain attenuation characteristics of satellite communication links using x-band

meteorological radars"

Rain attenuation characteristics of the Ku-band up-link satellite signals are presented for the past four years of 2003-2006 in Japan and Indonesia, using Japan's domestic communication satellite Superbird C that connects Research Institute for Sustainable Humanosphere of Kyoto University (RISH) to Equatorial Atmosphere Radar Observatory (EAR). Compared with the rainfall rates with the same time percentages, equivalent path lengths of the satellite signal against the rain area are shown to be reduced down to 2 km at EAR, which is remarkably shorter than those at RISH in Japan. The almost same attenuation values and annual statistics are, however, obtained from the X-band radar observations simultaneously conducted at EAR. This suggests that long-term radar observations of convective clouds are effective to estimate rain attenuation statistics of the satellite signals in the tropical regions. [C4119]

"Application of C-band polarimetric radar on rainfall-type classification"

The rainfall-type classification method which gives a judgment of the presence of the melting layer in addition to a conventional convective-stratiform classification was developed using a C-band polarimetric radar. The convective-stratiform separation was conducted based on the horizontal Zhhfield. The melting layer was detected using the vertical profile of rho_{hv}. Four rainfall types are identified by a combination of these two classifications: 1) convective rainfall with melting layer, 2) convective rainfall with no melting layer, 3) stratiform rainfall with melting layer, and 4) stratiform rainfall with no melting layer. [C4120]

"Spatial relationship of F-region field-aligned irregularities and medium-scale traveling ionospheric disturbances observed with the MU radar and all-sky airglow imagers"

We report simultaneous observations of medium-scale traveling ionospheric disturbances (MSTIDs) and field-aligned irregularities (FAIs) in the F region by using two all-sky airglow imagers and the MU radar in Japan. MSTIDs propagating southwestward were observed in 630-nm airglow images on the night of June 16, 2004. During this MSTID event, FAIs in the F region were observed by making multibeam measurements with the MU radar. We found that FAIs with intense (weak) signal-to-noise ratio (SNR) coincided with the airglow depletion (enhancement) caused by the MSTIDs. This result indicates that the FAIs could be generated by the gradient drift instability at the airglow depletion region. [C4121]

"Performance evaluation of adaptive scan with wide-band noise modulation for spaceborne rain radar based on simulation"

The adaptive scan technique using wide-band noise modulation is applied for the simulation of rainfall observation for spaceborne rain radar in a no-rain area. The accuracy of this method is discussed based on a simulation using rainfall data observed by TRMM (Tropical Rainfall Measuring Mission) Precipitation Radar (PR). [C4122]

"Utilization of audio source localization in security systems"

Paper deals with utilization of audio source localization in security systems especially dedicated for additional securing of larger objects like squares or military basis for instance. Proposed detection system supposes that intruder makes uniquely determinable noise which can be picked up by microphone array. On the basis of real-time signal analysis from each microphone unit direction to acoustic source can be determined. In this paper is presented time-delay estimation method of the direction of arrival of the sound wave which is used in many other practical applications. Experimental part proposes design of the evaluation system consisting of microphone sensory system and standard personal computer equipped with Advantech PCI-1716 multifunction data acquisition card. [C4123]

"Processing of synthetic Aperture Radar data with GPGPU"

Synthetic aperture radar processing is a complex task that involves advanced signal processing techniques and intense computational effort. While the first issue has now reached a mature stage, the question of how to produce accurately focused images in real-time, without mainframe facilities, is still under debate. The recent introduction of general-purpose graphic processing units seems to be quite promising in this view, especially for the decreased per-core cost barrier and for the affordable programming complexity. The authors explain, in this work, the main computational features of a range-Doppler Synthetic Aperture Radar (SAR) processor, trying to disclose the degree of parallelism in the operations at the light of the CUDA programming model. Given the extremely flexible structure of the Single Instruction Multiple Threads (SIMT) model, the authors show that the optimization of a SAR processing unit cannot reduce to an FFT optimization, although this is a quite extensively used kernel. Actually, it is noticeable that the most significant advantage is obtained in the range cell migration

correction kernel where a complex interpolation stage is performed very efficiently exploiting the SIMT model. Performance show that, using a single Nvidia Tesla-C1060 GPU board, the obtained processing time is more than fifteen time better than our test workstation. [C4124]

"Sensor fusion for obstacle detection and its application to an unmanned ground vehicle"

This paper presents a method for the detection of obstacles in the trajectory of unmanned ground vehicle (UGV). To detect obstacles, two different sensors are used, i.e., a vision sensor and a scanning lidar. While lidar measures the precise distance of the object, it cannot detect low objects due to its constant scanning height and angle. In contrast, vision sensor provides 2-D scenery information with relatively poor distance information. To compensate for the drawbacks of these two sensors, the sensor fusion method for obstacle detection of UGV is proposed. Finally the proposed method is validated experimentally. [C4125]

"Design of a semi-spherical microphone array based sound localization system"

This paper proposes a semi-spherical microphone array based sound localization system for a service robot. The hardware of the proposed system basically contains 12 capacitor microphones disposed in two layers on the semi-sphere of 19 cm diameter. It aims to estimate the degree relationship between the main speaker and the robot and provides the robot useful information for more effective human-robot interactions. The proposed system can determine the location of the voice according to energy information between the main speaker and robot not only in normal environment but also in blatant and/or reverberative spaces. The experimental results show that the proposed system has obtained satisfactory recognition efficiency, moreover, raised the robotic friendliness and adaptability. [C4126]

"Target tracking algorithm with application to naval fire control technology"

This paper presents the target tracking technology applied to the fire control system (FCS) which is used on warships. This FCS has the capability to track the targets moving in both high-speed-high-maneuver and low or non-maneuver motions with hybrid uncertainties. Here uses the variable structure interacting multiple model (VSIMM) algorithm as the core tracking algorithm because of its broad adaptability of target tracking. In VSIMM, the model-set is made adaptive by switching among a number of predetermined groups of models, and more cost-effective than fixed-structure IMM (FSIMM) estimator. The important applications of VSIMM estimator include the model-group adaptation logic and model-group design. This paper chose Kalman filter as the sub-filter of VSIMM algorithm. At last, this paper will present an activation-only VSIMM estimator as the simplified form of VSIMM. [C4127]

"Development of INS-aided GPS tracking loop and preliminary flight test"

Robust tracking of GNSS signal in a harsh environment such as a severe ionospheric scintillation is a challenge for civil aviation. The use of inertial sensor would improve the tracking performance since the Doppler frequency caused by aircraft dynamics could be compensated by the inertial measurements. In order to evaluate such an aiding, an INS aided GPS tracking loop was developed by using a software receiver, and a preliminary flight test was conducted. Off-line analyses showed a reduced carrier phase error and a possible reduction of noise band width in tracking loop, which would result in positioning accuracy improvement. [C4128]

"3D image reconstruction of reinforcing bar and pipe using handy microwave radar scanning system"

In this report, an advanced signal processing method for microwave radar is considered to reconstruct a precise 3D image for inner construction in concrete structuresC which consists of reinforcing bars and pipes. An antenna positioning error and an inappropriate signal processing method have caused a degradation of reconstructed images. First, a handy antenna scanning system has been modified, which enables real-time self-position measurement. Concretely, a wheel uplift phenomenon is restrained by stabilizing a compress force to a target surface, and positioning accuracy can be improved. On the image reconstruction result, a superposition of observed data cannot operate well in a region sandwiched by two scanned trajectories. Then, a pipe-shape model is newly introduced, and the 3D object's images have been reconstructed assuming that a continuity of buried object based on it. As a result, buried object's properties can be evaluated more precisely. An effectiveness of a proposed method has been confirmed experimentally, by applying it to a concrete test specimen and an actual wall. [C4129]

"Construction of a wireless sensor networking platform with vibration sensing and GPS positioning"

In this paper, the networking architectures and information middleware of wireless sensor networks are

developed to construct the heterogeneous information system platform for the real-time structural health monitoring application. The design and implementation of sensor firmware and networking middleware are the key study topics for WSN-based intelligent system platform. The networking gateway of system platform must be developed the independent and highly interoperability to integrate the heterogeneous networks. The application study combined with vibration sensing and GPS positioning is used to demonstrate the feasibility of the developed system platform. The middleware technology is implemented to filter and pre-process the received data from the Zigbee sensor node and extract the available information to transfer to and record in the system database. Moreover, the GPRS and GSM modules are used to be responsible for the long-distance and alarm message transmission on the information network, respectively. Furthermore, the integration system platform is constructed by integrating Zigbee sensor network, GPRS/GSM communication and LAN Internet to illustrate and evaluate the feasibility and performance of the proposed architecture for wireless sensor systems. In conclusion, the intelligent system platform of WSN-based monitoring system is developed and integrated to demonstrate and speed up the practical applications of wireless sensor networks in this paper. [C4130]

"Airborne GPS reflectometry from low altitude aircraft"

This work is intended to develop a software-defined Global Positioning System (GPS) receiver specifically designed to process reflected GPS signal off the ground or the ocean surface for purpose of remote sensing. A set of airborne campaign was conducted to evaluate the performance of the prototype GPS reflectometry receiver. The reflected signal was tracked in open-loop manner using the so called delay mapping receiver. The result shows that the prototype receiver was capable of providing altimetric measurements with a precision level of the order of few meters with an unknown system bias which should be estimated. [C4131]

"Forward vehicle and distance detecting using image processing technology for avoiding traffic jams"

This paper describes the development of an image-based traveling information monitoring system. It provides a practical solution that can detect the driving feature and the running environment of the mobile in real time, especially the distances between the forward cars and our car. Moreover, this system can strengthen the management ability to prevent the traffic accidents for the drivers. [C4132]

"Continuous monitoring of temperature profiles with a excellent vertical resolution by applying Frequency domain Interferometric Imaging technique to the Radio Acoustic Sounding System with a wind profiling radar"

This study applied the Frequency-domain Interferometric Imaging (FII) technique to Radio Acoustic Sounding System (RASS) measurement to improve the vertical resolution of temperature profiles obtained by RASS measurements. The FII technique was applied to RASS imaging measurements performed using the Middle and Upper atmosphere (MU) radar on October 29-31, 2006. The temperature profiles inside the radar range volume with the temporal resolution of 26 minutes were successfully estimated. The detailed temperature structure was revealed in the FII results. In particular, the detailed inversion layers structure inside the radar range gate were in good agreement with the simultaneous radiosonde results. [C4133]

"Terrain data aided passive ground target tracking"

The primary purpose of passive tracking function is to support weapon systems on the military aircraft. A ground-attacking aircraft must know the precise location of the target to fulfill its missions. The target tracking system must estimate location of the target passively, if the need of stealth performance is highly required. A target is designated using integrated sensors, such as Helmet Mounted Sights, Laser Designators, FLIR (Forward-Looking Infrared Radar),IRSTs (Infra-Red Search and Track), and RF Precision Direction Finding Equipments. These sensors can accurately provide the LOS (Line Of Sight) angle measurements to a ground target passively, but they cannot provide a measurement of range which is required to determine the location of targets on the ground. However, by using of stored digital terrain data, the target's location can be calculated. The digital terrain aided passive target tracking algorithm consists of the LOS intersection algorithm and the Kalman Filter. [C4134]

"Defense strategy against multiple anti-ship missiles"

There are few studies about defense strategy against anti-ship missiles in spite that an anti-ship missile is the most critical threat to naval vessels. This paper suggests defense strategy of single naval ship with closed range anti-air missiles against multiple anti-ship missiles. We define the engagement situation and suggest missile launch logic. The logic includes essential sub-logics, such as estimate threat pattern and establish engagement plan. Finally, we make simulation program for performing suggested logic. [C4135]

"A real-time high-precision localization algorithm for wireless sensor networks"

Besides sensing the environment variables, the application of localization in wireless sensor networks has become an important research subject. Unlike the other range-free localization schemes which are not effective in real time performance, we propose a real time algorithm, which determines the location of the moving object based on dynamically changing signal strength. The simulation results demonstrated our algorithm is more effective and precise in the sense of real time localization scheme compared with previous method. [C4136]

"RCS simulation of a shipboard cylindrical trihedral radar reflector in the S-band"

The paper analyzes the radar cross section (RCS) of a shipboard cylindrical radar reflector consisting of vertically stacked rectangular trihedral reflectors. This kind of reflector is commonly used on sailboats. However, there have been reports on its low quality regarding radar visibility, albeit without thorough analysis. The aim of this paper was to simulate its RCS trying to confirm or refute these observations. The simulation was done using Numerical Electromagnetics Code (NEC). The results show that the radar visibility of this reflector would be very poor. The RCS declared by the manufacturer cannot be achieved in the S-band, even for the upright vertical position of the reflector. If the reflector is heeled (which is always true), its RCS is even smaller, making it practically invisible to a S-band marine radar in real environment. [C4137]

"Inversion of wavelet coefficients in oil spills detection in radar images for environment risk reduction in Adriatic Sea"

Problem of oil spills detection is involvement of dark colors. Dark colors are close to 0 and cannot be detected by image differencing. The paper presents an idea to overcome the detection problem for oil spills. By using DWT, the idea is to remove parts of the signal which represent main structures such as coastlines and increase noise. Wavelet analysis in real time, for oil spills, has been applied to an inverted image. Then the so called frame differencing technique is applied. The benefits of using the proposed method is the reduction of risk for environment pollution, prevention of environment danger, tracking of pollution spread, and help in crisis management. The proposed method can be combined with VTS for narrow seas such as the Adriatic Sea. [C4138]

"The impact of RF nonlinearities in an optical link on the contrast of imaging radars"

The contrast of imaging radars is shown to be severely limited by RF nonlinearities, introduced by opto-electronic devices like intensity modulators. Limitations on the allowable modulation index are studied for linearly-chirped pulses returned from clutter. [C4139]

"Optimization of photonic transmit/receive module performance"

Previous publications have described techniques that various researchers at photonic systems, Inc. and elsewhere have used to optimize the performance of analog photonic links. The success of these efforts has made the incorporation of antenna-remoting photonic links into radars and RF communications systems attractive to the designers of such systems. In this paper we show that the simple addition of photonic links to carry signals to and from an RF transmit/receive (Tx/Rx) module, while straightforward, is often not the most beneficial approach because it unnecessarily subjects the inherently broadband photonic components to the same bandwidth limitations as the RF circuitry in the module. If one instead begins with the idea that the broadband photonics technology should be central to the design of the antenna Tx/Rx interface, a completely new architecture emerges-one that not only has greater capabilities than the conventional RF interface, but is simpler as well. As an example of a photonics-based antenna interface design that is simple and yields improved capabilities, we present a Tx-isolating photonic Rx (TIPRX) link that operates over many octaves or even decades of bandwidth while providing 40 dB or more of isolation between the transmit and receive signals. The potential system impact of the TIPRX is that an antenna can receive low-power signals while simultaneously transmitting much higher-power signals. [C4140]

"Real-time detection of sine waves by means of a discrete Fourier transform"

This paper deals with the problem of probabilistic detection of weak sine waves immersed in noise. The analysis is performed in the frequency domain after a discrete Fourier transform, and it is suited for real-time applications. The detection and false alarm probabilities are provided in analytical form as functions of the sampling parameters and the properties of the time window. In particular, both coherent and noncoherent sampling conditions are considered. Analytical results are validated by means of numerical simulations. [C4141]

"Classifier Design via Projection Approximation"

In the viewpoint of inverse problem and function approximation theory, we set up a framework for pattern classifier design, wherein the classifier is assumed to be an element of a Reproducing Kernel Hilbert Space (RKHS) continuously defined on the pattern feature space. Based on the RKHS metrics, an orthogonal projection criterion is adopted for pattern feature representation so that optimal generalization capability is ensured for the classifier, with respect to minimum error norm. In addition, by orthogonally projecting the outputs of the target class samples onto the null space of an operator defined by the sample outputs of other classes, the target class is optimally discriminated from other classes, with respect to minimum mean output energy. Combination of the above two criteria yields a criterion for optimal representation and discrimination of pattern features, which yields another classifier wherein the balance between representation and discrimination may be controlled by a parameter. Some experimental results on handwritten digit classification, face recognition, and radar target recognition are given to show the feasibility of the presented classifiers. [C4142]

"The use of resource list servers in IMS presence for developing networks"

The IP multimedia subsystem (IMS) is a next-generation service delivery platform that enables operators to deliver services such as multimedia and IP content to both fixed and mobile users. One of the important services for early adopters in the IMS is presence, an application well-known on platforms such as the Internet, which can be integrated into other applications as an enhancement. A major constraint to the implementation of IMS services over developing networks is the requirement of significant bandwidth, especially over the Г,Вilast mileГ,Вi access network, for the delivery of multimedia and associated data. However, the availability of broadband network access for multimedia services in rural and developing areas, particularly in South Africa, is very low. The resource list server (RLS) is important to the IMS presence application, as it optimises the management of intensive presence signalling, and aggregates information to subscribers from within the IMS core network. The use of an RLS can reduce the demands of the IMS Presence application on constrained access network resources. [C4143]

"Building and Applying of 2.5D Range Image Based on Data Fusion"

Propose an algorithm to detect road area in front of the robot based on 2.5D range image to satisfy the robot to find passable road lies 20-80 m in front of it. The algorithm builds a 2.5D range image by calibrating ladar and camera. Then, it clusters points in single ladar frame using KNN. Geometrical and color information were used to segment the range image and then road area was abstracted. The experiment show the algorithm can works in semi-structural environment and has ability to deal with shadow image and ladar noise. [C4144]

"Rare Class Mining: Progress and Prospect"

Rare class problems exist extensively in real-world applications across a wide range of domains. The extreme scarcity of the target class challenges traditional machine learning algorithms focusing on the overall classification accuracy. As a result, purposefully designed techniques are required for effectively solving the rare class mining problem. This paper presents a systematic review of the major representative approaches to rare class mining and related topics and gives a summary of the important research directions. [C4145]

"Heartbeat interval extraction using doppler radar for health monitoring"

In this paper heartbeat interval extraction methods using Doppler radar are reviewed. While single channel CW radar offers simple architecture and signal processing, this method is very sensitive to subject position and may result in rate doubling, or the coupling between heart and respiratory rates. Quadrature radio architecture is used to overcome this limitation. The use of linear and non-linear demodulation methods was explored for heartbeat interval extraction. [C4146]

"Multi-beam adaptive beam forming for SAR application and its DSP implementation on T-SHARC"

Linear and planar adaptive antennas have been explored since last few decades for employing tailor made multiple beams for synthetic aperture radar applications. DSP implementation of standard beam forming algorithms for space borne synthetic aperture radar processing is discussed here in this paper. A planar adaptive array can be exploited to generate multiple simultaneous beams to cater synthetic aperture radar modes like spotlight, scan and strip map. The multiple beams tend to cater range and azimuth requirement i.e. two dimensional beam forming. Real time DSP can increase cost of implementation of DBF array. Multiple beams are adapted optimally to get required directional beam forming or direction of arrival (DOA) estimation. Uniform linear as well as planar array (ULA-UPA) are modeled based on simulations of various adaptive and non-adaptive algorithms. The state of the art algorithms for adaptive antenna, are utilized for suppressing the interference in

directions other than desired and ones, reduce the error by optimally adjusting the weights. The use of analog DSP Tiger SHARC T-101 is suggested here for implementation. [C4147]

"A quantum-inspired evolutionary algorithm based on P systems for radar emitter signals"

In this paper, a quantum-inspired evolutionary algorithm based on P systems (QEPS) is used for radar emitter signals to promote the application of membrane computing. QEPS combines the framework and evolution rules of P systems with the chromosome representation and evolutionary mechanism of quantum-inspired evolutionary algorithms (QIEA). With good global search capability and rapid convergence, QEPS can extract specific information from radar emitter signals in a short span of time. Experiments are carried out on linear-frequency modulated radar emitter signals with 10 db signal-to-noise rate to test the effectiveness and practicality of the introduced approach. Experimental results show that QEPS performs better than the greedy algorithm and the counterpart QIEA. [C4148]

"Radar micro-doppler for long range front-view gait recognition"

We seek to understand the extraction of radar micro-Doppler signals generated by human motions at long range and with a front-view to use them as a biometric. We describe micro-Doppler algorithms used for the detection and tracking, and detail the gait features that can be extracted. We have measurements of multiple human subjects in outdoor but low-clutter backgrounds for identification and find that at long range and front-view, the probability of correct classification can be over 80%. However, the micro-Doppler signals are dependent on the direction of motion, and we discuss methods to reduce the effect of the direction of motion. These radar biometric features can serve as identifying features in a scene with multiple subjects. Ground truth using video and GPS is used to validate the radar data. [C4149]

"Estimation of angle glint for different radar targets"

Angle glint can be the distortion in the radar echo signal phase front and is observed as deviation of the direction of power flow from the radial direction and give rise to radar pointing errors. The mechanism that gives rise to these errors is also responsible for angular errors observed in radar multipath conditions. The effect can be either natural or intentional and is due to the destructive interference between the reflections from different scattering centers on the target. The apparent direction from where a scattered field originates is perpendicular to the phase front of the wave, and in regions where there is destructive interference between the fields there can be significant distortion of the front. For various glint angles using different frequencies the received echo power is calculated and the result is simulated using MATLAB. The range glint is also calculated using different carrier frequency. In obtaining the received echo power, the polarization aspect is considered and the received echo power for different glint angle is simulated for different polarization. Thus the different simulation has been carried out to find the glint error for different scatterers. The radar will move in such a direction so as to nullify the glint angle error produced by the scattering surface of the target. [C4150]

"Two-polarization two-frequency operation in a class-A semiconductor laser"

Tunable dual-frequency oscillation is demonstrated in a VECSEL using spatial separation of the two orthogonally polarized eigenstates. The VECSEL class-A dynamics enables to get rid of electrical phase noise in excess at relaxation oscillation frequency. [C4151]

"Overview of present/future needs of MWP for defence system applications"

For many years, optical-microwave technologies have appeared as promising for numerous applications. Indeed, fibre-based communications are well established nowadays in digital transmission systems. The maturity and the performances of optoelectronic components, in terms of spectral purity and linearity, are such that today they enable optical transmission and processing of analogue broad-bandwidth microwave signals. Moreover, the inherent parallel nature of light, the low sensitivity to electromagnetic perturbations and the capability to perform processing functions in the optical domain allow the introduction of new concepts such as local oscillator distribution, optical beam-forming, adaptive filtering or radar signal and waveform generation. These new concepts are good candidate for application and further validation into ship or ground-based radars, as well as into space or airborne systems. [C4152]

"DERACL: A distributed energy-efficient routing algorithm based on cross-layer design"

This paper proposes a distributed energy-efficient routing algorithm for mobile Ad Hoc networks (MANETs). We adopt the cross-layer design paradigm. The distance from the source node to the destination node is estimated based on the received signal strength indication (RSSI) of the packets and is used to adaptively adjust the

backoff time of the MAC layer. A distance threshold and a packet count threshold are used to schedule the transmissions of packets in the Network layer. The algorithm is distributed and works without needing any global network information or control packet. Experimental results show that the routing algorithm is energy-efficient and drastically alleviates the Broadcast Storm Problem. [C4153]

"Nonlinearly chirped microwave pulse generation using a spatially discrete chirped fiber Bragg grating"

In this paper, we propose an optical approach to generating nonlinearly chirped microwave pulses based on space-to-frequency-to-time mapping using a spatially discrete chirped fiber Bragg grating (SD-CFBG). The SD-CFBG functions to perform simultaneous spectral slicing, frequency-to-time mapping and temporal shifting. The generation of a nonlinearly chirped microwave pulse with a chirp rate varying from 93.6 to 11.2 GHz/ns is experimentally demonstrated. [C4154]

"Merged power amplifier and mixer circuit topology for radar applications in CMOS"

This paper presents a circuit topology merging power amplifier and mixer functionalities in a single circuit. The amplified local oscillator signal in the transmitter path is used simultaneously for the mixing operation along with the received radio-frequency signal, applied to the output of the power amplifier. The transistors at the output stage of the power amplifier are used for both amplification and passive mixing. The conversion loss of the mixer can be minimized, whilst the performance of the power amplifier is not affected. This approach is verified in measurement of a merged power-amplifier-mixer circuit in 0.13 μm CMOS technology. The mixer path offers a conversion loss of 10 dB, whilst the power amplifier achieves on-board output power of 7 dBm. The presented concept can be particularly advantageous for compact integrated monostatic radar solutions for low-cost mass-market applications. [C4155]

"An integrated 10A, 2.2ns rise-time laser-diode driver for LIDAR applications"

An integrated laser-diode driver for LIDAR applications in a 0.35 μm 80 V CMOS technology is realized. The integration of the power switch as a n-DMOS allows a peak current of 10 A, with a corresponding rise-time of 2.2 ns and a fall-time of 2.4 ns. Up to the authors knowledge this is a first-time achievement on a monolithic die. The laser can be operated at a maximum duty-cycle of 0.1 %, with a pulse duration of 10-50 ns. To overcome the parasitic inductances and their associated voltage drop, a high voltage of 70 V is applied to the LIDAR circuit. In order to drive the power switch within its safe operating area and to make sure the rise- and fall-time is minimized, a pre-driver is integrated on the same die. [C4156]

"The future of high frequency circuit design"

The cut-off wavelengths of integrated silicon transistors have exceeded the die sizes of the chips being fabricated with them. Combined with the ability to integrate billions of transistors on the same die, this size-wavelength cross-over has produced a unique opportunity for a completely new class of holistic circuit design combining electromagnetics, device physics, circuits, and communication system theory in one place. In this paper, we discuss some of these opportunities and their associated challenges in greater detail and provide a few of examples of how they can be used in practice. [C4157]

"122 GHz low-noise-amplifier in sige technology"

The paper presents two types of 122 GHz low-noise-amplifiers (LNA) fabricated in SiGe BiCMOS technology. The amplifier design takes advantage of a novel transmission line structure with thick metal ground-shield on top of the MMIC. The circuit is a two-stage cascode topology utilizing transmission lines for input, output and inter-stage matching. The amplifiers are designed for high gain, minimum noise figure and low power consumption. Measurements show a gain of 13.5 dB and a noise figure of 9.6 dB at 122 GHz. The power consumption is 52 mW from a 3.5 Volt supply. The other version of the LNA with transformer coupling to the output instead of capacitive coupling has slightly lower gain. The amplifier is intended for the use in ISM-band radar and communication systems, wide-band communication systems and in radar imaging systems. [C4158]

"Low-noise ESD-protected 24 GHz receiver for radar applications in SiGe:C technology"

This paper presents a low-noise ESD-protected 24 GHz receiver in Infineon's B7HF200 SiGe technology. The fully differential circuit integrates a low noise amplifier (LNA), two low-noise mixers and polyphase filters for on-chip quadrature generation. The front-end has been designed to meet high robustness requirements for industrial or automotive applications. It offers ESD hardness of 1.5 A Transmission Line Pulse (TLP) failure current on the RF pins, which corresponds to HBM protection above 2 kV. Furthermore, the performance variation of key

parameters has been analyzed in measurement over a wide range of temperatures from -40degC to 125degC. The receiver offers a conversion gain of 21.5 dB and a very low noise figure of 3.1 dB at the center frequency of 24 GHz. The circuit exhibits a linearity of -20.5 dBm and -11 dBm input-referred 1dB compression point and IIP3, respectively. The front-end consumes 39 mA from a single 3.3 V supply. The chip area including pads is 1 mm². [C4159]

"Radar cross section of human cardiopulmonary activity for recumbent subject"

The radar cross section (RCS) corresponding to human cardio-respiratory motion is measured for a subject in two different recumbent positions. Lying face-up (supine), the subject showed an RCS of 0.326 m². But when lying face-down (prone), the RCS increased to 2.9 m². This is the first reported RCS measurement corresponding to human cardio-respiratory motion. The results obtained in this experiment suggest modeling the upper part of the human body as a half-cylinder where the front body corresponds to the cylindrical surface and the back corresponds to the rectangular one. [C4160]

"Non-contact respiratory rate measurement validation for hospitalized patients"

This paper presents the first clinical results for validating the accuracy of respiratory rate obtained for hospitalized patients using a non-contact, low power 2.4 GHz Doppler radar system. Twenty-four patients were measured in this study. The respiratory rate accuracy was benchmarked against the respiratory rate obtained using Welch Allyn Propaq Encore model 242, the Embla Embletta system with Universal XactTrace respiratory effort sensor and Somnologica for Embletta software, and by counting chest excursions. The 95% limits of agreement between the Doppler radar and reference measurements fall within +/-5 breaths per minute. [C4161]

"A low noise, high gain, highly linear mixer for 77 GHz automotive radar applications in SiGe:C bipolar technology"

This paper presents a modified Gilbert type mixer which is fabricated in a 200 GHz fT_{SiGe:C} bipolar technology and well suited for 77 GHz bi-static automotive radar applications. The measured single sideband noise figure (NFSSB), conversion gain (CG), and input-referred 1 dB compression point (ICP) of this mixer are 10.8 dB, 21.5 dB, and -5 dBm, respectively. The current consumption is 21 mA under 3.3 V power supply. This mixer shows state-of-the-art noise figure, conversion gain traded-off with 1 dB compression point, and low power consumption. [C4162]

"Respiratory monitoring using a doppler radar with passive harmonic tags to reduce interference from environmental clutter"

A harmonic tag was designed and fabricated to show the feasibility of sensing cardiopulmonary related Doppler shift in the received second harmonic signal. A fundamental frequency of 2.45 GHz was transmitted at a target and a quadrature homodyne receiver used to sense the received signal from a tag on the target. The setup was used to successfully isolate periodic motion from a tag on a programmable mechanical target and to sense respiratory motion of a human subject, even when the targets were in close proximity to other moving objects. [C4163]

"Generating higher output power signals for today's test applications"

High test signal power provides multiple advantages within the RF test environment. It can mean greater accuracy of measurements and the ability to evaluate devices over a larger dynamic range. This in turn results in a wider breadth of capability from the test system ensuring coverage of the boundary conditions that may affect system readiness. Long cable runs and switch matrices that consume signal power before the test signal gets to the device under test aggravate the problem. As a simple example, when testing a high power microwave amplifier like a Traveling Wave Tube (TWT) to be installed in a radar system, high input level is needed to evaluate the unit over the entire linear range. This needed input level is often greater than 25 dBm. If the source input level is limited to evaluating the unit over just this range, the results of rare scenarios where the unit is overdriven are never characterized. This paper first explores the RF applications and measurements that benefit from a stimulus of high power signals. It will demonstrate methods by which higher RF power can be used to improve test coverage and measurement accuracy. Secondly, the paper will educate the test system designer how to incorporate and use high power stimulus in their test environment. [C4164]

"Intelligent Model of Microwave Band-Stop Filter in Microwave Communication System"

Microwave filter is a kind of device which can separate microwave signals with different frequencies, and the filter has widely been utilized in a great many fields such as communication, signal processing, radar etc.

Combinatorial non-periodic defected ground structures (CNPDGS) can be used to prohibit the propagation of electromagnetic waves within a certain band of frequencies because of special form being etched on the circuit's ground plane. In this paper, Radial basis function (RBF) artificial neural networks of CNPDGS are developed on the basis of FDTD (finite-difference time-domain method) analysis for the first time. The transmission coefficient of the CNPDGS at any arbitrary sizes and the frequencies within region trained can be obtained quickly from intelligent mode after having been successfully trained. Finally, intelligent model has been approved by results of experimentation. It is also showed that intelligent model is very effective. Intelligent model will provide powerful approach for intelligent design of microwave band-stop filter in microwave communication system. [C4165]

"A meothod for multi-target range and velocity detection in automotive FMCW radar"

FMCW(frequency modulation continuous wave) radar has many useful applications but a serious problems can occur in multi-target situations. Range-velocity processing should suppress so-called ghost targets and detect missing targets presented by beat frequency shift with Doppler frequency. In this paper, a new method is proposed for effective identification of the correct pairs of beat frequencies received from real targets. [C4166]

"Night-time vehicle classification with an embedded, vision system"

The paper presents night-time vehicle classification using an embedded vision system based on an optical transient sensor. This neuromorphic sensor features an array of 128times128 pixels that respond to relative light intensity changes with low latency and high dynamic range. The proposed algorithm exploits the temporal resolution and sparse representation of the data, delivered by the sensor in the data-driven address-event representation (AER) format, to efficiently implement a robust classification of vehicles into two classes, car-like and truck-like, during night-time operation. The classification is based on the extraction of the positions and distances of the vehicles head lights to estimate vehicle width. We present the algorithm, test data and an evaluation of the classification accuracy by comparison of the test data with ground truth from video annotation and reference results from a state-of-the-art ultrasonic/radar-combination reference detector. The results show that the difference in total truck counts with respect to a reference detector and to manually annotated video during nighttime operation under dry and wet road conditions is typically below 6%. [C4167]

"Recurrent Grid Based Voting Approach for Location Estimation in Wireless Sensor Networks"

With the advent of location aware sensor applications, precise location discovery has become an important technology in wireless sensor networks. Inter Peer communication in the sensor network has been modeled as the graph with constraints defined in terms of proximity. Recurrent grid based voting approach (RGBV) has been introduced to estimate the location of unknown nodes in the network. Voting scheme is adopted on an iterative basis for the nodes. For each node, region of interest (ROI) with the maximum votes is figured out as the collection of two-dimensional points after recursive voting. Convex hull is generated from this set of points to frame the actual ROI. Additionally, minimum bounding rectangle algorithm has been applied to figure out the centroid of the region. The centroid thus estimated is the required location of unknown node. Our methodology is shown to have fast convergence with low estimation error, even for complex networks. The simulation results demonstrate that the proposed method is promising for the current generation of sensor networks. [C4168]

"Design of the real-time data acquisition and transmission system for the Qinghai-Tibet Railway particular detection ground penetrating radar"

This project develops a set of ground penetrating radar system special for the Qinghai-Tibet Railway detection, in order to rapidly detect the freeze-thawing damage and so on to the Qinghai-Tibet Railway subgrade. The parallel analog-to-digital converter AD7634 with high speed and high precision is adopted in this paper, which combines the FPGA technology and the USB bus to realize the rapid and real-time transmission of the Radar echo data, and the high-performance floating point signal processor is also adopted for the Radar echo data of real-time proccession. Real-time data acquisition, proccession and transmission system with three channels is adopted in the ground radar, which has achieved well application result on the Qinghai-Tibet Railway, and reached the required detecting velocity of this project. [C4169]

"Application of DRFM in ECM for pulse type radar"

In this paper, we develop a digital radio frequency memory (DRFM) which samples and quantizes (A/D conversion) an incoming pulse-typed radar signal, stores it and produces (D/A conversion) a jamming signal from the sampled and stored radar signal. Electronic countermeasure (ECM) techniques against radar can be enhanced by using DRFM to simulate the radar signal for subsequent re-transmission to confuse radar at any distance. This paper presents the principle of DRFM and its application in ECM against pulse type radar. [C4170]

"Radar Stride Rate Extraction"

We seek to understand the extraction of radar signals generated by human motion and extract information from them. We demonstrate the extraction of information associated with gait, especially the stride rate, from radar data. We describe algorithms used for detection, the radar sensors used for the measurements, and detail some of the features that can be extracted. We make measurements of human subjects in outdoor clutter backgrounds for identification. These features can serve as identifying information in a scene with multiple subjects. We gather ground truth using video and accelerometers to validate the radar data. [C4171]

"Future event"

This paper dealt with the following topics: ITER CODAC; XFEL; machine protection system; synchronous Ethernet-based system; DAQ; microTCA; ATCA; control system; data acquisition system; fusion experiment; large-scale experiment; intelligent platform management controller; J-PARC; T2K experiment; fine grained detector; front-end electronics; time projection chambers; photodetectors; read-out electronics; waveform sampling; microchannel plate devices; picosecond timing; DTL; beam phase measurement system; energy measurement system; proton accelerator; ATLAS- RPCs ROD; embedded microprocessor; GLink chip-set; FPGA; embedded serial transceivers; ATLAS; triggering system; parallel computer; receiver assistant congestion control; jitter; EAST plasma discharges; online information; LHCb experiment; EPICS channel access; Internet communication engine; NEXT prototype; BESIII; TOF experiment; monitoring system; Wendelstein 7-X experiment; DC-DC converters; clock data recovery; Webscope; fusion data analysis and visualization; high-speed data injection; MAPS; serial link transmitter; microBooNe experiment; time-of-flight PET-MR; detector module; Ethernet LAN; gamma decays; CMS barrel electromagnetic calorimeter; online system; superKamiokande experiment; experiment at CERN; DWDM link; ALICE system; PET scanner; statistics-based online baseline restorer; digital filters; noise reduction; precision calibration; intellectual signal classifier system; wave union TDC; on-chip processing; real-time sampling system; JET tokamak; electronic noise; odor discrimination; time-mark technology; logic system; EUDET pixel telescope system; gas detectors; dynamic partial configuration; PITZ; MTF; interlock system; nuclear fusion devices; CompactPCI HA platform; railway radar system; clock synchronization; radiotherapy treatment planning; Monte Carlo methods; processing system; storage system; Ethernet prototyping; 2D X-ray detectors; hardware-software codesign; space charge simulation; unified interconnect network; GlueX experiment; signal processing; CMS ECAL detector; and other related topics. [C4172]

"Performance assessment techniques for doppler radar physiological sensors"

This paper presents a technique for assessing the performance of continuous wave Doppler radar systems for physiological sensing. The technique includes an artificial target for testing physiological sensing radar systems with motion analogous to human heart movement and software algorithms leveraging the capabilities of this target to simply test radar system performance. The mechanical target provides simple to complex patterns of motion that are stable and repeatable. Details of radar system performance can be assessed and the effects of configuration changes that might not appear with a human target can be observed when using this mechanical target. [C4173]

"Application of empirical mode decomposition in removing fidgeting interference in doppler radar life signs monitoring devices"

Empirical mode decomposition has been shown effective in the analysis of non-stationary and non-linear signals. As an application in wireless life signs monitoring in this paper we use this method in conditioning the signals obtained from the Doppler device. Random physical movements, fidgeting, of the human subject during a measurement can fall on the same frequency of the heart or respiration rate and interfere with the measurement. It will be shown how empirical mode decomposition can break the radar signal down into its components and help separate and remove the fidgeting interference. [C4174]

"Z-R relation for snowfall using small Doppler radar and high sensitive snow gauges"

Snowfall data was simultaneously recorded by a weather radar, two high sensitive snow gauges and an imaging system with high accuracy at short time intervals. The snowfall rate R was measured with two gauges and radar reflectivity factor Z was measured using a small bistatic X-band Doppler radar. The images of falling snow particles were used to obtain size and related parameters. Since all the measurements were located in a small area, it can be said that the obtained reference data corresponds well to radar data, and it is possible to analyze snowfall rate variations in sufficient detail for practical purposes. Snowfall was observed in Kanazawa, Japan, in the winter of 2009. A total of 22 snowfall events was extracted for type of snowflake or graupel, varying in

duration from 4 to 31 minutes. These were then treated separately to calculate the coefficients of Z-R relation. The observations suggest that parameters of snow particle properties are useful to understand radar measurement. [C4175]

"Evaluation of terrain using LADAR data in urban environment for autonomous vehicles and its application in the DARPA urban challenge"

This paper describes the autonomous ground vehicle developed by researchers at the University of Florida that participated in the 2007 DARPA Urban Challenge. Specifically, this paper introduces LADAR based terrain evaluation algorithms for an urban environments as well as off road. The terrain evaluation algorithm is very important for safe driving at high speed. On the real road, the driver is faced with numerous road conditions such as the smoothness of the road surface, curbs, or debris. For an unmanned vehicle to be successful, the algorithm has to decide whether the surface is traversable or non-traversable. For this reason, this paper focuses on the problem of extracting the ground terrain surface from 3-D point clouds obtained from LADAR sensors. The paper outlines the approach used by the University of Florida's Team Gator Nation to address the question of classifying traversable road conditions. [C4176]

"Shape classification of snow particle into snowflake and graupel using image processing"

Classification of snowflakes is important in the investigation of the growth process of snow particles and radar meteorology, etc. This paper proposes an automatic image processing method for classification of falling snow particles. A side view of natural falling snow particles was photographed by IEEE1394 camera (1280 times 960 pixel) with a shutter speed of 1/10000 s. To obtain shape parameters, both a binary and a gray-level image of each particle were recorded continuously. Each particle was classified into a graupel or a snowflake by statistical classification procedure using image features. The proposed method has been successfully tested in snowfall, obtaining the percentages of snowflakes and graupels at 1 min interval. [C4177]

"Visualization of water vapor distribution in the lower atmosphere using two lidars"

Water vapor distribution in the lower atmosphere was observed using two optical lidars (ceilometer) set up at the distance of 3.1 km. Range height indicator (RHI) display was constructed from two time series data measured by each lidar. The instruments were also included small vertical radar and snowfall gauge. All the data were displayed on the same coordinate system to compare the profiles with time synchronization. To examine horizontal distribution of water vapor (cloud) widely, conventional weather radar was also used. Combination of all these instruments and methods will be potent system for understanding lower atmospheric structure. [C4178]

"Life signal extraction in through-the-wall surveillance"

Technology of through-the-wall surveillance (TWS) is explosively developing in recent years and widely interested. This paper proposes the general TWSR system architecture and the whole signal processing units, both of which help researchers to design or improve the system performance conveniently. We also analyze the selection of radar signal and filter, and their influences on the system performance. Finally, our simulation demonstrates that our solution can successfully distinguish the breathing and heartbeat information from the echo signal of one stationary person. [C4179]

"A method of identifying the diameters of deformed bars nondestructively in concrete structures using an electromagnetic wave radar"

We previously proposed a method to measure the diameter of the deformed reinforcing bars in concrete structures nondestructively using an electromagnetic wave radar. The method estimated the periodicity of the knots of the inspected bar and utilized the standard relationship between the knot's pitch and the diameter of the bar to measure the diameter indirectly. The effectiveness of the method was verified using test specimens where the bars were placed parallel to each other. However, in practical case, where other reinforcing bars cross the inspected bar perpendicularly, the stronger reflections from the cross bars influence the reflection from the inspected bar. The paper thus proposes a general method which eliminates such unwanted influences from the cross bars and measures the diameter accurately even in practical environment. [C4180]

"A comparison of interpolation methods for breast microwave radar imaging"

In recent years, breast microwave imaging (BMI) has shown its potential as a promising breast cancer detection technique. This imaging technology is based on the electrical characteristic differences that exist between normal and malignant breast tissues at the microwave frequency range. A promising image formation technique for BMI radar based approaches is wavefront reconstruction. In this approach, the image quality and execution time of

this image formation technique is strongly affected by the interpolation method that is used. In this paper, a performance study between three popular interpolation techniques, nearest neighbor, linear and cubic splines, for breast microwave radar imaging is presented. The performance of the evaluated techniques was assessed using numeric phantoms obtained from Magnetic Resonance Imaging (MRI) data sets. The results of this study indicate that linear interpolation techniques are the most suitable choices based on their computational cost, and the focal quality and signal to noise of their resulting images. [C4181]

"A comparison of data-independent microwave beamforming algorithms for the early detection of breast cancer"

Ultrawideband (UWB) radar is one of the most promising alternatives to X-ray mammography as an imaging modality for the early detection of breast cancer. Several beamforming algorithms have been developed which exploit the dielectric contrast between normal and cancerous tissue at microwave frequencies in order to detect tumors. Dielectric heterogeneity within the breast greatly effects the ability of a beamformer to detect very small tumors, therefore the design of an effective beamformer for this application represents a significant challenge. This paper analyzes and compares 3 data-independent beamforming algorithms, testing each system on an anatomically correct, MRI derived breast model which incorporates recently-published data on dielectric properties. [C4182]

"Research on a wideband and high gain antenna element for an array antenna"

In this paper, we propose the new bow-tie antenna design method, which realizes the wideband and high gain antenna element for the shared aperture antenna on airborne radar. In order to improve the common bow-tie antenna characteristics, we propose four improvement approaches. The details of improvement approaches are presented. We built the prototype array antenna composed of 64 elements designed, and demonstrated that it had significant improvement on the antenna element gain over 6 to 18 GHz. [C4183]

"X-band GaN HEMT advanced power amplifier unit for compact active phased array antennas"

A compact power amplifier unit for X-band solid-state Active Phased Array Antennas (APAAs) has been developed. Its major features are, (1) high power GaN (Gallium Nitride) HEMT is employed, (2) 16 transmit MIC modules are arrayed in line on a thin flat printed wiring board (PWB), (3) output power is 30 W (pulse) at each transmit-output port of the unit, hence 480 W in total, and (4) other necessary functions for phased array antennas, such as digital phase-shifters and RF dividers, are all included in this PWB. Resulting electrical measured data are presented in detail in the paper, proving that further power and frequency range increase for APAAs would become feasible by the concepts employed in this unit design. [C4184]

"Microwave non-invasive sensing of respiratory tidal volume"

This paper describes the use of Doppler radar to measure respiration rate and air volume. The respiratory volume is measured indirectly via chest wall position. Calibration of displacement to airflow prior to subject measurements and accurate chest wall position information enable mean differences of less than 10 ml; with standard deviation of the difference of 20 ml between radar and reference measurements. [C4185]

"Verification of a non-contact vital sign monitoring system using an infant simulator"

In this paper, experimental result using a 5.8 GHz Doppler radar to monitor the variations of vital signs of an infant simulator under different medical conditions is presented. The infant simulator can mimic cardiovascular derangements seen in critically ill infants. The result demonstrates the system is capable of tracking a majority of the changes in heart rate and respiratory rate. Analysis suggests possible techniques for further improvement, such as direct coupling circuit, carrier frequency tuning and spectral analysis. [C4186]

"A simple method for estimation of maximum spurious radiation level from phased array antennas"

According to the new ITU regulation on unwanted spurious emissions from radar transmit antenna, it has become compulsory to measure transmit antenna patterns at spurious frequencies. However, the complex nature of phased array antennas, involving a large number of antenna elements with element-by-element phase-control for beam-scanning, usually makes it difficult to measure all the radiation patterns at spurious frequencies. This paper introduces our approach to this problem, where, under the principle of pattern multiplication, the spurious radiation maxima are estimated by the multiplication between calculated array-factors and measured element-factors, both at spurious frequencies. Among those antenna element types we have examined, this paper deals with the case for dipole antenna as the most typical array antenna element. [C4187]

"An analysis of 2D/3D data fusion for a sensor resource reduction"

In tracking flying objects using 3D sensors which observe range and angle observations such as elevation and azimuth in 3D sensor system, there may not be enough 3D sensor resources such as a number of radar and radar beams. In consequence, it is difficult to achieve desired tracking accuracy due to the lack of 3D sensor coverage, it cannot be done to achieve users' desired tracking accuracy. Therefore, to apply 2D sensors for 3D sensor system is needed in term of filling some blank of 3D sensor coverage, and moreover it is necessary to minimize the 3D sensor resources at the same time. 2D sensor observes angle observations (elevation and azimuth). In SICE2008, we have already proposed a 2D/3D data fusion method for launched target. However, this method is not confirmed in any condition, for example, situation based on combination of number of sensors, the location of sensors and performance of sensors, etc. In this paper, we carried on a sensitivity analysis of tracking accuracy for various location of 2D sensor platform with different location of 3D sensors, and various sensors, etc. As the result of the computer simulations, we could confirm one or two 3D sensors with 2D sensor system are superior to three 3D sensor system in a view point of tracking accuracy. [C4188]

"Tracking algorithm inheriting smoothing vector in splitting target tracking"

To track splitting targets using radar measurements, the tracking algorithm is required to maintain the track of the existing target and to initiate a track of new target. In this paper, we propose the track oriented mht (multiple hypothesis tracking) using the smoothing velocity test. In the proposed algorithm, the smoothing velocity vector of existing track is inherited in the new track. Through simulations, we show that the MHT's success rate of both maintaining the existing track and initiating the new track, is 96%. Furthermore, we show that the improved method has an effect of reducing the probability of false track establishment. [C4189]

"Researches on radar technology"

In Electronic Systems Research Center (ESRC), various researches have been conducted to realize defense radars with excellent functions and performance. This presentation introduces some of those radar research programs. Especially, the research concerning active phased array antenna started in an early stage of the 1970s. Successive various basic research programs have been conducted and finally led to successful development of first airborne active phased array antenna radar, J/APG-1, in Japan. The multifunction RF (Radio Frequency) sensor, the passive radar, the wall through radar and the space time adaptive processing are under research at present. [C4190]

"Asynchronous track algorithm using TDOA/FDOA measurements in the distributed sensor network"

This paper proposes a target tracking algorithm using asynchronous TDOA (Time Difference of Arrival) and FDOA (Frequency Difference of Arrival) measurements for a single target in a distributed sensor network. A conventional algorithm, target localization through TDOA measurements cannot estimate target position when the number of TDOA measurements are not enough for localization at the same time. Thereby, track initialization time is delayed and track accuracy deteriorates in case of that probability of measurements detection for each sensor is low. Our algorithm uses TDOA and FDOA measurements at the different time to compute the position and velocity estimates. Through computer simulation trials, the validity of our algorithm is confirmed. [C4191]

"Detection of a bandlimited signal with unknown parameters"

In this paper, we investigate the detection of a band-limited signal with unknown central frequency, exact bandwidth and the spectrum in white Gaussian noise with unknown variance. We propose a practically implementable Generalized Likelihood Ratio (GLR) detector with these unknown parameters and verify its performance through some simulation examples. Furthermore, in order to evaluate the performance of this detector, we derive a Most Powerful Invariant (MPI) detector in the case of known partial Signal to Noise Ratios (SNRs), i.e., where the SNR of the different Discrete Fourier Transform components of the signal are known. Our results show the close performance of the GLR detector and this MPI detector. In addition, we propose a locally MPI detector in small SNRs, that performs slightly better than GLR in these SNRs. [C4192]

"Fast evaluation for speckle feature in urban SAR images"

Coherent speckle is an important feature in Synthetic Aperture Radar (SAR) image. Testing the property of speckle is effective for urban SAR image performance evaluation. Through correlation analysis for speckle measures, this paper proposes a measurement for speckle feature based on parametric hypothesis test. Firstly selects homogeneous areas in tested SAR image with manual mode and estimates the ENL of each area. In

contrast with the speckle feature in sampled image from population, secondly utilizes the u-parametric hypothesis test to measure the quality of speckle. Finally obtains the result that accepts the null hypothesis or rejects it. Experiments of Japan Pi-SAR and East China Research Institute of Electronic Engineering (ECRIEE) SAR images in urban areas show the measurement could distinguish those tested images where speckle property is in accordance with the coherent imaging principle, which is one of the vital requirements for post processing technology of SAR imagery. [C4193]

"Three-dimension information extracting from high resolution airborne Synthetic Aperture Radar images"

According to the geometric imaging characteristics of airborne Synthetic Aperture Radar (SAR) system, the methods of extracting three dimension information for some typical ground objects with height have been described in this paper, including image preprocessing, height information extracting of buildings and trees, the final visualization and so on. And, the test result provided a practical reference for the application of urban and town area with high-resolution airborne SAR images. [C4194]

"Coherent stacking with TerraSAR-X imagery in urban areas"

The German radar satellite TerraSAR-X was launched in June 2007. It is one of the first satellites to continuously provide space-borne high resolution radar imagery with a slant range resolution in the order of 0.6 m times 1.1 m for civil applications. The sensor, the mission design, the orbit concept, and the SAR processor (TMSP) perfectly support interferometric applications. Naturally, DLR's operational interferometric system GENESIS has been adapted to exploit the innovative high resolution data. Algorithm updates have been proven indispensable due to the more complicated spectral characteristic of the data introduced by the spotlight acquisition mode. Also, the high spatial resolution requires that radargrammetric effects, i.e. local parallaxes, be considered in interferometric processing. [C4195]

"Automatic recognition of man-made objects in SAR images using support vector machines"

Over the past two decades the remote sensing technology is applied in a large scale in environmental research and policy, i.e. water pollution monitoring and conservation of soil, etc. The methods for recognition of man-made objects in remote sensing images are providing capabilities for mapping and monitoring crucial objects or sites in environmental management, i.e. hazardous chemicals storerooms, oil depots, etc. However, the task of recognizing key man-made objects from large images is time consuming and complex. In the paper we aim at developing an automatic and fast image processing method for the recognizing man-made objects in synthetic aperture radar (SAR) images, which is a supervised learning approach based on support vector machines. Firstly, a sample image data set which contains several classes of interested man-made objects is manually extracted from SAR images. Then we train the image data set by least squares support vector machines. After cross-validation and an exhaustive grid search, a model that can predict target label of data instances in the testing set is obtained. Finally we can implement classification in random image set using above prediction model and recognize the man-made objects. This approach needs no a priori knowledge, and only a set of train examples for the learning step is needed. [C4196]

"A modified method for relevance feedback in high-resolution SAR image retrieval system based on SVM"

Relevance feedback (RF) is an importance technique in CBIR (Content-Based Image Retrieval) systems to bridge the semantic gap between low-level visual features (eg. color, shape, texture) and high-level human perception. One of the most frequently used methods to do RF is Support Vector Machine (SVM), which has a good generalization ability in pattern recognition. But when the training data is insufficient, the performance of SVM may drop dramatically. In this paper, we proposed a method to alleviate the small sample problem in SVM based RF by using a new piecewise similarity measure function and ensemble learning. We compared our method with standard SVM based RF on a high-resolution SAR (Synthetic Aperture Radar) image database, the experiment results show that our method has a better performance and prove that it's an effective algorithm for RF. [C4197]

"An object-based two-stage method for a detailed classification of urban landscape components by integrating airborne LiDAR and color infrared image data: A case study of downtown Houston"

By exploiting high resolution airborne LiDAR data along with color infrared aerial photographs, this research aims to quantify the urban landscape components using an object-based two-stage method in the case of downtown Houston, Texas, USA. The urban landscape components will be identified and classified by integrating spectral

information from color infrared aerial photograph and surface geometric information from airborne LiDAR data. In first stage, the color near-infrared aerial photographs are used to segment the scene into image objects. Then, these objects are classified into three broad categories-impervious surface, vegetation, and water surface, based on their spectral and two-dimensional spatial attributes. In the second stage, the normalized Digital Surface Model derived from airborne LiDAR data is introduced into analysis. Two indicators, relative height and roughness, of each vegetation object from the first stage are calculated, and the threshold values are determined to separate vegetation into lawns, shrubs/hedges, and trees. Next, a series of image processing steps are applied to the nDSM to further classify the impervious surface objects into skyscrapers, high-rise buildings, ordinary buildings, streets, highways, and open spaces. The overall classification accuracy is evaluated as high as 94.10%, and the Kappa coefficient is 92.91%. This research suggests that the combination of morphological information of LiDAR data and spectral information from image data renders a powerful tool for a detailed investigation of urban landscape structure. [C4198]

"ACO algorithm processing multisensor data for urban land cover"

A novel ant colony optimization (ACO) algorithm takes inspiration from the coordinated behavior of ant swarms finding the shortest way from their nests and the food source, which has been applied on many research areas for solving optimization problems, but it has seldom been used in remote sensing data processing. ACO algorithm has many potential advantages in remote sensing data processing, such as it does not assume an implicit assumption for processing dataset, it can take into account of contextual information, it has strong robustness, and it can combine different sources of data. This paper represents an application of the combination of Landsat TM data and Envisat ASAR data based on ACO algorithm for land cover classification. The classification results based on ACO algorithm were compared with MLC and C4.5, the experimentation results and analysis indicate that the ACO algorithm can provide a new efficient approach for land cover classification using multi-source of remote sensing data. [C4199]

"Fast InSAR multichannel phase unwrapping for DEM generation"

In this paper, a method to solve the multichannel phase unwrapping problem is presented. MAP approach together with Markov Random Fields have proved to be effective, allowing to restore the uniqueness of the solution without introducing external constraints to regularize the problem. The idea is to develop a fast algorithm to unwrap the interferometric phase in the multichannel configuration, which is, in the main time, able to provide the global optimum solution. To reach this target, an a priori model based on Total Variation is used together with optimization algorithm based on graph-cut technique. The proposed approach has been tested both on simulated and real data. The obtained results show the effectiveness of our approach. [C4200]

"Space-borne high resolution SAR tomography: experiments in urban environment using TS-X Data"

Synthetic Aperture Radar (SAR) tomography aims at retrieving the 3-D reflectivity from multi-pass SAR data. It is essentially a spectrum estimation problem. As a consequence, complex values of a specific range cell in a SAR image stack as a function of baseline are closely related to the Fourier transform of the reflectivity function in the elevation direction. The new generation of SAR satellites, like TerraSAR-X, allow for the first time the building up of high-resolution SAR data stacks on a regular basis. TerraSAR-X in its high resolution spotlight mode provides data with 0.6 m slant range resolution. It has already been shown that persistent scatterer interferometry (PSI) benefits enormously from this new quality of data. The data stacks used for PSI in urban areas can also be used to derive tomographic information. This paper presents the first demonstration of space-borne high resolution tomographic reconstruction of multiple scatterers in a resolution cell situation in urban areas. Different spectrum estimation strategies such as the Singular Value Decomposition (SVD) and Nonlinear Least Squares estimation (NLS) are evaluated and compared using both simulated data and TerraSAR-X spotlight data over Las Vegas with special consideration of the difficulties caused by sparse and irregular samples. The nuisance of ill-conditioning is investigated and regularization tools are utilized to overcome this problem. For validation, the spectrum estimation results with TerraSAR-X data are compared to the plausible ground truth. In a second step of processing model selection criteria such as the Bayesian Information Criterion (BIC), Akaike information criterion (AIC) and Minimum Description Length criterion (MDL) are implemented on the spectral estimates to determine the number of scatterers inside a resolution cell. The probability of correctly detecting the number of scatterers and the accuracy of the corresponding elevation estimates are evaluated from simulated data.- Additionally, model selection results with TerraSAR-X data are analyzed. Finally, SAR tomography, as a straightforward extension to PSL is integrated into DLRs PSI-GENESIS processor to support deformation estimation and solve the ambiguity due to multiple scatterers inside a resolution cell. First processing results using TerraSAR-X data are presented that confirm the capability of space-borne high resolution SAR tomography for resolving multiple targets within the same azimuth-range cell and to map the 3-D scattering

properties of the illuminated scene. [C4201]

"An optimal radar detector threshold adaptation for maneuvering targets in clutter"

In this paper, we consider the problem of radar detector threshold optimization for maneuvering targets in clutter. In the earlier works, the problem was studied in the context of the probabilistic data association filter (PDAF) for non-maneuvering targets. In this study, we have extended the ideas, which were applied to the PDAF, to the interacting multiple model PDAF (IMM-PDAF) for maneuvering targets. The proposed optimization problem and its solution show better results over the traditional approaches in terms of track loss percentage and RMS position error criteria. [C4202]

"CA-CFAR detection in spatially correlated K-distributed sea clutter"

Radar detection of targets in sea clutter modelled by compound K-distribution is examined from a statistical detection viewpoint by Monte Carlo simulations. The detection performance of Cell Averaging Constant False Alarm Rate (CA-CFAR) is compared with the performance of fixed threshold detection. The performance evaluations are quantified by CFAR loss. Curves for CFAR loss to the spatial correlation and spikiness of sea clutter, number of cells of CA-CFAR processor and the number of non-coherently integrated pulses are presented. [C4203]

"Spectrum based covariance estimation for nongaussian multipulse detectors"

Multipulse detection under nongaussian clutter is addressed. GLRT based detectors have already been developed for this problem. These detectors require the correlation estimation of the local environment for practical use. Some ML based estimators have been developed for this purpose. Unfortunately the exact ML estimate does not exist for the compound gaussian clutter model considered in this study. Only approximations exist. In this work this problem is handled with a different approach. Correlation estimation problem is reformulated as a local doppler spectrum estimation problem. After the Doppler spectrum estimated, correlation estimate is obtained from spectrum-correlation relation. Proposed estimators are compared with the ML based estimators and it is shown that the performances of the proposed estimators are equivalent or superior to the ML based estimators in many conditions. [C4204]

"A nonquadratic regularization based image reconstruction technique for SAR data with phase errors"

One of the fundamental problems in Synthetic Aperture Radar (SAR) imaging is phase errors. Phase errors occur when the time required for the transmitted signal from SAR to the target and back cannot be obtained properly either because the distance between the SAR platform and the target cannot be measured exactly or in the case of random delays in the signal due to propagation in atmospheric turbulence. Phase errors cause blurring of the reconstructed image in the cross range direction. In this study, a nonquadratic regularization-based framework is proposed for joint image formation and phase error removal. The method involves the optimization of a cost function with respect to the image as well as the phase errors. Experimental results show the effectiveness of the proposed method. [C4205]

"Recursive geolocation with Time Differences of Arrival"

Geolocation has particular interest and importance in Electronic Warfare. In this work, Time Difference of Arrival (TDOA) Geolocation is studied. A recursive least squares filter based algorithm has been developed. Location estimation is updated using TDOA measurement sets from moving receivers under the assumption of fixed emitter location. Moreover, simulation results and comments are given at the end of the text. [C4206]

"SAR interferometry for long term deformation mapping using SBAS method: A case study in Nanjing area"

Synthetic aperture radar interferometry (InSAR) is a novel remote sensing technique to measure earth surface deformation, it is capable of obtaining dense information related to the deformation of a large area quickly, economically and effectively. However, Conventional InSAR technique is easily suffered from both spatial and temporal decorrelation which limits its application, especially for long term deformation mapping. In this paper, a Small BAseline SubSet (SBAS) InSAR approach, which generates interferograms between two SAR images with small spatial baseline was presented, this approach can reduce both spatial and temporal decorrelation for long term deformation using a data set of SAR images acquired subsequently; deformation maps and displacement time series of the Nanjing City, P. R. China was generated with SBAS approach. Results of 13 differential interferograms generated by 8 SAR images in Nanjing from August 1996 to April 2000, demonstrate its

efficiency. [C4207]

"Building extraction in urban scenes from high-resolution InSAR data and optical imagery"

Modern space borne SAR sensors provide geometric resolution of one meter, airborne systems even higher. In data of this kind many features of urban objects become visible, which were beyond the scope of radar remote sensing only a few years ago. However, layover and occlusion issues inevitably arise in undulated terrain and urban areas because of the side-looking SAR sensor principle. In order to support interpretation, SAR data are often analyzed using additional complementary information provided by maps or other remote sensing imagery. The focus of this paper is on building extraction in urban scenes by means of combined InSAR data and optical aerial imagery. [C4208]

"Kalman filter based sinusoidal Pulse Repetition Interval tracking"

Pulse Repetition Interval (PRI) tracking has particular interest and importance in Electronic Warfare. In this work, a specific part of PRI tracking, Sinusoidal PRI is studied. Extended Kalman Filter and Unscented Kalman Filter based algorithms have been developed. Moreover, simulations for performance comparison and comments are given at the end of the text. [C4209]

"An improvement of an RFID indoor positioning system using one base station"

The proliferation of mobile computing devices and wireless positioning networks has fostered a growing interest in location-aware systems and devices. Most technologies such as radio frequency identification (RFID), RADAR, etc, use at least three base station (BS) for calculating position of target objects. This paper describes an improvement of the previous OneBS algorithm. The proposed system uses only one BS based on the RFID infrastructure for positioning target tags amid the clutter of indoor interference environments. We proposed to fuse the round-trip time of flight (RTOF) and the received signal strength (RSS) in the positioning algorithm. Both information are kept in an intersection box (iBox). The RTOF information is used to focus a target tag's position among groups of four-nearest-neighbor reference tags kept within iBox. Then, the RSS information is weighted using the weighted center of gravity technique to estimate a location of the target tags. Our experiments are based on three dimension (3D) materials within interference environments. The interference environments are simulated based on uniform geometrical theory of diffraction (UTD), for measuring signals in each specific area. Our proposed algorithm gains 50 percents better average distance error compared to the OneBS algorithm. [C4210]

"The application of remote sensing technology in monitoring environmental disasters of mining cites"

Aiming at the increasingly serious pollution and ecological damage in mining cites, environmental information urgently are urgently needed to provide basis and decision-making for the economic transition of mining cites. This article describes main environmental problems existing in mining cites, as well as ways of monitoring these major environmental problems, such as the Landsat TM images are used in Land use dynamic monitoring, High Spectrum Images are used in the extracted vegetation monitoring, and the water quality change is monitored by the way of NOAA / AVHRR. Particularly, the effectual way of the Interferometric Synthetic Aperture Radar (InSAR) landslides monitoring is introduced, which is well applied to the opencast mine of Haizhou and Fushun in China with this technology. Differential interferometry using Synthetic Aperture Radar (SAR) is a powerful technology for detecting surface deformation of ground. Surface deformation can be analyzed from different phase of micro-wave between two observed data by SAR. The accuracy of measurement is less than plus-and-minus 1 cm. Achieved research results will provide early warning of environment disasters, rapid & real-time information and interpretation means for the mining cites. [C4211]

"Non-parametric multiple level set model for efficient image classification in urban areas"

Multispectral remotely sensing imagery with high spatial resolution, such as QuickBird, IKONOS satellite imagery or Aerial imagery, especially in urban scenes, often perform spectral variations and rich details within a category, resulting in a poor accuracy of classification. To seek an efficient solution, this paper presents a non-parametric and variational multiple level set model by a joint use of Aerial image and two products, digital terrain model (DTM) and digital surface model (DSM), directly or indirectly derived from raw LiDAR (Light Detection And Ranging) 3D point cloud data. Proposed model is to minimize an energy function. The energy includes two terms. First term is mainly image-based energy which introduces Parzen Window density estimation technique in the multiple level set framework. To make up the disadvantages brought by only multispectral image-based classification scheme mentioned above. A novel energy constraint term is added by combining elevation information of objects derived from LiDAR raw point cloud. Thus, a closely integrated and effective classification

model under variational level set framework has formed. Finally, comparative experiments on a pair of Aerial image and LiDAR point cloud data have demonstrated the our proposal can obtain more accurate and detailed classification than that of relevant methods only depending on spectral information of image. [C4212]

"Segment-based urban block outlining in high-resolution SAR images"

While analysing remotely sensed images of urban areas, in many cases an at least approximate knowledge of block partition is useful for specialising operations over areas within which a certain degree of homogeneity can be assumed. Unfortunately, though, this information is not always accessible in a reasonable time or with a reasonable effort, or even in some cases a GIS of the city is not available at all. Automatic extraction of block boundaries becomes thus an interesting means of obtaining such information. City blocks are usually separated by major urban roads; this paper presents a preliminary work on the use of a linear feature extractor, originally developed for road network extraction, as a tool to partition a very high resolution SAR scene acquired over an urban area. [C4213]

"Fast compression and access of LiDAR point clouds using wavelets"

To compress, access, visualize and analyze large 3D point clouds, they are often converted to Digital Surface Models, either as raster grids or Triangulated Irregular Networks. This paper proposes an approach, which works directly on the points as they were recorded during data capture. There is usually a strong correlation between successively recorded points. This correlation is used to compress the point clouds using wavelet transforms. The characteristics of wavelet coefficients are used to access areas of progressively higher resolution and quality. The detail coefficients can also be used for 3D analysis and reconstruction. [C4214]

"A detailed comparison between two fast approaches to urban extent extraction in VHR SAR images"

This work is devoted to the comparison of two algorithms for human settlement map extraction from VHR SAR data. The two approaches have been recently proposed in literature, but extensive comparison of their performance in different situation and in different areas of the world was not available yet. The first approach is based on the computation of local statistical indexes to detect "seed areas", which in turn are used to train a texture-based settlement detection procedure. The second approach is based directly on a textural feature, data range, and shows usually less precise, but equally useful results. In this work the two approaches are compared on a range of different SAR sensors, and a discussion of their relative performances for different spatial resolutions and radar frequencies is provided. Reference settlement extents are obtained from maps provided by global mapping projects. [C4215]

"Supervised land-cover classification of TerraSAR-X imagery over urban areas using extremely randomized clustering forests"

This study investigates the impact of the use of scattering intensity and texture features derived from TerraSAR-X intensity images on urban land cover classification accuracy, in combination with the Extremely Randomized Clustering Forests as the visual codebook former and classifier. We propose a multi-orientation ratio descriptor to represent the features of each SAR image patch effectively, and introduce a graph cut optimization based Markov Random Field smoothing processing to reduce block boundary effects due to patch-based classification method. We compare our classification results using one or all features together on 1 m resolution TerraSAR-X images and show that the reasonableness of the proposed descriptor and the effectiveness of the Extremely Randomized Clustering Forests classifier. [C4216]

"A classification method for building detection based on LiDAR point clouds"

Building detection using LiDAR data is a popular topic in LiDAR data processing. The object classification can play an important role in the detection. In this paper, a new algorithm based on LiDAR point clouds is developed to resolve the object classification difficulties in the case of trees close to buildings. Compared with other algorithms, the methods can work effectively due to use the combination of height texture and regular geometric element. The experiment results is also given and discussed to improve the validity of the proposed algorithm. [C4217]

"BREC: The Built-up area RECOgnition tool"

This paper presents the overall structure and some examples of use for BREC (Building RECOgnition tool) software, developed by the Remote Sensing Group at the University of Pavia. The software allows detecting the characteristics of built-up areas at different scales, from urban extent delineation to individual building

recognition, depending on the remote sensing data in input and their spatial resolution. A set of different tools for classification, feature extraction, and data fusion at the feature level have been developed and can be suitably combined to achieve the best results. All of them have been optimized for the analysis of urban areas and human settlements, and can be applied to both optical and radar images. [C4218]

"The utilization of SAR remote sensing and GIS technology to delineate urban extent in North China"

Urban environments represent one of the most dynamic regions on earth. In order to obtain more frequently updated and spatially detailed data on urban phenomena, remote sensing satellites can serve as a valuable instrument. With its ability to image the Earth's surface in nearly all weather conditions, together with its high spatial resolution, synthetic aperture radar (SAR) represents a very powerful observation tool for monitoring geophysical resources globally. SAR images with high resolution have proven their usefulness for land description and scene analysis. The goal of this study was the development of a temporally and spatially robust approach towards an automated identification of built-up areas based on RADARSAT imagery. In our work, the urban extent distributed in the major part of North China was extracted and delineated. By visual inspection, the resulting map of urban extent was acceptable. [C4219]

"Urban structuring using multisensoral remote sensing data: By the example of the German cities Cologne and Dresden"

The urban landscape is a highly complex and small-structured, heterogeneous area as a result of permanent human settlement. Urban structure is scale-dependant and can be expressed on various levels of detail by satellite imagery. Very high resolution satellite (VHR) sensors are capable of mapping and monitoring cities-on house/block level-with their high degree of landcover diversity. However, detection of morphological features such as shape and elevation of single objects is performed much better when a digital surface model (DSM)-e.g. derived by airborne laserscanning-is incorporated. An object-oriented methodology for the joint analysis of optical satellite data and a digital surface model is presented for the classification of the urban morphology in terms of urban structural types. These are spatial units-mostly on block level-with aggregated information on the classified single features like landcover/landuse and urban fabric. Hence, a hierarchical, modular segmentation and classification workflow is implemented to extract the required information. The methodology is applied on two study areas in the cities of Cologne and Dresden, Germany, and a validation of the capability of the potential for transferability of the rulebase is shown. [C4220]

"Potential and status of high-resolution remote sensing information applied in urban planning in China"

This paper discussed several facets of remote sensing information applying in urban planning in China. It emphasized the application and development process for high resolution remote sensing information during the last years, including new satellite-borne and airborne high resolution optical and Synthetic Aperture Radar (SAR) remote sensing data sources. And, the corresponding application questions about application history and status, main data processing flow, advantages and questions, the development potential in future and so on were discussed in detail. [C4221]

"Automatic 3D building reconstruction from airborne LiDAR measurements"

A framework which includes six major components has been developed to reconstruct 3D building models from airborne LiDAR measurements. The application of the framework to both commercial and adjacent residential areas shows that the proposed methods identified building patches well, and reconstructed 3D building models effectively. The entire process is highly automatic and requires little human aid, which is very useful for processing voluminous LIDAR measurements. [C4222]

"InSAR interferogram detail-compensating filtering method based on the stationary wavelet transform"

Speckle is an inherent characteristic of InSAR (Interferometric Synthetic Aperture Radar) interferogram, it affects the accuracy of prediction and evaluation of urban Geology and Geohazards, so it is necessary to carry out interferogram filtering to suppress the effect of speckle. However, there is a contradiction between speckle reduction and keeping the details of the interferogram in current methods of interferogram filtering. Using the difference idea and the character of the wavelet transform, we propose InSAR interferogram detail-compensating filter method based on the stationary wavelet transform. And an experiment is made on the partial interferogram generated by two SAR images of Bam earthquake with this method. As a result, not only can the new method

suppress the speckle effectively, but also it can maintain details of interferogram well by compensating the details, and it reduces the number of residual points greatly. [C4223]

"Point cloud segmentation towards urban ground modeling"

This paper presents a new method for segmentation and interpretation of 3D point clouds from mobile LIDAR data. The main contribution of this work is the automatic detection and classification of artifacts located at the ground level. The detection is based on Top-Hat of hole filling algorithm of range images. Then, several features are extracted from the detected connected components (CCs). Afterward, a stepwise forward variable selection by using Wilk's Lambda criterion is performed. Finally, CCs are classified in four categories (lampposts, pedestrians, cars, the others) by using a SVM machine learning method. [C4224]

"SAR interferometry atmospheric mitigation from GPS water vapor retrieval in Hong Kong"

Continuously observed GPS data and meteorological observations spanning rainy summer from May to August and covering entire Hong Kong were processed in this paper. Zenith Total delay (ZTD) and corresponding Precipitable Water Vapor(PWV) were retrieved from above observations and validated by tropospheric product from IGS and Radiosondes observations. Differential two-way Radar Line of Sight (LOS) slant atmospheric phase map was then obtained from GPS PWV through Universal Kriging Prediction and Niell Mapping Function with azimuth asymmetry consideration. In our designed experiment, the acquired Radar atmospheric phase map was used to calibrate the 35-day interval HK ASAR Interferogram and comparatively analyze the feasibility of such mitigation. Additionally, Coherent Point (CP) targets from Radar Image were extracted to perform deterministic assessment for the improvement of atmospheric mitigation on InSAR from GPS water vapor. The result demonstrated that atmospheric mitigation from GPS PWV could reduce the InSAR residual atmospheric noise under 1 cm for 88% coherent points in HK. The technique would to some extent break through the bottle neck of atmospheric de-correlation in case of small SAR image amount in hazard emergency monitoring in Hong Kong. [C4225]

"DEM reconstruction in urban scenario"

In this paper a method to handle layover regions in SAR images is presented. Layover occurs when multiple radar echoes collapse in the same resolution cell; presented approach is addressed to resolve the different echoes in order to allow a proper Digital Elevation Model generation, with particular attention to urban scenario. The problem is approached using a statistical modeling of the layover phenomenon and a classical statistical estimation technique. Some cases of study on realistically simulated SAR data are presented, showing the effectiveness of the method. [C4226]

"Advanced interferometric techniques for monitoring urban areas"

This paper addresses techniques for the imaging and monitoring of urban areas via advanced interferometric analysis. We discuss the multidimensional SAR imaging techniques and an approach for the generation of long term time series from multisensor data. Results of the application to real ERS and Envisat data are presented. [C4227]

"Urban dynamic change detection using interferometric SAR in Southeast China"

Synthetic aperture radar is the only instrument that can provide consistent remote sensing data for south China with persistent cloud cover and rain. In this paper, the potential of multi-temporal ERS and ENVISAT-1 SAR data for land cover/land use classification and urban change detection was investigated at a test area in Fuzhou city, the capital of Fujian province in southeastern China. Both SAR backscatter intensity characteristics and interferometric data were analyzed. A parcel-based approach has been implemented to overcome the limitations and weaknesses of traditional image processing methods for feature extraction from gray images. Two methods were carried out in the urban dynamics change detection: one was post-classification comparison, and the other one was multi-temporal image ratioing. The results from both classification and urban change detection were validated by field survey data and showed promising application of ESA SAR data in southeastern China, where clouds and rains persist. [C4228]

"Comparison of covariance estimators for nongaussian multipulse detectors"

In recent years, multi pulse nongaussian signal model has been one of the most frequently used signal model on radar detection. A suboptimum receiver for that model has been already developed. In order to realize that detector the correlation properties of the underlying clutter have to be estimated. Although there are several estimators proposed for that, they are not widely used. One of the main reasons of this is that there is not

enough comparison analysis between these estimators. So the suitable estimator for selected application is not known. In this paper these correlation estimators are compared under complex clutter scenarios. [C4229]

"Implementation of Header Compression in 3GPP LTE"

Header compression is the process of reducing protocol header overhead in order to improve link efficiency while maintaining the end-to-end transparency. Robust header compression (ROHC) is a scheme for IMS (IP multimedia subsystem) and MBMS (multimedia broadcast multicast service). ROHC is defined for 2.5 Gm (GPRS) and according to 3Gpp2 next generation network, in CDMA2000 1x EV-DO and 1x EV-DV (Release B and onwards) system. ROHC specifies compression of IP headers including IPv4, IPv6, RTP and ESP on a per hop basis. The compressed header size is reduced to around 1-3 bytes. This header compression can be implemented in mobile handsets and all of the wireless infrastructure equipment upstream BTS/NodeB. Header compression basically includes generation of IP context to send on wireless device and each IP context is given a sequence number which is encoded before sending the information. The audio-video streams is first encapsulated in RTP (real time transport protocol) packet, which is then included under UDP packet, and finally IP packet carries this whole UDP & RTP data. The compression takes place at the radio layer defined at PDCP link layer. ROHC is very robust against bit errors on the link and also against errors introduced due to long RTT. In addition, it results in very high compression ratios, which increase effective link bandwidth and decrease packet processing requirements in power sensitive downstream devices. [C4230]

"Multi-slot Channel Allocation for Priority Packet Transmission in the GPRS Network"

In the General Packet Radio Service (GPRS) network, data packets from services like mobility management and *push-to-talk* (PTT) are sensitive to delay. During the channel allocation process, the delay-sensitive packets should have higher priority than other packets. Previously priority queue and Uplink State Flag Channel Allocation (USFCA) have been used to reduce the transmission delay of priority packets. In this paper, we study the performance of channel allocation for priority packet in the GPRS network with multi-slot capability. The results show that the transmission delay of priority packet can be further reduced by assigning multiple channels to priority packet in addition to the use of priority queue and USFCA. [C4231]

"Research on Supervised Manifold Learning for SAR target classification"

Nonlinear manifold learning algorithms, mainly isometric feature mapping (Isomap) and local linear embedding (LLE), determine the low-dimensional embedding of the original high dimensional data by finding the geometric distances between samples. This paper proposed an approach to reduce the dimensions of SAR image targets based on supervised manifold learning algorithm. Three steps were done to reduce the dimensions of original data. Firstly take use of a priori information of the sample point to find the k-neighbors. Secondly to build the local reconstruction weight matrix W. Thirdly get the dimension reduction result based on W and the neighborhood of original data. Experiments were done to test the effect of dimensionality reduction to classification results. Three types of targets were used in the experiments. The implementation steps and parameter settings are discussed in details. The results show SLLE is more conducive to SAR image target classification than the traditional LLE. [C4232]

"Using a Supercapacitor to Power Wireless Nodes from a Low Power Source such as a 3V Button Battery"

Portable and remote data gathering systems often need to be powered from small long life batteries and are required to transmit data sporadically. GPRS RF transmitters typically operate at a minimum voltage of 3.2 Volts and draw pulsed currents in the order of 1 to 2 Amps. Zigbee typically requires 10-100 mA transmit current from a 3 V battery. These peak load powers are too great to be supplied by small long life batteries such as a CR2032, even though the battery can supply the average system power. This paper offers a solution using a single cell supercapacitor to supply the peak loads with low cost circuitry. A single cell supercapacitor cannot operate at 3 V, but does not require a balancing circuit and is lower cost and half the size of a dual cell supercapacitor required for 3 V operation. [C4233]

"Giving Every Child a Sense of Belonging: Improving Birth Registration in Developing Countries"

The registration of a child's birth recognises the child as a unique individual, and creates a legal platform for accessing life-enhancing services such as health and education. The United Nations Children's Fund (UNICEF) contends that a child who is off the birth registration radar, in comparison to a registered child, is a more attractive prospect to child traffickers, and is more likely to face discrimination and denial of access to basic life-enhancing services. Although birth registration alone does not secure access to vital social services, non-registration can further marginalise the people at the lower echelon of the society. The United Nations

Childrenpsilas Fund estimates that the birth registration rate in Vanuatu for 2005 was less than thirty percent. This paper examines the extent of non-registration in Vanuatu, in order to explore whether the opportunities offered by ICT do have a role in improving the provision of birth registration services in that country. It is anticipated that the outcome of this study can be extended to other developing countries in the Pacific. [C4234]

"A Novel Method for Sorting Unknown Radar Emitter"

A new method based on the second dimension of resemblance coefficient (Cr_2) and the fourth dimension of wavelet packet transform (Wpt4) to improve the sorting correct rate of unknown radar emitter is presented in this paper. The Cr_2 and Wpt4 is extracted firstly and used as the sorting basis when the unknown radar emitter signal is received, then the radar emitter sorting can be realized by the fuzzy c-means algorithm based on kernel(KFCM). Simulation result shows that the new method can get higher correct rate than traditional method. [C4235]

"Distributed ODV-CFAR Detection Based on Fuzzy Logic"

A new type of distributed constant false alarm rate(CFAR) scheme based on fuzzy logic and Ordered Data Variability CFAR(ODV-CFAR) algorithm is proposed in this paper. In this scheme, each ODV-CFAR detector computes the membership function value mapping to the false alarm space from the samples of reference cells, and transmits it to the fusion center. These values are combined according to fuzzy fusion rules to produce a global membership function to the false alarm space. Simulation results indicate that the fuzzy fusion rule corresponding to the algebraic product operator provides better detection results than binary OR fusion and binary AND fusion. [C4236]

"Chirplet Based Denoising of Reflected RADAR Signals"

In this paper we propose a new denoising method of radar reflected signals. Using signal processing techniques such as the short time Fourier transform (STFT) and the chirplet transform, various parameters of signal can be extract. In this paper we can obtain the signal's parameter by using the chirplet transformation as a tool to denoise the signals. We have already tested this algorithm on the real data and have obtained chirplet transformation has the perfect results on system identification by denoising returned signal. [C4237]

"A Method of Same Frequency Interference Elimination Based on Adaptive Notch Filter"

The torpedo active electromagnetic fuze is an active electromagnetic detection system, as the distance between the transmitting and receiving antennas is very short, the direct coupling signal will inevitably appear in the receiving signals. This interference has the same frequency as target signal, and is of great harm to the detection system's normal operation. Traditional methods of same frequency interference elimination were analyzed, and it was found that neither of them were suitable for the object studied in this paper, so a method of same frequency interference elimination was put forward based on adaptive notch filter. Its working principle, working process and performance were analyzed; also its numerical value simulation and engineering test had been carried out. The results indicated that as long as the magnitude and phase of the same frequency remained unchanged, it would be effectively eliminated with this method; moreover, this method could be used in a low SNR situation. [C4238]

"Aspects and results of numerical methods and wave propagation integrated into system simulations"

Navigation, radar and communication systems rely on radio signals. Objects in the vicinity of these systems can create distortions. This paper describes the advanced system simulation by the integrated scattering analysis by numerical methods. The simulation procedure and the criteria for a suitable method are described. Two practical cases are outlined. [C4239]

"Millimetre-wave reflectarray fed by a diffraction-shaped dielectric lens"

Low cost mm-wave radar has become established in the automotive industry for collision avoidance and cruise control. Incorporating more sophisticated antenna and signal processing techniques can allow the same underlying low cost core to be used more widely. This paper describes a low-cost antenna structure that increases the resolution of the automotive radar for imaging applications such as autonomous navigation. [C4240]

"Integrated atmospheric profiling for satellite communication"

Future satellite communication will put a strong demand on the use of high frequencies. In such case the satellite signal will be more susceptible to small scale properties of the atmosphere it is passing through. To understand and predict this impact long term experiments are needed. This paper describes the state-of-the-art of ground based remote sensing of clouds. The work is based on experiments at the Dutch multi-instrumental CESAR research site for atmospheric processes. [C4241]

"Dual polarized subarray for spaceborne SAR at X-band"

Following EADS CASA Espacio heritage on space borne SAR radiators (ASAR instrument at C-Band already flying on board ENVISAT platform and LARSAR developments in L-Band) the qualified technology is applied to the antenna of the SEOSAR/PAZ SAR instrument. It consists of 384 16-element subarrays working at X band (9.65 GHz with a bandwidth of 300 MHz) and performing in dual linear polarization. The elementary radiator for the sub-array is a dual linearly polarized circular patch excited by electromagnetic coupling by stripline technology. The ring aperture is excited by electromagnetic coupling through two orthogonal end stubs providing horizontal and vertical polarization. Compared to conventional slotted waveguide radiators, it offers attractive features such as low profile, lightweight, flexibility of BFN topologies (possibility of using series or parallel feeding), easiness of manufacturing (capability of maintain a series production) while providing good radiation efficiency and low losses. The beam forming network is full corporate and it is implemented in low-losses stripline technology. Tests on first subarray breadboards are presented, showing ohmic losses around 0.5 dB, good polarization purity (crosspolar better than -25 dB) and good bandwidth performances regarding radiation patterns and sidelobes. [C4242]

"Feed Systems for array-fed reflector scansar antennas"

Dual linearly polarized feed systems illuminating a highly elliptical reflector antenna for scansar instruments are discussed. Linear arrays with elements sharing through reconfigurable beamforming networks (RBFN's) and/or stacked multimode sectorial horns operated on a single feed per beam basis are examined and compared. The initial design of the preferred solution, based on stacked multimode smoothed wall rectangular feeds is further presented. [C4243]

"Spatial decorrelation of VHF and UHF trans-ionospheric signals measured at Ascension Island"

The effect of spatial decorrelation of signals of space-based synthetic-aperture radars by equatorial ionospheric turbulence, is studied by monitoring 150 and 400 MHz signals from LEO beacon satellites on an array of spaced antennas located on Ascension Island, and analysing the cross-correlations of the phases of the received signals. The special property of this approach is that it does not convolve the spatial fluctuations with the movement of the satellite. The geometrical component of the phase difference between antennas is accurately removed by adjusting the satellite position using the measured phases. As expected, the phase of VHF signals is much more affected by scintillation than the UHF phase. In the example given, the spatial correlation over 130 m falls to zero at VHF and 0.55 at UHF. Correlations over longer distances have been determined using a novel dasiaphase reconstructionpsila technique. In the absence of scintillation the decorrelation distance is ~10 km for both frequencies. With increasing scintillation, the decorrelation distance decreases to around 100 m at VHF and 300 m at UHF. [C4244]

"A comparison of AIRSAR and SPOT imagery for land cover mapping"

There are two main types based of remote sensing which is known as optical based and radar based. This study related to investigation of the use of AIRSAR imagery compare to SPOT imagery for land cover mapping purpose. Covering the Muda Merbok area as a case study, 10 meters resolution of airborne (AIRSAR imagery) and 20 meters resolution of optical based (SPOT imagery) which has been resample into 10 meters resolution output were used. The imageries used were at same year 2000. Both imageries had been processed by using ENVI (for AIRSAR imagery) and ERDAS IMAGINE (for SPOT imagery). The synthesize or decompress data, slant to ground range conversion, mask pixels of extreme values, antenna pattern correction and speckle removing were among the steps in AIRSAR data processing. For SPOT imagery the general steps like geocoding, subset, clumps, eliminate and recode were used. The supervised classifications for both images were performed to produce the classification maps. From these two images processing, comparison between both of the images were performed and then the land cover mapping for AIRSAR and SPOT were produced. It is found that land cover mapping based from the AIRSAR imagery is also reliable for land cover mapping compared to SPOT imagery. [C4245]

"Exploiting multipath from airborne platforms for direction of arrival estimation"

In the direction-of-arrival estimation, the scattering of the incident signal from airborne platforms is often

neglected or considered as a source of clutter. However, these additional signal paths, mostly due to the diffraction from the platform wedges, contain useful information about the incoming waves. Recent research showed that the waves reflected from the known objects surrounding the target improve the accuracy of the target estimation or image. We show that similar improvement is obtained if the array interaction with the hosting platform is taken into the account. We incorporate the multipath into the signal processing algorithms, and study the improvement by computing the Cramer-Rao bound. We show that the exploitation of the multipath from the sensor platforms improves the estimation accuracy significantly. Moreover, the capacity to resolve multiple incident signals is enhanced. [C4246]

"Back radiation minimization of ultra wideband Vivaldi antenna for radar application"

This paper deals with the minimization of the back radiation of the Vivaldi antenna for the radar application (e.g. portable through-wall radars). The high back radiation can give rise to the reflection from the radar operator or from the area behind the radar. These reflections can influence negatively the captured useful signal. Consequently, the measured view of the guarded area can be distorted or the undesired reflections can lead to a false alarm. In the paper, several types of shielding for the back radiation minimization are presented: an antenna with planar back-plane, a boxed antenna, a skewed and boxed antenna and a skewed and boxed antenna with planar frontplane. The reflections, radiated impulses and their distortion are discussed. [C4247]

"UWB LNAs for ground penetrating radar"

Two LNA topologies for use in UWB systems are examined and compared in this paper. Design specifications have been derived from a ground penetrating radar system which is the target application. Circuits have been designed to cover the frequency range from 3.1 GHz to 10.6 GHz. The SiGe:C technology SGB25V of IHP Microelectronics is applied to enable volume production at low prices. For measurement purposes, input and output are matched to 50 Ω . [C4248]

"Low-power sliding correlation CMOS UWB pulsed Radar receiver for motion detection"

This paper presents a low-power coherent receiver for UWB pulsed radar for motion detection. Due to accuracy of the radar motion detection, coherent detection scheme is adopted in the receiver. To relax the stringent requirement of timing synchronization, sliding correlation detection is proposed. The clocking step which determines detection resolution is determined by 2 ns which is half of a pulse width or equivalent to 30 cm. Receiver is designed in 0.13- μ m CMOS process from 1.5 V supply. The pulse center frequency is 4 GHz. The receiver includes a high voltage gain LNA, a analog correlator, a sampling comparator and a flip flop. The whole receiver excluding an LNA consumes 0.9 mA of DC current and 10 pJ/pulse at the pulse rate of 16 MHz. The active size is 600 times 380 μ m². [C4249]

"The Australian Coastal Ocean radar Network facility"

The Australian Coastal Ocean radar Network (ACORN) is a monitoring network of HF radars which are being installed around Australia under a National Collaborative Research Infrastructure Strategy (NCRIS). It is a five-year project, at the end of which there will be five pairs of radar stations and one triplet installed and operating, enabled by the central pool of funding for the Integrated Marine Observing System (IMOS) which is a part of NCRIS, and augmented by funding from other sources. At each chosen site there is a pair (or triplet) of radar stations, mounted on the shore, which receive radar echoes from the rough sea. Four of the pairs of radar stations are phased array installations and one pair and the triplet are of the amplitude direction finding genre. The NCRIS strategy is to provide easily accessed data, freely available to researchers in quality controlled archives. The IMOS aim is to produce data which will support research into coastal dynamics and exchange between the open ocean and the continental shelf. In addition to research in coastal oceanography, the data are available for algorithm development and evaluation of new applications for HF ocean radar. There is potential for application of the data to management of coastal marine resources, and in marine safety areas. Real-time maps of surface currents and the prospect of short-term forecasting have the potential to reduce search areas in coastal waters and to make pollution/spill mitigation more effective. With the establishment of HF radar monitoring stations like those in ACORN, there is growing opportunity for researchers around the world to access data from well curated archives to carry out basic research on physical oceanography, or applications research without having direct access to the measuring facility. This feature brings the ACORN HF radars into GEOSS for coastal processes and dynamics. [C4250]

"Multi-core for mobile phones"

High-end mobile phones support multiple radio standards and a rich suite of applications, which involves advanced radio, audio, video, and graphics processing. The overall digital workload amounts to nearly

100GOPS, from 4b integer to 24b floating-point operations. With a power budget of only 1W this inevitably leads to heterogeneous multi-core architectures with aggressive power management. We review the state-of-the-art as well as trends. [C4251]

"An improved direction-of-arrival estimation via phase information of sparse solution"

An improved direction-of-arrivals (DOAs) estimation via phase information of sparse solution is presented in this paper. Unlike the conventional sparse source localization approach using the amplitude of sparse solutions only, through a special partition of the receiving data of the sensors, the phase information of the available sparse solutions is also extracted to estimate DOAs. For the true DOAs exactly on the grids which are used to generate the over-complete dictionary, the performance of our method is close to the conventional sparse source localization method. For the true DOAs that are not on the grids, our method is far superior to the conventional method, as demonstrated by several simulation results. [C4252]

"An 8-18GHz 0.18W wideband recursive receiver MMIC with gain-reuse"

This paper presents an 8-18 GHz wideband receiver with superheterodyne topology. In order to save power, both RF and IF signals share the tunable transconductance stage. The IF output of the first mixer is fed to its tunable input stage for IF amplification in a recursive manner, which significantly enhances the gain tuning without increasing the power. The wideband receiver MMIC is implemented in a 0.13 μm SiGe BiCMOS technology and achieves 6.7-7.8 dB noise figure (NF). The average voltage gain of the receiver is measured as 53 dB maximum with 20 dB continual tuning and 36 dB discrete tuning. The average output P1dB is measured as -10 dBm at maximum gain. The receiver dissipates 180 mW with 2.2 V power supply. To the authors' best knowledge, this is the first fully integrated single-chip receiver MMIC with the coverage of the entire X-band and Ku-band realized on a commercial SiGe process. [C4253]

"Ship classification by sound signature"

Nowadays, either for supervision or for defense purposes, the transportation is being controlled by RADAR (Radio Detecting and Ranging). RADAR helps us get information about objects of interest by transmitting electromagnetic radio waves to the target and analyzing the reflecting signals. We understand that in order to determine any given object's information (speed, distance etc) the first action is always taken by the control center. This also tells us that the moving object can also notice the electromagnetic radio waves and hence the control center can also be sensed. It is of great importance in the defense systems that the object under inspection should not notice being recognized. If we could get information about the target by controlling the waves sent by the target rather than sending any signals to it we could be on the advantageous side. In this study the vehicles were classified by the sounds they make while operating. Working units of the marine vehicles (engine, fan, the generator and etc) analyzed and the sounds they diffuse to the environment while operating were characterized. In the characteristics determination the MFCC (Mel Frequency Cepstral Coefficients) method used to determine the features of the vehicles and by the k-means method, the defined features degraded to a specific number, k-NN (k-Nearest Neighbor) method selected for the classification and recognition of the vehicles. [C4254]

"Software configurable 5.8 GHz radar sensor receiver chip in 0.13 μm CMOS for non-contact vital sign detection"

A direct conversion 5.8 GHz radar sensor chip with 1 GHz bandwidth was designed and fabricated. This radar sensor chip is software configurable to set the operation point and detection range for optimal performance. It integrates all the analog functions on-chip so that the output can be directly sampled for digital signal processing. Important design issues for direct conversion non-contact vital sign detection sensors, such as the effect of baseband flicker noise and gain budget, have been discussed. Experiments have been performed successfully in lab environment to detect the vital signs of human subject seated at a distance of up to 1.5 meter. [C4255]

"A low-cost quad-band single-chip GSM/GPRS radio in 90nm digital CMOS"

In this paper we present a quad-band single-chip GSM/GPRS radio in 90 nm digital CMOS process based on the digital RF Processor (DRPtrade) technology. This chip integrates all functions from physical layer to the protocol stack and peripheral support in a single chip RF SoC. The transmitter uses a low-area small-signal digital polar architecture merging amplitude and phase information directly in an RF DAC. The receiver is based on direct RF sampling and discrete-time analog signal processing. A dedicated internal microprocessor manages the digital RF controls to provide best achievable RF performances. The transceiver exceeds all 3GPP specifications demonstrating a receive NF of 1.8 dB and a margin of 8 dB on TX spectral mask at 400 KHz

offset in GSM850/900 bands. The transceiver is best-in-class in area and occupies only 3.8 mm² of silicon area. [C4256]

"Orthorectification of TerraSAR-X Images Based on Precise Orbit Information"

This paper describes a method for the orthorectification of TerraSAR imagery. Being an effective earth observation technique, the synthetic aperture radar (SAR) systems supply extremely detailed radar images, day and night, under all weather conditions. EADS Astrium's new radar satellite TerraSAR-X was launched in June 2007, which provides earth observation data of unprecedented quality, with a resolution of up to one meter and the error of orbit information up to 0.2 m, for increasingly diversified commercial as well as for scientific applications. This paper describes a method for the orthorectification of TerraSAR imagery. The correction method is based on a rigorous orbital/attitude model. The result from testing the method demonstrates the possibility to orthorectify TerraSAR imagery to sub-pixel accuracy. This research makes the well technique foundation of using high resolution satellite-borne SAR to update topographic map of scale 1:50,000 in Western China. [C4257]

"An OFDM System Concept for Joint Radar and Communications Operations"

In this paper the possibility of designing an OFDM system for simultaneous radar and communications operations is discussed. A novel approach to OFDM radar processing is introduced that overcomes the typical drawbacks of correlation based processing. A suitable OFDM system parameterization for operation at 24 GHz is derived that fulfills the requirements for both applications. The operability of the proposed system concept is verified with MatLab simulations. [C4258]

"Improved Design of Remote Wireless Transmission Terminal using GPRS/GSM Integrated Network"

A GPRS/GSM hybrid communication method is designed to develop a low-power RTU (remote terminal unit) for sensor signal acquisition and data transmission of distributed monitoring systems in industrial fields. The hardware architecture, key technology and transmission protocol of RTU are illustrated. Considering to GPRS network congestions, the reliability design of RTU is analyzed. When GPRS connection fails, the RTU switches to the SMS mode to resume the data transmission such that data integrity is ensured. Besides, the RTU is provided with multiple data sampling interfaces and low power mode. The data transmission experimental results show that the average GPRS transmission delay is 1.126~2.669 s, and the data loss rate decreases to 0 in hybrid communication from 6.94%, in single GPRS mode. [C4259]

"Location-based Services Applied to an Electric Wheelchair Based on the GPS and GSM Networks"

With the development of social affairs and human civilization, the services demand for the ageing and handicapped people will be increasing, as well as for the development of better means of service robot. This paper outlines a design which incorporates the power of concurrent GPS and GSM networks positioning technology to provide location-based services for an electric wheelchair. It offers a better monitor service for elder and the person who has a handicap in the using of a wheelchair. In contrast to methods which depend solely on GPS positioning, the proposed method provides higher positioning accuracy and is capable to compensate the problem of the lost of GPS signals in urban areas or indoors. The design is composed by a GPS receiver, a GSM/GPRS module for location acquisition and message transmission, a 32-bit DSP microprocessor as controller and a web-based management server designed on the LabWindows/CVI for monitoring and tracking the wheelchair's positions. We have implemented several real world experiments for our design and results are promising. [C4260]

"Millimeter Wave Ultra Wide Band Short Range Radar Localization Accuracy"

In the coming years, it is expected that long and short range road vehicle radars (LRR, SRR) will all operate at millimeter wave. In several regions of the world, a one GHz bandwidth was selected between 76 and 77 GHz for LRR. To obtain a very high distance resolution for applications like brake-assist and pre-crash, SRR need an even larger bandwidth. Hence, a 4 GHz bandwidth was allocated to provide precise radial range information of objects with a range separation of approximately 5 cm to 10 cm. Directions of the targets are obtained using two or more separate sensors associated to localization techniques. The purpose of this paper concerns a simulation and experimental evaluation of an impulse radio, ultra wide band (IR-UWB) vehicle localization system. In this context, different localization techniques (TDOA, TOA, DOA) will be evaluated in terms of position error for scenarios using three distant, separate sensors. Our objective is to evaluate an optimum technique as a function

of the localization range. Simulation results will be compared to experimental results obtained in laboratory. These results will show the interest of coupling two of the following TOA, TDOA and DOA techniques, at different ranges. [C4261]

"Hardware Design of Signal Processing System Based on DSP"

Millimeter wave short range combined detection technology refers to that combining millimeter wave radar with radiometer and taking full advantage of the active range measurement and passive radiation characteristics of target to realize target bearing decision and target recognition, which is the development trend of millimeter wave detection technology and greatly improves the performances of millimeter wave detector. This paper takes TMS320VC5410 DSP chip as the core and utilizes the high-speed signal processing ability, rich on-chip resources and flexible external interfaces of C5410 DSP chip to finish the hardware design of signal processing system, including the following modules, such as AD sampling, memory extension, system power and system clock, etc, finally debugs the system and sums up the debugging experience. [C4262]

"The second-order monostatic HF radar cross section incorporating antenna barge motion"

The second-order HF radar ocean cross section is derived for the case of the transmitting and receiving antenna undergoing platform (i.e. barge) motion. The derivation for electromagnetic patch scatter begins with a general expression for the bistatically received second-order electric field. Based on an assumption that the ocean surface can be described as a Fourier series with coefficients being zero-mean Gaussian random variables, the second-order monostatic radar cross section is developed. The derivation for the hydrodynamic patch scatter follows from an earlier first-order analysis. The second-order HF radar cross section is found to consist of Bessel functions, and no singularity exists in the new electromagnetic coupling coefficient. Simulation results depict the effects of barge motion under a variety of sea states. It is evident that first-order effects spread into the second-order region and thus could have detrimental effects on wave measurement schemes. [C4263]

"UWB Radar for Railway Fall on Track Object Detection and Identification"

This paper presents a new system for detecting and identifying objects fallen onto railway tracks. The proposed solution is based on an ultra-wideband (UWB) radar technique combined with a long travelling wave radiating microwave transmission line. This line is maintained adequately all along the railway station platform. Scheduled steps for system realization are presented. A preliminary analysis of different transmission lines which could be used and their performance is provided. Automatic Target Recognition (ATR) application, which describes identification procedure, is discussed. An overview of extraction methods is provided and a procedure of selection of contributing poles is presented. Available target identification techniques based on UWB pulse are analyzed and compared to experimental results. [C4264]

"The Adaptabilities of Different UWB Technologies to the FCC UWB Emission Limit"

UWB devices must meet the FCC's restrictions on the radiation power. This paper researches the power spectral densities of UWB signals transmitted by IR-UWB, DS-UWB, and MB-UWB. It analyzes the adaptabilities of these UWB signals to the FCC emission mask, and gives the conclusion of the study finally. [C4265]

"Automatic registration of SAR and optics image based on multi-features on suburban areas"

Image registration, the process of estimating the optimal correspondence relation between two or more images taken at different time, from different viewpoint or by different sensors, is essential for a variety of applications in remote sensing, computer vision, pattern recognition and medicine, etc. It is a prerequisite for accomplishing high level tasks such as sensor fusion, surface reconstruction, change detection, and object recognition. In order to realize the automatic registration between Synthesize Aperture Radar(SAR) and Optical images, in this paper, an automatic registration algorithm based on different features is proposed. This method is proposed according to characteristic of image of remote sensing. Patches, edge and point features are used in our paper to registry. The evaluation of the image registration accuracy proves that the stratified registration algorithm based on multi-features proposed in this paper work well in automatic registration of SAR image and optical image with pixel accuracy. [C4266]

"Fast DOA estimation for widebandsources based on perfect sampling"

In DOA estimation of wideband sources, Approximated Maximum Likelihood estimator (AML) has been shown to have the best performance. However, the computational load of AML is very high. In order to reduce its computational complexity, Markov Monte Carlo method with perfect sampling is introduced by the author to work with AML. And it results in a novel Approximated Maximum Likelihood DOA Estimator based on Perfect

Sampling (PAML). PAML regards the power of the AML spectrum function as the target distribution up to a constant proportionality, and uses Perfect sampler to sample from it. Simulations show that PAML not only keeps the excellent performance of the original AML but also reduces the computational complexity to a great extent.

[C4267]

"WiMAX signal generation based on MIMO-OFDM testbed for passive radar application"

In order to analyze the ambiguity function of WiMAX signals and evaluate their suitability for passive radar, the first step should be the generation of WiMAX transmission signal, including random data generation, modulation, Space Time Block Coding (STBC), preamble generation for synchronization and channel estimation, frame combination and Orthogonal Frequency Division Multiplexing (OFDM) modulation. In this paper, WiMAX signal generation based on a Multiple-Input-Multiple-output (MIMO) OFDM testbed as well as detailed baseband signal processing algorithms are presented. Field trials and measurements based on the MIMO-OFDM testbed in different channel conditions have verified that the signal generation method and the adopted baseband signal processing algorithms are effective. [C4268]

"Signal processing techniques in high-resolution RCS measurement system"

Comparing with traditional way of continue-wave RCS measurement system, high-resolution information is gained in stepped-frequency system. Using inverse fast Fourier transform, the frequency-domain data of the whole chamber obtained by testing is interpreted into high-resolution time-domain response, and the unwanted signals can be removed by adding a gating function. The measurement of finite frequency spectrum makes a cut of data; the use of windows reduces the effect of side lobe. Some experiments show that the accuracy will be improved after the signal processing techniques are used. [C4269]

"A novel algorithm for missile borne linear array antenna synthetic aperture radar imaging"

Different properties of two operation modes for cruise missile borne side looking instantaneous imaging synthetic aperture radar with linear array antenna along flight track were investigated. Its theoretical azimuth resolution was induced and a novel imaging algorithm called compound range-doppler algorithm was proposed. The imaging procedure was given and images were gained with both ECS and compound range-doppler algorithm in the end. The feasibility and validity of compound range-doppler algorithm were confirmed. [C4270]

"Multiclass segmentation of SAR image using modified unit-linking pulse coupled neural network"

A method for segmentation of SAR images based on modified unit-linking pulse coupled neural networks (unit-linking PCNN) is presented. The segmentation images using traditional unit-linking PCNN are binary, and we modify unit-linking PCNN to be two levels in order to make it segment images for more classes. The primary level corresponds to finding the clustering centers, and the similar neurons are captured using unit-linking PCNN in the secondary level. Because the grey distribution of SAR image is uneven, the gray mean of the neuron's n times n window image is used as the input pulse signal. Experimental results show that the proposed method is effective. [C4271]

"Multiple hypothesis tracking using clustered measurements"

This paper introduces an algorithm for tracking targets whose locations are inferred from clusters of observations. This method, which we call MHTC, expands the traditional multiple hypothesis tracking (MHT) hypothesis tree to include model hypotheses-possible ways the data can be clustered in each time step-as well as ways the measurements can be associated with existing targets across time steps. We present this new hypothesis framework and its probability expressions and demonstrate MHTC's operation in a robotic solution to tracking neural signal sources. [C4272]

"Analyse, identification, and modelling of electromagnetic disturbance sources. Actual signal approach applied to power supply unit"

The aim of the study is the analysis of EMC disturbances production from a power supply unit for a radar subset (power amplifiers, transmitter and reception (T/R) modules, synthesizers. The front stage of the power circuit is made of a power factor corrector (PFC). The output circuit is a buck converter insulated from the PFC by means of a transformer. Both PFC and output circuits, required the analysis of critical frequencies appearance facing the EMC standard for such application. For a given device the first step of modelling can be achieved by identification of the circuits' active loops. This is aimed to investigate EMC by means of simulation. The near field analysis and Fourier transform computation can give the relevant parameters values and the deterministic way to investigate or cancel the disturbances. This can give a tool of good design process for future devices. [C4273]

"Study on radar data processing algorithm with improved Kalman filter"

A data processing algorithm for the tracking and measurement radar is presented in this paper. The proposed algorithm uses a 3rd order improved Kalman filter to implement federal filter for the range and velocity measurements, which can stably track the range and velocity, and can also accurately estimate the acceleration; on the other hand, the proposed algorithm uses two 2nd order improved Kalman filters with the same structure to implement filters for the elevation angle measurements and the azimuth angle measurements respectively, which can effectively ensure the measurement accuracies of the angle and the angular velocity. The experimental results indicate that the proposed algorithm can attain high accuracy of tracking and measurement for the range and the velocity, and that it also has high tracking accuracy for static, uniform, uniformly accelerated angular motion. [C4274]

"Time-scale analysis of wideband HFM signal and application on moving target detection"

The interchangeability between time scale and time shift of wideband HFM signal is proposed. The self-CWT ridge of the rectangle enveloped HFM signal is derived in detail. Moving target detection and signal design are discussed. The numerical simulation is done to verify the characteristic of the ridge. Also the analysis and simulation of the LFM signal is given as a contrast. Real time simulation results are presented and show the prospect of wideband HFM signals in underwater signal processing applications. [C4275]

"Post-earthquake landslide detection and early detection of landslide prone areas using SAR"

High-resolution synthetic aperture radar (SAR) played an important role in the disaster management efforts after the Wenchuan Earthquake on May 12, 2008. SAR data was used for damage assessment, risk monitoring, and for the continuous monitoring of the so-called quake lakes. Landslides, triggered by the earthquake and the aftershocks, devastated large areas, killing thousands of people. Landslides formed natural dams, blocking rivers and leading to 34 so-called quake lakes, endangering millions of inhabitants and rescue workers downstream. SAR, amongst other sensor systems, was used to detect landslides and monitor those quake lakes. SAR can also assist the risk analysis by early surveying landslide prone areas and supporting the risk management and disaster reduction approaches. [C4276]

"Monitoring terrain motion in China by means of spaceborne SAR images"

In this work we recall a recently developed processing chain (called Quasi-Permanent Scatterers -QPS- technique) that, by analyzing all possible interferometric pairs in a given SAR data-set and by evaluating the spatial interferometric coherence, is able to exploit partially coherent targets to estimate the ground motion. The technique has been successfully applied in the Badong site in China for retrieving the local DEM and for individuating active landslides. The possibility of processing effectively short-term coherent scatterers will turn out particularly useful to process series of high-resolution SAR data with short repeat-cycles. [C4277]

"Automatic road extraction from LIDAR data based on classifier fusion"

The ultimate goal of pattern recognition systems in remote sensing is to achieve the best possible classification performance for recognition of different objects such as buildings, roads and trees. From a scientific perspective, the extraction of roads in complex environments is one of the challenging issues in photogrammetry and computer vision, since many tasks related to automatic scene interpretation are involved. Roads have homogeneous reflectivity in LIDAR intensity and the same height as bare surface in elevation. Proposed method in this paper is based on combining multiple classifiers (MCS) is one of the most important topics in pattern recognition to achieve higher accuracy. Majority Voting and Selective Naive Bays are two methods that used for fusion of classifiers. [C4278]

"A multi-agent method for automatic building recognition based on the fusion of Lidar range and intensity data"

Lidar has proved to be a promising data source for various mapping and 3D modeling of buildings in urban areas. Therefore, many researchers have been trying to study and develop automatic building recognition algorithms based on Lidar data. But, according to the complicated relationships between buildings and other objects in urban areas, especially trees and vegetations, the performance of obtained results from most of these algorithms is still dependent to several assumptions and simplifications. In this paper a multi-agent methodology has been proposed for automatic building recognition based on the fusion of textural and spatial information extracted from Lidar range and intensity data. The evaluation of obtained results confirms the high capabilities of this proposed multi-agent algorithm to decrease the conflicts in the field of automatic building recognition in

complex urban areas. [C4279]

"Steps towards a new technique for automated registration of pre- and post-event images"

With the continuing increase in the number of images collected every day from different sensors, automated registration of multisensor/multispectral images has become a very important issue. This is especially true when pre- and post-event image comparison is concerned: for this particular application, the requirement of obtaining the earliest possible post-event image imposes the use of data potentially showing strongly different characteristics with respect to the pre-event image. Non-homogeneous image pairs require robust automatic registration techniques. Resolution-independent, feature-based registration is naturally preferred over correlation-based registration but finding correct and sensible feature point sets to be matched is still an open problem today. In this paper we propose to use intersection points of extension off longest linear features found in the images. The fixed points are then matched using a modal matching approach. The procedure is illustrated and results over a set of high-resolution SAR images are presented and discussed. [C4280]

"PSInSAR Analysis over the Three Gorges Dam and urban areas in China"

In this work we present the results achieved within the Dragon project, cooperation program between the European Space Agency (ESA) and the National Remote Sensing Center of China (NRSCC), about monitoring the terrain motion in urban areas, measuring the city growth rate and analyzing the stability of big manmade structures. Among the processed areas, we report here the main results we obtained in the test sites of Shanghai, Tianjin and Three Gorges. The techniques that have been used to process the data are classical SAR interferometry (InSAR), Permanent Scatterers (PSInSAR) and a combination of coherent-uncoherent analysis. Particular attention is worth to be paid to the analysis of the Three Gorges Dam, biggest hydroelectric plant in the world, in which stability and characteristics of its scattering structures have been studied. [C4281]

"Persistent scatterer pairs (PSP) technique and high resolution SAR interferometry in urban areas"

We have recently proposed a new approach, named persistent scatterer pairs (PSP), for the identification and the analysis of persistent scatterers in series of full resolution SAR images. In this technique, atmosphere phase artefacts are effectively eliminated by exploiting their spatial correlation, but without using model based interpolations to remove orbital and atmospheric phase artefacts. This approach allows efficiently identify the persistent scatterers, and to retrieve the corresponding terrain height and displacement velocity. [C4282]

"Multi-source SAR remote sensing data for emergency monitoring to Wenchuan Earthquake damage assessment"

Synthetic Aperture Radar (SAR) has significant advantages in disaster monitoring that are all weather, independent of illumination imaging capabilities and strong stereoscopic sense. SAR technology played irreplaceable role in rapid response to Wenchuan Earthquake monitoring and damage assessment. With multi-source and multi-temporal high resolution SAR images, we conduct rapid, systematic and seriate observations regarding to town damage and secondary disaster in Wenchuan Earthquake area. And based on special SAR image characteristics of building damage conditions, distributions and scopes of landslides and dammed lakes, we carried out rapid quantitative evaluation and built corresponding interpretation symbols. The detection reports and achievements are presented to related apartments of country and rescue teams, supplying full and accurate scientific basis about emergency service and disaster relief. [C4283]

"Building extraction and 3D reconstruction in urban areas from high-resolution optical and SAR imagery"

In this paper, we propose to investigate the joint use of high-resolution optical and SAR data, for building extraction and 3D reconstruction in large urban areas. A sequence of methods providing, in a semi-automatic way, the building detection and reconstruction is presented. Potential building footprints are first extracted on an optical image by a two-phases process (coarse detection and boundaries refinement). The framework of fusion with SAR data is then developed. A first step of registration allows us to get a fine superposition of optical and SAR building features. Then, we show how to take benefit from the introduction of SAR data: The proposed methodology, based on the optimization of criteria referring to building SAR characteristics, allows us to simultaneously deal with the building presence validation and with the height retrieval. [C4284]

"Remote Sensing of Human Body by Stepped-Frequency Continuous-Wave"

Remote sensing of human body is very useful in many services. The micro-Doppler characteristic of human body can be detected to identify life target. In this paper, another new theoretical method to obtain the range and

Doppler frequency of human body is proposed in which multiple periods stepped- frequency continuous-wave signal and moving target indication (MTI) filter are adopted. The simulation results illustrate the validity of this method and present the detection of the target range and the vibration frequency of heart beating and breathing. [C4285]

"Research on Characteristic Extraction of Human Gait"

When a human walks, the motion of various components of the body including the head, torso, arms, legs, and feet produce a very characteristic Doppler signature. A new signal model of the walking human, based on the linear frequency modulated (LFM) signal, is proposed. This model contains 12 scatter-points of human, together with kinematic equations of motion of each body part. For each part of human body, an estimated radar cross section was assigned by the radar range equation. Short time Fourier transform (STFT) is used to obtain the human's spectrogram at first, from which the walking velocity can be estimated. Both a traditional method based on the cadence frequency and a new echo decomposition method are used to obtain the human gait frequency. Several unique features of human targets, like the height of human and so on, can be revealed by utilizing these parameters. Some simulations show that basic information extraction from spectrogram has some ability to identification human targets. [C4286]

"Doppler radar and postprocessing techniques for small area surveillance"

In this paper the use of Doppler signatures for human motion detection is presented. This can be of interest during search and rescue missions where visibility can be poor or even absent. Human movements give rise to specific Doppler frequencies. Their corresponding speeds can be exploited for recognition and can be visualized by means of reassigned spectrograms. A simulation tool is developed and validated by measurements. Scenarios with increasing complexity are treated. [C4287]

"Design and Realization of Distributed Wireless Telemedicine Monitor Center Based on Virtual Instruments"

This paper presents a new model of distributed wireless telemedicine physiological monitor center, which is developed by the Laboratory Virtual Instrument Engineering Workbench (LabVIEW) and integrates general packet radio service (GPRS) technology and signal processing with DSP processor. At the patient's location, a wireless PDA-based monitor is used to continuously acquire the patient's vital signs, including heart rate, ECG, SpO2 and so on. Through the internet and LAN, the patient's physiological signals can be transmitted in real-time to telemedicine monitor central unit, and the unit can access the data and the case history of the patient to medicine database. This paper presents our prototype implementation of signal processing based on a high-performance DSP processor on distributed nodes. The nodes analyze the patient physiology signal data which transmits from the central server through the LAN and transmits the results to telemedicine monitor central through the LAN. The results of the designing also show that the wireless telemedicine physiological monitor center model is superior to the currently used monitors both in mobility and in usability, and, therefore, is better suitable for monitor patients under the state of activities. [C4288]

"Multiresolution Framework with Neural Network Approach for Automatic Target Recognition (ATR)"

Automatic Target Recognition (ATR) is an approach by which we identify one or a group of target-objects in a scene. It plays a pivotal role in the challenging fields of defense and civil. Most of the methods in this context are based on fix window-size technique. In this paper we propose a novel approach which gives scale, rotation and translation invariant results for automatic target recognition in high-resolution satellite images which in turn are able to recognize the multiple targets in a scene. We have developed a system which can predict the possible area of interest in a scene, where target may be present or not. Prediction of areas of interest is based on edge detection and similarity measure of wavelet co-occurrence features of segmented sub-blocks. Zernike moments, calculated for scale and translation normalized area of interest, is thereby used as the features of the concerned area. Zernike moments are rotation invariant. The extracted features are then fed to trained neural network for recognition. This approach is more suitable for the satellite images because resolution of image and idea about the target are two essential factors by which we can predict the minimum and maximum size of the target. The approach takes considerably less time compared to the fix window based approach because the predicted numbers of interest areas to be processed in a scene are very less. The proposed approach has successfully been tested on number of satellite images of different resolutions and their timing analysis has been compared with fix window based approach. [C4289]

"Segmentation of 3D lidar data in non-flat urban environments using a local convexity criterion"

Present object detection methods working on 3D range data are so far either optimized for unstructured offroad

environments or flat urban environments. We present a fast algorithm able to deal with tremendous amounts of 3D lidar measurements. It uses a graph-based approach to segment ground and objects from 3D lidar scans using a novel unified, generic criterion based on local convexity measures. Experiments show good results in urban environments including smoothly bended road surfaces. [C4290]

"Research on key technologies for collision avoidance automotive radar"

Anti-interference capability and low cost play decisive roles for the break-through on the market of collision avoidance automotive radar. With the increasing use of automotive radar, the mutual interference becomes an issue. This paper proposes a novel signal design and signal processing methods for automotive radar, which combine good anti-interference capacity and the low cost of conventional frequency modulated continuous wave (FMCW) radar. The radar signal is easy to be generated and its signal processing can be performed by Fast Fourier Transform (FFT) algorithm. So, the proposed new methods is feasible and effective. [C4291]

"Analysis of some CFAR detectors in nonhomogenous environments based on switching algorithm"

In radar signal processing distinction of false targets from real targets and fixing their rate in different radar environments is desirable. In this paper, at first, switching constant false alarm rate (S-CFAR) processor has been improved to achieve Improved SCFAR in order to fix the false alarm rate not only in homogenous environment only with thermal noise but also in non-homogenous environment, consisting clutter edge and multiple targets in the background Gaussian noise. Then in continue, a new CFAR detector which is composed of an excisor and a switching CFAR detector, in an environment with K distribution, has been introduced. The new detector is named an excision switching CFAR (EXS-CFAR). The equations have been achieved by assuming the targets in Swerling I and closed form. The simulation results confirm that the introduced processors can fix the false alarm rate in both homogenous and non-homogenous environment with less detection loss. In addition, this method is simpler in implementation comparing with other samples ordering processors. [C4292]

"A method for authentication of the GPS transmitter"

The activities related to IRNSS (Indian Regional Navigational Satellite System) are at the peak at this time. It includes the integration of GPS, GNSS (Global Navigational Satellite System) and Galileo navigational systems. The single chip solution looks at integrating the RF/IF block with the digital signal processing block on a single chip. Such solutions invoke the possibilities of integrating GPS with the technologies like GPRS, GSM, etc. The goal of the experiment is to implement and authenticate the GPS system on the Texas Instrument DSK TMS320C6713. As a part of that in this paper an approach to implement and authenticate the GPS transmitter on the DSK is described. MATLAB is used to implement each blocks of GPS transmitter. First part of the paper describes the software implementation of the GPS transmitter, and the later part contains the description of the hardware implementation and the authentication of the same. [C4293]

"Research on the cascaded inverter with hybrid control of step waveform and instantaneous feedback"

This paper proposes a hybrid control method for cascaded inverter with step waveform and instantaneous current control. With this method, one part of the cascaded unit uses step waveform control, and the other part of the cascaded unit uses instantaneous control. The output voltage comes from the two parts in series. This method can decrease the switching time, reduce the switching loss. The structure of the system is very easy. The theory analysis and simulation is done, and the simulation results show the validity of the proposed method. [C4294]

"Research on a kind of photovoltaic grid-connected cascaded inverter"

Based on a kind of hybrid control photovoltaic grid-connected cascaded inverter proposed by the author, this paper proposes a simple method by which we can confirm the triggering angles of the unit inverter with the step wave overlap control mode, computes the output power of each unit inverter, proposes the operation mode exchange solution to solve the unbalanced output power problem of the cell modules, through the analysis and computation, introduces how to choose and match the photovoltaic cells of various cascaded units. The simulation results show the validity of the proposed method. [C4295]

"Correction of signal induced noise for Photo-Multiplier Tube"

Photo-multiplier tube is the key of photoelectric conversion subsystem of light detecting and ranging. When it is exposed in an intensive light, the response of PMT systems becomes nonlinear, that is, the output count rate is no longer proportional to the incident light intensity. A nonlinear effects caused by the intensive light are

analyzed in this paper and the errors induced by the nonlinear effects are measured. According to these measurements, two different corrections of these nonlinear effects are proposed and the result of correction is reasonable. This electronic document is a *template*. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document.

[C4296]

"A simple control arithmetic of step wave cascaded multilevel inverter with different voltage step"

Besides effectively reducing the voltage stress of switches, the cascaded multilevel inverter could also improve the quality of output waveforms by addition of waveforms. The step waveform addition is a usual method. The addition could reduce the loss of switches, but the introduced angle of flow calculating methods of cascade inverters based on step waveform addition are only suitable for cascaded inverters with the same voltage step. To this situation, an angle of flow calculating method of inverters with the different voltage step is proposed in this paper. The method is very suitable for the application of solar battery cascaded inverters and fuel battery cascaded inverters. The method follows the equal area principle, and the online calculation is realized by some constraint conditions. Finally, the correctness of the method is validated by simulations. [C4297]

"Mine detecting GPS-based unmanned ground vehicle"

Mines which are located on the ground have been threatening not only military forces but also civilians. These threatening mines are classified as wooden, plastic and metal types. In this study a detector, which is able to detect all the mines placed on the ground, has been developed. Detecting and destroying the mines on a suspicious area without personnel have been possible with remote control devices. In our work we aimed to produce a GPS-based mobile prototype vehicle carrying a system which can jam electromagnetic waves to blow up the mines with a remote control. This vehicle runs on solar energy and it can be steered by simulation glasses. [C4298]

"Title page"

The following topics are dealt with: electronic circuits; head position monitoring; CDMA transmission system; fading channel; power line communication; local area networks; radar; inductors; switch mode power supplies; electric motors; channel estimation; OFDM system; telecommunication security; VHDL; signal processing; broadcasting; antennas; TCP; radio networks; steganography; telecommunication control; FSO links; modem; power spectra measurement; transponder architecture; power plant; software tool; multimedia communication; and microwaves. [C4299]

"Copyright"

The following topics are dealt with: communication over time-varying channels; distributed detection and estimation; cognitive radio; multiuser MIMO systems and scheduling; channel estimation and equalization; relay communication; space-time coding and diversity; MIMO communication and precoding; peak power reduction, transmitter leakage, and ADC's; cooperative communication; radar, ranging, localization, and beamforming; interference channel and mitigating interference; and error control coding and source coding. [C4300]

"A GPS-based system design for the recognition and tracking of moving targets"

This study aimed to develop a software to enable recognition of moving objects and detection of their orbits by processing the images obtained through a camera. The secondary objective was to design a GPS-based mobile robot which tracks moving objects. [C4301]

"FPGA-based Radar Signal Processing for Automotive Driver Assistance System"

Safety and comfort applications are addressed using driver assistance (DA) systems like adaptive cruise control (ACC) system using long range radar (LRR) or short range radar (SRR) or both. Novel waveforms and functionalities applied to next generation DA multi-sensor systems and their corresponding complex algorithms require advanced digital hardware supporting high computation rate and severe real-time constraints. In this paper, we present a flexible FPGA-based architecture for digital control and signal processing of a DA system. The considered DA system makes use of a new particular waveform to enhance capabilities of old generation ACC radar. Hardware/software partitioning has been explored in order to match the real-time requirement of the system. Development steps, from algorithm specification to on-board demonstration, are detailed. Promising results in terms of resources use and execution time are shown using a prototyping board with a single Virtex-II Pro device. [C4302]

"Data Fusion towards building roof reconstruction based on CSR approach"

3D building modeling has emerged as a focus of research as well as development for many urban planning and geo-information related applications. To its most abstract form on geometric level, 3D building roofs are regarded as the fundamental elements to present outlines of 3D building models. The emphasis of this study is to demonstrate a novel algorithm of building roof reconstruction, termed CSR (Construct-Shape-Refine). The proposed algorithm aims at reconstructing building roof models purely by employing 3D line features or integrating 3D and 2D line features from existing data. In particular, the latter integration involving fusion from multiple data sources strengthens the reliability as well as the precision of 3D building roofs. The CSR approach is characterized through three stages. Geometric inferences are imposed at the stage of Construct where topological relationship of the 3D line features is established while 3D coordinates of roof corners are adjusted and estimated through Shape processes, apart from compensating the hidden boundaries, if any. The efficiencies of two fusion streams, including fusion of 3D line features that result from different sources or fusing 3D line features with photogrammetric line features, are gained as promoting the building roof quality via Refine workflow. Experiments of the Construct-Shape stages show that the proposed method is independent of building roof types, however constrained in polygons under current consideration, as well as whether 3D line features are complete for both successful and efficient performance of building roof reconstruction on a 3D line feature basis. Moreover, the Refine stage offers more up-to-date and satisfactory building roof reconstruction results as compared to the situation when only one single data set is considered. [C4303]

"Road tracking by circular template matching from high resolution remotely sensed imagery"

Template matching has been brought effective results in road tracking. Actually, the shape of template plays a very important role. In this paper, a novel circular template is utilized to search the center points of the road. The circular template is not necessary to rotate for the isotropy of template when searching the optimal road axis point, which means less computation. At the same time, least square matching method is employed to trace the road trajectory. The main purpose of the paper is to propose a circular template that improves the performance value of tracking road axis. Experiments show that the circular template matching method (CTM) is more efficient than the rectangular template matching (RTM). [C4304]

"Mining area subsidence monitoring using multi-band SAR data"

In this work, DInSAR technique has been applied to the monitoring of mining induced land subsidence in many areas. In this paper, the DInSAR technique is used to process the space borne SAR data including C band ENVISAT ASAR and L band JERS, PALSAR SAR data to derive the temporal land subsidence information in Fengfeng coal mine area, Hebei province in China. Since JERS do not have precise orbit, an orbit adjustment must be accomplish before the DInSAR interferogram was formed. We designed a images coregistration method based on the imaging geometry of interferometric SAR, and an external DEM. We analyzed 8 differential interferograms derived from JERS SAR, PALSAR, ENVISAT ASAR data. In our analysis, the DInSAR results were compared with leveling data that show high consistency. The characteristics of phase pattern on these C band and L band deformation interferograms were compared; we can notice that in most situations, the obtained deformation pattern on the surface is not the same of L and C band. And at last the feasibility and limitations in mining subsidence monitoring with DInSAR were analyzed. The experimental result shows that both C band and L band can accomplish monitoring mining area subsidence, but C band has more restrict conditions of its perpendicular baseline. In order to get a satisfactory outcome in mining area subsidence by DInSAR method, the time series of SAR images of every visit period and SAR deformation interferograms should be archived. [C4305]

"Ground settlement monitoring from temporarily persistent scatterers between two SAR acquisitions"

We present an improved differential interferometric synthetic aperture radar (DInSAR) analysis method that measures motions of scatterers whose phases are stable between two SAR acquisitions. Such scatterers are referred to as temporarily persistent scatterers (TPS) for simplicity. Unlike the persistent scatterer InSAR (PS-InSAR) method that relies on a time-series of interferograms, the new algorithm needs only one interferogram. TPS are identified based on pixel offsets between two SAR images, and are specially coregistered based on their estimated offsets instead of a global polynomial for the whole image. Phase unwrapping is carried out based on an algorithm for sparse data points. The method is successfully applied to measure the settlement in the Hong Kong Airport area. The buildings surrounded by vegetation were successfully selected as TPS and the tiny deformation signal over the area was detected. [C4306]

"A method of deriving features of building from LIDAR point clouds in urban area"

This research paper aims at extracting features, especially the plane feature, of building from Light Detection

And Ranging (LiDAR) point clouds in Urban Area, and with these features and information to build the model of object. Unlike modeling object in other fields, such as reverse engineering, surfaces of building usually consist of abundant big and plane surfaces which are significant features. In urban area, most buildings can be simplified to the models that are made up of approximate plane surfaces to which features of buildings refer, in this paper. Among these surfaces, there are distinct points and intersection lines (the edges and vertices of the building object). Plane detection, surface adjacency relations restoration, model parameter calculation, and model reconstruction constitute the main research of extracting geometric features and modeling the object. In this contribution, some examples of deriving information from the point clouds are presented to demonstrate the method. And, the results prove that when the geometric information of vertices, edges and normal lines of the plane surface, together with the topological relations (Surface adjacency relations) among them, is derived from the point cloud data, the model, representing building in this paper, can be built effectively. Equally significant, models generated from this method, while occupying less memory space, can store more comprehensive structural information, and have a better exhibit effect. And this method can provide three dimensional data of buildings from point cloud data in applications like GIS, navigation and virtual city. [C4307]

"Monitoring ground subsidence in mining area using spaceborne InSAR technology"

A case study of INSAR application to monitor the ground subsidence of colliery area in Fengfeng coal mining area, Hebei Province, China is investigated in this paper. Using the data of ENVISAT ASAR and JERS SAR, the interferometric results of this area are derived. At the same time as acquisition of ENVISAT ASAR data, field leveling measurement in this area was carried out, and the historical excavation data were collected as well. A synthetic comparison is done between the results of D-InSAR and leveling measurement. The comparison shows that the D-InSAR subsidence results are consistent with the field measurement results and the historical excavation data. Finally, some ideas and suggestions about InSAR applications to deformation monitoring in mining areas and mining industrial cities are given based on this case study and other applications. [C4308]

"Construction and visualization of photo-realistic three-dimensional digital city"

This paper presents systematic approaches to create photo-realistic three-dimensional (3D) digital city systems. In the created 3D digital city systems, prismatic and polyhedral building models are constructed from assorted remote sensing and spatial datasets, including topographic maps, aerial and satellite images, airborne and ground-based LIDAR point clouds. Close-ranged digital photographs and video sequences are used to generate facade texture images for photo-realistic texture mapping of the constructed building models. High performance visualization algorithms based on Level of Detail (LOD) processes are also implemented for real-time, interactive exploration and applications. A few applications of the constructed 3D digital cities to urban development evaluation, environmental simulation, hazard mitigation and crime scene reconstruction are presented to demonstrate the usability of the developed 3D digital city system. [C4309]

"Inversion of leaf area index for invasive plant using ENVISAT ASAR"

In this paper, leaf area index LAI retrieval of invasive plant species from C-band synthetic aperture radar (SAR) data was demonstrated to be feasible via experiment. Taking an invasive plant of spartina alterniflora in Dongtan of Chongming island, Shanghai, China as example, a specific method that inversion LAI of invasive plant from the ENVISAT dual-polarization Advanced Synthetic Aperture Radar (ASAR) imagery would be presented in the paper. In the experimental test, the functional relationship model between the LAI values and backscattering ratio values was at first built and the model parameters were then objectively calculated by fitting, using simulated LAI values according to published research work and backscattering ratio values converted from the ENVISAT ASAR images. Moreover, it is confirmed in our study that it is being computably functional relationship between the LAI and the image pixel for either HH polarization mode image or VV polarization mode of ENVISAT ASAR image. The experimental conclusions are finally revealed that: 1) The 2-polynomial fitting is better than the 1-polynomial for both HH polarization mode image and VV polarization mode in approximation degree; 2) The difference of using the 1-polynomial fitting and the 2-polynomial fitting as adopting the HH polarization mode image is larger than the one as adopting the VV polarization mode image; 3) Adopting the HH polarization mode image is more effective than adopting the VV polarization mode image in inversion LAI for invasive plant from ENVISAT ASAR image; and 4) the related coefficient between the LAI and backscattering ratio corresponding to ENVISAT ASAR image were acquired up to 0.7100 in the HH polarization mode and 0.6657 in the VV polarization mode. [C4310]

"Fuzzy samples retrieval: A method of SAR image retrieval in urban areas"

As the retrieval entrance, description of retrieval objects plays an important role in CBSIR (Content-Based SAR (Synthetic Aperture Radar) Image Retrieval) systems. Most of the CBSIR systems take one Region of Interest

(ROI) from the original image, which contains the retrieval object, as the retrieval entrance. Besides, freehand sketch retrieval methods are used extensively in CBOIR (Content-Based Optical Image Retrieval). But when the retrieval objects are fuzzy in SAR image, methods mentioned above are no longer applied because speckle noises make the description of retrieval objects unfeasible. In this paper, a method is proposed to describe the retrieval objects in SAR image, which is called Fuzzy Samples Retrieval (FSR). In the experiments FSR is compared with the retrieval based on ROI of original image and freehand sketch sample, the results show that FSR has a better performance in CBSIR systems. [C4311]

"Object extraction based on 3D-segmentation of LiDAR data by combining mean shift with normalized cuts: Two examples from urban areas"

In this work, we have looked into the problem of urban analysis using airborne LiDAR data based on the strategy of classification by segmentation. Segmentation is a key and hard step in the processing of 3D point clouds, which is not perfectly solved in view of different applications. A new 3d segmentation method incorporating the advantages of nonparametric and spectral graph clustering is presented here to facilitate the task of object extraction in urban areas. This integrated method features local detection of arbitrary modes and globally optimized organization of segments concurrently, thereby making it particularly appropriate for partitioning raw airborne LiDAR data of urban areas into segments approximating semantic entities. Two examples in urban areas-flyover and vehicle are chosen as interest objects to be extracted by a classification-based step. The approach has been tested on LiDAR data of dense urban areas, and the results that are obtained have been compared with manual counts and showed us the efficiency and reliability of the strategy. [C4312]

"Assessment of urban tree shade using fused LIDAR and high spatial resolution imagery"

Advancements in high spatial resolution remote sensing technologies including multispectral satellite (Quickbird, IKONOS) and active airborne sensors (LIDAR-Light Detection and Ranging) are enabling detailed analysis of physical features across the urban environment. Often these datasets have been applied in isolation, however by fusing these technologies significant added benefit can be gained. Specifically, LIDAR data enables highly accurate extraction of three dimensional urban structures such as buildings, trees, and the underlying terrain; while multispectral data can provide accurate estimates of surface cover type. In this paper we present a technique to model and map seasonal solar radiation effects related to urban trees by integrating structural and spectral data. Results indicate that across the study area (The District of North Vancouver) trees reduce incoming potential solar radiation in summer by 4.38 MJm-2day-1(24%) and in winter by 0.28 MJm-2day-1(13%). In addition, solar radiation is decreased by 0.2 MJm-2day-1(11%) in winter when deciduous tree species are removed. Finally, solar radiation is summarized by urban land use and results suggest that radiation in developed regions is most affected by tree shading in single-family residential areas (3.5 MJm-2day-1) and least affected in commercial areas (1.22 MJm-2day-1). [C4313]

"Assessing the utility of DMSP/OLS night-time images for characterizing indian urbanization"

Urbanization, that is the movement of population from rural to urban locations, is a process that has been occurring for hundreds of years, but is increasingly prevalent in today's world. In 2008 most of the global population was resident in urban areas. It has been predicted that in the coming years, an increasing number of people will be living in cities; especially in the developing countries within in Asia and Latin America. This study considers the case of India, the second most populated country in the world, with a present total population exceeding 1 billion. It focuses on the state of Maharashtra (including the mega-city of Mumbai and its surrounds-the largest in India with a population of approximately 18.1 million). The Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) is a spaceborne system that detects visible light and thermal emissions of the earth at night. The data is collected nightly, on a global basis. The aim of this paper is to correlate the values obtained from the radiance calibrated DMSP/OLS night-time images of 2001 with population data. The spatial resolution of DMSP/OLS images is approximately 1 Km. This paper asks the question over what range of spatial scales does DMSP/OLS have utility in retrieving metrics of urbanization. [C4314]

"Analysis of active ground subsidence zones in Guangzhou city using ASAR Persistent Scatterer Interferometry"

A Persistent Scatterer Interferometry (PSI) technology is used to detect ground deformation from ASAR images acquired from 2007-2008 in the urban area of Guangzhou in South China. To obtain active ground subsidence zones a great value filter method is developed to extract characteristic points with great values. Based on the ground deformation rate maps of the study area, a thematic map of the active ground subsidence zones is

generated. To interpret the distribution of active ground subsidence zones, a local geological map of faults and rock type information is used to generate a series of thematic maps. The results show that geological faults, rock distribution, over-development, and underground engineering projects may be four factors leading to the distribution of the active ground subsidence zones in the study. [C4315]

"An automatic method on detecting image control points from SAR imagery based on Optical Image Patches"

In this paper, we propose a novel procedure of detecting control points from SAR image based on Optical Image Patches procedure. The method presented here is a three-step procedure. In the first stage, a local image patch from the SAR image is estimated from the geo-information of the SAR image and the GCP geo-coordinate, and the local patch is performed an affine transformation by using the four geo-coordinates of the SAR image in advance. In the second stage, the NCC procedure is performed on the GCP and the preprocessed local SAR image patch to find the candidate image control point(ICP). In the third stage, the pairs of ICP and GCP are refined, and the false pairs are discarded by the RANSAC algorithm. Experiments on SAR-Optical satellite images demonstrate the reliability and effectiveness of the presented method. [C4316]

"Water feature extraction from aerial-image fused with airborne LIDAR data"

An innovative method to extract water feature from aerial-image is introduced in this paper. This approach extracts water feature from coarse to fine considering laser spectral bands of current existing airborne LIDAR systems and the spectral characteristic of these bands. Quad-edge based incremental inserting algorithm is used to construct the TIN (Triangulation Irregular Network) from LIDAR points. According to the triangulate features of different objects, area-analysis is performed to extract water triangles from TIN. Water triangles depict the water location of aerial-image. Then buffering is performed to extend the area of water triangle and to uptake the whole water-related points cloud data. Raster calculation is used here to obtain the rough water feature. Then, Mean-Shift algorithm is used to reclassify the rough water feature and to obtain the precise water. Finally, the feasibility of the approach is verified using comparison between two ordinary methods and the approach proposed in this paper. [C4317]

"Urban DEM generation from airborne Lidar data"

Digital surface model (DSM) can be acquired from airborne Lidar (light detection and ranging) directly. But for the production of digital elevation model (DEM) from the point cloud, the filtering of the point cloud should be carried out in order to remove points representing surface of non-ground objects. According to the deficiencies of slope based method and characteristics of Lidar data in urban area, a novel filtering algorithm for Lidar data that combining slope based method and region growing is presented in this paper. This method can improve precision and efficiency of filtering, and is very suitable for Lidar data of complex urban area. Experiment results show that the proposed method can remove objects in complex urban area effectively and rapidly. [C4318]

"Monitoring urban subsidence with coherent point target SAR interferometry"

Spaceborne SAR interferometry (InSAR) is a well known microwave remote sensing technique which has been applied for topography mapping and ground motion monitoring by exploiting phase difference from SAR data acquisition with relevant large spatial scale and high precision. The developed Permanent Scatterers Interferometry (PSI) is a further step of InSAR technique which offers a convenient processing framework that enables the use of all data acquisitions. It aims to bypass the problem of geometric and temporal decorrelation by considering long term coherent point. Furthermore, by using a large number of data, atmospheric signal is estimated and compensated for. We present in this work the development of an improved PSI, called Coherent Point Target InSAR, for land subsidence velocity field estimation in urban area as well as rural area in China. A series of case studies demonstrate the ability of CPT InSAR for monitoring ground subsidence field with relevant large spatial extent as well as small area. [C4319]

"Surface subsidence and ground fissures activity monitoring based on D-InSAR: A case of Datong city"

The Synthetic Aperture Radar Interferometry technique has become one of geological disaster monitoring tools, for its economical, efficient, high-precision and large-scale surface deformation monitoring capacities. Datong is a well-known historical and cultural city, which is also a major energy bases and known as "town of coal" reputation in China. Since 1980s, with the development of industry and agriculture the amplitude of groundwater withdrawal has increased year by year, which lead to serious surface subsidence and ground fissures hazards in this city, even active up-to-date. Presently, 10 ground fissures with a total length of 34.5 km

can be found in Datong region. However, the city-level spirit leveling only carried out during years of 1988-1993 to monitor the surface subsidence, and ceased later on. So in this paper, we collect 8 scenes of Envisat SAR data covering Datong city to monitor the subsidence evolution during Jan. 2005 to Feb. 2008. The interferometric pairs are set according to the principles that temporal and geometric baseline limits. Finally, we obtain the annual and accumulated subsidence amounts. The study shows that the land subsidences in Datong are greatly correlated with the groundwater withdrawal and seasonal variation. And some new subsidence cones are located at new economic and technological development zones of Datong city. Thirdly, ground fissures deformation in Datong is controlled by the regional tectonic activity and also affects the land subsidence in its surroundings.

[C4320]

"Building extraction by fusion of LIDAR data and aerial images"

It is well known that geometric filters for points cloud can only go so far when removing above-ground phenomena for it's difficult to determine whether a laser point has hit a special object when only spatial analysis is included. And comparing to the discrete points cloud, the high quality, large-coverage images provided by aerial cameras is a very important advantage of photogrammetry, which can be a very important complement data source to the points cloud. And by a process of spectral imagery LIDAR composite, points cloud can be fused with accurate spectral images provided by aerial CCD cameras on the same board. And the points cloud, with both high quality of reflection and geometric properties, can be filtered by integrating the reflectivity and geometric method. In this paper, the measurement characteristics and advantages of reflectivity of laser scanning and CCD cameras for the classification of return points are analyzed, and a building extraction method, integrating the geometric feature and reflectivity information of the return's intensity and the spectral range of CCD camera are presented. In which, the vegetation points are filtered by spectral attributes initially, and then points belonged to the building walls are segmented by a area attributes after constructing the return points' voronoi diagram; and building surface points are filtered by plane-fitting clustering method. [C4321]

"Application of Mathematical Morphology to automatically extract roads on radar images"

The new constellation of remote sensing satellite COSMO/SkyMed will guarantee a combination of spatial and temporal resolution never reached by previously systems. The full exploitation of this system can allow the development of new applications, like these aiming at providing insight into the magnitude of a disaster and a detailed assessment of the damages as required by first responders for planning relief actions. [C4322]

"An investigation of urban water automatic extraction based on texture and imaging knowledge from high resolution SAR images"

Extracting water body information with SAR images is distinctive and important. Especially for high-resolution SAR images, it's hard to extract water accurately because of Speckle Noises, so a Gabor filtering method related to the image texture is proposed. Firstly, frequency spectrum analysis method was used to identify the wedge and ring characters of image texture, and the period and directional parameters of the texture distribution were computed. Based on these characters, Gabor filter were constructed in order to filter the frequency spectrum of the multi-texture image, and best filter parameters were selected. After the filtering in frequency domain, components of corresponding texture were acquired by transforming the filtered frequency spectrum image to time domain image. The test results of terra SAR image indicate that the water body extraction method is good.

[C4323]

"Geometric processing of QuickBird stereo imagery with high building data in megapolis"

Much research work has been done concerning the geometric accuracy for High-Resolution Satellite Imagery (HRSI), the conclusion regarding this respect in photogrammetric society is that Ground Control Points (GCPs) are necessary for the accurate geo-positioning to get meter or sub-meter positioning accuracy. But most existing publications are about the horizontal positioning determination rather than vertical direction. This paper aims to evaluate the geo-positioning capability in vertical direction for HRSI and analyze the influence of GCPs vertical distribution to that of the final vertical accuracy. The study is performed in Shanghai, China, the typical metropolis, using a pair of across-track QuickBird stereo imagery, within a relatively small but representative area filled with very high buildings to provide height difference for GCPs and Independent Check Points (ICPs). A new accuracy evaluation scheme in vertical direction is put forward and employed in the assessment. Processed with the Rational Function Model (RFM) and its accuracy improvement models in image space, some relations are found between the GCPs height and obtainable ICPs vertical accuracy in different height ranges, discussions and conclusions are presented in the end. [C4324]

"Low-resolution urban area outlining in satellite SAR images"

Urban areas represent a vital and highly dynamic environment, and monitoring their growth provides important input to decision and policy makers at large scale. Detection and outlining of urban areas from satellite sensors, though less precise, is faster than any on-site data collection. Various techniques have been proposed to classify urban areas, based on their typical features like textural features or backscatter intensity. In this paper a fuzzy-connectedness technique proposed for coastline detection, based on interferometric coherence and backscatter intensity, has been tested and adapted to urban area boundary detection. The modified method appear to be suitable for urban area extraction at ERS-like resolutions, for which long historical records are available allowing to reconstruct urban area growth in the past. [C4325]

"Reliable ranging technique based on statistical RSSI analyses for an ad-hoc proximity detection system"

We propose a proximity detection system that supports pedestrian traffic. Active radio tags are utilized for building the system to reduce the overall system cost. But accurate ranging based on utilizing active radio tags only is difficult to achieve, since the RSSI is affected by small-scale fading of a radio signal in real-world environments. In this paper, 4 simple statistical RSSI filtering methods and a packet exchange protocol for reducing the fading effect are proposed. Combinations of proposed methods are thoroughly experimented in real-world environments and discussed for determining the best combination for the system. Our results show that the variation of detecting distance is successfully reduced to 4 meters for particular combinations. [C4326]

"Tile mapping of urban area extent in VHR SAR images"

At the high resolutions attainable with the new generation space-borne sensors, the focus moves increasingly from spectral characteristics to geometric features. This trend is even more evident for urban areas which tend to show an unpaired concentration of linear features with respect to any other land cover. This naturally applies to both optical and radar images, and suggests one may use local concentration of linear features to gauge the presence of urban structures. In this paper we exploit a linear feature extractor to map the extent of urban areas in very high resolution optical and SAR images. [C4327]

"Application of Bridge Function Sequences in Passive Beamformer"

This paper provides a new kind of passive beamformer which uses bridge function sequences as spreading sequence weights. The passive beamformer uses pseudorandom spreading sequence as weight of signal from each antenna element. Then it forms spatial radiation pattern by combining these signals. It can track and locate multiple objects positions simultaneously without the need of phase shifters and attenuators and any adaptive electronic beamsteering. And its antenna array can be any arbitrary geometry displacement. It can discriminate directions of arrival with as high angle resolution as 1.40 when there are 2000 elements in the antenna array. We use bridge function sequences as its pseudorandom spreading sequence weights. Owing to Bridge function sequences with better cross correlation characteristics, the passive beamformer gets better performance promotion than ones with Walsh function sequences as spreading sequences. [C4328]

"A Novel Method for Sorting Radar Radiating-Source Signal Based on Ambiguity Function"

Sorting rate of current methods is not high and too sensitive to the signal noise ratio (SNR), in order to solve this problem, a novel algorithm for sorting radar radiating-source signal is proposed. The ambiguity function of received signal is extracted and predigested to two-dimension characteristic, then decomposed into eight wavelet package transformation (WPT) characteristic parameters whose WPT2 and WPT5 have the best separability and be used as the sorting parameters at last. For ambiguity function of different signal is distinguishing and not sensitive to SNR, the WPT2 and WPT5 are divisible and steady. The advantage of this new method is validated by simulation result, and the lowest sorting rate is 90% at SNR=10 dB. [C4329]

"A New Method for SORTING Radiating-Source"

Sorting of Radiating-source is an important technique of Radar countermeasure systems. The disadvantages of sorting algorithm based on PRI are analyzed, and a new multi-parameters sorting method based on common parameters and Wavelet packet transform (WPT) is proposed in this paper. This new method is validated by computer simulation, and the result shows that it operates well in sorting radiating-source. [C4330]

"Mobile mapping system and computing methods for modelling of road environment"

Mobile mapping is a new way of efficiently collecting three-dimensional data from the road environment. Mobile mapping systems are cost efficient and robust technique to acquire information about even highly dynamic environments like highways and urban streets, where the data collection has previously been laborious and even

dangerous for the staff performing the surveying. The dynamic mobile mapping systems could access the site with less risk to the personnel and with less need for road closures. The need for high resolution and details captured in to the data for street and road inventories, or city modelling, are the main reasons for the rapid adoption of the mobile mapping techniques in these fields. Lidar based mobile mapping system produces three-dimensional points from the surrounding objects. Typically, two-dimensional profiling scanner is mounted on the system and the third dimension is achieved by the movement of the vehicle. The characteristics of the obtained point cloud depend largely on the sensor arrangement and the sensor properties. The ROAMER, a single-scanner system for road environment mapping presented in this paper, is able to use various tilted scanning planes for the point acquisition with 120 kHz point measurement frequency and up to 48 Hz profile measurement rate. The relative point precision for the system is estimated to be a few millimetres, but is eventually defined absolutely by the accuracy of the navigation solution that could be provided in real-time, or more reliably through post-processing. We believe that in the future, lidar based mobile mapping will be used considerably for urban and road environment modelling, as well as in many other applications in the fields of construction, forestry, railways, and even in environmental modelling and monitoring e.g. hydrology and glaciology. In urban context, the main applications of these models could include urban and environmental planning, road safety assessment, road construction plan- ning and navigation. [C4331]

"Study of residents information extraction in SAR image based on texture features"

This paper focuses on the topic of extracting residential properties information based on texture features in low or moderate resolution SAR image, because the residential area has characters of high bright and regular texture in that scale image. Firstly, filtering the noises of the SAR image by using the FROST algorithm; secondly, obtaining a binary image which contains the residential information by threshold processing; thirdly extracting texture features based on the gray-level co-occurrence matrix and the texture features such as entropy, variance and correlation are selected according to actual situation, then the selected images are combined into a multiband image; Finally, the multi-band image multiplies the binary image and gets a new image, then classifying it by unsupervised classification, connecting the break points by using the morphology algorithm, a boundary of residential areas is obtained. As results, both the theoretical analyses and the experimental results indicate that this method is very efficient in extracting the residential information. [C4332]

"An approach to urban surface features identification using Pushbroom Hyperspectral Imager"

The hyperspectral data can identify the complicated urban surface features which can't be identified using the multispectral data because of their lots of continuous bands in a narrow band width. The goal of this paper was to perform the urban surface features identification based on airborne Pushbroom Hyperspectral Imager (PHI) data. At first, some preprocessing of PHI data from original data, such as atmospheric correction and geometry calibration has been done. Then, the endmembers were located and identified using the n-d Visualizer on the pixels determined from pixel purify index (PPI) which was run on the Minimum Noise Fraction (MNF) transform result. The most crucial step is the matching between the target spectra and the reference spectra. In this paper, four matching algorithms were introduced and analyzed such as the spectral angle measure (SAM), the spectral correlation measure (SCM), the Euclidean distance measure(ED) and the spectral information divergence (SID).SAM and SID were used and compared in the target area. At last, the validation of the identification results was done and the error of the SID method was analyzed. The result indicated that water, vegetation and buildings can be identified exactly and the asphalt road can't be distinguished from the buildings because their spectra are similar in PHI image. To be concluded, SID is a more effective algorithm for the spectral matching than SAM in that it can identify the minute difference of the surface features and there are too many isolated pixels in the SAM algorithm. [C4333]

"Object-based level set model for building detection in urban area"

This paper studies an new approach to creating a variational level set model for buildings detection by combining LiDAR point clouds and Aerial image data. The level set model introduces an object-based image analysis technique. Firstly, a fundamental object-based level set framework is built by neighbor analysis of remote sensing image. Then, several derived products directly or indirectly from LiDAR raw point cloud data, like nDSM and absolute roughness data, are used to construct a novel energy term in relation to height and roughness of non-terrain objects, in order to make up the disadvantages caused by insufficient information only from remote sensing image. Thus, a closely combined model for buildings extraction has formed. The model can well fuse spectral feature, height and roughness information of objects from different sensors. Finally, experiments on pairs of Aerial image and LiDAR 3D point cloud data are carried out, and conclusions can be drawn that our model can effectively separate various small or high building in urban area from other land covers, including trees, grass, ground etc., and alleviate those influence caused by shadow, occlusions or spectral inhomogeneity. [C4334]

"Seasonal displacements in upper-middle alluvial fan of Chaobai River, Beijing, China, observed by the permanent scatterers technique"

Miyun-Huairou-Shunyi area, located on the upper-middle alluvial fan of Chaobai River, is the largest groundwater source region of Beijing, China. The study area is approximately equal to 479 km² and covers three counties. The area includes one ground-water sub-basin, named Chaobai River, which is filled with unconsolidated alluvial deposits that comprise the aquifer system. Groundwater constituted about 66% of the municipal water supply in this region. Groundwater withdrawals had not exceeded the natural recharge between 1989 and 1992. During a period of low runoff and extensive ground-water extractions from about 1993 to 2006, ground-water levels fell as much as 25.6 m. Extensive groundwater use in upper-middle alluvial fan of Chaobai River has resulted in the continual decline of piezometric levels associated with the environment consequences of land subsidence. [C4335]

"Observation of urban heat island using airborne thermal sensors"

As a basic study on urban heat island, the surface temperature of the central Tokyo, Japan is investigated using images obtained by airborne thermal sensors. Thermographies were taken from a helicopter on August 7, 2007, both in the daytime and at night. Using these thermal images, the variation of surface temperature can be observed in a detailed manner. Although the road surface and building roofs shows very high temperature, vegetation and water bodies show much lower temperature. The temperature at night also shows significant variation depending on the surface material and the sunlight condition in the daytime. Ground based verification of surface temperature was also carried out using a handheld thermal sensor. Based on these observations, detailed variations of temperature on various urban earth surfaces were revealed. [C4336]

"Airborne laser scanner point clouds strip adjustment aided by photogrammetry"

Airborne LIDAR has obtained more and more attention, especially in the field of 3-D city modeling, surveying and mapping. Laser Scanner Point Clouds strip adjustment plays a very important role in the processing and application of Airborne LIDAR. In this paper, some conventional algorithms of the airborne laser scanner point clouds strip adjustment are reviewed and contrasted, then a new method using the photogrammetric images and relative information such as the EOP (exterior orientation parameters) and IOP (interior orientation parameters) and VLL (Vertical Line Locus) based on object space matching method is introduced. A certain dataset which contains two strips of laser point clouds and the same region photogrammetric images is used to implement the algorithm. The result of experiment validates this method and future work and research direction is discussed. [C4337]

"A study of land subsidence with PS-InSAR method based on wavelet phase analysis"

By estimating the phase information of stable natural reflectors or permanent scatterers of a set of SAR images, Persistent Scatterers for SAR Interferometry (PSInSAR) can be used to obtain the land subsidence information at millimeter level while the serious noises of multi-temporal SAR images which make it difficult. In this study, we study the influence of PS-InSAR method based on wavelet phase analysis to the PSs selection and surface deformation monitoring. We then use the method to process ENVISAT SAR images covering Jiaying city in Zhejiang province in China. The experiment results have shown its effectiveness. [C4338]

"Statistical characterization and modeling of high resolution COSMO/SkyMed SAR images over urban areas"

As less attention has been devoted to land scattering in high-resolution SAR, especially satellite image, a comprehensive statistical analysis of COSMO/SkyMed SAR data is carried out in this paper. The images of different land types (such as bare soil, grassland, water, forestland, urban area and farmland) are analyzed by means of histogram, kurtosis and covariance estimation. As the experimental data over urban areas show impulsive characteristics that correspond to underlying heavy-tailed distributions which are clearly non-Rayleigh, some alternative distributions have been suggested and discussed such as the Weibull, lognormal, Gamma and K-distribution. Furthermore, the Alpha-stable distribution is introduced for modeling SAR images over urban areas. And by comparing with other amplitude distribution models, its performance is demonstrated to be better than others. [C4339]

"Gain allocation in proportionate-type NLMS algorithms for fast decay of output error at all times"

In this paper, we propose three new proportionate-type NLMS algorithms: the water filling algorithm, the feasible water filling algorithm, and the adaptive mu-law proportionate NLMS (MPNLMS) algorithm. The water filling

algorithm attempts to choose the optimal gains at each time step. The optimal gains are found by minimizing the mean square error (MSE) at each time with respect to the gains, given the previous mean square weight deviations. While this algorithm offers superior convergence times, it is not feasible. The second algorithm is a feasible version of the water filling algorithm. The adaptive MPNLMS (AMPNLMS) algorithm is a modification of the MPNLMS algorithm. In the MPNLMS algorithm, the parameter μ of the μ -law compression is constant. In the AMPNLMS algorithm the parameter μ is allowed to vary with time. This modification allows the algorithm more flexibility when attempting to minimize the MSE. Compared with several feasible algorithms, the AMPNLMS algorithm has the fastest MSE decay for almost all times. [C4340]

"Optimal and suboptimal micro-Doppler estimation schemes using carrier diverse Doppler radars"

Carrier diverse radars employing two different frequencies, termed as dual-frequency radars, prove effective in determining the target range in urban sensing and through-the-wall applications. In this paper, we derive the maximum likelihood (ML) estimator for the dual frequency radar returns for a micro-Doppler motion profile, which is commonly exhibited by indoor moving targets. Unlike linear models, the respective ML estimator does not have a closed form. We solve the ML estimator for dual frequency radar operations, using iterative reweighted least squares (IRLS). The ML-IRLS algorithm is applied to experimental radar returns for estimating the motion parameters of indoor targets. [C4341]

"Compressive sensing for MIMO radar"

Multiple-input multiple-output (MIMO) radar systems have been shown to achieve superior resolution as compared to traditional radar systems with the same number of transmit and receive antennas. This paper considers a distributed MIMO radar scenario, in which each transmit element is a node in a wireless network, and investigates the use of compressive sampling for direction-of-arrival (DOA) estimation. According to the theory of compressive sampling, a signal that is sparse in some domain can be recovered based on far fewer samples than required by the Nyquist sampling theorem. The DOA of targets form a sparse vector in the angle space, and therefore, compressive sampling can be applied for DOA estimation. The proposed approach achieves the superior resolution of MIMO radar with far fewer samples than other approaches. This is particularly useful in a distributed scenario, in which the results at each receive node need to be transmitted to a fusion center for further processing. [C4342]

"Iterative target detection approach for Through-the-wall Radar Imaging"

We consider the problem of target detection in Through-the-wall Radar Imaging when no a priori knowledge about the image statistics is available. An iterative approach which adapts itself to the unknown image statistics and thus allows for automatic target detection is presented. Two variants, based on 2D median filtering and morphological operations, are described in details. The proposed detection schemes are tested using experimental data, considering the problem of 3D reconstruction of a scene hidden behind a concrete wall. [C4343]

"Quantizer noise benefits in nonlinear signal detection with alpha-stable channel noise"

Two new theorems show how deliberately adding quantizer noise can improve statistical signal detection in array-based nonlinear correlation detection even in the case of infinite-variance alpha-stable channel noise. The first theorem gives a necessary and sufficient condition for such quantizer noise to increase the detection probability for a fixed false-alarm probability. The second theorem shows that the array must contain more than one quantizer for a stochastic-resonance noise benefit and that the noise benefit improves in the small-quantizer noise limit as the number of array quantizers increases. It further shows that symmetric uniform quantizer noise gives the optimal noise benefit among all symmetric scale-family noise types. [C4344]

"Recursive errors-in-variables approach for ar parameter estimation from noisy observations. Application to radar sea clutter rejection"

AR modeling is used in a wide range of applications from speech processing to Rayleigh fading channel simulation. When the observations are disturbed by an additive white noise, the standard least squares estimation of the AR parameters is biased. Some authors of this paper recently reformulated this problem as an errors-in-variables (EIV) issue and proposed an off-line solution, which outperforms other existing methods. Nevertheless, its computational cost may be high. In this paper, we present a blind recursive EIV method that can be implemented for real-time applications. It has the advantage of converging faster than the noise-compensated LMS based solutions. In addition, unlike EKF or Sigma Point Kalman filter, it does not require a priori knowledge such as the variances of the driving process and the additive noise. The approach is first tested with synthetic data; then, its relevance is illustrated in the field of radar sea clutter rejection. [C4345]

"Multidimensional Unitary Tensor-ESPRIT for non-circular sources"

Recently, many authors have shown that high-resolution parameter estimation schemes can be significantly improved if the sources are non-circular. For example, enhanced versions of root MUSIC and standard ESPRIT for non-circular sources as well as the entirely real-valued NC unitary ESPRIT algorithm have been proposed. We can achieve further enhancements in the R-dimensional (R-D) case by using tensor algebra to express and manipulate multidimensional signals in their natural R-D structure. This has led to tensor-based parameter estimation algorithms with enhanced estimation accuracy such as R-D unitary tensor- ESPRIT. In this paper we demonstrate how to achieve both benefits at the same time. This is not straightforward since the usual method to exploit non-circular sources destroys the tensor structure and therefore a new approach had to be found. This approach allows us to derive the NC R-D unitary tensor-ESPRIT algorithm which exploits the non-circularity of the sources and the R-D structure of the measured signals jointly. Numerical computer simulations demonstrate the benefit in terms of a significantly improved accuracy compared to state of the art algorithms. [C4346]

"A near optimum detection in alpha-stable impulsive noise"

Alpha stable distribution has gained much attention due to its generality to represent heavy-tailed and impulsive interference. In such non-Gaussian interference, the detection key is to evaluate the zero-memory nonlinearity (ZMNL) function of locally optimal (LO) detector. Unfortunately, there is no closed form expression for the probability density function (PDF) of alpha-stable distributions. Hereby, sub-optimum ZMNL function is adopted as an unavoidable approximation, such as classical Cauchy and Gaussian-tailed ZMNL (GZMNL). In this paper, an algebraic-tailed ZMNL (AZMNL) with a concise form is proposed. Based on such ZMNL, derived detector has near optimal performance in various impulsive noise environments. Furthermore, using Bi-parameter CGM (BCGM), a concise approximate expression for PDF of symmetric alpha-stable (SalphaS) distribution, the test threshold can be evaluated according with preset false alarm ratio easily. [C4347]

"Generating matrix of discrete Fourier transform eigenvectors"

This paper provides a novel method to obtain the eigenvectors of discrete Fourier transform (DFT), which are accurate approximations to the continuous Hermite-Gaussian functions (HGFs). The proposed method uses a generating matrix and an initial eigenvector. By multiplying the initial eigenvector with the generating matrix, we can derive a new eigenvector. Repeating this procedure we can acquire all the eigenvectors. Compare with the conventional $O(N^3)$ commutative matrix method, this new method can generate all the DFT eigenvectors with complexity reduced to $O(N^2 \log N)$. The generating matrix can be further used to intensify the conventional commuting matrix. The simulation result shows that the Hermite-Gaussian like (HGL) eigenvectors of the strengthened commuting matrix outperform those of Santhanam's. [C4348]

"New polarimetric signal subspace detectors for SAR processors"

This paper deals with three new polarimetric SAR processors based on subspace detectors. These algorithms aim at using models with physical and polarimetric scattering properties not exploited by the isotropic point model. These processors are implemented by computing the corresponding target subspaces. Results on simulated data with realistic targets show the interest of these new processors. [C4349]

"Robust target localization in moving radar platform through semidefinite relaxation"

Accurate target localization is an important task in various commercial and military applications. One way to achieve this goal is to use the time-of-arrival (TOA) or time-delay-of-arrival (TDOA) information observed at multiple distributed sensors. On the other hand, there is a great need to use moving sensors to form a radar platform with synthetic apertures. In this paper, we consider the problem of target localization based on the range information estimated from two-way time-of-flight (TW-TOF) at multiple synthetic array locations, where the position of these synthetic array locations is subject to certain random errors. The nonconvex estimation problem is approximated by a convex optimization problem using the semidefinite relaxation (SDR) approach. Simulation results show that the proposed estimator provides mean square position error performance close to the Cramer-Rao lower bound. [C4350]

"Array interpolation based on Local Polynomial Approximation with application to DOA estimation using weighted MUSIC"

The problem of direction-of-arrival (DOA) estimation using an array of sensors has received much attention for more than 3 decades. This is due to a rich interest from application areas such as radar, sonar and wireless communication channel characterization. However, high resolution DOA estimation requires an accurate model of

the array response. This is usually achieved by measuring the response using sources at known positions (calibration). This paper considers interpolation of the calibration measurements using knowledge of a nominal response model. Standard linear interpolation is compared to an approach based on local polynomial approximation (LPA). We also derive a weighted MUSIC estimator, which is applied using error estimates from the interpolation. Both LPA interpolation and weighted MUSIC are found to improve the performance, but not uniformly in all scenarios. [C4351]

"Subspace based DOA estimation in the presence of correlated signals and model errors"

High-resolution subspace based direction-of-arrival (DOA) estimation requires a number of assumptions about the signal and antenna. In our application automotive radar, among many practical problems, signals are often correlated and the antenna is not calibrated. This difficult combination has been seldom addressed in the literature. In this paper, we study their simultaneous impact on DOA estimation, describe a so called incoherent model error interference phenomenon, propose a prewhitening scheme for algebraic subspace based DOA estimation, and show some simulation results. [C4352]

"Hands-on engineering and science: Discovering cosmic rays using radar-based techniques and mobile technology"

This paper reports on the latest efforts of the MARIACHI program at Stony Brook University, a unique endeavor that detects and studies ultra-high-energy cosmic rays. This is done by using a novel detection technique based on radar-like technology and traditional scintillator ground detectors. Using the phenomena of cosmic rays and meteors as vehicles to motivate research and educational activities, innovative hands-on modules in physics, engineering and cyberinfrastructure based on a learning by doing philosophy are offered to high school teachers and students. Participants at all levels are engaged in research projects, seminars, and workshops, where they will learn to use tools needed in MARIACHI by means of mobile technology. [C4353]

"Optimal inference of the inverse Gamma texture for a compound-Gaussian clutter"

We first derive the stochastic dynamics of a Gaussian-compound model with an inverse gamma distributed texture from Jakeman's random walk model with step number fluctuations. Following a similar approach existing for the K-distribution, we show how the scattering cross-section may be inferred from the fluctuations of the scattered field intensity. By discussing the sources of discrepancy arising during this process, we derive an analytical expression for the inference error based on its asymptotic behaviours, together with a condition to minimize it. Simulated data enables verification of our proposed technique. The interest of this strategy is discussed in the context of radar applications. [C4354]

"Instantaneous frequency rate estimation for high-order polynomial-phase signal"

For a high-order polynomial-phase signal (PPS), instantaneous frequency rate (IFR), which is defined as the second derivative of the phase, is estimated by using an estimator with only a second-order nonlinearity. Compared to high-order phase function (HPF), the proposed IFR estimator presents improved performance including smaller mean-squared error (MSE) and lower SNR threshold. Statistical analysis via a multivariate first-order perturbation analysis is derived for the estimate bias and MSE. Numerical results verify our analytical results. [C4355]

"Unimodular sequence design for good autocorrelation properties"

Unimodular (i.e., constant modulus) sequences with good autocorrelation properties are useful in several areas, including communications, radar and sonar. The integrated sidelobe level (ISL) is often used to express the goodness of the autocorrelation properties of a given sequence. In this paper, we present several cyclic algorithms for the local minimization of ISL-related metrics. To illustrate the performance of the proposed algorithms, we present a number of examples including the design of sequences that have virtually zero autocorrelation sidelobes in a specified lag interval, and of long sequences that could hardly be handled by means of other algorithms previously suggested in the literature. [C4356]

"Reduced-complexity delay-Doppler correlator for time-frequency hopping signals"

The delay-Doppler correlator is most commonly used for target detection in a radar system. It is essentially a two-dimensional filter matched to the hypothesized delay and Doppler shifts of echoes reflected from the illuminating signal. More recently, it has been applied in communication to the detection of signature sequences generated from artificially introduced time-frequency shifts of a base sequence. In this paper, we derive a computationally efficient delay-Doppler correlator for a class of time-frequency hopping waveforms that can be

represented by segments of equal-length sinusoids. These sequences can be found in applications such as continuous waveform radar and device identification in wireless communication. By applying sliding discrete Fourier transform and exploiting the structure of the waveform, the number of multiplications required for evaluating the entire delay-Doppler range can be reduced by a factor equaling the length of the sequence.

[C4357]

"Cancellation of range ambiguities with block coding techniques"

This paper presents radar signaling schemes for cancellation of late time arriving echos. Signal reflections arriving delayed at the radar when the radar has already emitted a next pulse result in range ambiguities and materialize as potential false targets. In this work we propose pulse block coding techniques to distinguish echo reflections originating through the recently emitted pulse and those impending from subsequent pulses. The methods introduced require only simple matched filtering operations at the receiver and permit usage of arbitrary waveforms with potential for waveform diversity gains. [C4358]

"Optimized detection of spatially extended fixed objects in clutter"

Range-spread Doppler-spread signals in interference are readily discernable via the application of classical algorithms and architectures presented by Van Trees [1], and more recently by Kay [2] and others. However, when these returns emanate from stationary objects, the Generalized Inner Product (GIP) offers a unique tool for detection and discrimination processing. This paper offers insight into how the GIP may be applied to optimize the detection of spatially extended fixed objects in clutter. [C4359]

"A new multi-beam forming method for large array"

The conventional multi-beam forming is performed at the element or subarray level. With the former it is not feasible for cost and complexity reasons to process all array element outputs individually. With the latter it is perfect to form singular beam but not perfect for multi-beam. In this paper combining pattern synthesis with spatial interpolation a multi-beam forming method is proposed. The new method can not only achieve multiple beams in arbitrary direction, but also avoid processing all array element outputs individually. Consequently, the proposed method is applicable in practice. Simulation results show that the new method is effective for the multi-beam forming of a large array. [C4360]

"A transmitting wideband DBF algorithm based on time-domain filter"

A novel transmitting wide DBF algorithm based on time-domain filter is presented in this paper. The mature FIR filter was used to form transmitting wideband digital beam in time domain. The signal with continuous phase cannot be transmitted by frequency-domain algorithm. The right beam direction in non-reference frequency point couldn't get by adaptive filter algorithm. Many flaws in traditional method can be overcome by the method in this article. Finally, the practicability and validity of the proposed algorithm were proved by computer simulation.

[C4361]

"MIMO radar angle-range-Doppler imaging"

Through waveform diversity, multiple-input multiple-output (MIMO) radar can achieve higher resolution and better sensitivity to slowly moving targets than phased-array radar systems. Furthermore, with a MIMO antenna array, the linear independence of reflected signals from scattering points allows for the direct application of adaptive array processing techniques. High levels of noise and strong clutter presence, however, significantly worsen detection performance. The iterative adaptive approach (IAA), a non-parametric and user parameter-free weighted least-squares algorithm, was recently shown to offer improved resolution and interference rejection for array processing applications. In this paper, we extend IAA to perform angle-range-Doppler imaging using a MIMO radar system. We furthermore demonstrate the superior performance of a MIMO radar system compared to a single-input multiple-output (SIMO) radar system. [C4362]

"Fast Detection of Moving Targets by Focusing in UWB low frequency SAR"

Moving target detection in ultra-wideband (UWB) low frequency synthetic aperture radar (SAR) is associated with long integration time and has to handle azimuth focusing for reliable detection. This paper presents the theory and simulation results of the fast detection of moving targets by focusing method (FDMTF) which is understood as the detection of moving targets by focusing method (DMTF) incorporating fast time-domain algorithms in the process. Two fast time-domain algorithms fast backprojection (PBP) and fast factorized back-projection (FFBP) are considered. The results show that FDMTF performs very efficiently and still retains the ability of detection. [C4363]

"Passive coherent locator signal processor on IBM Cell broadband engine (Cell BE)"

The passive coherent location system described by Howland et al. (2005) is taken as a case study to demonstrate the Cell BE processor capabilities in signal processing applications; we implemented the whole processing chain on a single blade achieving interesting performances. [C4364]

"Surface echo reduction by clutter simulation, application to the Marsis data"

Low frequency spaceborne radar is a promising opportunity to investigate Earth subsurface in arid and polar areas and for planetary exploration. The radar signal penetrates subsurface and the return signal is the sum of the surface clutter and the subsurface signal that is the signal of interest. In this paper, we describe the simulation of the surface clutter. This signal consists of two parts: electromagnetic waves scattered and one coherently reflected by the surface. Both components are jointly simulated using facet method and an elevation model. So, the method is applied to the Marsis radar experiment. The surface description (elevation model) is based on the Mola data while the simulation parameters are optimized using the instrument characteristics. The comparison of the real data with the simulated clutter allows discrimination of subsurface echoes. This comparison demonstrates the method efficiency and is the base for Marsis data interpretation. Some general conclusions concerning the simulations for other radars will be drawn. [C4365]

"Novel architecture for hardware efficient FPGA implementation of real time configurable "variable point FFT" using NIOS II™"

Signal processor forms the heart of the radar subsystems and is responsible for the discernment of targets from interfering clutter and improving the SNR of the received signal for better detection of targets. Doppler filter bank is one of the modules used in signal processor to extract the Doppler information from the target, to improve the SNR and it also provides information regarding target velocity. In this paper we present a novel and simple architecture to perform hardware efficient real time configurable "variable point FFT" using NIOS II trade. The architecture can be used in multiple scan rate radars to reduce the resource utilization which can be used for other additional processing features. The architecture is generic in nature and can be extended to other platforms besides FPGA. [C4366]

"Block Least Mean Squares processing of noise radar waveforms"

Noise radars usually employ correlation processing of waveforms. However, vulnerability to clutter is a serious disadvantage of this approach. This paper considers using Least Squares (LS) based methods. In particular, highly efficient Block Least Mean Squares (Block LMS) algorithm is studied in details. The formula for integration gain of Block LMS is derived. Compared to analogue quantity for correlation processing, it shows significant advantage of the proposed solution in terms of robustness to clutter. The Doppler response of the algorithm is analyzed, which-under proper choice of algorithm parameters-is identical to that of correlation approach. Simulation experiments confirm that when heavy clutter is present, the proposed method outperforms correlation processing significantly. [C4367]

"Technology intercepts for the S-APAS architecture"

The implementation of the S-APAS (Scalable Multifunction Radio Frequency-Active Phased Array System) concept requires the use of autonomous T/R modules connected to a common digital bus. The T/R modules have the functions of radiating energy in the radar space, collecting the relative returns and exchanging data and commands with the processing/control blocks. The technological aspects related to producing a T/R module, that is flexible and cheap enough to be used in different radar systems, at least within the same operating band, have been analyzed in previous papers. Further aspects derived from the S-APAS architectural concept have been considered here, in order to find the right intercepts with available technologies and with new technologies under development. In particular, the transmitter performance, the bus throughput and the performance of the data/ signal processing blocks are among the most critical items, to be analyzed carefully. This paper defines the dimensioning criteria for the proposed architecture in a number of cases related to different applications at different operating frequencies, defines the basic design principles and discusses the results, with respect to the above parameters, in order to find the technological constraints related to the physical implementation of the S-APAS architectural concept. The study is limited to applications with operating frequencies ranging from L band to X band, but the results can be easily extended to other frequencies of interest. [C4368]

"The Global Road Extraction Approach from Synthetic Aperture Radar Images"

The extraction of road networks from synthetic aperture radar imagery is of fundamental importance for

geospatial applications. The methods basically go through the steps such as road sharpening, road finding, road tracking and road linking. In this paper, a new global approach to road detection that is motivated by Kohonen neural network is proposed. It makes the joint of the roads more fluent and reduces detection errors. The computer simulation results show the highest extraction quality from the real SAR images. [C4369]

"Response of polar format algorithm to moving target with consideration of wavefront curvature"

The synthetic aperture radar (SAR) signatures of moving target are the basis of ground moving target detection and imaging (GMTI&Im). However, previous studies are mainly focused on the influence of target's motion on phase history; and little work has been done to investigate the signatures of moving target after the application of a particular SAR image formation algorithm. In this paper, we derive the image spectrum of moving target after polar format algorithm (PFA) processing. Based on this image spectrum, detailed analysis on the SAR signatures of moving target, including the geometric displacement, residual range migration, range and azimuth defocusing are performed. Simulation results validate the theoretical analysis. [C4370]

"Spatial, temporal, and spectral aspects of radar data"

We develop a linearized imaging theory that combines the spatial, temporal, and spectral aspects of scattered waves. We consider the case of fixed, distributed transmitters and receivers, and a general distribution of objects, each undergoing linear motion; thus the theory deals with imaging distributions in phase space. We derive a model for the data that is appropriate for any set of waveforms, and show how it specializes to familiar results when the targets are far from the antennas and when narrowband waveforms are used. [C4371]

"Application of the frequency-domain synthetic bandwidth approach in Polar Format Algorithm"

The problem of wide bandwidth management in current ultra-high resolution spotlight SAR systems could be solved by adopting stepped chirps and utilizing synthetic bandwidth approach. High resolution SAR image formation is a non-separable 2-D impulse compression processing, so the synthetic bandwidth procedure should be modified correspondingly with the image formation algorithm adopted. This paper demonstrates the application of frequency-domain synthetic bandwidth approach in SAR Polar Format Algorithm (PFA). The problem of motion compensation between the subpulses within a burst is discussed, and the signal processing flows are investigated in detail. The presented approach is validated by point target simulation. [C4372]

"From AESA radar to digital radar for surface-based applications"

This paper describes how Thales surface radar product policy is evolving from active electronically steered antenna (AESA) radar to digital radar in order to improve its capabilities when operating in challenging electromagnetic environments. It shows how digital receiver technology (with an analogue-to-digital converter behind every receive antenna element) tailored for the digital beam forming array application is a key enabling technology for enhancing the detection of radiofrequency signals of interest mixed with strong interference. After a description of the architecture and packaging design choices, some recent developments of digital tile receivers in S band are presented. Examples using digital technology are given including M3R, GM400 and SM400. The conclusion focuses on future perspectives in digital radar technology. [C4373]

"Reconstruction of constant envelope signals with given Fourier transform magnitude"

In this paper, we consider the problem of reconstructing a signal with constant envelope property in the time domain from its Fourier transform magnitude. The constant envelope property makes the signal reconstruction problem difficult. In this context, several convex-set like signal properties are used to generate projection based iterative reconstruction algorithms possessing error reduction property. [C4374]

"STAP performance analysis for MIMO radar with waveform diversity"

This paper studies the waveform effect on the space time adaptive processing (STAP) of multiple-input multiple-output (MIMO) radar systems. A general signal model based on waveform diversity is constructed for MIMO STAP. System sensitivity and optimal adapted pattern are investigated according to waveform diversity. These studies show how the MIMO STAP performance is affected by waveform diversity, based on which we can do better trade-off to balance the system performance under different conditions. [C4375]

"Experimental study of extended target imaging by time reversal SAR"

Conventional SAR images under rich scattering suffer degradation because of ghost images caused by multipath propagation. In this paper, we develop a time reversal SAR (TR-SAR) imaging algorithm for extended (nonpoint-

like) targets in rich multipath scattering. We test the TR-SAR algorithm using experimental electromagnetic data collected in a laboratory environment where the extended target (a galvanized steel sheet) is surrounded by a large amount of PVC rods. Our experiments show that the collected EM data in frequency and aperture after TR-SAR processing produces a higher resolution, cleaner target map compared with conventional SAR images.

[C4376]

"UHF Radar Designed for Inshore Wave Watcher and Ocean Power Application"

This paper presents a remote sensing method for the measurement of inshore wave energy, which can be used for the investigation of some regional coast for building wave power plants and monitoring the waves near dykes. It is designed to operate at UHF channel, and it is a portable and low power system, it can measure the movement of sea surface simultaneously without probing into the water. The field test on the beach of Zhujiajian Island proved that the system can be used successfully.

[C4377]

"Image distance based ship detection using SAR images"

A novel method is developed for ship detection in synthetic aperture radar (SRA) images, which is based on image distance computation techniques. Using a second-order hidden Markov mesh model to learn statistical models of images, one can obtain the distance of two images for the purpose of detecting ships. First, the features of an image can be extracted using a method that best matches its statistical model, which is related to dynamic programming. Second, given the state transition matrix and observation distributions within states, statistical distance between images based on the similarity of their statistical models can be estimated.

Experimental results demonstrate that this ship detection algorithm can effectively enhance ship target as well as suppress speckle and has better detection precision and lower calculation complexity.

[C4378]

"Study on Bifurcation and Chaos in Boost Converter Based on Energy Balance Model"

Based on boost converter operating in discontinuous mode, this paper proposes an energy balance model (EBM) for analyzing bifurcation and chaos phenomena of capacitor energy and output voltage when the converter parameter is varying. It is found that the capacitor energy and output voltage dynamic behaviors exhibit the typical period-doubling route to chaos by increasing the feedback gain constant K of proportional controller. The accurate position of the first bifurcation point and the iterative diagram of the capacitor energy with every K can be derived from EBM. Finally, the underlying causes for bifurcations and chaos of a general class of nonlinear systems such as power converters are analyzed from the energy balance viewpoint.

Comparing with the discrete iterative model, EBM is simple and high accuracy. This model can be easily developed on the nonlinear study of the other converters.

[C4379]

"Study on Sine Waveform Inverter Based on S-Domain Repetitive Control"

The key of the sine waveform inverter design is to assure the quality and stability of its output waveform, as well as the adjusting ability to different kinds of loads. The repetitive control technology is used in this paper to realize the periodic signal tracking control of the sine waveform inverter, and a new method of stability analysis and design of repetitive controlled sine waveform inverter is also proposed. Analog repetitive controller is realized by using analog delay chip MN3304, and repetitive control for the single phase sine waveform controller is researched. The experiment results show that this method is valid.

[C4380]

"Multiobjective tuning of a multitarget tracking algorithm using an evolutionary algorithm"

Multitarget tracking MTT algorithms have been tuned by a variety of optimization methods using a single objective, but only recently have they been tuned with multi-objectives technique. The desire to compare single-objective MTT algorithms using numerous metrics is well documented in the literature for over a decade. We discuss an experiment to quantify the need or lack of need for Monte Carlo (MC) runs in tuning the parameters of a MTT algorithm using some of these metrics. The extreme computational requirement of running a MTT MC experiment for each individual evaluation function drives the need to determine the worth of doing so. The results of using a single run are compared to that of using a MC evaluation with multiple runs as compared to a multiobjective evolutionary algorithm approach. Additional analysis is performed on the search space demonstrating other useful information the decision maker may use to select an optimal operating point from a calculated Pareto front.

[C4381]

"Radar-based measurements of periodic movements"

In this work, the continuous wavelet transform (CWT) is used to analyze periodic motions, measured by contactless Doppler radar, which have small amplitudes, drifting frequencies and dropouts. Using a classical

method like fast Fourier transform (FFT) for periodic signals results in loss of the time behavior of the signal, drifting frequencies and dropouts, causing distortion in the frequency peaks of the FFT signal. An alternative is the short-time Fourier transform (STFT), also known as *windowed FFT* (WFFT), where additional time information is obtained by sequential time shifted windowing of the input signal, but the fixed window size limits its time-frequency resolution. The wavelets of the CWT have frequency dependent sizes, permitting the CWT to have an optimal time-frequency resolution. This enables the identification and tracking of the frequency, as well as detecting dropouts of the signals. [C4382]

"System level integration of handheld wireless non-contact vital sign detectors"

An integrated non-contact vital sign detector for handheld applications is demonstrated. The detector includes a radio frequency transceiver, baseband analog circuits, and a baseband signal processor. The RF transceiver transmits a continuous RF signal toward the subject and receives the reflected signal. The direct conversion receiver chain down-converts the received signal to baseband and the baseband analog circuit further amplifies and level-shifts the output. The signal processor performs spectrum analysis on the baseband signal. The baseband signal processor is realized by an ARM7TDMI microprocessor. Key algorithm of the spectrum analysis is described in detail. Experiments were performed with two subjects, a human subject and an actuator moving in two-tone motion. Results were analyzed to verify the accuracy of the detection. The guideline on selecting sampling frequency for different applications is described. [C4383]

"Optimization of a low noise amplifier in UWB band"

New technologies tend to improve our everyday life and to make it easier and this is shown especially within the framework of the medical analyses where the doctor always seeks the ease of its patient. In this context, a radar UWB was designed in order to extract, remotely and without any direct contact by electrodes, the rate of heartbeat of a patient. This radar contains a transmitting part and another receiving where we study the reception antenna and the LNA. [C4384]

"Software development for the prediction of interferences in wind farms"

One of the environmental effects of wind farms is that they wind turbines act as scattering devices of the electromagnetic RF waves and thus, may cause interferences to different telecommunication services around them. A software application that has been developed to predict the interference caused by wind farms to TV broadcast service is presented in this paper. An extension of the RCS model of a wind turbine, adding a scattering model of the nacelle, is shown. The developed software is explained, along with different measurements carried out to adjust and validate the functionality of the software. [C4385]

"Systolic array implementations for real time enhancement of remote sensing imaging"

In this paper, we propose a hardware/software (HW/SW) co-design approach for near real time implementation of high-resolution reconstruction of remote sensing (RS) imagery using systolic arrays as coprocessors. The proposed design is based on a field programmable gate array (FPGA) and implements the image enhancement/reconstruction tasks in an efficient concurrent processing architecture with systolic arrays that meets the (near) real time imaging systems requirements in spite of conventional computations. The software design is aimed at the algorithmic-level decrease of the computational load of the large-scale SAR image enhancement tasks. The innovative algorithmic idea is based on the concept of descriptive regularization (DR) approach. Finally, we report and discuss the results of the hardware/software co-design implementation in a Xilinx Virtex-4 XC4VSX35-10ff668 for reconstruction of large scale real world RS images of 512 times 512 pixel format. [C4386]

"Cognitive Node Selection and Assignment Algorithms for Weighted Cooperative Sensing in Radar Systems"

For the radar spectrum to be shared efficiently a good sensing capability within a secondary cognitive communication system is required. In this paper, the swept radar's rotation mechanism is explored to improve the sensing performance. Several node teaming algorithms are proposed for cooperative sensing along with the use of weighted sensing algorithms in a swept radar scenario. These teaming algorithms are considered in respect of the mobile team node selection and the sensing task assignments of the team nodes. Performance results show that selecting appropriate sensing nodes to join the sensing-active team in different sensing cycles and exploring their frequency diversity (to perform the sensing task at the most suitable frequency subchannels), yields a substantial improvement in performance. In addition, it is illustrated that proper node teaming algorithms should be chosen based on several key factors, including the characteristics of the primary signal and the sensing team node's computational capabilities. [C4387]

"Adaptive cruise control for an intelligent vehicle"

In this research, an adaptive cruise control system is developed and implemented on an AIT intelligent vehicle. To develop the adaptive cruise control system, the original throttle system and braking system of the vehicle have to be modified. The original throttle valve which is controlled by a cable from the accelerator pedal is modified to the drive-by-wire system by using a dc motor with a position control algorithm. The braking system is modified by using a dc servo motor to directly control the brake pedal. A proportional and derivative control with error compensation algorithm is proposed to perform the velocity control mode. In the distance control mode, a fuzzy logic algorithm is applied. Inputs of the fuzzy controller are distance error and relative velocity read from a laser range finder. The experiments on a racing circuit show that the vehicle can perform adaptive cruise control efficiently. [C4388]

"Experience of AMR systems based on BPL in China"

With the energy reduction become more and more popular, power company need to build AMR system to improve energy efficiency. Many AMR systems around the world have used PLC as communication channel and it's the same in China. BPL technology has become more mature, and it's reliability, stability and practicality has been verified in a number of field trial which shows great potential in the future market. This paper introduces the status of AMR in China at first, and shows two typical application cases of AMR system based on BPL, and also describes the perspective of this solution. The use of BPL technology in AMR system laid the foundation of smart grid in the future. [C4389]

"A New Control Strategy for Voltage-Type PWM Inverter to Realize Zero Steady-State Control Error"

In this paper, a new simple control strategy for the output voltage of voltage-type pulse width modulation (PWM) inverter which can eliminate the steady-state control error completely is proposed. In the proposed control system, a resonant element implemented by a digital signal processor (DSP) is introduced as a feedback controller. The resonant element exhibits a function similar to an integrator for the fundamental frequency component. Thus, it can eliminate the steady-state control error completely. The principle of the proposed control method is discussed, and its effectiveness is shown theoretically. To confirm the effectiveness of the proposed control method, some simulation testing are shown. [C4390]

"Sea Wind Power Energy Evaluation by HF Radar System"

This paper presents a remote sensing method for wind energy measurement and evaluation on sea surface, which can be used for the investigation of wind farm. It provides a valid proof for building wind plants or monitoring wind farms on the sea surface. The wind speed and direction can be derived from radar echo spectrum as well as wind profile, and it can cover a large area (thousands of square-kilometers) and measure wind simultaneously. It provides a real-time, all-weather remote sensing measurement and it is a new method for wind evaluation comparing to conventional methods. [C4391]

"Strategy on Eliminating Transformer Bias Magnet in Push-Pull Forward Converter"

In this paper, voltage loop and peak-value current loop are used to control a high power DC/DC converter, one strategy on eliminating transformer bias magnet is proposed, 3 kw push-pull converter is designed and MATLAB is applied to verify the strategy on eliminating the transformer bias magnet. The strategy has already been used in some converter with low voltage input. [C4392]

"Power Distribution System Design for a FPGA-Based Ground-Penetrating Radar Receiver"

Power distribution system (PDS) development of compact, low-cost ground penetrating radar (GPR) receiver based on field programmable gate array (FPGA) environment is presented. Four key steps of PDS design: transient current, target impedance calculation; bypass capacitor determination; voltage regulator module (VRM) design and inter-planar capacitance calculation are discussed in detail. The design and fabrication process of PDS as well as FPGA-based GPR receiver board are introduced. The frequency spectrum of designed PDSs and data capture experiment results demonstrated that the PDS and other critical hardware components on the receiver are fully functional. [C4393]

"Research of Supercapacitor Voltage Equalization Strategy on Rubber-Tyred Gantry Crane Energy Saving System"

A model for supercapacitor voltage equalization strategy is analyzed, and on this basis a supercapacitor voltage equalization method for rubber tyred gantry crane (RTG) energy saving system is proposed, namely active voltage equalization method based on buck-boost converter. The equalizing speed of the proposed method is fast. Firstly, the working principle and process of the voltage equalization circuit is analyzed in detail. In addition, design of active voltage equalization circuit parameters and control strategy are given. Finally, simulation analysis of the series connection of super-capacitors module is performed. Results show that this method for equalizing voltage can avoid over-voltage of each cell and possess practicable and high value for supercapacitor RTG energy saving system. [C4394]

"Space-time-range three dimensional adaptive processing"

Space-time adaptive processing (STAP) is an effective tool for moving target detection. Conventional STAP methodologies process the angular and Doppler two dimensional data vector. In practical applications, adjacent range cells are statistically dependent due to filtering, since the point spreading function of a target is not an ideal delta function. In this paper, a novel approach incorporating range (fast time) information in STAP is presented for clutter rejection, which we term space-time-range adaptive processing (STRAP). This method takes advantage of the correlation information of neighboring range cells. Therefore, the stationary clutter can be suppressed better compared with traditional STAP algorithms ignoring fast time information, resulting in more effective moving target detection. The validity of the STRAP algorithm is verified by the experiments of processing the real measured data of the three-channel X-band radar and MCARM radar systems. [C4395]

"Spatio-temporal adaptive detector in non-homogeneous and low-rank clutter"

Reducing the number of secondary data used to estimate the Clutter Covariance Matrix (CCM) for Space Time Adaptive Processing (STAP) techniques is still an active research topic. Low rank CCM estimates have already been proposed but only for homogeneous and Gaussian clutter. We propose in this paper to extend the low-rank CCM methods for heterogeneous and/or non-Gaussian clutter. We derive a new detector based on low-rank techniques and exploiting properties of the Normalized Sample Covariance Matrix (NSCM). This detector is shown to exhibit a smaller SNR loss than classical STAP detectors. Moreover, the new detector has a texture-CFAR property with respect to non-Gaussian SIRV model and has more robust behavior when some targets are present in the secondary data. We also give experimental comparison results between the classical STAP detectors and the new one for STAP data. [C4396]

"Using complex-valued ICA to efficiently combine radar polarimetric data for target detection"

Target detection in sea clutter is a challenging problem in radar detection, specifically, when the Doppler return of the target and clutter are collocated. Polarization diverse radars provide additional information that enhances target detection. In this paper, we use an effective independent component analysis (ICA) approach, adaptive complex maximization of non-Gaussianity (A-CMN), to efficiently combine polarimetric radar data prior to detection. We show that A-CMN estimates the polarimetric scatter coefficients for the single target in clutter case, thereby providing matched-filter performance without the need for clutter or target models. The detection performance using ICA is evaluated with sea clutter collected with the McMaster IPIX radar off the coast of Canada. We also demonstrates the ability of this approach to adapt to the changing sea clutter conditions using simulation results. [C4397]

"Sub-band STAP for stretch processed systems"

This paper considers adaptive jammer rejection algorithms applicable to wideband stretch-processed systems. Specifically, sub-banding algorithms in which the received data is first pre-processed into narrow frequency bins are studied. In conventional sub-band STAP, the received signal is divided into narrowband frequency bins, following which the interference is adaptively rejected in each bin. This usually requires that a different weight vector be computed for each sub-band. Alternatively, the received data can be pre-processed so that every sub-band is shifted to a common central sub-band. This enables computation of a single weight vector that can be applied to all of the shifted sub-bands. Simulation results are presented to assess the behavior and performance of these algorithms. [C4398]

"Joint MIMO radar waveform and receiving filter optimization"

The concept of MIMO (multiple-input multiple-output) radar allows each transmitting antenna element to transmit an arbitrary waveform. This provides extra degrees of freedom compared to the traditional transmit beamforming approach. It has been shown in the recent literature that MIMO radar systems have many advantages. In this paper, we consider the joint optimization of waveforms and receiving filters in the MIMO radar when the prior information of target and clutter are available. A novel iterative algorithm is proposed to optimize the waveforms

and receiving filters such that the detection performance can be maximized. The proposed algorithm guarantees that the SINR performance improves in each iteration step. The numerical results show that the proposed methods have better SINR performances than existing design methods. [C4399]

"Optimal and robust waveform design for MIMO radars"

Waveform design for Target identification and classification in MIMO radar systems has been studied in several recent works. While the previous works considered signal independent noise, here we extend the results to the case where signal-dependent noise, clutter, is also present and then we find the optimum waveform for several estimators differing in the assumptions on the given statistics. Computing the optimal waveforms for MMSE estimator leads to the Semi-definite programming (SDP) problem. Finding the optimal transmit signals for CSLS estimator results in a minimax eigenvalue problem. Finally it is shown that equal power waveforms are the best transmit signals for the SLS estimator. [C4400]

"Transmit/receive beamforming for MIMO radar with colocated antennas"

We propose a new technique for multiple-input multiple-output (MIMO) radar with colocated antennas. The essence of the proposed technique is to partition the transmitting array into a number of subarrays that are allowed to overlap. Each subarray is used to coherently transmit a waveform which is orthogonal to the waveforms transmitted by other subarrays. Coherent processing gain can be achieved by designing a weight vector for each subarray to form a beam towards a certain direction in space. Moreover, the subarrays are combined jointly to form a MIMO radar resulting in higher resolution capabilities. Simulation results show the substantial improvements offered by the proposed technique as compared to previous techniques that validate its effectiveness. [C4401]

"A PARAFAC-based technique for detection and localization of multiple targets in a MIMO radar system"

In this paper, we show that the problem of detection and localization of multiple targets in a bistatic MIMO radar system can be solved by parallel factor (PARAFAC) analysis. Our method is deterministic and fully capitalizes on the strong algebraic structure of the received data, where the radar cross section (RCS) fluctuation is not regarded as a nuisance parameter but rather as a source of time diversity. Simulation results show that our technique outperforms existing beamforming-based radar imaging methods at a lower complexity. [C4402]

"Frequency invariant MVDR beamforming without filters and implementation using MIMO radar"

Frequency invariant beamforming with sensor arrays is generally achieved using filters in the form of tapped delay-lines following each sensor. However it has been recently shown that with the help of the rectangular smart antenna array, it is possible to generate frequency invariant beam pattern without using filters. In this paper, this frequency invariant beamforming technique is utilized to perform MVDR beamforming in the beamspace by designing frequency invariant beams spanning the desired range of azimuthal angles and optimally combining them. However, the performance of the frequency invariant beamformer depends on the number of sensors which could be large for a rectangular array of size M times N . Making use of the virtual array concept used in MIMO radar, a novel method of producing the same frequency invariant beam, using only M transmitting and N receiving antennas, is proposed and a design example is provided to demonstrate the idea. [C4403]

"Synthesis of Antenna Arrays Shaped-beam Using Mind Evolutionary Algorithm"

Mind evolutionary algorithm (MEA) uses dasiasimilar taxispsila operation and dasiadissimilationpsila operation by imitating the human mind evolution to processes numerical optimization, overcoming the prematurity and improving searching efficiency. Given the determinate number and space between the antenna arrays units, the feeding-back amplitudes and phases are optimized and selected by this way to make the shaped-beam patterns satisfy the designing request. Computer simulations show that Mind Evolutionary Algorithm can be applied in optimization problems of uniformly-spaced linear array and the optimization result is better than that obtained from Genetic Algorithm. [C4404]

"Image Denoising of Ground Penetrating Radar Based on Wavelet Scale Space Correlation"

Donoho and Johnstone (1994) proposed a method for threshold shrink denoising based on wavelets coefficient estimation of each isolating scale get optimal results, but the correlation of contiguous coefficients is not considered. The detail of signal will be dismissed if its coefficient is similar to noisy coefficients. a novel algorithm for ground penetrating radar (GPR) image denoising based on scale space correlation, and wavelet coefficients

energy transformation rule, is proposed to solve this problem. The results of simulation experiment and processing GPR images show that, compared with the existing denoising methods, the proposed algorithm can more effectively denoising noise in GPR image. [C4405]

"Software Architecture and Design for Airport Scene Surveillance Radar Data Processing System"

Airport scene surveillance radar has high data rate and huge echo data, and it needs to complete target tracking, data storing and displaying quickly. So the airport scene surveillance radar data processing software system is complex, it needs to support multi-sensor data fusion, distributed data services, remote control, and multi-surveillant terminals etc. Based on orthogonal software architecture, this paper proposes new software architecture: object-oriented component orthogonal architecture, and the airport scene surveillance radar data processing system was designed by this. After the system development and test, it proves that the software architecture is reasonable and applicable. [C4406]

"Analysis of Polynomial FM Signal Based on Wavelet-Reassignment Method"

Aiming on the problem of low precision and crossterm in the conventional method of in analyzing polynomial FM signal. The method that based on wavelet transform and time-frequency reassignment is proposed. Not only overcomes the contradiction between the crossterms of polynomial FM signal and the approximate time-frequency centering, but also is good at reducing noise. In this paper, the principle and application of wavelet-reassignment are summarized, and the polynomial FM signal analysis method is made based on the wavelet-reassignment and other methods. The simulation results show that the novel method has compositive advantages. [C4407]

"Parameter estimation of non-Rayleigh RCS models for SAR images based on the Mellin transformation"

The Mellin transformation-based method is developed to estimate the parameters of non-Rayleigh radar cross section (RCS) models for synthetic aperture radar (SAR) images from the observed image. Models investigated include heavy-tailed Rayleigh and Weibull. For each model, we consider the three kinds of images: intensity, square-root of intensity, and multi-look averaged amplitude. Using the Mellin transformation, we derive the analytical expressions of the first two second-kind cumulants for speckle and RCS respectively, and obtain the estimators according to the multiplicative model of SAR images and the Mellin convolution. Results of parameter estimation from Monte Carlo simulation and real SAR images demonstrate that the proposed estimators, which are easy to implement in the form of closed expressions, are efficient in estimating the parameters of non-Rayleigh RCS models from the observed SAR images. [C4408]

"Exploitation of SRTM DEM in InSAR processing and its application to phase unwrapping problem"

A novel approach is proposed in this paper to exploit the shuttle radar topography mission (SRTM) digital elevation model (DEM) in the interferometric synthetic aperture radar interferometry (InSAR) processing. The proposed algorithm includes three steps: the first step is to patch the void cells in the SRTM DEM; the second step is to determine a one-to-one correspondence between the interferogram and the SRTM DEM; the third step is to eliminate the phase trend between the original and simulated interferogram. Meanwhile this algorithm can be applied to help the phase unwrapping problem. Conventional techniques approach phase unwrapping as an optimization problem, where the total branch-cuts, or the gradient errors, etc. are to be minimized. Generally speaking, they consider phase unwrapping as a blind procedure, i.e., without any external guidance. The purpose of this paper is to fill this gap by introducing the SRTM DEM as a phase unwrapping guidance. Some experimental results with JESR verify our theoretical analysis and show that our method can improve the performance of the phase unwrapping to a great degree. [C4409]

"Optimal geometry configuration of bistatic forward-looking SAR"

With appropriate geometry configurations, bistatic Synthetic Aperture Radar (SAR) can break through the limitations of monostatic SAR on forward-looking imaging. With such a capability, bistatic forward-looking SAR (BFSAR) has extensive potential applications. In this paper, based on the resolution calculation using gradient theory, we give a general rule to determine the optimal geometry configuration of different modes of BFSAR. The results can be used to design BFSAR flight campaign and measure the performance of a specific BFSAR system. [C4410]

"Phase unwrapping for interferometric SAR using multibaseline joint data group"

Phase unwrapping is the key problem in building the digital elevation model (DEM) of a scene from

interferometric synthetic aperture radar (SAR) system data. In this paper, we propose a method of phase unwrapping based on the model of the multibaseline joint data group. The method can not only adaptively coregister the SAR images, but also accurately provide the accurate estimation of the terrain unwrapped phase in the presence of the large coregistration errors. Moreover, the improvement in computational complexity is achieved by using the multibaseline joint data group. The method is investigated by simulations, and results show successful phase unwrapping even if the image coregistration error is close to one pixel. [C4411]

"Compressed sensing and multistatic SAR"

We demonstrate that the remarkable advantages of compressed sensing remain in force when the information operator is constrained to obey the physical rules of a multistatic SAR measurement. The design guidelines of the SAR information operator for lscr2reconstructions is compared to those provided for generic lscr1reconstructions. We report little or no degradation in compression performance when using an information operator obeying SAR sampling constraints. Simulations for a Shepp-Logan image show an image is faithfully reconstructed when the number of measurements is about a third of the number of image pixels, using a minimum total-variation technique. We observed high sensitivity in performance and algorithm convergence to small perturbations in the measurement vectors. [C4412]

"Rotating velocity estimation for ISAR targets via Radon detection of lines"

Rotating velocity (RV) estimation is a prerequisite for inverse synthetic aperture radar (ISAR) to re-scale the imaging results from the conventional range-Doppler (RD) domain to the range-cross range domain. Based on the mapping of RD imaging, two slope functions, i.e. Doppler-range slope and range-Doppler slope, are defined for a line on the image plane. Then, by detecting the line features on the RD plane with a radon-CLEAN scheme, this paper proposes a RV estimation method by fitting the slope function of the extracted line features. Key steps for the method are presented and numeric experiments are given to demonstrate the effectiveness of the proposed method. [C4413]

"SMAP's radar OBP algorithm development"

An approach for algorithm specifications and development is described for SMAP's radar onboard processor with multi-stage demodulation and decimation bandpass digital filter. Point target simulation is used to verify and validate the filter design with the usual radar performance parameters. Preliminary FPGA implementation is also discussed. [C4414]

"Multi-channel conversion of the National Weather Radar Testbed receiver"

The National Weather Radar Testbed (NWRT) system is based on WSR-88D technology enhanced with the significant capability of a phased array antenna. The agile beam capability provides a unique and powerful tool to focus weather radar asset on observation of severe weather phenomena including structures that lead to formation of these storms. The NWRT system has demonstrated the ability to provide weather data consistent with that from adjacent WSR systems at greatly reduced volume coverage time. Significant success has been reported in use of this tool for gathering and presenting specific, real-time storm-cell 3D data to weather scientists and meteorologists for in-depth interpretation of these pencil-beam radar returns. Specific extensions to the conventional weather radar capabilities now in place include beam multiplexing (spatial filtering), oversampling and whitening (signal processing) and transverse wind estimation (multi-beam). The latter capability has recently been added by activating the difference beam channels of the array and sequentially sampling and comparing these with the conventional sum-only mode. Under the auspices of a National Science Foundation, Major Research Instrument (NSF/MRI) grant, and in cooperation with the United States Navy, the NWRT is now being extended with an 8-channel digital receiver for simultaneous processing of sum, difference and ancillary beam returns. Expectations are high that application of multi-beam adaptation algorithms and other signal processing techniques using multiple channels will lead to improved detection and storm queuing techniques to greatly extend the forecast lead time for severe storms. Multi-channel capability also opens the NWRT for the possibility of testing multi-function radar system algorithms and operations. This paper will describe the attributes of the COTS, rf-system extensions and the specific steps being taken to baseline these changes to the current NWRT system performance. [C4415]

"Programmable radar signal processor for a multi function radar"

The programmable radar signal processor caters for a multi-function radar performing the major functions of target surveillance and track. This paper describes a high performance multiprocessor DSP based solution for a real time radar signal processing application. A parallel DSP system that can run radar signal processing algorithms in real time, is made available whose computing power can be harnessed through specific software

tools developed for the application. This scheme has been successfully implemented for a multi function phased array radar which can detect and track high speed and low RCS targets with high gain and accuracy. [C4416]

"A multifrequency interferometric CW radar for vital signs detection"

The use of radar techniques to detect minute body movements which are associated with respiration and cardiac activity (vital signs) is known at least since 1975 when J.C. Linn and J. Salinger proposed a non-contact microwave respiration monitor. This paper sets up to discuss further development of CW radar based vital signs detection systems. The purpose here is to enhance target detection probability in a highly cluttered environment and to add range and angle-of-arrival estimation without dramatically enhancing RF spectrum requirements by transition to a multicarrier interrogating signal. [C4417]

"FPGA based Digital Beam Forming for Radars"

Array beam forming techniques exist that can yield multiple, simultaneously available beams. The beams can be made to have high gain and low sidelobe levels or controlled beam width. Beam forming techniques dynamically adjust the array pattern to optimize some characteristic of the received signal. Antenna arrays using beam-forming techniques can reject interfering signals having a direction of arrival different from that of desired signal. The principal reason of interest is their ability to automatically steer nulls into undesired sources of interferences, thereby reducing output noise and enhancing the detection of desired signal. Digital beam forming is thus a powerful technique for boosting the antenna performance. Our work emphasizes on the FPGA (Field Programmable Gate Array) based digital technique adopted for the implementation of fixed beam forming. This paper mainly focuses on the implementation solution provided by utilizing the efficient FPGA resources so as to meet the timings in the crucial application of beam forming. Extensive use of intellectual properties of Xilinx has been employed keeping in mind the time efficiency it provides. Beam forming and beam scanning are generally accomplished by phasing the feed to each element of an array so that signals received from all the elements will be in phase in particular direction. This is the direction of the maximum beam. The FPGA based approach facilitates the design with high degree of flexibility, reliability and upgradeability. The implementation also overcomes the main difficulty of compensating minute propagation delays often encountered while using beam forming for radar applications. The paper discusses all the critical implementation issues that are taken care of in the development of the efficient FPGA structure for implementation. [C4418]

"Recent experiments in Ocean remote sensing with bistatic radar using Navigation Satellite Signals"

This paper will present results from a recent airborne campaign to collect and analyze reflected Global Navigation Satellite System (GNSS-R) signals. The objective of this experiment was to test the GNSS Instrument for Multistatic and Occultation Sensing (GISMOS) and provide additional data for comparison of GNSS-R sea roughness retrievals with in situ measurements. Raw sampled data from the direct GPS signal (using a conventional navigation antenna) and the reflected signal (both right and left-hand circularly polarized nadir antennas) were recorded at both the L1 (1575.42 MHz) and L2 (1227.6 MHz) frequencies. These signals were post-processed using a software-defined radio. Low cost consumer gaming processors were reprogrammed to efficiently generate Delay-Doppler maps (DDMs). A scattering model was then fit to these DDMs in order to estimate the upwind and cross-wind slope variances and the principal axis direction. Initial results suggest a sensitivity to wind direction. [C4419]

"Sidelobe mitigation in MIMO radar with multiple subcarriers"

This paper presents the studies on the reduction of peak sidelobe level in distributed MIMO radar with multiple subcarrier signals. Multiple subcarriers with sufficient frequency spacing become an alternative to increasing the number of sensors for sidelobe reduction. It is shown that the multiple subcarrier signals are most effective in reducing sidelobes at locations far from the target. Two signaling methods, namely continuous carrier transmission and Gaussian-OFDM signals are studied with respect to the sidelobe mitigation properties. The paper also presents an upper bound to the peak sidelobe level considering the non-coherent combining. It is shown that with non-coherent combining, the peak sidelobe of the localization metric scales down as $1/MNL\sin(3\pi/2L)$ where L is the number of subcarriers, and M , N are the number of transmit and receive sensors. While there are grating lobes present in the metric with non-coherent combining, there is a grating lobe free region around the mainlobe, lower bounded by $\rho = \pm \sqrt{mN}L\theta_0/2B$. With coherent processing, multiple subcarriers are effective in reducing the sidelobes as well as grating lobes. [C4420]

"The ultra high resolution QuikSCAT product"

Although QuikSCAT was originally designed to measure winds at a resolution of 25 km, higher resolution wind

and rain products have been developed. The 2.5 km ultra high resolution (UHR) products allow QuikSCAT data to be used for applications involving rain, meso-scale phenomena, and in coastal applications. This paper overviews and unifies the various UHR products and discusses their advantages and limitations as compared to each other and the conventional 25 km product. Theory, consequences of assumptions, and trade-offs are also discussed. [C4421]

"Interferometric absolute phase determination with TerraSAR-X wideband SAR data"

Wideband SAR systems such as TerraSAR-X bring the range resolution down to the order of the carrier wavelength. This opens the possibility to determine not only the fractional phase of SAR interferograms, but also the absolute phase value including the unknown number of integer phase cycles. This possibility enormously helps all interferometric applications such as DEM generation or land surface motion determination. Here we review the basic theory of such processing techniques and show a number of recent results from an ESA study aimed at developing an operational system. Furthermore we show how such techniques can be optimized by the use of customized dasiasplit-bandwidthpsila chirp signals in place of the standard chirps used in contemporary SAR systems. [C4422]

"Time-frequency entropy of Hilbert-Huang transformation for detecting weak target in sea clutter"

In this paper, Hilbert-Huang transformation is adopted for analyzing the sea clutter with the fixed weak target. It's found that the fixed target only affects the low frequency component of the sea clutter. So the time-frequency entropy of the low frequency component is applied for the weak target detection. Compared with another weak target detection method directly using the box dimension, the method proposed in this paper improves the effect of the fixed target on the sea clutter. And the detection performance of the fixed weak target is improved distinctly. [C4423]

"Near real-time adaptive radar processing using analog dithers"

This paper explores the performance of a novel analog technique for estimating the gradient of a cost function and its application to adaptive processing in radar. The technique relies on using analog sinusoidal dithers to estimate components of the gradient vector in near real-time with a latency on the order of microseconds. The advantages of this approach are that the adaptive processor can quickly adapt to nonstationary environments and the dynamic range at the input to the adaptive processor is not constrained by the limits of an analog-to-digital converter. Simulated results are shown for an adaptive sidelobe canceler in a radar configured with a main beam sum channel and auxiliary channels. Some drawbacks of the proposed technique for sidelobe cancellation include that it is suitable only for steepest descent type algorithms which have an inherently slower convergence rate, as well as the requirement to carefully account for or remove any time delays, and gain or phase imbalances in the analog dither circuitry, so as not to degrade the estimate of the gradient. [C4424]

"Multistatic scattering from moving targets in multipath environments"

We are examining the feasibility of ground target detection and tracking in urban centers using ground moving target indicator (GMTI) radar when line-of-sight (LOS) coverage is intermittent, yet multipath responses from building walls are available. We enhance the standard ray-tracing propagation methods that assume specular wall reflections and point scattering target models. Our two-dimensional analysis includes near field reradiation from the illuminated wall to a target having a multistatic response. We also evaluate the degradation of power and coherency in the signal processing due to wall surface roughness. Results of this work provide insight for the development of processing techniques that may be required for multipath exploitation radar. [C4425]

"A Science Data System approach for the SMAP mission"

Though Science Data System (SDS) development has not traditionally been part of the mission concept phase, lessons learned and study of past Earth science missions indicate that SDS functionality can greatly benefit algorithm developers in all mission phases. We have proposed a SDS approach for the SMAP Mission that incorporates early support for an algorithm testbed, allowing scientists to develop codes and seamlessly integrate them into the operational SDS. This approach will greatly reduce both the costs and risks involved in algorithm transitioning and SDS development. [C4426]

"RF photonic signal processing components: From high order tunable filters to high stability tunable oscillators"

We report on our research and development efforts toward realizing tunable RF photonic filters and tunable local oscillators. In particular, we demonstrate a high order RF photonic filter having 250-1000 MHz bandwidth and

more than 70 dBc rejection rate at 2 GHz detuning from the pass-band center. The filter can be tuned across 1-40 GHz frequency range. We also report on our design of a compact tunable RF photonic oscillator with phase noise less than -140 dBc at 100 kHz. The frequency of the oscillator can be tuned from 20 GHz till 35 GHz. We present a theoretical analysis of the capabilities of the devices as well as recent experimental data. [C4427]

"Spatial resolution enhancement of Cassini Titan Radar mapper data"

Post processing reconstruction and resolution enhancement algorithms can be applied to Cassini Titan Radar Mapper data to improve the image resolution for scatterometermode imagery. Reconstruction algorithms can also yield enhanced resolution images when multiple passes are combined. This paper briefly describes the application of the AVE and the Scatterometer Image Reconstruction (SIR) algorithms to Cassini Radar data. Some sample results are provided. A comparison with the Backus-Gilbert algorithm is also provided. [C4428]

"Enhanced DOA visibility of correlated sources for multistatic shipborne surface wave radar"

A modified array interpolation approach to correlated source localization is presented for the surface wave radar (SWR) that employs multiple uniform linear subarrays (ULSAs) mounted on different ships to compose a multistatic shipborne SWR receiving array. This approach that overcomes the main shortcomings of some existing interpolation techniques, comprises three stages: a first stage for preestimating direction-of-arrivals (DOAs) on an assumption that at least a single ULSA is available for correlated source localization, a second stage for specifying a union of nonoverlapping narrow subsectors as the interpolated sector to cover only the preestimates, and a third stage for reestimating DOAs with the virtual uniform linear array (VULA), in which we skip noise prewhitening and appropriately increase the amount of forward/backward spatial smoothing (FBSS) that plays a major role in lowering noise floor while decorrelating correlated sources. Monte Carlo simulations demonstrate the validity of our proposal. [C4429]

"Picosecond pulse generation on CMOS: Design beyond transistor limits"

Nonlinear transmission media can be used for high amplitude, narrow pulse generation. We developed the theory of pulse generation in one- and two-dimensional transmission lattices. We used a conventional CMOS process to fabricate these lattices. Using these structures, it is possible to generate signals with a bandwidth of more than the cut-off frequency of the fastest transistor on the same process. We showed a 2-D nonlinear lattice that can generate pulses as narrow as 1 psec with an amplitude of more than 3V by using nonlinear constructive interference in a conventional 130 nm CMOS process. [C4430]

"On interference immunity of angle tracking systems under conditions of interference distorting location characteristic"

Tasks of assessing accuracy and stability in angle tracking of a radar target are considered under conditions of interference which impairs location characteristic of angle tracking system, and an option is advanced to enhance interference immunity of angle tracking system. [C4431]

"Evaluation method of jamming effect on ISAR based on symmetry cross entropy"

Some methods used to evaluate jamming effects on conventional radar are unsuitable to ISAR because of their particularity. In this paper, the cross entropy theory is utilized to evaluate the jamming effect on ISAR. We investigated the cross entropy and presented the concept of symmetry cross entropy (SCE) to compensate for its shortage, and then theoretically proved that it was a distance measure; thereby, a new evaluation model was found that used SCE as an evaluation index. In the end, two typical noise blanket jamming modes, RF noise jamming and FM noise jamming, are employed in computer simulation of interference with ISAR, and the SCE was used to quantitatively evaluate jamming effect. The result shows that the method proposed is effective and feasible. [C4432]

"Self-adaptive frequency agility realized with FPGA"

Searching radar or surveillance radar has to resist diversified jamming; self-adaptive frequency agility is an important and effective function for radars to resist jamming. The detailed steps to achieve this function are described, and the function is realized with FPGA using hardware description language, the validity is proved by on-line sampling and simulation. The self-adaptive frequency agility module can analyze the type of jamming to select transmitting frequency to avoid the frequencies which have interference, under frequency diversity and fixed frequency, respectively. The practical application on a searching radar shows that the module has good real-time and anti-jamming capacity. [C4433]

"Study on roadbed disease recognition algorithm based on support vector machine"

Based on the principle of support vector machines as well as the analysis to the characteristics of roadbed diseases, a new GPR echo signal recognition algorithm is brought up. By using the proposed method to identify the ground-penetrating radar measured data, the test results show that this algorithm is better than the neural network recognition algorithm and overcomes the shortcomings of the local minimum value and over-learning. The algorithm is suitable for ground-penetrating radar signal recognition and is an efficient algorithm. [C4434]

"Vision enhancement system for SAR based on infrared video"

With the expansion of the transportation volume at sea, maritime search and rescue became an enormous task. To improve the rate of life saving, this paper puts forward a vision enhancement system based on infrared video for the maritime search and rescue. A method is proposed for detecting and tracking targets at sea. Based on the characteristics of infrared image and the sea environment, we combine the approaches of frame difference and target region-growth to detect and track targets. The image of the current frame is different from the previous one and the result is transformed into a binary image using threshold segmentation. Then the region growth algorithm is employed to mark the targets' position on the video. The experimental result shows that the system is suitable for searching the overboard personnel at sea. [C4435]

"Proportional-type NLMS algorithm with gain allocation providing maximum one-step conditional PDF for true weights"

In this paper, we present a proportionate-type normalized least mean square algorithm which operates by choosing adaptive gains at each time step in a manner designed to maximize the conditional probability that the next-step coefficient estimates reach their optimal values. We compare and show that the performance of the maximum conditional probability density one-step algorithm is superior to the normalized least mean square algorithm and the proportionate normalized least mean square algorithm. Additionally, we argue that the algorithm we present operates for any impulse response. [C4436]

"Some autocorrelation properties of phase-coded waveforms"

In this paper we study some autocorrelation properties of a train of identical signals overlaid with a phase coding. Prior publications have investigated this problem under the assumption that, for the purpose of the phase coding, the original (uncoded) signal forming the train is divided into a number of bits that are either all identical or all distinct. This paper extends the discussion to the case of repeated bits. We derive and analyze sufficient conditions for cancelation of the waveform's autocorrelation sidelobes located around the main lobe area. [C4437]

"Resolving more sources with multi-frequency coarrays in high-resolution direction-of-arrival estimation"

This paper presents a multi-frequency method to increase the number of incoherent sources that can be resolved using multiple signal classification (MUSIC). The method uses coarray equivalence to construct a virtual correlation matrix with a higher dimension than the number of receiving elements. This allows for more sources to be resolved than with traditional MUSIC, where the number of sources must be less than the number of receiving elements. This method will prove to be useful in situations where the number of antenna elements must be limited, but there are many sources. The method as presented here has restrictions on the types of sources that can be resolved. [C4438]

"Non-coherent MIMO radar for target estimation: More antennas means better performance"

This paper presents an analysis of the joint estimation of target location and velocity using multiple-input multiple-output (MIMO) radar. A theorem is formulated on the asymptotic properties of the maximum likelihood (ML) estimate. The joint Cramer-Rao bound (CRB) is calculated for a Rayleigh fluctuating extended target. The mean square error (MSE) of the ML estimate is analyzed for orthogonal Gaussian pulses. It is shown that the signal to noise ratio (SNR) boundary between low and high MSE values can be lowered by increasing the number of antennas. The non-coherent MIMO radar ambiguity function (AF) is developed and illustrated by examples. It is shown that the product of the number of transmit and receive antennas can control the sidelobes level of the AF. [C4439]

"Range and speed resolution in coherent distributed MIMO radar with Gaussian pulse trains"

This paper presents studies on the range and speed resolution in distributed MIMO radar with the use of finite

duration Gaussian pulse trains. We consider a network of transmit and receive sensors, where the distance between the randomly placed sensors is comparable to the distance to the target. While the resolution capability of a single transmitter-receiver pair is determined by the carrier frequency and parameters of the pulse train, namely the pulse width, pulse interval and the number of pulses, the orientations of the sensors with respect to the target has a major effect on the ambiguity due to subsidiary peaks. The randomness in the sensor locations randomizes the relative positions of subsidiary peaks of the ambiguity function. With multiple transmitter-receiver pairs, the randomness in the locations of sensors in effect reduces the subsidiary peaks in the ambiguity function of a single transmitter receiver-pair by a factor of MN , where M and N are the number of transmitters and receivers. [C4440]

"MIMO enabled multipath clutter rank estimation"

Multiple-input multiple-output (MIMO) radar is an emerging technology that has the capability of providing range dependent transmit-domain degrees of freedom via receiver processing. When providing these additional degrees of freedom for target tracking, MIMO radar exhibits a lower signal-to-noise ratio (SNR) when compared to that of traditional single-input multiple-output (SIMO) phased array radar. Previous work has indicated the efficacy of combining MIMO operation with space-time adaptive processing (STAP) techniques in the presence of multipath clutter to improve the signal-to-clutter-plus-noise ratio (SCNR). The tradeoff between target SNR and SCNR in multipath propagation environments is a crucial consideration in MIMO radar. In this paper, a transmit-receive directionality spectrum (TRDS) is used to examine the clutter characteristics at a range-Doppler bin of interest, most notably in multipath situations where MIMO operation is advantageous. In situations where ground clutter is spread in Doppler frequency and azimuth by motion in the propagation environment, the clutter rank can be significantly higher than a Brennan's rule estimate. However, the transmit observability within the MIMO data vector allows for a low rank representation of the clutter when compared to the total available degrees of freedom. A TRDS-based method based on the resolution limits of uniformly spaced linear transmit and receive arrays is presented which furnishes an estimate of the transmit-receive clutter rank in scenarios where Brennan's rule provides a significantly underestimated measure. The proposed TRDS-based clutter rank estimation method is applied to both numerical simulations and experimental data. [C4441]

"SweepSAR: Beam-forming on receive using a reflector-phased array feed combination for spaceborne SAR"

We have seen in the above that the SweepSAR technique offers the potential for significant reductions in the transmit peak and average power required for a SAR system. This is achieved by making full use of the areal extent of a reflector antenna on receive. The SweepSAR rate is not as big a problem as it might appear initially: note that in the 30 years since Seasat launched downlink rates for LEO satellites have increased significantly- from ~85 Mbps up to ~640 Mbps. In addition, analog-to digital converters (ADCs) have increased in bandwidth from ~ 20 MHz to several GHz. In this paper, an alternative approach is described that is suited for longer wavelength SARs in particular, employing a large, deployable reflector antenna and a much simpler phased array feed. To illuminate a wide swath, a substantial fraction of the phased array feed is excited on transmit to sub-illuminate the reflector. Shorter transmit pulses are required than for conventional SAR. On receive, a much smaller portion of the phased array feed is used to collect the return echo, so that a greater portion of the reflector antenna area is used. The locus of the portion of the phased array used on receive is adjusted using an analog beam steering network, to 'sweep' the receive beam(s) across the illuminated swath, tracking the return echo. This is similar in some respects to the whiskbroom approach to optical sensors, hence the name: SweepSAR. SweepSAR has advantages over conventional SAR in that it requires less transmit power, and if the receive beam is narrow enough, it is relatively immune to range ambiguities. Compared to direct radiating arrays with digital beam-forming, it is much simpler to implement, uses currently available technologies, is better suited for longer wavelength systems, and does not require extremely high data rates or onboard processing. [C4442]

"Ambiguity function analysis for the Hybrid MIMO Phased-array Radar"

The hybrid MIMO phased array radar, or HMPAR, is a notional concept for a multisensor radar architecture that combines elements of traditional phased-array radar with the emerging technology of multiple-input multiple output (MIMO) radar. A HMPAR comprises a large number, MP , of T/R elements, organized into M subarrays of P elements each. Within each subarray, passive element-level phase shifting is used to steer transmit and receive beams in some desired fashion. Each of the M subarrays are in turn driven by independently amplified phase-coded signals. This paper derives a version of the radar ambiguity function that is appropriate for this radar architecture. The ambiguity function is a function of time delay, Doppler frequency shift, and two or more spatial variables. An illustrative example for a particular MIMO signal set is given. [C4443]

"A simplified parametric GLRT for STAP detection"

We consider multichannel signal detection in the presence of spatially and temporally colored disturbance, a problem also known as space-time adaptive processing (STAP) in radars. A number of sample covariance matrix based STAP detectors have been proposed, which often require a lot of training data to ensure convergence. In many practical scenarios, these detectors may suffer significant performance loss due to a lack of sufficient training data. This has motivated interest in techniques with reduced training requirements, such as partially reduced rank-dimension detection, parametric STAP, and others. [C4444]

"A brief history of waveform diversity"

The U.S. Air Force has set an ambitious goal to be able to anticipate, find, fix, track, target, engage, and assess—anything, anytime, anywhere. We will not achieve order of magnitude improvement in detection and tracking performance solely through larger antennas and more power. Instead, advanced signal processing techniques and system concepts will be required. Achieving the sought after demanding goals will instead require a distributed network of heterogeneous sensors. [C4445]

"Archeological researches of the ancient fortress by GPR"

The investigation purpose is studying by ground penetrating radar (GPR) methods of the fortification features of Hakassko-Minusinsk Region at the Bronze Age. The estimation of GPR efficiency at monitoring researches, time and expenses on engineering archeological works were carried out. Object of researches is the ancient fortress on Stone Island of Yenisei River. In 2007 GPR researches of total amount 1500 meters of GPR tracking structures has been carried out by Radar R&D. As a result of researches, contours of fortifications battlement are restored. Contours of the stone bases under dwellings are found out and restored. In the studying, GPR sounding is practically tested with the purpose of detection and construction of contours of the fortification rests and other objects. The software for efficiency increase of archeological researches and reduction of expenses was developed. By results of experimental and practical works the GPR method is proved and practically approved for the undersurface environment monitoring with the purpose of revealing of the zones interesting from the archeology point of view. [C4446]

"Atmospheric ultraviolet transmission and Lidar returns"

The atmospheric transmission model UVTRAN is modified by use of molecular absorption cross sections taken from Hitran2004 database. The modified UVTRAN can be utilized to calculate atmospheric transmission with both high accuracy and super spectral resolution. It can replace FASCOD3 model because the current FASCOD3 for micro-computer can not be used in the ultraviolet spectrum. As an example, atmospheric transmissions and return signals are calculated by the modified UVTRAN for the 6 laser wavelengths at visible and ultraviolet spectrum. The results show that the laser wavelength at medium ultraviolet, e.g. 308 nm XeCl Excimer laser, is suitable for working at short distance in the troposphere. The ultraviolet detector with very high sensitivity is required if a laser is chosen to work in deep ultraviolet. [C4447]

"A fully integrated 24GHz UWB radar sensor for automotive applications"

Radar-based advanced safety systems are crucial to reduce road accidents caused by driver inattention. An actual and pervasive adoption of radar technology requires the development of low-cost Silicon-integrated sensors, including microwave, analog, and digital blocks on a single chip, able to replace existing discrete electronics based on compound semiconductors. Indeed, the considerable advantage of silicon lies in its natural capability for integration that will enable a higher level of complexity in such sensors. This paper presents a fully integrated 24GHz UWB radar sensor implemented in a 0.13μm SiGe BiCMOS process. The UWB signal generation takes advantage of a PLL. The produced 24.125GHz carrier is properly BPSK modulated to increase sensor robustness within the entire SRR sensor network. [C4448]

"Improving principles of construction and development of circuits for HF receiving multi-channel antenna systems"

The results of improving principles of construction and analysis of basic parameters of HF receiving multi-channel antenna systems are considered. [C4449]

"Development of a FPGA-based high speed FFT processor for wideband Direction of Arrival applications"

A parallel and pipelined Fast Fourier Transform (FFT) processor for use in the Direction of Arrival (DOA) estimation of a wideband waveform is presented. The selected DOA algorithm follows the Coherent Signal

Subspace Method (CSSM). The target device for implementation is a Xilinx Virtex-5 Field Programmable Gate Array (FPGA). The FFT processor was developed in MATLAB Simulink using the Xilinx System Generator block-set to auto-generate VHDL code. Although the parallel and pipelined architecture uses a large portion of the available FPGA resources, the architecture does yield a high throughput. [C4450]

"Suppression of anomalous clutter caused by evaporation duct propagation"

Microwave propagation is adversely affected by evaporation duct, which can occur as often as 85% of the time in the sea of the world. Evaporation duct propagation is the abnormal bending and diversion of electromagnetic radiation from the intended paths, that resulting in the problems of extended propagation of microwave signals well beyond the radio horizon, high probability of intercept, measurement errors, radar holes, and anomalous clutter. A kind of anomalous clutter caused by evaporation duct propagation is described through analysis of experimental data collected from an S-band search radar. To suppress the anomalous clutter, a MTI processing with entropy detection is proposed, which utilizes the weak correlation characteristic and the certain position relation between anomalous clutter echoes. Compared with normal MTI processing, it can suppress anomalous clutter effectively and the performance is validated by simulation of the experimental data. [C4451]

"System architectures and algorithms for radar imaging by MIMO-SAR"

The multi-input / multi-output (MIMO) principle is well known for communication applications, whereas at least the name dasiaMIMOpsila is relatively new for radar applications. Nevertheless, the principle has been analyzed and used in a few examples since the early 80s or even before. A MIMO-radar is characterised by a number N of transmitting and a number M of receiving antennas forming N times M Tx/Rx pairs where each propagation path from the n th transmit antenna to the object to the m th receive antenna is made available to the signal processing. This can be achieved by temporal multiplexing, spatial coding and/or orthogonal waveforms. A further step is to transfer this technique to the SAR case. Additionally, the whole array is moving, SAR processing can be applied. Possible geometries of MIMO-SAR are along track arrays (reduction of azimuth-ambiguities, moving target indication, super resolution) or across track arrays (reduction of elevation-ambiguities, interferometry, 3D down-looking SAR). In this paper, some aspects of moving MIMO-arrays for SAR will be addressed. [C4452]

"Multi-carrier radar waveform schemes for range and Doppler processing"

A processing technique that utilizes the OFDM communication waveform as the radar waveform is considered. The double use of the waveform for communications and radar enables establishing radar networks communicating through the radar beam. The processing technique exploits the Doppler sensitivity of the OFDM to reduce the Doppler ambiguity. An enhancement to the waveform and the processing is proposed to completely eliminate the Doppler ambiguity. [C4453]

"Two-dimensional adaptive processing for ionospheric clutter mitigation in High Frequency Surface Wave Radar"

High Frequency Surface Wave Radar (HFSWR) is a technology used for over-the-horizon detection of ocean vessels. This radar exploits the diffraction of electromagnetic waves around the curved surface of the Earth. To minimize the attenuation of the diffracted waves, the radar must operate at frequencies in the lower part of the high frequency (HF) band. However, radar signals at these frequencies also reflect from the Earth's ionosphere, which leads to radar clutter at ranges beyond 200 km. The linear broadside receive arrays used by conventional HFSWR systems cannot filter out this clutter as the arrays do not have any resolving power in elevation angle. Reported here are experimental investigations of the clutter suppression capability of one- and two-dimensional HFSWR adaptive processors. Three configurations are compared: one-dimensional spatial adaptive processing, two-dimensional spatial adaptive processing, and space-time adaptive processing. In all cases the number of adaptive degrees of freedom is 16. It is found that the best results are achieved by two-dimensional spatial adaptive processing, where a processing gain of up to about 20 dB can be achieved. [C4454]

"Frequency diverse array: Simulation and design"

In this paper, the radiation characteristics of frequency diversity array are concerned. With a set of CW signals of different frequencies transmitted simultaneously from the array, the transient field is examined by electromagnetic field simulation software. A periodically scanning beam is observed and the scanning speed is shown to be related to the frequency increment between two neighboring elements. Based on electromagnetic field simulation results, a low cost frequency diverse array is designed. 4 PLL frequency synthesizers sharing the same reference signal generate the desired signals. The output frequencies can be easily configured and flexibly changed by 16 bit parallel programming. [C4455]

"Correlation properties of UWB Radar target impulse responses"

In this paper the time domain responses of UWB radar signals from scattering targets are analyzed. In particular, the aim of this paper is to investigate the pulse distortion of UWB radar signals by a scattering object, i.e. how does the scattered signal vary with respect to the radar signal incident on the object itself. The investigation is performed analyzing the polarimetric responses of different targets (flat plate, sphere). The time domain description (impulse response and pulse preserving capability) of a generic scattering process is mathematically described. Then for verification and application, these prior defined quantities are experimentally measured for two particular targets, a flat plate and a sphere. [C4456]

"Adaptive digital beamforming for super-resolution angle estimation in jamming"

This paper describes a technique for maintaining angle super-resolution capability of multiple sources in jamming. This technique exploits flexibility provided by digital beamforming (DBF) array to form adaptive sub-arrays or adaptive beams in canceling jamming, followed by super-resolution processing for determining the number of sources and then estimating the corresponding directions-of-arrival (DOAs). In this arrangement, super-resolution capability in angle estimation of multiple sources can be maintained while jamming is canceled in the sub-array based or the beamspace based pre-processing stage. [C4457]

"A novel approach to OFDM radar processing"

In this paper a novel approach for the calculation of the radar range profile in OFDM radar systems is presented. The proposed algorithm operates directly on the modulation symbols and overcomes the typical drawbacks of correlation based baseband signal processing. An example system configuration as well as simulation results from a dedicated MatLab model will be presented and discussed. [C4458]

"CPM-based radar waveforms for efficiently bandlimiting a transmitted spectrum"

In this paper we shall demonstrate how a polyphase-coded radar waveform can be implemented using a continuous phase modulation (CPM) framework so as to achieve spectral containment while maintaining a constant envelope to maximize energy-on-target. Current modulation techniques such as derivative phase shift keying (DPSK) and minimum shift keying (MSK), which are applicable to binary-coded waveforms, are well-known implementation schemes for spectral containment. The CPM implementation is applicable to polyphase codes and can also achieve better spectral containment, though a by-product is increased range sidelobes that result due to the deviation from the idealized code (implicitly defined for squared-shaped chips). To ameliorate the increased range sidelobes, a version of least-squares mismatched filtering is employed that accommodates the continuous nature of the CPM structure. Also, continuous rise/fall-time transitions of the pulse are addressed as part of the holistic implementation of the CPM-based waveform. It is observed that for the CPM implementation the rise/fall-time becomes the limiting factor on spectral containment and a rather simple scheme based on Chireaux out-phasing is suggested as a means to "slow down" the pulse rise/fall. [C4459]

"Derivation of the frequency mismatch probability in linear FMCW radar based on target distribution"

In LFM CW (linear frequency modulated continuous wave) radar, there is a nonzero probability for mismatches to occur under certain conditions. This probability strongly depends on the modulation employed as well as on the distribution of targets in the radar's field of view, i.e. the application of the radar sensor. Hence to reduce mismatches in a given application, an effective approach is to carefully design the modulation used. Instead of utilizing extensive simulations, we derive the distribution of mismatches analytically, solely based on the modulation parameters and a given distribution of targets. Based on that mismatch distribution, an application-specific optimization of the modulation is feasible. [C4460]

"Extending the frequency matching in linear FMCW radar exploiting extreme frequencies"

Frequency matching is an essential block of the signal processing chain in LFM CW (linear frequency modulated continuous wave) radar. Its task is to associate frequency detections obtained in multiple measurements. Under certain conditions, this association may fail and frequency detections from multiple real targets may be combined to a mismatch. The classification of a frequency association as match (real target) or mismatch (ghost target) is commonly regarded impossible if we only have frequency detections. Yet in this paper we show that even in this case, a reliable classification is possible when special attention is paid to the two outermost frequencies in each spectrum. Furthermore, the radar's modulation can be designed such that the reliable classification can be achieved in the regions of interest of the distance-velocity-plane, i.e. application-specific. [C4461]

"Target detection in high clutter using passive bistatic WiFi radar"

The rapid rollout of wireless local area networks (WLANs) has provided a ubiquitous source of signal transmissions that may be exploited for surveillance applications using passive bistatic radar (PBR) and passive multistatic radar (PMR) systems. In this study, a series of experiments were conducted to examine the feasibility of using IEEE 802.11 wireless fidelity (WiFi) transmissions for detecting uncooperative targets in high clutter indoor environments. The range and Doppler characteristics of the system were also assessed theoretically from an ambiguity function analysis on WiFi signals having similar transmission parameters. Through-wall detections of personnel targets moving at differing velocities within an indoor environment are presented for the first time. The work demonstrates the feasibility for developing a low cost surveillance device that utilises WiFi networks as transmitters of opportunity. [C4462]

"MMSE recursive estimation of high phase-noise that is Wiener non-stationary"

To estimate Wiener phase noise of arbitrarily large magnitude (relative to the symbol duration), this work pioneers a linear minimum-mean-square error (LMMSE) discrete-time estimator. This proposed estimator may be pre-set to any arbitrary number of taps and any arbitrary latency. The coefficients of this linear estimator depend only on the values of the signal-to-(additive)-noise ratio and the phase-noise variance. Moreover, rigorous analysis here (1) proves that this sequence of LMMSE-weights are unimodal when plotted against the weight-index, (2) derives an upper bound and a lower bound, in closed forms, for the LMMSE-weights, and (3) proves that this sequence of LMMSE-weights converges to be Laplacian when plotted against the weight-index, as the number of taps approaches infinity. [C4463]

"Distributed aperture OFDM radar"

This paper presents a new method of obtaining frequency diversity using orthogonal frequency division multiplexing (OFDM). Exploiting spatial diversity, the key advantage of a distributed aperture radar, requires orthogonality in, for example, the frequency, time, waveform, dimensions across sensors. This paper focuses on the simplest of these cases; frequency orthogonality. Here we address the key drawback associated with frequency diversity: whereas the use of multiple frequency bands requires additional RF hardware, an OFDM-based system needs only a single oscillator and demodulator while yet maintaining frequency orthogonality. OFDM employs many sub-carriers within a single frequency band instead of occupying different frequency bands. Separation of the signals can be performed oversampling of the incoming signal followed by a Fast Fourier transform (FFT). [C4464]

"The application of the principle of chirp scaling in processing stepped chirps in spotlight SAR"

A new approach for processing stepped chirps in spotlight SAR is presented in this manuscript, which is based on exploiting the principle of chirp scaling (PCS). In particular the PCS is integrated in a polar format algorithm (PFA), obtaining a more efficient solution compared with the existing interpolation based technique. The main contribution is the implementation of the azimuth scaling with the bandwidth synthesis embedded in, and it is developed dedicatedly for dealing with stepped chirps. The signal processing flow is investigated in detail, with no interpolations but only FFT's and complex multiplications involved, and point target simulation has validated the new approach based on PCS is feasible and more efficient than the existing interpolation based approach. [C4465]

"MCMC-based iterative method for mixed spectrum estimation"

From the Bayesian statistical inference theory, a new mixed spectrum estimation method, which is based on Markov chain Monte Carlo (MCMC) approach, is proposed in this paper. The proposed method iteratively extracts the estimates of sinusoid parameters via the traditional methods, and estimates the ones of AR clutter parameters via the MCMC approach. Because the MCMC approach can fully dig the inherent information among the samples, it is more suitable for estimating the AR parameters from the less samples. Consequently, the proposed method is an efficient method for extracting the parameters of mixed spectrum for the applications with a small number of samples. Simulation results show that, comparing with the similar structure method, the method presented in this paper behaves superior estimation performance for the less samples case, and the estimation performance is less influenced by the signal-to-clutter ratio. [C4466]

"SOSTAR-X flight tests: Statistical analysis of avionic GMTI radar data"

This paper presents the results of the long term statistical analysis performed over real multi-channel radar data collected during the flight tests of the SOSTAR-X avionic program. The analyzed datasets include clutter echo

samples collected in GMTI operational modes over a number of geographic regions, each containing homogeneous clutter sources. Temporal and spatial correlation properties are investigated for each region as well as their statistical behavior. The clutter amplitude cumulative distributions are analyzed and compared to standard models (Rayleigh, K, Weibull and Lognormal) via Cramer-Von Mises distance. Power spectra are then estimated and compared with widely used models. [C4467]

"Analysis of bistatic tracking accuracy in passive radar"

In the paper, an analysis of bistatic tracking accuracy in passive radar is presented. The influence of parameters such as integration time, probability of false alarm, signal-to-noise ratio and spectral density of process noise is investigated. Simulations are performed for three popular types of illuminators of opportunity: FM, DAB and DVB-T. [C4468]

"Topographic relief compensation on spaceborne polarimetric SAR for forest applications"

In order to use the advanced capabilities of polarimetric SAR data for forest applications, analysis methods must address topographic relief effects in mountainous regions. ALOS PALSAR L-band and Radarsat-2 C-band polarimetric SAR data over study sites in Hinton, Alberta, and the Greater Victoria Watershed District, BC, were collected and used to investigate the effectiveness of polarization orientation shifts correction, decomposition filtering techniques and local incident angle compensation. We found that the polarization orientation shifts estimated from PALSAR winter data corresponded to the topographic relief. The shifts from the PALSAR summer data were noisy. The polarization orientation shifts were not seen in the Radarsat-2 data. Various polarimetric parameterizations were useful for identifying terrain features and land cover types. The Cloude entropy, dominant scattering alpha and eigenvalues ($\lambda_2 + \lambda_3$) were used to create HSV coding images for better differentiation of forest, vegetation and water surfaces with minimized topographic effects. The local incident angle compensation on single polarization backscatters was applied to Radarsat-2 data. Due to the high biomass volume in the study area and the higher radar frequency, the correlations between the polarization backscatter and the ground measured volumes at the plot level were poor. [C4469]

"Reconfigurable digitally scanned polarimetric L-Band radar"

We present the design and initial results from a digitally steered, polarimetric, phased array L-band radar utilizing a novel, high performance architecture. The instrument leverages recent advances in radio frequency and digital signal processing components in order to enable colocated measurements of emission and backscatter in a compact aircraft instrument with no moving parts. The driving methodologies are the minimization of costly and inflexible analog circuitry, adoption of standardized manufacturing processes, and inclusion of reconfigurable firmware and software architectures to facilitate fulfillment of varied sensing requirements. [C4470]

"Wideband OFDM system for radar and communications"

This paper describes the design and architectural composition of a radar system built on OFDM platform. The radar signal is generated digitally by forming an arbitrary-length vector of OFDM sub-carrier amplitudes and translating it in analog format via 1000 Ms/s D/A conversion. The resultant baseband signal has a bandwidth of 500 MHz, and variable number and composition of sub-carriers, which may be changed on a pulse-to-pulse basis. The signal is upconverted to 7.5 GHz carrier frequency and emitted via small-form horn antenna. The receiver includes 1 Gs/s A/D converter and processing is performed in frequency domain. The system is currently configured for short-range applications (3-5 m) and can be used as radar or communication unit without any changes to hardware and with very minimal changes to software. Experimental results from high-resolution range profile imaging and broadband data communications are presented and discussed. [C4471]

"Analysis of radar dismount signatures via non-parametric and parametric methods"

We present novel approaches to the analysis of radar dismount signatures that entail the characterization of the time-frequency (TF) structure of the received radar signal associated with the dismount gait by both non-parametric and parametric methods. We first introduce the concept of Gaussian g-Snakes in order to parametrically characterize the TF distribution of radar signals. In particular, we derive simple steepest descent equations that enable the estimation of the (locally) optimal g-Snake parameters for a given TF distribution. Furthermore the g-Snake modeling methodology gives us an objective unsupervised criterion from which to quantify the quality of the motion curve estimates that have been tracked from the TF data. We then formulate the non-parametric motion estimation for TF signals by a coupling of a simple partial tracking methodology in conjunction with boundary condition enforcement with regularity constraints. Finally we propose a coupling of the above non-parametric approach with g-Snake modeling that result in improved overall modeling of the given real and simulated radar TF data. [C4472]

"GMTI tracking improved by 18 dB using cognitive algorithm"

Existing tracking algorithms face combinatorial complexity in heavy clutter. Their performance is limited by the number of computer operations, they do not extract all the information available in radar signals, and do not reach Cramer-Rao performance bounds. A cognitively inspired algorithm was developed and applied for improved tracking. Models for GMTI tracks have been developed as well as cognitive architecture incorporating these models. The cognitive tracker overcomes combinatorial complexity of tracking in highly-cluttered scenarios; its performance achieves Cramer-Rao Bounds and results in about 20 dB (two orders of magnitude) improvement in signal-to-clutter ratio. [C4473]

"Phase spectrum of signals in ground Penetrating Radar applications"

Phase structure of signals relating to the ground penetrating radar (GPR) using the stepped frequency continuous wave (SFCW) signal is being analyzed for extraction of additional information about physical properties of buried objects. It was shown that the gradient of phase frequency dependence of signals reflected from underground layers is determined by their electrical properties. The method of representation of signals phase structure at georadar movement along earth surface like the image of phase shift isolines (lines corresponding to phase shift of $n2\pi$) is proposed. It was shown that the variability of the isolines is determined by medium physical properties change or presence of nonhomogeneous objects. [C4474]

"Bi-static ISAR range-doppler imaging and resolution analysis"

Bi-static ISAR has many advantages compared to mono-static ISAR. In this paper, we describe the bi-static ISAR signal model, range resolution and Doppler resolution; discuss coherent processing of reflected signals at the receiver site to produce ISAR range-Doppler images of moving targets; and analyze bi-static Doppler and micro-Doppler features of target motions. We use simulated bi-static radar data to generate ISAR images of moving targets and extract bi-static micro-Doppler features. [C4475]

"Waveform diversity and knowledge based signal processing in distributed radar"

The asymmetric threat of the twenty-first century is presenting a challenge for the information and sensors domain. The intelligent aggregation of information and sensor data in real-time is required. The use of waveform and geometric diversity along with knowledge based signal processing in distributed radars and heterogeneous sensors is necessary. Three example cases are presented illustrating how to intelligently aggregate information and sensor data for delivering the desired effects to the asymmetric threat. [C4476]

"Synthetic Aperture Radar moving target indication processing of along-track monopulse nonlinear gotcha data"

This paper is concerned with imaging and moving target detection using a synthetic aperture radar (SAR) platform that is known as Gotcha. The SAR platform can interrogate a scene using an imperfect circular trajectory; we refer to this as nonlinear SAR data collection. This collection can make monostatic and quasi-monostatic measurements in the along-track domain. We present subaperture-based wavefront reconstruction algorithms for motion compensation and imaging from this nonlinear SAR database. We also discuss adaptive filtering algorithms to construct MTI imagery from the two receiver channels of the system. Results will be provided. [C4477]

"Detection of scatterer multiplicity in spaceborne SAR tomography with array errors"

Processing of multibaseline/multitemporal SAR data from complex urban or infrastructure areas is of increasing interest. In this framework, the detection of single and multiple layover scatterers is an important problem, for an extensive and accurate signal interpretation. Recently, an hybrid 3D adaptive tomography-complex data domain model fitting detection method has been proposed. In this work, the basic method is tested with simulated data corrupted by non-idealities, in particular residual atmospheric compensation errors. Afterwards, the analyzed effects specific of the presence of the data non-idealities are taken into account for a more robust design of a detection method based on the same principle. The effectiveness of the algorithm is experimented with real satellite C-band data. [C4478]

"Design and implementation of Long Range Radar service life extension"

This paper presents an overview of a service life extension program that is being applied to the continental US Long Range Radar (LRR) network. Initially the architecture of the system is presented and key components

selected for upgrade are identified. In addition to hardware upgrades innovative signal processing algorithms have also been added. The LRR consists of 68 radars that are used for the joint purposes of air traffic control and surveillance. The upgraded radar consists of a solid state transmitter, a state-of-the-art receiver and signal data processor. With advanced signal processing algorithms, the upgraded radar system provides 200 nmi coverage in natural interference environment while minimizing the false alarms. The radar has also been upgraded to enhance weather detection performance. [C4479]

"Digital beamforming of multiple simultaneous beams for improved target search"

This paper describes several digital beamforming radar techniques for improving target detection and determination of the angular location of a target using multiple simultaneous received beams. These techniques improve target search and angle estimation performance over the conventional monopulse processing in the elimination of beam-shape loss. [C4480]

"Gain-constrained adaptive pulse compression via an MVDR framework"

Much work has been done to discover pulse compression methods that alleviate the effects of range sidelobes, though pulse compression filters that deviate from the matched filter suffer from varying degrees of mismatch loss. The Minimum Mean-Square Error (MMSE) based Adaptive Pulse Compression (APC) algorithm is capable of suppressing range sidelobes into the noise by employing a unique pulse compression filter for each range cell. Recently, Fast APC (FAPC) has been developed to reduce the computational cost of APC while maintaining much of the sidelobe suppression capability. This paper utilizes the MVDR framework to facilitate inclusion of a unity gain constraint within the APC and FAPC cost functions in an effort to mitigate mismatch loss. The APC algorithm exhibits almost no mismatch loss and, as such, the full-dimension algorithm benefits little from the gain constraint. However, FAPC occasionally suppresses small targets in dense scattering environments due to fewer degrees of freedom inherent to reduced-dimensionality processing. The constrained FAPC algorithm preserves gain on small targets consequently improving detection performance. [C4481]

"Super-resolution processing technique for vector sensors"

Vector sensors are used in radar, sonar and communications applications. Vector sensors use measurements from multiple, co-located sensors to achieve improved spatial resolvability. Vector sensors obtain multi-variate measurements at a point by measuring the signal in multiple polarizations or the spatial derivatives of the signal. This study focuses on vector sensors which measure the spatial derivatives of the signal. The measurement of the spatial derivatives allows one to extrapolate the signal over an aperture significantly greater than the real aperture of the sensors themselves. The degree to which the signal can be extrapolated will depend on the number of spatial derivatives which are measured. In practice, the vector sensors measure only the lowest order spatial derivatives of a signal. This limits the size of the aperture over which the signal can be extrapolated. In this paper, a super-resolution processing technique is developed for extending the aperture by estimating the higher order spatial derivatives from the measured lower order derivatives. A linear prediction (LP) model is used to write the higher order derivatives in terms of the lower order derivatives. The coefficients of the LP model are estimated using the measurements. The Least Mean Square (LMS) algorithm is used to estimate the LP coefficients from the vector sensor measurements. The LP model is then used to estimate the higher order spatial derivatives. Using the higher order derivatives, the signal can be extrapolated over a larger aperture. The LP model that relates the higher order spatial derivatives to the measured lower order derivatives is formulated. For the purpose of clarity, the study focuses on one-dimensional vector sensors. Simulations are used to study the effectiveness of this technique. The improvement in the spatial resolution is studied as a function of the order of the LP process and signal-to-noise ratio. [C4482]

"Millimeter wave radar for remote measurement of vital signs"

We present the development of a 228 GHz heterodyne radar system for the remote measurement of respiration and heart rates. The advantages of a millimeter wave system include a higher sensitivity to small displacements, transmission through the atmosphere and clothing and the ability to maintain a collimated beam over large distances. We present a set of respiration and heart rate measurements out to a range of 50 meters. [C4483]

"Spatial compressive sensing approach for field directionality estimation."

This work addresses the problem of field directionality estimation using uniform linear array. Recent advances from the compressive sensing theory were invoked for this application. Motivated by a sparse representation of the field directionality in frequency-wavenumber domain, a spatial compressive sensing-based method for the field directionality estimation is proposed in this work. This method is conceptually different from other classical algorithms, achieving a high azimuth resolution using relatively short array. This work provides an alternative,

spatial interpretation for the compressive sensing theory in application to array signal processing. Major advantages of the proposed approach are simplicity of an implementation and a high angular resolution achievable by short arrays. [C4484]

"Image while scan (IWS): An adaptive Gabor spectrum estimation approach"

We extend the classical ISAR imaging methodology by introducing a rotating transmit-receive antenna structure that allows us to simultaneously perform target imaging and surface surveillance operations. The inherent problem of processing only a limited number of pulses (per range-bin) is overcome by characterizing the received Doppler signals via a Kalmanized sparse Gabor representation that allows us to accurately capture the spectral information contained in the radar signals at different levels of resolution while also affording us the ability to adapt the representation based on the radar signals received in successive frames. We demonstrate the performance of our spectrum estimation methodology by testing it on real radar data, and comparing it with linear prediction (Burg's method) and sinusoidal Bayesian spectrum estimation algorithms. We find that our approach offers important advantages over previous approaches to Doppler spectrum estimation, while also potentially enabling the incorporation of wavelet thresholding strategies in order to suppress noise present in radar signals due to environmental and systemic factors. [C4485]

"Circuit level analysis of analog signal processing based MIMO radar system"

Conventional digital signal processing (DSP) based systems, when expanded into a multi input multi output (MIMO) system, suffer from increase of power consumption and computational burden. In this paper, an analog based MIMO radar system is introduced. The proposed system uses a combination of wavelets as its pulse at transmitters. Using the property of wavelets being orthogonal in time, our proposed system achieves waveform diversity. Implementation of a MIMO radar system based on analog circuitry results in significant decrease in power consumption of the system. This was verified by comparing systems with similar performance and estimating their power consumption. While our proposed system consumed 422.2 mW, a DSP-ASIC MIMO radar system consumed 2621.6 mW, a conventional DSP-ASIC single input single output (SISO) radar system consumed 1767 mW, and a conventional DSP-FPGA SISO radar system consumed 4158 mW. [C4486]

"A model-based object following system"

In this paper we describe an object following system for ground robot mobility, which incorporates LIDAR-based object perception and model-based lane estimation into control signal generation. The approach enables our autonomous ground vehicle MuCAR-3 to safely follow an object even in curved, narrow roads without using GPS or any prior environmental information at all, and to push the follower vehicle backwards in case of dead ends or blocked roads. The effectiveness of this approach originates from a tight coupling between object recognition and control signal generation. Objects are detected, classified and tracked using a unique combination of 3D point clouds and a 2D occupancy grid. With the object information gained, a Kalman filter is used for lane estimation. Furthermore to cope with the problem of local obstacle avoidance, a set of drivable primitives, called tentacles, is integrated into the system. Using parameters from both, a controller generates an appropriate control signal for underlying vehicle control circuits. With this approach we are able to demonstrate smooth steering behavior at speeds up to 20 m/s while following an object even in rough terrain with high precision. The system was tested in various urban and non-urban scenarios like inner city traffic with crossings including stop lights, as well as roundabouts and pedestrian areas, which requires accurate lane execution. [C4487]

"Research on Radar Emitters Classification with Fuzzy Support Vector Machines"

In this paper, a novel method based on kernel principle component analysis is proposed to extract features of radar emitter signals image of Choi-Williams distribution. Then these discriminative and low dimensional features obtained were fed to the classifier designed for different radar LFM signals which is based on fuzzy support vector machines (FSVMs). In simulation experiments, the classifier attains over 90% overall average correct classification rate. Experimental results show that the proposed FSVM classifier is efficient for different complex radar signals detection and classification. [C4488]

"Study on Automotive Anti-collision Radar System and Its Signal Processing Algorithm"

Through analyzing the applied require for millimeter wave automotive anti-collision radar, we design the simple structure of radar system. For satisfying the demands of digital signal processing and dispatching affairs, the signal processor is designed by linking DSP and SCM. Considering the complexity of radar signal received, high efficient digital signal processing algorithms should be applied to radar. Useful targets can be detected in clutter through self-adaptive filtering, and the targets' distance/velocity can be measured through frequency domain pairing. So we introduce a signal processing algorithm through combining self-adaptive filtering with frequency

domain pairing in order to get the targets' accurate distance/velocity information in clutter and multi-targets environment, and simulate the algorithm by computer. The simulation results prove that this algorithm is effective. [C4489]

"IceSynth: An Image Synthesis System for Sea-Ice Segmentation Evaluation"

An ongoing challenge in automatic sea-ice monitoring using synthetic aperture radar (SAR) is the automatic segmentation of SAR sea-ice images based on the underlying ice type. Given the intractability of obtaining ground-truth segmentation data from polar regions, the evaluation of automatic SAR sea-ice image segmentation algorithms is generally limited to tests using real SAR imagery based on pseudo-ground truth data (e.g., manual segmentations) and simple synthetic tests using basic shape primitives. As such, it is difficult to evaluate automatic segmentation algorithms in a systematic and reliable manner using realistic scenarios. To tackle this issue, a novel image synthesis system named IceSynth is presented, which is capable of generating a variety of synthetic sea-ice images that are representative of real SAR sea-ice imagery. In IceSynth, SAR sea-ice textures for each ice type are synthesized via stochastic sampling based on non-parametric local conditional texture probability distribution estimates. A stochastic sampling approach based on non-parametric local class probability distribution estimates is used to generate large-scale sea-ice structures of various ice types based on ice classification priors extracted from real SAR sea-ice imagery. Experimental results show that IceSynth is capable of generating realistic-looking SAR sea-ice images that are well-suited for performing objective evaluation of SAR sea-ice image segmentation algorithms. [C4490]

"JEDI: Adaptive Stochastic Estimation for Joint Enhancement and Despeckling of Images for SAR"

Synthetic aperture radar (SAR) images are degraded by a form of multiplicative noise known as speckle. Current methods for despeckling are limited in that they either do not perform enough noise attenuation, or do not adequately preserve or enhance image detail. We propose a novel adaptive stochastic method for joint enhancement and despeckling of images (JEDI) for SAR. The proposed method utilizes an adaptive importance sampling scheme based on local statistics to generate random samples while reducing estimation variance. A Monte Carlo estimate is computed based on the generated samples, wherein the samples are aggregated to form a despeckled and detail-enhanced result. The advantage of JEDI is the ability to efficiently take advantage of information redundancy in speckled images to reduce the effects of speckle while simultaneously enhancing detail visualization. Testing with both simulated and real speckled images shows that JEDI typically outperforms popular despeckling algorithms such as Frost filtering, anisotropic diffusion, median filtering, Gamma-MAP and GenLik in terms of quantitative and qualitative visual quality. On average, JEDI provides a 2-15% improvement in PSNR and a 5-14% improvement in image quality index measures over the tested methods. [C4491]

"Amplitude Phase Algorithm for SAR Signal Processing"

In space borne SAR systems some form of data compression is required to reduce the bandwidth of the downlink channel. In the present paper we have represented the complex SAR raw data with amplitude-phase (AP) and then applied the devised algorithm. It is observed that the phase information of the compressed data is preserved to the great extent. The quality of the reconstructed data is compared in terms of the important performance evaluation parameters like signal to noise ratio (SNR), standard deviation of the phase (PSD), mean phase error (MPE) and the compression ratio (CR). The amplitude-phase algorithm is compared with that of Block Adaptive Quantization (BAQ) algorithm. The evaluation procedure is carried out in two domains, raw data domain and image domain. Numerical experiments were carried out using ERS-2 satellite data supplied by European Space Agency (ESA) showing that amplitude-phase algorithm provides us with more compression ratio (CR) choices than BAQ and for certain CR, AP algorithm provides at least one choice whose performance is better than or equal to that of BAQ. These two algorithms neither affect spatial resolution nor generate geometric distortion. Both of them have only a little effect on radiometric resolution. [C4492]

"An Indoor Positioning Algorithm Based on Received Signal Strength of WLAN"

A simple technique to position a mobile node inside a building based on the Received Signal Strength (RSS) of wireless LAN (WLAN) is proposed. Compared to existing positioning algorithm, it is more economical, of low complexity and high-precision. To evaluate the position estimation accuracy of the proposed algorithm, we developed the prototype system and experimented in our office. The result presents that the proposed algorithm has higher accuracy with low complexity. [C4493]

"The applications of the ultra wide band radar in detecting the characteristics of the human arm muscles"

This paper presents another application of the ultra wide band radar, where it deals with the characteristics of

the biceps and the triceps muscles at different angles of attachment as compared to the normal relaxation cases of these muscles. The responses of these muscles will be detected by using the ultra wide band pulses with very wide frequency band as sensing signals. A certain perturbation in the returned signal will be detected as changing the attachment angle of the arm. These responses can be used as tools to diagnose the muscles, classify the motion and study the activity of the human organs. [C4494]

"Synthetic Aperture Radar Image Processing Based on Piecewise Linear Mapping"

Block adaptive quantization (BAQ) has been an optimum method of SAR raw data compression technique for quite long time due to its simplicity in implementation and results but its performance deteriorates as the saturation level of the data input increased. In order to overcome this drawback, the author has studied the mapping between the average signal magnitude (ASM) and the standard deviation of the input signal (SDIS). We also evaluated the mapping between the ASM and SDOS from the A/D. Monte-Carlo experiment shows that none of the above two mappings is the optimal in the whole set of SD. Thus, this paper proposes the concept of piecewise linear mapping and the searching algorithm in the whole set of SD. According to the linear part, this paper gives the certification and analytical value of k and for nonlinear part, and utilizes the searching algorithm mentioned above to search the corresponding value of k . Results obtained from simulated data and real data show that the performance of new algorithm is better than conventional BAQ when raw data is having heavy SD. [C4495]

"A High-Resolution DOA Estimation Algorithm Based on Sub Array Partition"

A broadband high resolution algorithm is proposed to estimate direction of arrival (DOA) of the source based on two stages beamforming and the sub array partition approach. The two stages beamforming scheme includes the sub array broadband beamforming stage and the minimum variance distortionless response (MVDR) beamforming stage in sub array level. Consequently, the proposed algorithm can be applied to broadband source detection and holds the high resolution ability meanwhile. What is more important is that it can be calculated very fast, thus it is suitable for realtime applications. Simulation results show the proposed algorithm works effectively. [C4496]

"Advances in microwave systems for medical applications"

A new system for contact-less heartbeat detection is proposed. Operating at 2.4, 5.8, 10, 16, and 60 GHz, our system shows the possibility to detect the heartbeat rate at a distance of 1 m from the person. The heart rate variability is extracted as well. Originating from experimental measurements, a model presenting the cardiopulmonary activities is proposed. Separating the heartbeat signal from the respiration signal is done using different methods and for several SNR values. [C4497]

"The use of fuzzy neural networks for estimating the parameters of the K-distribution"

Recently, artificial neural network have been used in radar signal detection. In this paper, a fuzzy neural approach for estimating the parameters of the K distribution is proposed. We use the back propagation (BP) algorithm for the training process. We obtain improved results compared with those obtained by the method based on higher order and fractional moments for small sample sizes. [C4498]

"Modified PN codes for laser remote sensing measurements"

We describe a modified pseudo noise code for laser remote sensing measurements. Our experiments show it improves receiver signal to noise ratio and time resolution and is well suited for lasers with limited peak power. [C4499]

"Design automation for a 3DIC FFT processor for synthetic aperture radar: A case study"

This work discusses a 1024-point, memory-on-logic 3DIC FFT processor for synthetic aperture radar (SAR), sent to fabrication in the 180 nm MIT Lincoln Labs 3D FDSOI 1.5 V process along with the design flow required to realize it with off-the-shelf commercial 2D tools. The work shows how the vertical dimension can be exploited for novel memory architecture tradeoffs that are not feasible in 2D, reducing the energy consumed per memory operation in the FFT by 60.3%. In comparison to its 2D counterpart, the SAR FFT processor exhibits a 53.0% decrease in average wire length, a 24.6% increase in maximum operating frequency and a 25.3% decrease in total silicon area. [C4500]

"Modified AIC and FPE criteria for autoregressive (AR) model order selection by using LSFB"

estimation method"

The Least-Squares-Forward-Backward (LSFB) method for estimating the parameters of the autoregressive (AR) model is considered and new theoretical approximations for expectations of the prediction error and the residual variance are derived. These results are used for modifying the AR order selection criteria FPE and AIC. The performance of these modified criteria is compared with other AR order selection criteria using simulated data. The results of these performance comparisons show that the new criteria have better performance in the finite sample case. [C4501]

"Design and realization of the vehicle-mounted unit for a remote electronic monitoring and calibration system"

This paper introduced the GPS/GPRS-based remote electronic monitoring and calibration system, as well as its working principle and system framework. Then the hardware structure and software designing of vehicle mounted unit were introduced. Next, we emphasize testing the reliability and speed of communications while refreshing the data of ECU through GPRS. As a conclusion, it quickly implements the functions of vehicle remote supervision and ECU calibration. [C4502]

"SEC: Stochastic Ensemble Consensus Approach to Unsupervised SAR Sea-Ice Segmentation"

The use of synthetic aperture radar (SAR) has become an integral part of sea-ice monitoring and analysis in the polar regions. An important task in sea-ice analysis is to segment SAR sea-ice imagery based on the underlying ice type, which is a challenging task to perform automatically due to various imaging and environmental conditions. A novel stochastic ensemble consensus approach to sea-ice segmentation (SEC) is presented to tackle this challenging task. In SEC, each pixel in the SAR sea-ice image is assigned an initial sub-class based on its tonal characteristics. Ensembles of random samples are generated from a random field representing the SAR sea-ice imagery. The generated ensembles are then used to re-estimate the sub-class of the pixels using a weighted median consensus strategy. Based on the probability distribution of the sub-classes, an expectation maximization (EM) approach is utilized to estimate the final class likelihoods using a Gaussian mixture model (GMM). Finally, maximum likelihood (ML) classification is performed to estimate the final class of each pixel within the SAR sea-ice imagery based on the estimated GMM and the assigned sub-classes. SEC was tested using a variety of operational RADARSAT-1 and RADARSAT-2 SAR sea-ice imagery provided by the Canadian Ice Service (CIS) and was shown to produce successfully segmentation results that were superior to approaches based on K-means clustering, Gamma mixture models, and Markov Random Field (MRF) models for sea-ice segmentation. [C4503]

"Dynamic home agent assignment in WLAN with cellular networks"

Wireless local area networks (WLANs) are providing the most economical means of Internet access. However, their access is very much limited. They can be deployed in a large scale by integrating them with cellular networks such as universal mobile telecommunication system (UMTS), general packet radio services (GPRS) etc. A seamless roaming between these two hetero networks can be ensured through mobile IP. But the two networks don't have support towards mobile IP which requires the deployment of home agents and a protocol between the mobile nodes, home agents and foreign agents. Hence seamless roaming can be provided by incorporating Mobile IP support in 802.11 (WLAN) networks. The cellular networks require the home agent placement to be placed and the appropriate home agents to be assigned. The home agent placement and home address assignment are the issues for supporting Mobile IP for heterogeneous roaming. If the mobiles use a home agent (HA) that is deployed in a UMTS network when roaming in a WLAN network, the UMTS network may get overloaded with WLAN traffic. The solution to this problem is to dynamically assign an HA in the WLAN domain. Different architectures can be obtained by placing HA at different positions each having its own shortcomings, in which HA is placed between border router and GGSN that requires HA performing very high speed routing as fast as GPRS gateway signaling node (GGSN) which is practically not possible occurring in the existing architecture. To overcome these difficulties different architectures are proposed in this paper. In the first architecture the HA and GGSN is connected to the border router instead of tightly coupling the HA to the GGSN, and the second architecture is HA can be collocated with one of the GGSN in UMTS network and in the third architecture, GGSN is the default router of the mobile nodes (MN) under its coverage area, the foreign agent (FA) is best collocated with the GGSN. Based on the observation of proposed architectures through performance metrics on packet overhead an attempt towards dynamic home agent assignment has been proposed. [C4504]

"Improving particle filter with a new sampling strategy"

Particle filter has many variations, one of which is the unscented particle filter. The unscented particle filter uses

the unscented Kalman filter to generate particles in the particle filtering framework. This method can give better performance than the standard particle filter in some practical problems that are raised in computer vision field. But one critical issue in the unscented particle filter is that it has very high computational complexity which constrains its broader application. In this paper, we give an improvement strategy aiming at reducing the computational complexity of the algorithm. This strategy combines the general framework of particle filtering with the transition prior and the unscented Kalman filter, taking advantage of the low computational complexity of the standard particle filter and the high estimation accuracy of the unscented particle filter. The experimental results show that this strategy can reduce the running time cost of the unscented particle filter greatly without loss of accuracy. [C4505]

"A variable-structure IMM filtering algorithm based on current statistical model"

A new variable-structure IMM method for maneuvering target tracking using current statistical model is presented. The maximum acceleration a design parameter in current statistical model, is used to design various motion models. The model set adaptation logic according to the maximum acceleration variety is also proposed in the paper. Simulation shows that the performance of new method is superior to the fixed structure IMM algorithm when target maneuver is intense. [C4506]

"OTHR impulsive interference characteristics and detection based on AR model"

A novel impulsive interference (IMI) detection algorithm based on AR model is proposed in this paper, aiming at detecting the IMI and estimating its position in the echo samples received by Over-the-horizon Radar (OTHR). The key to the algorithm is the exploitation of the IMI's spectrum characteristics which is regarded as complex sinusoid and modeled as autoregression(AR). When getting the AR model, the amount of the contained sinusoid signals and their frequency parameters can be estimated by the transfer function, where the frequency is just corresponding to the IMI's position. This algorithm's operational performance is evaluated using experimental data sets from a high frequency surface wave (HFSW) OTHR system, and is proved to be suitable for most types of IMIs. [C4507]

"Implementation and analysis of the NLMS algorithm on TMS320C6713 DSP"

In this paper we present an implementation of the LMS (Least Mean Square), NLMS (Normalized Least Mean Square) and other LMS based algorithms on the DSK (DSP Starters Kit) TMS320C6713 with the intention to compare their performance. We obtained the time and frequency behaviour, and the processing speed of the analyzed algorithms. The objective of the NLMS algorithm is to obtain the best convergence factor considering the input signal power in order to improve the filter convergence time. The obtained results show that the NLMS has better performance than the LMS, unfortunately, the computational complexity increase which means more processing time. [C4508]

"3D imaging algorithm and implement for through-wall synthetic aperture radar"

Typical synthetic aperture radar (SAR) images are two-dimensional, providing range and azimuth information, but furnish few details with respect to elevation. First of all, one approach to extend SAR to three-dimensional imaging is considered. The simplest implementation of this would replace the single antenna element by a linear array oriented vertically. Secondly, the outlining data and image processing for a three-dimensional application is introduced in detail in the paper. Finally, simulation results show that the proposed algorithm is effective, while maintaining good image quality in terms of the reconstructed target response. [C4509]

"An airborne radar system for three dimensional SAR tomography"

In this paper, a new airborne radar system for three dimensional SAR tomography is proposed. The multiple antennas are amounted under the wing of airplane with one transmitter element and all receivers. The signal model of this system is presented and the unambiguous elevation is given. The feasibility is validated by simulation results both from single flight and multiple sparse flights. [C4510]

"OTHR impulsive interference detection in strong clutter background"

External impulsive interference (IMI) will severely degrade the performance of an Over-the-horizon radar (OTHR), and detection and suppression of IMI in strong clutter environment is the prerequisite for the target detection. This paper proposes a novel method based on the signal subspace properties, aiming at effectively detecting IMI with easy or without clutter suppression. Selective survey on median eigenvalues variation and discarding two largest eigenvalues can suppress clutter and simultaneously show peaks indicating the IMI position, which can be viewed as a joint clutter suppression and interference detection. Its operational

performance is evaluated using experimental data from a high frequency surface wave(HFSW) OTHR system. [C4511]

"A design of motion compensation for high resolution imaging of missile-borne SAR"

The accurate motion compensation is important for gaining high resolution of imaging for some characteristics of missile-borne SAR, such as high speed, motion pose errors, high real-time and so on. The paper first introduces the two types of errors of missile-borne SAR and their effects to image. Subsequently, the first class of error, including normal face error and error along flight route, is described in details due to its serious effects to imaging. At the same time, the corresponding compensation algorithms are also showed. Finally, the paper gives the simulation results that the phase compensation to Doppler phase errors resulting from slant distance can improve the imaging resolution effectively. In the meantime, the phase compensation to Doppler modulation frequency errors resulting from speed error ameliorates Doppler mismatching. The resolution of the system reaches two meter. [C4512]

"A novel approach to improve Doppler tolerance of polyphase code"

Polyphase codes have a large mainlobe-to-sidelobe ratio in matched filter processing. However, the conventional matched filter processing of polyphase codes suffer severe signal loss in performance under large Doppler environment. The basic approach for overcoming the Doppler effect is to use a bank of Doppler-matched filters. Each of the Doppler-matched filters is designed to match a different Doppler frequency. However, the brute force method causes heavily computed burden. This paper proposed a novel correlator based on partial match filter (PMF), followed by the FFT and maximum output selector. The method can simultaneously search all possible Doppler frequencies. The processing scheme can cancel the phase rotation resulted from Doppler frequency, therefore, improve Doppler tolerance when detecting polyphase codes. The performance for the Doppler tolerance improves with decreasing of size of partial correlator and FFT. The scalloping loss can be compensated by zero-padding FFT. [C4513]

"GPS synchronized wide area multilateration system"

This paper discusses a global position system (GPS) synchronized wide area multilateration (WAM) system for air traffic management. The system takes advantage of secondary surveillance radar (SSR) downlink mode S/A/C signals on 1090 MHz channel, determines the position of airplane passively by TDOA (time differential of arrival) hyperbolic position method. Also this system has ADS-B (auto-dependent surveillance-broadcast) capability to position those airplanes with onboard ADS-B transponders, and the experimental results of WAM and ADS-B are discussed. [C4514]

"Design and implementation of an improved channelized architecture"

When complex signals go through poly-phase digital channelized receiver, in order to ensure there are no blind spots and frequency aliasing, the maximum decimation factor per channel can only be half of the number of the channels. In this way, the entire receiver has to process at least twice as much data as before. This directly sets much higher requirements to the processing rate of signal processors. What is more, the sampling rate of analog-to-digital converter today is far beyond the processing rate of signal processor. With the expectation to fill the gap between the processing rate of signal processor and the sampling rate of DAC, this paper developed a parallel computing architecture. This method analyses the law of the convolution in the non-blind spots digital channelized receiver and the filter bank structure is achieved by using two modules. Besides, this design ameliorates the source problem of processors efficiently by adopting parallel computing on multi-processors. Experimental results proved that the proposed method performs well in improving the characteristic of ultra-wideband channelized receiver, especially complex signals involved. [C4515]

"A joint time and frequency synchronization method based on PN sequences for OFDM"

OFDM system performance is sensitive to frequency offset and timing error than single-carried system. In this paper, a novel joint time and frequency synchronization method is proposed based on PN sequences for OFDM. A special training symbol of OFDM is constructed with the PN sequence and the differentially coded PN sequence in the transmitter, in the receiver, the training symbol is differentially decoded to get the time synchronization with the autocorrelation property of PN sequence before the frequency offset is estimated, then it eliminates the effect of polarity of the received signal with local PN sequence to get the fine frequency offset estimation combined with ML method. The performance of time synchronization is excellent in low SNR, the maximum frequency offset estimation range can be up to one half of overall signal bandwidth, the simulation results show that the proposed method is effective. [C4516]

"A sidelobe level reduction (SLL) for planar array antennas"

The application of the genetic algorithms to the optimization of planar array weights will be investigated. The aim is to adjust the weights coefficients of the array elements to achieve a minimum sidelobe level (SLL) with narrower beam width. The peak (PSL) sidelobe level of the synthesized beam pattern has been successfully lowered. The results are compared with synthesized pattern using Gaussian, Kaiser, Hamming and Blackman weights coefficients and gives a significant improve for a peak sidelobe level (PSL). The minimum achieved peak sidelobe level (PSL) is -32 dB for beam width of 16deg and -22.82 dB for beam width of 12deg. [C4517]

"Estimation of angle glint for different radar targets"

Angle glint can be the distortion in the radar echo signal phase front and is observed as deviation of the direction of power flow from the radial direction and give rise to radar pointing errors. The mechanism that gives rise to these errors is also responsible for angular errors observed in radar multipath conditions. The effect can be either natural or intentional and is due to the destructive interference between the reflections from different scattering centers on the target. The apparent direction from where a scattered field originates is perpendicular to the phase front of the wave, and in regions where there is destructive interference between the fields there can be significant distortion of the front. For various glint angles using different frequencies the received echo power is calculated and the result is simulated using MATLAB. The range glint is also calculated using different carrier frequency. In obtaining the received echo power, the polarization aspect is considered and the received echo power for different glint angle is simulated for different polarization. Thus the different simulation has been carried out to find the glint error for different scatterers. The radar will move in such a direction so as to nullify the glint angle error produced by the scattering surface of the target. [C4518]

"Asynchronous and variable data rate OFDM modem for RADAR data transmission"

This paper addresses the real trials of a new OFDM modem specifically designed for data RADAR transmission that was promoted by the Spanish aeronautical authorities. The nature of this environment is very different of standard applications and has required some new features that will be described in the sequel. The data source is asynchronous depending on the appearance of new plots, and therefore the data rate is also variable. Frames transmission must be very short, less than one second because it is a critical real time application. It is unidirectional, that means that we do not have a feedback channel to inform the transmitter about the channel state. To cope with this lack of time diversity we have implemented a parallel transmission strategy by different channels well separated in frequency. Also, FEC and CRC codes are included working with very short interleavers due to the delay requirement. This design has been tested in a real link between Madrid and Las Palmas de Gran Canaria with quite satisfactory performance using our own broadband transceiver to make the multiband transmission efficiently. [C4519]

"HF radar observation of ionospheric irregularities with unusual behaviour"

HF radar ionospheric echoes have been observed at mid latitudes, exhibiting a very unusual behaviour in the RTI (Range-Time-Intensity) display with fast quasi-periodic variations of the power of the echoes in the range 1-10 seconds. A wavelet analysis reveals that periodicities are in fact present in the data ranging from 1 second up to 400 seconds, depending on the time of observation. The strongest radar echoes were recorded during the first 40 minutes of the experiment. The radar used for these observations offers the possibility to perform scanning in elevation and in azimuth by software. Elevation scans have been used to estimate the height of the echoing region. Apparently the echoes are not coming exactly from the aspect-sensitive region. This result must be considered carefully because at HF frequencies refraction of radio waves easily produces ray bending. [C4520]

"Electromagnetic Earth environment-new radio diagnostic"

Electromagnetic emissions observed in the nearest Earth environment are a superposition of natural emissions and various types of man-made noises. Also, as a consequence of catastrophic events on the Earth surface such as: thunderstorm activity, earthquakes, volcanic eruptions, electromagnetic signals are registered on board low orbiting satellites. Therefore, a more accurate physical description of such a complex and dynamic system calls for a long term multi-point and multi-scales coordinated monitoring of space environment. The magnetised solar-terrestrial space plasma is a highly non-linear medium, which exhibits many different types of turbulence and instabilities. A study of mass, energy, and momentum transport in the solar terrestrial plasma is directly related to the study of space plasma turbulence. The wide range wave in situ diagnostics and new generation multi-point and multi-type sensor diagnostics, as the LOFAR-LOIS system can be a good tool for monitoring such complex system. Ground-based multi-frequency and multi-polarisation netted radio and radar facilities and observation clusters in space will be helpful to find solutions to problems in space physics and to detect long-

term environmental changes. The presentation will give the overview of physical problems relates to diagnostics the plasma turbulence in near Earth environment and will present the new observation techniques devoted to the space plasma diagnostics; as in situ wave measurements combined with ground based LOIS netted radar registration. [C4521]

"Spatial decorrelation of VHF and UHF trans-ionospheric signals measured at Ascension Island"

The effect of spatial decorrelation of signals of space-based synthetic-aperture radars by equatorial ionospheric turbulence, is studied by monitoring 150 and 400 MHz signals from LEO beacon satellites on an array of spaced antennas located on Ascension Island, and analysing the cross-correlations of the phases of the received signals. The special property of this approach is that it does not convolve the spatial fluctuations with the movement of the satellite. The geometrical component of the phase difference between antennas is accurately removed by adjusting the satellite position using the measured phases. As expected, the phase of VHF signals is much more affected by scintillation than the UHF phase. In the example given, the spatial correlation over 130 m falls to zero at VHF and 0.55 at UHF. Correlations over longer distances have been determined using a novel 'phase reconstruction' technique. In the absence of scintillation the decorrelation distance is ≈ 10 km for both frequencies; with increasing scintillation, it decreases to around 100 m at VHF and 300 m at UHF. [C4522]

"The synthetic aperture radar transionospheric radio propagation simulator (SAR-TIRPS)"

Space-based synthetic aperture radars (SAR) operating below 1 GHz are subject to forward scattering by ionospheric irregularities. This limits the synthetic aperture and bandwidth over which phase coherence can be maintained. This paper describes the SAR trans-ionospheric radio propagation simulator (SAR-TIRPS), a phase screen model which simulates ionosphere-corrupted SAR images of point targets. The Parabolic Equation propagation method allows both phase and amplitude fluctuations to be modelled. Background Total Electron Content (TEC) is modelled as an additional frequency-dependent phase shift. Examples are presented of L-band and P-band SAR simulations, showing how the target image and derived quantities (sidelobe ratios along- and cross-track) vary with changing ionospheric phase spectrum parameters. SAR-TIRPS proves to be a useful tool in assessing design concepts for low-frequency space radars. [C4523]

"Application of nonlinear optical mixing to microwave photonic instantaneous frequency measurement"

We demonstrate use of all optical mixing in a highly nonlinear fiber to achieve microwave photonic frequency measurement. The system is simple, compact, predictable and stable with potential applications in next generation radar warning receivers. [C4524]

"A tunable-frequency system for touch-less heartbeat detection and HRV extraction"

This paper presents a practical study for heartbeat detection at 1 m distance. Our microwave system, based on a vector network analyzer, is used at 2.4 GHz, 5.8 GHz, 10 GHz, 16 GHz, and 60 GHz. Heart Rate Variability is extracted from the time domain variation of the phase of S21 for both the original and the smoothed signal, and its standard deviation is calculated. [C4525]

"Location systems with sensors-Overview and new approach"

A traditional approach to indoor tracking uses non-RF techniques, such as infrared and ultrasound. A disadvantage of these methods is that they do not work unless the sensors have direct connection with the nodes, to which the reference made the estimations of the distance. Another approach for inside buildings location systems uses only RF sensors, a similar principle to the one used by the Global Position System (GPS). The goal of the paper is to highlight the main differences between these systems and to propose a new method for inside buildings location systems. [C4526]

"Transformation effects on invariant property of invariant hypothesis test and UMPI detector"

The Uniformly Most Powerful (UMP) test, which is one with the highest probability of detection over all unknown parameters in a composite hypothesis test, does not exist in the most practical problems. It is common to derive the suboptimal Generalized Likelihood Ratio (GLR) detector, that is shown to perform close to optimal invariant tests in some problems. The Uniformly Most Powerful Invariant (UMPI) test is the one that is used for the performance evaluation of the GLR detector. However, the GLR or UMPI detectors are not simply derivable in many problems. In this paper, we suggest that the problem be transformed to a new space. We derive the conditions of the transformation, such that the detectors for the original problem and the transformed ones become equivalent. In addition, using this method, we discuss two practical problems (one in radar and other in

communication) and derive the GLR detectors. We also find the UMPI detectors in these problems to verify the performance of the derived GLR detector. [C4527]

"A sequential procedure for simultaneous detection and state estimation of Markov signals"

The problem of joint detection and state estimation of a Markov signal when a variable number of noisy measurements can be taken is here considered. In particular, the signal-observation sequence $\{X_i, Z_i\}_{i=1}^N$ is a hidden Markov process (HMP) while, if the signal is absent, the measurement $\{Z_i\}_{i=1}^N$ is an i.i.d. process. In this framework, two coupled detection and estimation procedures are introduced for the cases of discrete and continuous state space. Bounds on the performance of the proposed procedures in terms of the thresholds are derived, similar to the classical bounds for the sequential probability ratio test (SPRT). Moreover, it is shown that, under a set of rather mild conditions, the procedures end with probability one and the stopping time is almost surely minimized in the class of tests with the same or smaller error probabilities. [C4528]

"Performance enhancement of pulsed solid state power amplifier using Drain Modulation over Gate Modulation"

The study was conducted to compare the RF parameters of pulsed solid state power amplifier using drain modulation and gate modulation and thereby to analyze the impact of modulations on the pulsed performance. To establish this, the C-band pulsed SSPA is designed, fabricated and tested at 5.35 GHz frequency with 225 MHz bandwidth using two different methods of modulation techniques, implemented on electronic power conditioner. The performance of two modulation techniques is compared for different RF parameters. The test results of drain and gate modulated pulsed solid state power amplifier are discussed at length for identical dc operating conditions and based upon the measured performances, conclusion are derived. This pulsed microwave solid state power amplifier can be used by pulsed RADAR community for the development of space borne RADAR like synthetic aperture radar, altimeter etc. for microwave remote sensing applications. [C4529]

"Automatic reconstruction of cities from remote sensor data"

In this paper, we address the complex problem of rapid modeling of large-scale areas and present a novel approach for the automatic reconstruction of cities from remote sensor data. The goal in this work is to automatically create lightweight, watertight polygonal 3D models from LiDAR data (Light Detection and Ranging) captured by an airborne scanner. This is achieved in three steps: preprocessing, segmentation and modeling, as shown in Figure 1. Our main technical contributions in this paper are: (i) a novel, robust, automatic segmentation technique based on the statistical analysis of the geometric properties of the data, which makes no particular assumptions about the input data, thus having no data dependencies, and (ii) an efficient and automatic modeling pipeline for the reconstruction of large-scale areas containing several thousands of buildings. We have extensively tested the proposed approach with several city-size datasets including downtown Baltimore, downtown Denver, the city of Atlanta, downtown Oakland, and we present and evaluate the experimental results. [C4530]

"Real-time vehicle detection for highway driving"

We present a new multi-stage algorithm for car and truck detection from a moving vehicle. The algorithm performs a search for pertinent features in three dimensions, guided by a ground plane and lane boundary estimation sub-system, and assembles these features into vehicle hypotheses. A number of classifiers are applied to the hypotheses in order to remove false detections. Quantitative analysis on real-world test data show a detection rate of 99.4% and a false positive rate of 1.77%; a result that compares favourably with other systems in the literature. [C4531]

"NQR-based explosives detection-an overview"

Nuclear quadrupole resonance (NQR) is a radio frequency spectroscopic technique that can be used to detect solid-state compounds containing quadrupolar nuclei, a requirement fulfilled by most high explosives (and narcotics). In this paper, we present an overview of recent research in the detection of explosives using this technique. We also present mathematical models for the data for different acquisition techniques and discuss different state of the art detection algorithms. Finally, we evaluate various algorithms on measured and simulated NQR data. [C4532]

"Automatic registration of LIDAR and optical images of urban scenes"

Fusion of 3D laser radar (LIDAR) imagery and aerial optical imagery is an efficient method for constructing 3D virtual reality models. One difficult aspect of creating such models is registering the optical image with the LIDAR

point cloud, which is characterized as a camera pose estimation problem. We propose a novel application of mutual information registration methods, which exploits the statistical dependency in urban scenes of optical appearance with measured LIDAR elevation. We utilize the well known downhill simplex optimization to infer camera pose parameters. We discuss three methods for measuring mutual information between LIDAR imagery and optical imagery. Utilization of OpenGL and graphics hardware in the optimization process yields registration times dramatically lower than previous methods. Using an initial registration comparable to GPS/INS accuracy, we demonstrate the utility of our algorithm with a collection of urban images and present 3D models created with the fused imagery. [C4533]

"Multiple dictionaries-based radar target identification via a likelihood ratio test"

Target identification has been an active researching area in past decades. In this paper, we present an iteration procedure to optimize the size of the undercomplete dictionary when multiple undercomplete dictionaries are used to characterize the scattering signatures of a complex target. Furthermore, we extend the signature reconstruction and decision criterion with only single undercomplete dictionary to the case with multiple dictionaries for a more practical target identification application. The proposed approach is compared with the matching-score criterion-based approach and single dictionary-based approach using measured signatures of three aircraft models in an ultra wide-band chamber. Results show that the proposed approach can provide more promising identification accuracy due to a more effective representation to the complex scattering behaviors. [C4534]

"Specific radar emitter recognition based on wavelet packet transform and probabilistic SVM"

Radar emitter recognition plays an important role in military automated command and control system. It is a composite task that involves radar signal interception, modulation recognition, features extraction and classification. In this paper, a wavelet packet transform is used for feature extraction of unintentional modulation on pulse (UMOP). Then specific radar emitter recognition is achieved by a probabilistic SVM (PSVM). Experiments on simulation and actual radar data verify the correctness and validity of this method. [C4535]

"Implementation of optimized 6-bit phase angle calculation from phase gradients for T/R Modules in active phased array radars using FPGA"

The Beam steering controller plays a vital role in steering the antenna beam of active phased array radars where beams are formed electronically. The Transmit / Receive Modules (T/R Modules) are key parts of advanced phased array radar systems. In order to produce beam pattern from multiple radiating elements, the phase angle of each T/R Module must be assigned with a calculated value. When Common phase gradients are sent to all Transmit / Receive Unit Controllers (TRUCs), the respective phase values are calculated for the radiating element associated with them. The position of a T/R Module in the array decides the phase angle of corresponding radiating element. In this paper, the calculation of optimized 6-bit phase angle from the phase gradients carried out using FPGA is discussed in a detailed manner. Also the use of logic core and quantization of phase values are discussed elaborately. The implementation is carried out using the Xilinx Spartan chip XC2S100tq144-5. Also synthesis and Place and Route reports are discussed. [C4536]

"Dual-modal indoor mobile localization system based on prediction algorithm"

Object localization defines an important application for wireless sensor networks. In this paper, we present a hybrid of dual-modal mobile localization system to support the object tracking in indoor environment. In order to decrease the system cost and simplify the sensor deployment, we implement the localization by the received radio signal strength approach and the unscented Kalman filter (SPKF) algorithm in active and passive dual-modal architecture. We realize the system by employing the wireless sensor network and the LAN medium Zigbee/802.15.4. Experimental results demonstrate that the hybrid mobile localization system can significantly improve the localization accuracy and robustness, and reduce the cost of communication among sensor nodes while mobile user is moving in the indoor environments. [C4537]

"Serial Concatenation of LDPC and Turbo Code for GPRS System under Different Fading Channels"

In wireless communication systems, error control coding is necessary to provide reliable communications over fading channels. Turbo code is used practically in third generation due to good error correcting capability. However, it has error floor at high signal-to-noise ratio (SNR). Concatenation of another code as an outer code is an alternative to reduce turbo code error floor. In this paper, we study the behavior of a general packet radio service (GPRS) system, under different scenarios. We propose a method for reducing transmitter energy

versus bit error rate and eliminating the error floor via a serial concatenation of low density parity check (LDPC) and turbo codes instead of the convolutional coded system. Moreover, computer simulations were conducted to compare the overall system performances obtained with turbo coding to the serial concatenation coded and channel non coded systems. The performance of the coding scheme is discussed in a Rayleigh fading channel with correlated and non correlated fading amplitudes and an additive white Gaussian noise (AWGN). Evaluation of the proposed encoder has shown a performance improvement over fading channels. [C4538]

"A RF receiver front-end with adaptive discrete-time charge-transfer filter and passive gain-boosting in 90nm CMOS"

Discrete-time signal processing receivers combine gain, down-conversion, anti-aliasing, down-sampling, filtering and dc-offset compensation in one analog block to reduce the size of the solution. This paper presents an analog front-end (AFE) of a single-chip GSM/GPRS/EDGE (GGE) radio in 90nm digital CMOS which based on discrete-time analog signal processing. At the heart of the AFE is the passive switched-capacitor stages providing gain-boosting by impedance transformation while providing a 3rdorder RC filter response. The AFE achieves 1.8dB NF with -19dBm IIP3. The filter occupies 0.2mm² and consumes only 7mA. [C4539]

"CMOS frequency generation system for W-band radars"

A CMOS frequency generation system for W-band radars, including a phase-locked loop (PLL) (55-60 GHz) with a frequency-divided-by-2 output and an offset mixer for generation of a W-band carrier (83-90 GHz) is realized using low leakage transistors of a low cost 65-nm bulk CMOS process. The phase noise of PLL is as low as -87 and -112 dBc/Hz at 1 and 10 MHz offsets. The PLL consumes 46 mW. The total frequency generation system consumes 180 mW. [C4540]

"A 77 GHz 90 nm CMOS transceiver for FMCW radar applications"

The first 77 GHz frequency modulated continuous wave (FMCW) radar transceiver IC with an accurate FMCW signal generator using a 90 nm CMOS process is presented. To realize accurate FMCW radar system in CMOS, a PLL synthesizer that is able to output linear FMCW frequency is applied. Measured radar performances, output spectrum and distance of a target, show the transceiver achieves a fundamental function for radar applications. [C4541]

"A direct digital frequency modulation PLL with all digital on-line self-calibration for quad-band GSM/GPRS transmitter"

The quad-band GSM/GPRS transmitter is implemented by using a PLL with an all-digital on-line self-calibration. Based on the all-digital self-calibration algorithm, all RF impairments including VCO gain and loop filter variations can totally be calibrated and repaired all digitally within 1% error. The calibration time is only 50usec by using digital adaptive gain algorithm so that the RF impairments are calibrated for every burst to track temperature, voltage, and process (PVT) variations. The measurement results show that the typical RMS phase error < 0.7° and 0.8°, 400kHz ORFS are < -69 and -66dBc, and the receive-band phase noise is 165 dBc/Hz and 158 dBc/Hz for the low and high bands, respectively. It demonstrates that exceeds 4° margin to phase error and 6dBc margin to ORFS requirements for GSM/GPRS SAWless application. [C4542]

"Speckle Noise Filtering for Sea SAR Image"

The aliasing of the speckle noise and echo information of sea SAR blurs the structure character of sea SAR image. It is difficult that to enhance structure character of sea SAR image. Aiming at this difficulty, we propose an amalgamation frame based on EMD and exponent. The frame can effectively filter the speckle noise and enhance the structure character which finally can be seen by people's eyes. Using the different frequency character of each level, the content of each level noise and non-noise are analyzed and exponent of each level is adjusted. And the speckle noise of simple SAR image in different scale is filtered. At last, we obtain the new denoised SAR image. The experiment result indicates that speckle noise of our result is substantially decreased and the structure character and texture of the result is clearer. And our eyes can distinguish the character of sea SAR image. So that it proves that our filtering algorithm is effective to filter the speckle noise of sea SAR image. [C4543]

"A Comparison of Bayesian Filter Based Approaches for Patient Localization during Emergency Response to Crisis"

In order to overcome the logistical impediments caused during mass casualty disasters, we had proposed a new emergency response system based on a location aware wireless sensor network in our previous work. In this

paper, we have implemented two new Bayesian filter based algorithms called improved range-based Monte Carlo patient localization and range-based unscented Kalman filter patient localization for real time localization of large number of patients at the disaster site. The simulation in realistic conditions of both the algorithms is done using a random waypoint and a disaster management mobility model to identify their suitability for patient tracking. The new localization solution in tandem with the emergency response system shall facilitate efficient logistic support at the disaster site. [C4544]

"Radar Signal Automatic Classification Based on PCA"

This paper introduces an efficient approach to radar signal automatic classification by extracted fusion feature entropy. In this approach, wavelet packet reconstruct coefficient features are extracted from given radar signals in frequency domain based on wavelet packet decomposition. Then, these features are fused with the principal component analysis and a single characteristic feature vector which can effectively represent difference radar signals is obtained. Aiming at the single fusion feature, its energy entropy and symbolization probability entropy are extracted and extracted fusion feature entropy are used to classify emitter radar signal with fuzzy c-mean clustering algorithm. Simulation experiment show that the proposed approach is verified to be highly accurate and robust even in the low SNR, and the classification algorithm needs only very small memory space to store the reference information and can fast implement radar signal classification. [C4545]

"An Improved Algorithm of PRI Transform"

It is a difficult problem to deinterleave radar radiating source in the electronic countermeasure field at present, the pulse repetition interval (PRI) constant and PRI jitter pulse sequence can be deinterleaved by PRI transform algorithm, but it has some disadvantages. The deinterleaving right rate is affected by the range of PRI value, and the PRI transform algorithm is not useful to PRI stagger pulse sequence. In order to resolve the two problems, an improved algorithm is proposed in this paper, and simulation results show that this improved algorithm is effective. [C4546]

"Study on radar emitter recognition signal based on rough sets and RBF neural network"

With the development of new type and use of radar emitter, it is more difficult to recognize radar emitter signal. The radar emitter signal information is converted into discrete value in this paper. The attribute of radar emitter signal is reduced and the decision rules are extracted based on rough sets. Then the cluster center of radial basis function (RBF) neural network is gain by rough K-means cluster method. The RBF neural network is constructed with the help of decision rules extracted from information table. The simulation result shows this radar emitter recognition model base on rough sets and RBF neural network can cut down the redundant attribute, lessen the neural network structure and recognize radar emitter signal effectively. [C4547]

"A novel deinterleaving algorithm of radar pulse signal based on DSP"

A deinterleaving algorithm of radar signal based on DSP is presented in this paper, which is according to the structure of the deinterleaving system, characteristics of PDW (pulse descriptor word) and histogram method. The threshold determination, accumulation of PRI (pulse repetition interval) and others in the algorithm applied in different fields are introduced in detail. The experimental results and comparison with PRI transform method show that the algorithm in the paper does not only achieve the excellent deinterleaving performance in the mixed signal of normal pulses, staggered pulses and jittered pulses with high density of 200 thousand pulses per second from the same direction, but also do well with the capability of real-time processing and robustness. [C4548]

"24GHz-band UWB-IR pulse generation using optical signal processing"

Experimental demonstration of a 24 GHz-band ultra wideband impulse radio (UWB-IR) pulse generation has been reported. The generated UWB-IR pulse has 24.7 GHz of a center frequency and 9.4 GHz of a -10 dB bandwidth. [C4549]

"SAR image speckle reduction algorithm based on second wavelet packet transform"

According to the different characteristics that signal and noise exhibit during the wavelet decomposition, a new denoising method based on the second wavelet packet decomposition is presented. In this paper, by using the best wavelet packet, the synthetic aperture radar (SAR) images are decomposed and the norm of each sub-band is calculated. Then signals and noise can be discriminated and the images can be denoised based on the norm and soft-threshold ways. Experiments show that the proposed algorithm is of excellent performance in denoising SAR images, and can remove most noise of images with well-kept texture detail information. The

calculating speed of the method is twice the speed of the general wavelet packet transform algorithm. [C4550]

"Resolver-to-digital converter based on tangent algorithm"

The paper proposes a solution to digitize the angle information of the two speed resolvers based on tangent algorithm. This solution is simple than the tracking types in common use. The principle is analysed and the configuration of software and hardware is presented. To avoid overflow and improve precision, sampling at the signal peak and two tables are adopted. The experiments show that the solution is steady, reliable, high-accuracy, and low-cost. [C4551]

"Vanishing point detection for road detection"

Given a single image of an arbitrary road, that may not be well-paved, or have clearly delineated edges, or some a priori known color or texture distribution, is it possible for a computer to find this road? This paper addresses this question by decomposing the road detection process into two steps: the estimation of the vanishing point associated with the main (straight) part of the road, followed by the segmentation of the corresponding road area based on the detected vanishing point. The main technical contributions of the proposed approach are a novel adaptive soft voting scheme based on variable-sized voting region using confidence-weighted Gabor filters, which compute the dominant texture orientation at each pixel, and a new vanishing-point-constrained edge detection technique for detecting road boundaries. The proposed method has been implemented, and experiments with 1003 general road images demonstrate that it is both computationally efficient and effective at detecting road regions in challenging conditions. [C4552]

"LidarBoost: Depth superresolution for ToF 3D shape scanning"

Depth maps captured with time-of-flight cameras have very low data quality: the image resolution is rather limited and the level of random noise contained in the depth maps is very high. Therefore, such flash lidars cannot be used out of the box for high-quality 3D object scanning. To solve this problem, we present LidarBoost, a 3D depth superresolution method that combines several low resolution noisy depth images of a static scene from slightly displaced viewpoints, and merges them into a high-resolution depth image. We have developed an optimization framework that uses a data fidelity term and a geometry prior term that is tailored to the specific characteristics of flash lidars. We demonstrate both visually and quantitatively that LidarBoost produces better results than previous methods from the literature. [C4553]

"A robust approach for automatic registration of aerial images with untextured aerial LiDAR data"

Airborne LiDAR technology draws increasing interest in large-scale 3D urban modeling in recent years. 3D LiDAR data typically has no texture information. To generate photo-realistic 3D models, oblique aerial images are needed for texture mapping, in which the key step is to obtain accurate registration between aerial images and untextured 3D LiDAR data. We present a robust automatic registration approach. A novel feature called 3CS is proposed which is composed of connected line segments. Putative line segment correspondences are obtained by matching 3CS features detected from both aerial images and 3D LiDAR data. Outliers are removed with a two-level RANSAC algorithm that integrates local and global processing to improve robustness and efficiency. The approach has been tested on 2290 aerial images that cover a variety of urban environments in Oakland and Atlanta areas. Its correct pose recovery rate is over 98%. [C4554]

"A streaming framework for seamless building reconstruction from large-scale aerial LiDAR data"

We present a streaming framework for seamless building reconstruction from huge aerial LiDAR point sets. By storing data as stream files on hard disk and using main memory as only a temporary storage for ongoing computation, we achieve efficient out-of-core data management. This gives us the ability to handle data sets with hundreds of millions of points in a uniform manner. By adapting a building modeling pipeline into our streaming framework, we create the whole urban model of Atlanta from 17.7 GB LiDAR data with 683 M points in under 25 hours using less than 1 GB memory. To integrate this complex modeling pipeline with our streaming framework, we develop a state propagation mechanism, and extend current reconstruction algorithms to handle the large scale of data. [C4555]

"Radar transmitter classification using a non-stationary signal classifier"

This paper presents a classification method which discriminates between two radar transmitters based on the received pulses. A simple radar transmitter model is presented to which a non-stationary signal classifier is applied. The classifier is a support vector machine which is applied to the radar pulse's time-frequency representation. The time-frequency representation is refined using particle swarm optimization to increase the

classification accuracy. The classification accuracy is tested in an additive white Gaussian noise channel. An acceptable classification accuracy is reported for component tolerances as small as 2% on the transmitter's modulator. [C4556]

"A Tunable System for Contact-Less Heartbeat Detection and a Modeling Approach"

The aim of this work is to present a practical study to detect heartbeats from distance, as well as cardiopulmonary activity modeling and simulation, in order to separate the heart and the respiration signals. Using a Vector Network Analyzer, measurements are taken at 2.4, 5.8, 10, 16 and 60 GHz. The Matlab simulation permits comparing several signal processing techniques in order to identify the most accurate one. [C4557]

"A Data Fusion Algorithm for Marine Radar Tracking"

Automatic radar plotting aids (ARPA) and automatic identification system (AIS) are the most important navigational systems on board. ARPA is considered as the primary anti-collision system, but its detecting ability, tracking accuracy and reliability are affected badly under the rough environmental weather condition. AIS provide steady and continuous navigation data come from GPS or DGPS with higher precision. In this paper, a data fusion algorithm has been developed for ARPA with AIS position data to improve its tracking accuracy and reliability. The proposed algorithm was experimented on a navigational radar simulator and a PC based platform programmed with VC++. The simulating results show that this method can effectively improve the accuracy and reliability of tracking. [C4558]

"A radar ranging algorithm based on characteristic decomposition power spectrum estimation"

The linear frequency modulation (LFM) signal is the main signal form of the high resolution radar. By analysis for the principle of the LFM radar signal to realize the high range resolution profile and the impact of clutter and noise over target echo signal, we propose the method of using spectrum estimation based on the characteristic decomposition to estimate the frequency and realize the LFM signal range profile. The simulation results prove that this method to the goal 1D range profile is effective under low signal-to-noise ratio conditions. [C4559]

"Space Target Recognition Based on Biomimetic Pattern Recognition"

Biomimetic Pattern Recognition is a new model of Pattern Recognition based on "cognition" instead of "classification". This new model is much closer to the function of human being, than traditional statistical Pattern Recognition using "optimal separating" as its main principle. But it has been investigated in 2D sample space, In this paper, we extend to space target Image sample space by Clifford Algebra, and study its property. The experiment result proves the efficiency of our theory. [C4560]

"Performance of the improved channel equalization method for Wideband Digital Array Radar"

Channel equalization algorithm must be used to achieve the idea effect of digital beamforming in wideband digital array radar. Performance of based on inverse Fourier transform method deteriorate in low signal to noise ratio (SNR) environment. An improved method is presented. This method only calibrate the error of signal in passband not the differences caused by noise outside the band. Finally, simulations are carried out with 20dB SNR and comparisons are made to demonstrate the performance improvement of improved calibration method. [C4561]

"A joint 3-D parameter estimation method without parameters pairing for near field sources"

A new method based on fourth-order cumulant for the joint estimation of the range, elevation and azimuth of spatial near-field sources is presented. The proposed method adopts non-centro-symmetric cross array, constructs cumulant matrixes using received array data, and constructs five signal subspace matrixes through SVD decomposition. According to the tripartite relationships among subspace matrixes, eigenvalue of the matrix and the eigenvector of opposition the eigenvalue, the parameters can be auto paired. The method does not require any spectral peak search, and can be applied to additive Gaussian noise environment. The performance of the proposed method is verified by computer simulations. [C4562]

"Design of high-frequency Gm-C wavelet filters"

A high-frequency wavelet filter which employs Gm-C blocks based on leap-frog (LF) multiple-loop feedback (MLF) structure is presented. The proposed method is well suitable for high-quality high-frequency operation since the Gm-C based filter can achieve high frequency, whilst LF MLF configuration has the characteristics of

lower magnitude sensitivity and capability of realizing arbitrary rational functions. The Marr wavelet is selected as an example in this paper, and the design for a 100 MHz frequency operation is elaborated. The wavelet filter is simulated using TSMC 1.8 V 0.18 μm CMOS technology. Simulation results indicate that the proposed method is feasible for high frequency operation with relatively low power consumption. [C4563]

"Summary on weak signal detection methods based on Chaos theory"

Definition, significance and traditional method of weak signal detection (WSD) are introduced. Content of WSD methods based on chaos theory is sorted in detail. Theory base, principle and main content of WSD method based on chaos oscillator are introduced. Its main content contains detection task, detection system, detection condition, chaos criterion, method improvement and method realization. Detection task is to measure parameters of the various periodic signals to be detected. Duffing oscillator is usually used as a chaos detection system and would have different detection performance with different equation form. Detection condition includes noise condition and initial condition. Noise condition means noise type and SNR. Chaos criterion is about identifying and describing state of chaos system. Hardware realization includes design of chaos measurement circuit and sometimes with DSP. This WSD method can be combined with traditional WSD method for lower SNR. [C4564]

"Digital signal processing method and implementation for pulse laser rangefinder"

The laser echo pulses of a pulse laser rangefinder are narrow, weak and low SNR (signal-to-noise ratio) signals. Digital signal processing method was presented for such signals to improve SNR. A digital signal processing circuit of a pulse laser rangefinder was designed, based on DSP (digital signal processor) and CPLD chips. The algorithms of digital filtering, pulse accumulation, target detection and tracking are all implemented in the DSP chip. The CPLD chip was used to design the digital interface circuit. The experiments were completed and showed that compared with traditional pulse laser ranging method, digital signal processing method increased the SNR of echo pulse signal clearly, accordingly improved ranging ability of pulse laser rangefinder. At the same time, the high-speed DSP chip ensures real-time ranging. [C4565]

"A simulation technique for high frequency Doppler spectra and comparison with high-bandwidth WERA data"

HF ground wave radar data, collected as part of the European Radar Ocean Sensing Experiment (EuroROSE) in Lyngoy, Norway during April, 2000 using a Wellen Radar (WERA) system with an FMCW waveform, are compared with data simulated from models designed at Memorial University. The similarities between them give a solid confirmation not only of the backscattering cross sections developed for the FMCW waveform, but also of the simulation algorithm for the radar received signal. However, two significant differences need to be highlighted. Firstly, the amplitude of the high-frequency spectral tails is about 10 dB higher for the field data as compared to the simulated spectra. Secondly, the Bragg peak for the real Doppler spectrum is much wider than that for the simulated spectrum. Such differences between the simulated and field Bragg regions may result from, among other possibilities, current fluctuations on the scattering patch. [C4566]

"Quality assessment of synthetic aperture sonar images"

We consider the problem of navigation error detection in synthetic aperture sonar images. Specifically, the effect of errors in the position and attitude of the sonar antenna is explored in the image and frequency domain. We present two metrics which can be used to discriminate between images with different degrees of navigation errors. A systematic test is developed which allows an automatic detection of navigation errors. Simulated synthetic aperture sonar images are used to test the presented methods. [C4567]

"Global maritime surveillance with satellite-based AIS"

A space based receiving system for signals of the automatic identification system (AIS) will extend the coverage of the existing ground network, which is limited to the coastal zone (30-50 nautical miles) to open seas. With newly available satellite-based AIS receivers, the complete global ocean shipping fleet of about 60,000 ships (AIS Class A) can be tracked. The safe processing and distribution of satellite-based AIS messages to authorized users by a public traffic monitoring centre will contribute to a significantly enhanced maritime safety and security. [C4568]

"New concept of passive measure using GNSS reflected signals in oceanographic applications"

Today, one of the methods in monitoring oceans is the use of radar systems or more generally the use of electromagnetic diffusion. Thanks to the deployment of satellite navigation systems (GNSS), such as GPS, GNSS signals are being used more and more as an opportunity source for this kind of observation. This paper

assesses the measurement of oceanographic parameters within a few meters near the surface. The oceanographic phenomena that is currently available for recording is limited. That is why we propose a much finer analysis of the diffusion and the scattering of GNSS signals near ocean surface, by employing very fine time steps and integration over the long periods of code. The final goal is to be able to perceive very fine phenomena, among which the ocean surface kinematics. In order to achieve this, the application of sophisticated processing algorithms is needed. In this work we simulate and highlight the observable effects expected as a result of use of such a method. The work is realized as a part of the MOPS project. [C4569]

"On the influence of positioning errors on tomography-based sonar imaging systems"

The receiver signal of sonar systems consists of the sum of reflected signals stemming from many scatterers. The resolution of sonar imaging systems depends in range direction on the bandwidths of the transmitter signal and in angular direction on the beamwidth of the receiver antenna. Tomography is a very promising method to improve the resolution of such sonar systems in angular direction. Basically, tomography relies on an appropriate fusion of sonar images of a scene derived from different spatial positions and thus under different viewing angles. Obviously, knowledge of the exact antenna position during acquisition of the different basic images is substantial for achieving high quality tomography reconstructions. Positioning errors, i.e. differences between real antenna locations and assumed (measured) antenna positions, causes blurring of the reconstructed image of the scene. In this paper the aforementioned image degradations are demonstrated by means of simulation results. Furthermore, basic ideas to reduce the problems caused by positioning errors are presented for a forward looking sonar with tomographic signal processing. [C4570]

"Navigation radar signal acquisition and measurement system"

In the course of navigation, radar is a very important navigation aids. However, different types of radar always have different signal definition. In this paper, a kind of method on radar signal acquisition and measurement based on embedded system is proposed. The system, which could automatically detect some common radar signal parameter, is consist of CPLD, ARM micro processor, ADC and amplifier. Radar echo video, heading position, bearing and trigger pulse signal are sent to the control unit through filter and acquisition circuit. After being processed by CPU, the frequency, amplitude and range of radar signal will be accurately shown to the user. [C4571]

"Design of a remote-monitoring system of MOA based on GPRS"

By measuring resistive current of the Metal-oxide Arresters(MOA) on-line monitoring technology, we can understand the performance condition of MOA at any time without unnecessary power-cut-off overhaul. Thus we can detect the abnormal phenomena and hidden accidents of MOA in time, take measures in advance to prevent the accident from getting worse and to avoid the economic loss resulted from the accident. To conquer the defect of this transmission method, a new method of monitoring of metal-oxide arresters in long distance was presented. The monitoring system consists of on-spot collection module, GPRS transmission module, long-distance monitoring center. The design of hardware and software of TMS320F2812 microprocessor according to the data collection and processing module was introduced. Data report can be formed in this system. The state of MOA can be inspected conveniently and accurately. Electric Power system can run in the reliable state. [C4572]

"Design and measurement of compact tapered slot antenna for UWB microwave imaging radar"

A compact tapered slot antenna (TSA) for an ultra-wideband (UWB) microwave imaging system is investigated in this article. The proposed TSA, which takes a microstrip-line as its feeding construction, is electrically small size with wideband and good directivity. The measured and simulated results show the good performance of the antenna, and means that this type of antenna can be used in a UWB microwave imaging system and the experiment of a microwave imaging system proves the conclusion. [C4573]

"A novel method for extraction of in-pulse feature of multi-component LFM signal"

Aiming on the problem of low precision and cross term in the conventional method of multi-component LFM signal detection and parameter estimation. A time-frequency associated analyzed method based on wavelet transform and time-frequency reassignment and Hough transform is proposed. Overcome the interferences of cross term by wavelet transform, guarantee the accuracy by time-frequency reassignment, use the distribution of time-frequency after reassignment as the image, then achieves the interception of component and the estimate of parameter based on Hough transform. Simulation results show that this method is feasible. [C4574]

"Research and development of non-magnetic heat meters based on ZigBee and GPRS"

Adopting MSP430 ultra-low power 16-bit single-chip microcomputer as the core of heat meters, Pt1000 matching platinum resistance as temperature measurement sensor, non-magnetic meter as the hot water flow measurement sensor, the micro-power testing of heat consumption in the heat exchange circuit and wireless reading meter combined with ZigBee and GPRS are realized here. ZigBee node module uses high-performance microcontroller module CC2430 wireless transmission module and transplants ZigBee2006 protocol stacks, GPRS module uses MC39i module. After more than four months' running and testing, the test results show that the system has outstanding benefits of low power consumption, low transmission error rate and high antiinterference performance and deserves better popularization. [C4575]

"Design and realization of arbitrary radar waveform generator based on DDS and SOPC technology"

A radar waveform generator is designed, employing directly digital modulation method based on DDS and SOPC technology. It is able to output arbitrary signals with amplitude, frequency or phase modulation under the control of signal characteristics description words outputted from an external computer. Up to four waveforms with different modulation can be generated simultaneously by single circuit module with good quality. Parameters of each waveform are programmable and easy to be updated. [C4576]

"Self-constructing simulation system for propelling AAA"

Based on the theory and function of modular artillery, the overall structure design of the self constructing simulation system for aerial defence is proposed in this paper. The modular design and workflow of the system are introduced in detail. The way in which simulation system construct itself and the workflow in which the system run in nature are the emphases of the paper. The practical operation makes it clear that the system has a very well real-time nature and expansibility. It is flexible to change and modify the corresponding hardware or software modules for the different needs. [C4577]

"New approach of imagery generation and target recognition based on 3D LIDAR data"

Light Detection and Ranging (LIDAR) sensor is an advanced technology of 3D-measurement with high accuracy. The processing of 3D point cloud data collected via LIDAR sensor is of topical interest for 3D target recognition. In this paper, a new approach of imagery generation and target recognition based on 3D LIDAR data is presented. The raw 3D point cloud data are transformed and interpolated to be stored in 2D matrix. The target imagery is generated and visualized by means of height-gray mapping principle proposed in paper. For different poses of target, the affine invariable moments of target imagery are selected as features for recognition because of its invariance in rotation, scaling, translation and affine transformation. BP neural network algorithm and Support Vector Machine (SVM) algorithm are utilized as method of target classification and recognition. The recognition results by two algorithms are compared against and analyzed detailedly. The new method had been applied into target recognition in outdoor experiments. Different types of targets are classified and the rate of correct recognition is greater than 95%. Through outdoor experiments, it can be proven that this new method is applied to the field of 3D target recognition effectively and stability. [C4578]

"Industrial high-temperature radar and imaging technology in blast furnace burden distribution monitoring process"

A new kind of industrial high temperature radar has been developed, which is used for real-time monitoring of the burden surface under the harsh environment inside blast furnace (BF) and observing the decline rate of the burden surface. This radar technology is also used for determination of the burden profile through multi-point arrangement of the radars. The 26GHz frequency radar is introduced with the FMSW structure of the hardware model, as well as the heat and dust resistant solid burden surface algorithm with the monitoring range of 0-100 meter and the measurement accuracy of 1%, a specially designed ceramic antenna with the temperature range of 0-600 degree, and the drift < plusmn 0.1%/year. Six industrial high temperature radars have been installed on the top of the BF at the industrial field, and optimized the radar installation location through electromagnetic simulation. The real-time image of the burden surface has been obtained by surface fitting and digital simulation of the data from the six-point radars. The effective application of this technology has improved significantly the fluctuation of burden surface, the production of BF, the energy saving and gas emission reduction. [C4579]

"Beampattern optimization by minimization of quartic polynomial"

Beampattern synthesis is a common problem in array signal processing. Recently, methods for beampattern optimization using multiple simultaneously transmitted waveforms have been published in the context of MIMO

radar. In this paper, we formulate the beampattern optimization problem as minimization of a multivariate quartic polynomial. The advantage of this approach is that iterative line searches are not needed and that the low-rank case can be solved directly without finding the minima of the full-rank system. The method does not guarantee convergence to the global minimum, but numerical examples provided demonstrate that results comparable to the other approaches are achieved. [C4580]

"Multivariate Markovian gamma distributions for multitemporal sequences of SAR images"

This paper introduces a family of multivariate gamma distributions characterized by a Markovian correlation structure. These distributions are interesting for detecting changes between multi-temporal sequences of synthetic aperture radar images. The parameters of these distributions can be estimated by using the maximum likelihood principle. This estimation procedure allows one to obtain a change indicator between each pair of images. A performance comparison with maximum likelihood estimators derived from a bivariate gamma distribution model is conducted. The gain of performance provided by the Markovian multivariate model with respect to a bivariate model is emphasized on synthetic and real images. [C4581]

"Likelihood adjustment among multiple targets for particle dependent tracking in particle filters"

A problem arising at multiple target tracking with particle filters typically in vision has been claimed and a likelihood adjustment method has been proposed. First, classify tracking methods by particle filters into two categories, detection first tracking and particle dependent tracking. Then this research focus on the particle dependent tracking. It involves the problem in case of multiple target tracking that difference of likelihood among target leads to unintended convergence of particles to one target. This is a phenomenon in particle filters that particles prefer easier target having large likelihood value than the difficult target to track having small likelihood value. To overcome this problem, the author proposes to adjust the likelihood among the targets by taking difference in log-likelihood to local maximum of them in each target. Performance of the proposed method has been shown in visual target tracking experiment based on color region. [C4582]

"A robust W-MUSIC algorithm for GPR target detection in the presence of noise"

When applied to ground penetrating radar (GPR), the multiple signal classification (MUSIC) algorithm is an important frequency estimation method as it can detect very closely spaced targets, particularly when one of the target responses is substantially lower than another. The MUSIC algorithm however must be seeded with the number of targets to find and will indicate that number of targets regardless of the number of targets actually present. In the presence of relatively low levels of noise the MUSIC algorithm is prone to reporting the position of false targets in preference to weaker genuine target responses. In this paper a superimposed MUSIC technique is proposed to suppress false targets. A novel windowed FFT MUSIC (W-MUSIC) algorithm is examined using a linear sweep frequency in noise. It is seen to give a clear indication of targets in the presence of modest noise that prevents MUSIC from working. [C4583]

"A practical point of view: Performance of Neyman-Pearson detector for MIMO radar in K-distributed clutter"

Use of multiple transmit and receive antennas have become a popular research area in radar community after the success of the same concept in communication. It is shown by Fishler et al. that multi-input multi-output (MIMO) radar has considerable advantages compared to traditional radar and phased array radar systems. In this paper, detection performance of MIMO radar using Neyman-Pearson detector is investigated in K-distributed sea clutter for a practical scenario. Also, spikiness of K-distributed MIMO radar clutter is discussed with respect to the number of nodes. [C4584]

"Azimuth, elevation, and polarization estimation for arbitrary polarimetric array configurations"

In this paper we propose an algorithm for high-resolution, joint azimuth, elevation and polarization estimation using polarimetric arrays of arbitrary geometry. The array elements may be placed on a planar or conformal surface and all the array imperfections are considered jointly. In particular, we focus on real-world arrays with imperfections. The Cramér-Rao Lower Bound (CRLB) for polarimetric arrays is established taking into account imperfections of the array. [C4585]

"A novel approach to adaptive beamforming for multi-path broadband signals"

A novel approach for broadband beamforming in the presence of multi-path signals is proposed based on a frequency invariant transformation. In this approach, the received array signals are first processed by a frequency invariant beamforming network and then a traditional narrowband adaptive beamformer is applied to

its output. It is shown that with the proposed structure, the cancellation of the desired signal is reduced greatly and a significantly improved output SINR is achieved. [C4586]

"Real-time acquisition and tracking of sniper bullets using multi-sensor multi-frequency radar techniques"

Real-time acquisition and tracking of sniper bullet trajectory is important in various military operations. While the majority of the existing work on gunshot is based on acoustic sensors, such technologies cannot provide timely response because sound propagates much slower than a bullet does. In this paper, we propose the use of an array processing framework that uses multi-frequency continuous-wave (CW) radio frequency (RF) signals to enable robust real-time tracking of the direction as well as the range of a bullet for accurate trajectory tracking. The proposed technique will effectively lead to the reduction of injuries and casualties as well as fast response in military operations as a result of providing individual soldiers with the sub-time-of-flight tracking capability for rapidly determining the location of threats. [C4587]

"Performance analysis of DOA estimation for MIMO sonar based on experiments"

In this paper, a Multiple Input Multiple Output (MIMO) monostatic sonar scheme that can deal with multiple targets is presented, where orthogonal waveforms are transmitted simultaneously. Meanwhile the Capon estimator for this sonar system is derived in detail. And the performance of the MIMO sonar is analyzed via experiments in an anechoic water tank, as compared with its phased-array counterpart. The used sonar array is a uniform linear array with 10 closely spaced elements. Experimental results show that, by orthogonal transmit, this sonar system could achieve 12~15 dB additional array gains over its phased-array counterpart, which means the maximum detection range could be doubled; also, the angle resolution capability could be significantly improved at lower SNR. [C4588]

"Accuracy and reliability of ocean current and wave monitoring with the coastal radar "WERA""

The WERA system (Wave RADar) is a shore based remote sensing system to monitor ocean surface currents, waves and wind direction. WERA is using the lowest noise FMCW technique to provide highest temporal and fine spatial resolution for time critical applications. The vertical polarised electromagnetic wave is coupled to the conductive ocean surface and will follow the curvature of the earth. This over the horizon oceanography radar can pick up back-scattered signals (Bragg effect) up to ranges of more than 200 km. Publications about the results from systems installed all over the world have proved the accuracy of the WERA system. The reliability of these ocean data was studied for more than 2 years at a permanent WERA installation at the French coast near Brest. [C4589]

"Simulation of tsunami signatures in ocean surface current maps measured by HF radar"

The high frequency (HF) surface wave radar has a unique capability to monitor the coastal environment far beyond the conventional microwave radar coverage. The HF radar could contribute to the development and improvement of Tsunami Early Warning Systems. Bragg-resonant backscattering by ocean waves with half the electromagnetic radar wavelength allows measuring the ocean surface current at distances up to 200 km. The developed software package allows reconstructing an ocean surface current map of the area observed by HF radar based on the radar range-Doppler spectrum processing. In case of an approaching tsunami, a strong ocean surface current signature can be observed by the radar when the tsunami wave enters the shelf edge. In order to simulate the signals seen by an HF radar in case of a tsunami travelling towards the coast, the tsunami induced current velocity is calculated using the oceanographic HAMBURG Shelf Ocean Model (HAMSOM) model, then converted into modulating signals, and superposed to the measured radar backscatter signals. After applying conventional signal processing techniques, the radar spectra include the simulated tsunami wave. The surface current map based on these spectra has a pattern, which changes very quickly in the shelf area before the tsunami wave reaches the beach. Specific radial tsunami current signatures are clearly observed in these maps. If the shelf edge is far off the coast sufficiently then the first appearance of such signatures can be monitored by an HF radar system early enough to issue a warning message about an approaching tsunami.

[C4590]

"True time-delay bandpass beamforming: A new implementation"

Beamforming as a basic approach of array signal processing has been widely used in many important applications such as radar, sonar, and communications. Typical algorithms include time-delay-based and FFT-based, and various implementation structures have been developed. For bandpass sampled signals, a true time-delay beamformer involves three processes: signal demodulation to obtain its complex envelop; delay of the complex envelop; and phase rotation of the delayed complex envelop. Those processes can be realized using

FIR filters. In this paper, a few improvements are proposed for the above bandpass beamforming implementation, including a new way of filter coefficient selection and a polyphase filter structure. The new implementation generates exactly identical results as the conventional zero-padding interpolation beamformer, and meanwhile can readily fit into a low-power, highly-parallel processing unit such as FPGA. [C4591]

"Ship surveillance by joint use of SAR and AIS"

The detectability of ships on synthetic aperture radar (SAR) images is validated by coastal (live) AIS and space AIS. The monitoring area chosen for surveillance is mainly the German coast and the Panama Canal. The detectability in respect to environmental parameters like wind field, sea state, currents and changing coastlines due to tidal effects is investigated. In the South Atlantic tracking of the German research vessel Polarstern has been performed. Issues of piracy in particular in respect to ships hijacked at the Somali coast are discussed. Possibilities and limitations of a near real time service are evaluated. As images from the SAR sensor do not only contain information on intensity, but as well on the phase of the returned signal, ship speed can be derived from Doppler effects. The ship wakes contain additional information on ship speed and type of ship. Some examples using the ESA satellites ERS and ENVISAT, that provide large coverage (up to 400 km) at moderate resolution (30 meters) are given together with high resolution images from TerraSAR-X. [C4592]

"Doppler radar signatures analysis by using joint bispectrum-based time-frequency distributions"

Estimation of instantaneous frequency (IF) time-varying behavior of a non-stationary and multi-component signals embedded in additive Gaussian noise is considered for Wigner-Ville (WVD), Wigner bispectrum (WBD), parametric (PBB) and non-parametric (NPBB) bispectrum-based distributions. A performance comparative study between WVD, WBD, PBB and NPBB is carried out by computer simulations both for several non-stationary and multi-component test signals and real radar backscattered echo-signals measured by Doppler surveillance radar for a moving human. Analysis of time-frequency (TF) distributions shows that bispectrum-based approach permits to detect and extract phase coupling among pairs of Doppler IFs containing in non-stationary and multi-component wideband signals. Experimental radar micro-Doppler signatures derived from the returns measured for moving human demonstrate important information features about the object dynamics and kinematics. These information features can be useful in radar automatic target recognition systems. [C4593]

"Optimal waveform precoder design for narrowband MIMO radar systems"

This paper addresses the problem of coded waveform design for Multiple Input-Multiple Output (MIMO) radar systems. The paper proposes a signal model based on the assumption of a small array aperture relative to the signal wavelength and a single target in far field. It is argued that near maximum likelihood performance can be obtained by choosing the transmitted waveforms on different antennas to be orthogonal. The Cramer-Rao Bound (CRB) for estimating the target distance, radial velocity and wavenumber is derived. The paper presents a convex optimisation procedure to yield an optimal energy distribution across the transmitted signals. Simulations demonstrate a reduction in CRB in the order of 25% compared to the use of a random unitary code. The paper concludes by indicating a natural generalisation of the method to optimal design for MIMO tracking radars. [C4594]

"Blind extraction of noncircular complex signals using a widely linear predictor"

Real valued blind source extraction based on a linear predictor is extended to the complex domain using recent advances in complex domain statistics. It is shown that, in general, the mean square prediction error of the algorithm depends both on the covariance matrix and the pseudo-covariance matrix of the source signals. To fully utilise the available information, it is thus natural to adopt a widely linear predictor to extract the latent sources from the observed mixture. This way, we derive a new algorithm for the extraction of general complex signals and provide simulation results using benchmark complex data. [C4595]

"Optimal decision fusion in Through-the-Wall Radar Imaging"

We consider the problem of target detection behind walls based on optimum decision fusion using Neyman-Pearson tests. A framework, demonstrating the use of multiple sensor platforms and distributed detection for the emerging application area of Through-the-Wall Radar Imaging is presented. We derive the optimum decision rule at the fusion center for three dissimilar sensors and compare the corresponding target detection results to that achieved when using a centralized decision approach. Real data generated using a two dimensional scanning system is used for the performance comparison. [C4596]

"High-resolution direction finding of coherent sources in the presence of model errors using

alternating projections"

Direction finding with coherent source waveforms is of practical importance in radar array processing, e.g. for specular multipath propagation. Furthermore, high-resolution methods require an accurately calibrated array. In this paper, we combine local and global manifold correction with maximum likelihood direction finding using the method of alternating projections. We use simulations to study the effect of array errors and noise. We further apply the combined algorithm to real data recorded using a radar array for an automotive application. [C4597]

"Development of portable integrated signal source for circuit unit test of radar"

Diversification and complication of circuit units of modern radar bring requirement of more functions for signal source used for test. Based on virtual instrument, microprocessor, DDS, CPLD and circuit share technologies, a portable integrated signal source for circuit unit test of radar is developed, which integrates DC power supplies, AC power supplies, low frequency signal source, intermediate frequency signal source and digital signal source into one instrument. The composition of the hardware and the software of the integrated signal source and their design principles are given in the paper. Testing results show that the integrated signal source provides a good test platform for circuit units of radar. [C4598]

"Keynote"

{no data available} [C4599]

"A new method of 4D trajectory generation in the airspace simulation system"

4D trajectory generation is one the most fundamental functions in the airspace simulation system. Currently, most methods are based on partitioning of the flight. In this paper, a new 4D trajectory generation method is proposed based on historical radar data processing, which includes implementing the traffic flow theory to generate the initial state of each flight, and introducing the interacting multiple model smoother and spline interpolation to determine the intermediate flying status. Results on simulated and real data are discussed at the end. [C4600]

"Simulation verification and evaluation of radar BIT system based on multi-signal model"

By utilizing the multi-signal model, the simulation-based BIT testability verification and evaluation has lower cost and requires less time than traditional methods, which has lower risk accordingly. The intelligent diagnosis system based on this method integrates the system modeling, testability analysis, diagnosis and presentation, which not only helps to testify the BIT quantitatively, but also helps to improve BIT maturity. Finally the system is applied to a radar assembly for BIT testability verification and evaluation. [C4601]

"No fault found events during the operational life of military aircraft items"

No fault found (NFF) events are critical and well-known problems for certain aircraft items. This paper presents a study of these events for repairable items with on-condition maintenance, based on operational data from a military aircraft. Some findings are that: the number of NFF events is influenced by item type and number of repairs; most NFF events are initiated by faults recognized during operation; and different inspections contribute to NFF events. Hence, item design and tests at different operational modes and maintenance echelons should be better aligned to reduce the number of NFF events. [C4602]

"Acquisition performance analysis of a synchronization scheme of DS/FH hybrid spread spectrum signals for TT&C"

A synchronization scheme of DS/FH hybrid spread spectrum signals based on fast frequency identification is proposed, for high dynamic characteristic of signals in TT&C system. On basis of providing the mathematical model of synchronization process of the signal, three-dimensional mean acquisition time expression as well as probabilities of detection and false alarm of acquisition system with PN phase error, Doppler frequency and AWGN, is derived. Based on numerical simulation of three-dimensional acquisition performance with the DSSS mode of matched filter in time domain and multiple channels in frequency domain, impact of parameters of the signal and the acquisition system on acquisition performance is analyzed. Theoretical derivation and simulation results provide theoretical basis and practical reference for signal design as well as parameters selection of the acquisition system. [C4603]

"SAR and visible image fusion based on local non-negative matrix factorization"

Although some of the traditional methods of image fusion such as wavelet transform fusion and Laplacian

pyramid fusion have good effect on most visible images, it is not suitable for SAR image fusion. Because the speckle noise in SAR images is multiplicative and coherent. In this paper, we propose a method called local non-negative matrix factorization (LNMf) for SAR image fusion. LNMf uses multiplicative iteration to approximate the standard image and reduces speckle noise. For getting more localized, parts-based representation of images, LNMf improves the objective function of the standard NMF to enhance localization constraint. The result of experiments approved that LNMf method is efficient and effective for image fusion of SAR and visible images compared to other traditional methods. [C4604]

"Method to remove the interference in reflected wave of passive radar based on the improved FastICA"

In allusion to the complexion that the serious harm to passive radar which is based on FM (the resource of frequency modulation) by the multiplex interference in identical frequency, and the average method such as filter couldn't remove it, a novel method to eliminate the interference based on the improved FastICA (fixed point independent component analysis) is presented. This method pick-up the pure signal by blind source separation which is depended on the improved FastICA and eliminate the multiplex interference in identical frequency. The result of blind source separation for the data show that the improved FastICA is a effective method in eliminating the interference. Therefore, this method can improve the precision of orientation for passive radar which is based on the FM. [C4605]

"Detection of bolt tightness degree based on HHT"

To solve the problems of bolt tightness degree detection in large structures, this paper studies the bolt tightness degree detection method in aluminum plate structure, by using piezoelectric sensor array to stimulate Lamb wave and HHT method to pick-up damage diagnostic parameter. The theory of HHT method is introduced, as well as the constitutions of the experimental system. Deal the echo signal that is received by sensors with EMD (empirical mode decomposition) method. After that, we get the IMF(Intrinsic mode function)-C2, and we further handle C2 with HHT method. According to the HHT results, we extract out the damage eigenvalues-Energy Frequency Shifting Ratio (EFSR) and Damage Energy Estimate Ratio (DEER) to improve the recognition rate of bolt tightness degree detection. In the end, an experiment of bolt tightness degree detection is carried out. The results indicate that the detection technology about Bolt Tightness degree based on HHT is quite effective. [C4606]

"Using multi-scale density for local feature-based registration in SAR imagery"

We present a registration algorithm for automatic, robust SAR (Synthetic Aperture Radar) image alignment. The registration problem is handled using sparse feature representation, which comprises local feature localization and description. The feature location is determined by detecting bifurcation structure in edge image and its orientation is assigned using corresponding bifurcation structure type. Then, the local structure is characterized by distinctive non-parametric cross-scale descriptor derived from image patches which extracted in every level of multi-scale pyramid and centered at relevant bifurcation structure. We adopt an elaborate feature mismatches identification strategy to perform Generalized Hough Transform and robust RANSAC fitting in sequence. Accordingly, a group of more accurate warp parameters can be derived even when outliers are predominant in primary feature match set. This approach provides robust matching across a substantial rang of distortion and is less sensitive to speckle noise as well as lack of stable details in SAR imagery. In experimental results, we demonstrated the effectiveness of this approach for natural SAR images. [C4607]

"Location for audio signals based on empirical mode decomposition"

In this paper, empirical mode decomposition (EMD) denoising is applied in audio signals location when speech signals are received at several spatially separated sensors in the presence of noise. Firstly, Prior to cross correlation, each of the sensor outputs is separated into several intrinsic mode functions (IMFs) using EMD. Then, we compute normal energy of each IMFs and denoise IMFs according to a thresholding rule. The signals is restructured only using main IMFs in order to increase the input signal-to-noise ratio. Lastly, time delay is estimated by generalized cross correlation-phase transform (GCC-PHAT) between signals and location is completed by solving the geometry equation. The results show that the proposed method may provide not only an increase in the location but also reliability in the noise entironment. [C4608]

"Design on radar signal simulator of automotive ACC"

Radar simulator of automotive adaptive control cruise system (ACC) has been designed with the principle of radar ranging. Based on synthetically considering the relationships between the actual kinematical status of the host vehicle and the virtual kinematical status of the preceding vehicle, the simulator can generate simulated

radar data streams inputted into the controller of the real vehicle test platform of the ACC system. In this paper, the basic principle and the hardware and software scheme of the radar simulator of ACC are introduced in detail. Moreover, the cause of the relative distances error of the simulator has been analyzed and it is solved by the integral algorithm correction of the relative vehicle distance that the integral error has been modified and simultaneously the sampling points do not decrease. The results of trial show that the radar signals can meet the ACC controller and accordingly the safety and efficiency of the exploitation of the ACC system and the real vehicle experiment can be ensured. [C4609]

"The Remote Wireless Monitoring System Based on GPRS for Off-Grid Wind Turbine"

The article introduced a remote wireless monitoring system for the off-grid wind turbine. Considering the characteristics of the off-grid wind turbine, the system will have primarily function-monitoring, counting and saving the operation data. And, the design adopts primarily the remote communication technique to finish communication between control terminal and monitoring center. It can master the operation conditions of the wind turbine in real time, and can also manage dozens of or hundreds of wind turbines together. The test results of the system are satisfied. [C4610]

"Asynchronous consensus protocols for multi-agent systems"

Motivated by the famous Vicsek's model, this paper addresses the problem of heading consensus for a multi-agent group by using asynchronous decentralized algorithms. Two algorithms, one for the leaderless case and one for the leader based case are proposed. The appealing feature of both algorithms is that neither a global coordinate system nor a common clock is required. It is proved that these algorithms guarantee (almost) global consensus of the headings under some well known connectivity assumptions. [C4611]

"Multi-target tracking using mixed spatio-temporal features learning model"

In image sequence, target's features has two components: the spatial features which include the local background and nearby targets, and the temporal features which include all appearances of the targets seen previously. In this paper, we develop a multi-target visual tracking method based on mixed spatio-temporal features learning model which is a probabilistic inference model considering the above components. The proposed model combine the incremental appearance descriptor update strategy which can update descriptor dynamically according to previous appearances during tracking, and mix probabilistic data association which take targets' spatial features into account. In addition, we also apply the incremental update strategy into HSV histogram and region covariance descriptor, and compare these two descriptors in multi-target visual tracking. The results validate the proposed method in tracking moving multi-target in video streams. [C4612]

"The design of a vertically polarized antenna array used for the suppression of Es layer clutter"

There has Es layer clutter in the high frequency surface wave radar, and the Es layer clutter has the difference arrival direction with the signal. So a vertically polarized antenna array whose mainlobe is put on the reverse direction of the signal arrival direction and a low sidelobe is put on the direction of the signal arrival direction, can be added as auxiliary antennas in the high frequency surface wave radar system to suppress the Es layer clutter. The clutter-to-signal ratio in the outputs of the auxiliary antennas will affect the suppression of the Es layer clutter in the main antennas. The bigger of the clutter-to-signal ratio in the outputs of the auxiliary antennas, the better suppression result of the Es layer clutter in the main antennas can be achieved. Used the superdirective synthetically method, the auxiliary vertically polarized antenna array will have a lower gain on signal than the main antenna, when it can maintain the same gain on Es layer clutter as the main antenna. So the clutter-to-signal ratio in the outputs of the auxiliary vertically polarized antenna array will be increased, the suppression of the Es layer clutter in the main antennas which use the vertically polarized antenna array as auxiliary antenna will be more effective. [C4613]

"The design of a horizontally polarized antenna array used for the suppression of Es layer clutter"

There has Es layer clutter in the high frequency surface wave radar, and the Es layer clutter has the difference polarized characters with the signal. Horizontally polarized antenna can be added as auxiliary antenna in the high frequency surface wave radar system that uses vertically polarized antennas to suppress the Es layer clutter. The clutter-to-signal ratio in the outputs of the auxiliary antennas will affect the suppression of the Es layer clutter in the main antennas. An antenna array consists of three horizontally polarized antennas is proposed in this paper. Using the superdirective synthetically method, the mainlobe of the auxiliary horizontally polarized antenna array is put on the direction of the Es layer clutter arrival direction, and a low sidelobe is put on the direction of the signal arrival direction. Then the auxiliary horizontally polarized antenna array will have a big gain on Es layer clutter and a little gain on signal. So the suppression of the Es layer clutter in the main antennas

which use the horizontally polarized antenna array as auxiliary antenna will be more effective. [C4614]

"Study of the characteristic on the one-dimensional rough sea surface"

In this paper, an introduction of chaos is firstly present. The subject matter selected for this part of the paper is given with emphasis on analysis of chaotic characteristic of radar echoes from the one dimensional rough sea surface. Based on the time series of radar echoes, the problems which are involved in the reconstruction of chaotic dynamics, calculation of correlation dimension and the largest Lyapunov exponent are discussed, and the numerical results indicates radar echoes shows the chaotic characteristic obviously. [C4615]

"Temporal difference learning waveform selection"

The largest difference between cognitive radar and other adaptive radar is the adaptivity of transmitter in cognitive radar. How to optimally decide or select the radar waveform for next transmission based on the observation of past radar returns is one of the important issues. In this paper, with the stochastic dynamic programming model of waveform selection, we use the method of temporal difference learning to solve this problem and realize the adaptivity of waveform selection. The simulation results show that the uncertainty of state estimation using temporal difference learning is less than that using fixed waveform. [C4616]

"Research on the anti-collision system of surface coal mine based on the highly accurate GPS location technology"

Recently traffic accidents have frequently happened in mining areas, which people have already paid attention to. Among these accidents, collision accounts for a high percentage. Consequently, the research on automobile anti-collision system in mining areas has become worldwide. In this paper, an anti-collision system in mining areas based on the highly accurate GPS location technology is introduced. When something dangerous happens to the vehicle, with the accurate location, the assist device can let out a warning signal, getting the driver to take effective measures to prevent an accident. [C4617]

"RCS reduction of missile-borne quasi-traveling wave microstrip antenna"

The reduction of a missile-borne microstrip antenna's radar cross section (RCS) is very important for improving the stealth performance of the missile. In this paper, the principle of antenna's RCS is firstly analyzed. By taking a kind of missile-borne quasi-traveling wave microstrip antenna as example, a new method is then presented to reduce its RCS significantly and improve its performance as well. The main point of this method is to cut two H-shape slots and install two short-circuit pins in each microstrip unit of the antenna, which reduces the RCS significantly in a wide frequency band, expands the bandwidth, and remains the gain of the antenna unchanged at the same time. [C4618]

"Simulation experiment of breast cancer detection using an ultrashort-pulse radar system"

Simulation experiment of breast cancer detection has been performed using an ultrashort-pulse radar. Breast models for the experiment are made from cooking oil or use a commercial made phantom. We measure reflection data in order to reconstruct images of the breast models with different dielectrics alien objects. [C4619]

"Design wireless multi-sensor fire detection and alarm system based on ARM"

The system uses nRF2401 for short-range wireless communications, GPRS for long-distance wireless communications, ARM9 for center console, Wireless Multi-sensor Fire Detector for node, and BP algorithm is used for judging the probability of fire. Wireless Multi-sensor Fire Detector is formed of the low-power electrochemical carbon monoxide sensor, photoelectric smoke detector and semiconductor temperature sensor. BP algorithm program is embedded in the S3C2440A ARM. The samples of BP algorithm were derived from the fire detection standard room of the State Key Laboratory of Fire Science of China. Center console uses Em GIS(embedded GIS) to show where the fire break out and uses GPRS to transmit SMS to the fire command center. The system is low false alarm rate, low cost, fast response and convenient to install. [C4620]

"A modeling and performance evaluation method about the parallel multi-task radar automatic test system"

The structure of the test system gets more complicated, the test tasks increases in number, and the relations between them are stronger. So, the traditional establish method of the test system relying on people's experiences does not meet the needs. Then in the process of test system's design, a new modeling and performance evaluation method based on the generalized coloured stochastic Petri net (GCSPN) is used in the

article. For example in the design of the radar automatic test system, the system structure, test resources and test function are firstly analyzed, then the GCSPN model of the system is built. The model needs to be made simple and decomposed on the rules. Moreover the system's resource utilization and test time are evaluated on the stochastic Petri net. At last, the radar test system is built up referring to the Petri net model. The system runs normally, and the test values are almost consistent with the evaluations. It is compared with the parallel system designed by TestStand software. The result embodies the advantages of the GCSPN modeling method. [C4621]

"Search detection modeling and simulation for missile-borne high resolution radar"

Missile-borne high resolution radar search detection is a very important aspect in its signal processing flow, their modeling and simulation is an extremely necessary and basic work. In this paper, a coherent video signal simulation is applied to establish signal received model (i.e. antenna gain model, clutter receiver model, the target receiver model) and signal processing model based on missile-borne high resolution radar. Simulation is carried out and the results validate the efficiency. [C4622]

"New method for unambiguous velocity measurement in low PRT radar"

Low pulse repetition frequency (PRF) radars are mainly used for target tracking and measurement of distance and angle. Because the pulse repetition frequency is very low and there is serious ambiguity in radial velocity measurement, many common methods can not resolve the ambiguity effectively. Based on the velocity measurement system which includes the digital intermediate frequency locked loop (DIFLL) and spectrum peak search (SPS), a changeable step search method is put forward to resolve the ambiguity, and the symmetrical coefficient is used to judge the spectrum peak. In the result, the anti-noise performance is improved by nearly 24 dB and the speed of ambiguity resolution is greatly increased. The simulation results prove that this method is available and has high practicable value. [C4623]

"Wireless and batteryless surface acoustic wave sensors for high temperature environments"

Surface acoustic wave (SAW) devices are widely used as filter, resonator or delay line in electronic systems in a wide range of applications: mobile communication, TVs, radar, stable resonator for clock generation, etc. The resonance frequency and the delay line of SAW devices are depending on the properties of materials forming the device and could be very sensitive to the physical parameters of the environment. Since SAW devices are more and more used as sensor for a large variety of area: gas, pressure, force, temperature, strain, radiation, etc. The sensors based SAW present the advantage to be passive (batteryless) and/or wireless. These interesting properties combined with a small size, a low cost radio request system and a small antennas when operating at high frequency, offer new and exiting perspectives for wireless measurement processes and IDTAG applications. When the materials constituting the devices are properly selected, it becomes possible to use those sensors without embedded electronic in hostile environments (as high temperature, nuclear site, ...) where no solutions are currently used. General principle of the SAW sensor in wired and wireless configurations will be developed and a review of recent works concerning the field of high temperature applications will be presented with specific attention given to the choice of materials constituting the SAW device. [C4624]

"Target range profiling algorithm for airborne microwave sensor detection system"

The range profile is redundant and disordered because the sample interval time is less than transmitted pulse width. The accurate estimation and optimization of the target range profile are essential for realizing the airborne microwave sensor detection system. In this paper, an algorithm for the real-time estimation and optimization of the target range profile due to over-sampling is presented for the airborne stepped frequency pulse sensor system. Under the condition of over-sampling this new algorithm employs the FFT and optimization method to estimate and optimize the target range profile within antenna beam dwell time by using high speed DSP. Through the simulation of sensor data, the target range profile spectrum is measured and analyzed. The result of simulation is that this new algorithm can reduce the effect of over-sampling on the range profile and obtain high resolution range profile of target. [C4625]

"A kind of algorithm similar to amplitude demodulation for sonar array direction of arrival"

Presented is a kind of algorithm similar to amplitude demodulation for sonar array DOA (direction of arrival) for the purpose of simple algorithm, low processing requirement and low cost. According to the fixity of delay between units and the character of trigonometric function, the formula of DOA is got by deduction in the algorithm. Simulation results show that when the interval between units is quarter of wavelength, the precision is less than 0.3deg when SNR is 10dB and DOA is 5deg~85deg the precision is less than 0.5deg when SNR is 0dB and DOA is 10deg~85deg and the precision is not more than 1deg when SNR is -10dB and DOA is

15deg~80deg. Simulation results also show that the precision can be less than 0.3deg by changing the proportion of units interval and wavelength, when SNR is between 0 dB~10 dB and DOA is 4deg~86deg.

[C4626]

"Novel scheme for sar image compression based on JPEG2000"

This paper presents a novel speckle noise suppression and SAR image compression scheme in discret wavelet domain. First, in the novel speckle noise suppression, a modified soft-thresholding denoising method was applied to reduce speckle noise and it can protect more edge information at the meantime. Then, a new SAR image compression structure based on JPEG2000 was presented. The efficiency of the proposed structure is demonstrated. [C4627]

"A wideband pulse detection algorithm based on autocorrelation"

An improved autocorrelation algorithm aiming at digital wideband pulse detection is proposed in this paper. Absolute values of the signal amplitude are calculated for autocorrelation function. Then we compare autocorrelation result with threshold to determine the time of arrival (TOA) and pulse width. Measurement accuracies of the optimal thresholds under different signal-to-noise ratios (SNR) are discussed and the algorithm is implemented on FPGA. The simulations show the algorithm has good detection performance in real-time processing environment. [C4628]

"Tracking and imaging algorithm of walking human bodies for ultra wideband radar"

The Ultra WideBand(UWB) Radar used for detecting human bodies is a promising technique in many fields such as urban-warfare, counter-terrorism and calamity rescue scenarios. Conventional UWB imaging algorithm can not meet the demand in the capability of targets recognition and calculation efficiency. The SEABED Algorithm based on the reversible Boundary Scattering Transform (BST) can be used to fast reconstruct target shape, but its application is restricted because antenna are scanned to collect data, which is impractical for systems of detecting moving targets. In this paper, walking motion was used to replace antenna scanning by assuming a system model, and a novel algorithm based on SEABED for UWB radar systems is proposed. Simulation results show that the proposed algorithm features simple hardware requirement, low calculation, and high imaging precision, and it can also estimate the velocity, image and track walking human bodies. [C4629]

"Remote measurement and control system based on GPRS for multi-frequency IP instrument"

We have developed a remote measurement and control system based on GPRS for multi-frequency IP instrument to resolve the problem that the receiver cannot control the transmitter and controller remotely in electrical exploration. The system is composed of communication module, host apparatus and slave apparatus. Communication module contains three DTUs inserted with three SIM cards, respectively, which implements the function of remote data transmission via message way and realizes data communication between host apparatus and slave apparatus. As the active station of system, the host apparatus initiates connection and fulfills the monitoring as well as function control of slave apparatus. As the passive station, the slave apparatus receives connection and carries out any command from host apparatus. Three modules realize mutual coordination and various functions. Our test of the system shows that it ensures normal operation and reduces labor intensity as well as highly improves work efficiency for electrical exploration which is carried out in outdoor area. [C4630]

"A relative bias estimation algorithm on airborne radar networks"

A practical integrated estimating algorithm is proposed for multiple dynamic airborne radar networks without common targets to modifying the systematic bias, which extended innovatively from multiple sensors registration methods on common targets. On the frame of multi-sensor data fusion, the approach on overlapping common targets can be executed using Kalman filter and Earth-Centered Earth-Fixed coordinate system (ECEF) by many targets loops and times loops. The experiment shows it has good precision and robust for short distance dynamic radar networks using high speed data link even though no overlapping coverage areas are existed. The mean of ECEF X axis bias and Y axis bias are improved perfectly when compared before and after registration.

[C4631]

"Path planning for UAV based on improved heuristic A* algorithm"

A 3D vehicle path planning method based on heuristic A* algorithm is proposed and simulated which makes the UAV's path planning for low altitude penetration more real-time, effective and engineering-oriented. The digital terrain information is processed with the integrated terrain elevation smoothing algorithm at first, and then, the safe flight surface which integrates the maneuverability of vehicle is built. At last, the mathematical models of the

threats are established. An improved A* algorithm is used to plan 3D vehicle path on the safe surface, and the planned path is optimized and smoothed. Simulation results indicate that the method has a good performance in creating optimal path in 3D environment and what's more, the path planning algorithm is simple, efficient and easily realized in engineering field, thus adapting to the different missions of the UAV. [C4632]

"An application of new direct digital frequency synthesizer"

In this paper, we propose an application of new direct digital frequency synthesizer, which clock frequency is up to 3.2 GHz. The design can generate single signal, chirp signal, stepped-frequency signal and stepped-frequency chirp signal from dc to 1500 MHz. The conclusions are drawn after comparing the NEW DDS with AD9858: phase noise and spurious spectrum of the NEW DDS are better than AD9858. [C4633]

"Study on the target association arithmetic of the marine radar and AIS"

AIS (Automatic Identification System), a new type of Navaid at sea, is one of the key equipment to navigation for a ship as same as radar. But, there are many differences between them in the performance. It is very important to fuse the target information from the two sensors to get mutual benefits. The paper studies on the association arithmetic of the targets from the two sensors by adopting T_D coarse target association judgment and multi-factor fuzzy integration decision-making, including target position coordinate conversion, space time unification and so on. By the use of computer simulation, the results show that the arithmetic is right and effective. At the same time, It discusses the relation of the association probability with the association threshold. [C4634]

"A review of radar techniques for ornithological observations"

This paper reviews some popular radar techniques involved in ornithological observations. Due to the biological properties of the observable targets, in order to collect correct signatures of the size, ground speed, height and wing beating information, most radar systems originally designed for meteorological detection require various upgrades and modifications, either in the hardware or software design process. Biological targets have relatively smaller Radar Cross Section (RCS) and greater variations in different species. The flying speed could be estimated by a Doppler radar. However, in order to distinguish species from each other, more information such as target altitude, flock patterns, even wing beating frequency have to be obtained from the radar signal processing. The aforementioned considerations and such related issues introduce new aspects and requirements to the radar system design. In the following section, we review various radar considerations in terms of different ornithological signatures. Emphasis is put on the pulse compression and dual polarization imaging techniques from the point of view of recent digital signal processing (DSP) implementation, which may be able to contribute to the advanced radar ornithology system design of the future. [C4635]

"Characterization of UWB antenna in time domain using the complex natural resonances"

In this paper, we have shown the possibilities to extract CNR (coefficient natural of resonances) of an UWB antenna with a signal processing in time domain (SEM method). Complementary analyses are in progress to enhance the first interesting results obtained on CNR's extracted from TLS-Prony processing. [C4636]

"Radar target imaging using distributed radar networks"

Target images can be clearly reconstructed from the monostatic and bistatic range profiles generated by a DRN with enough radar sensors. Because the images are instantly formulated, no synthetic aperture processing or motion compensation is needed. From the generated image, various target features such as target sizes, speed and scattering center pattern can be extracted for target recognition. [C4637]

"Microwave mammography using multi-static UWB radar"

In this paper, we enhanced the MIST beamforming for multi-static radar, and have demonstrated the performance using the 3-D breast model containing the 3mm-radius tumor by numerical experiments. We can clearly recognize small tumor without false image as compared with MIST and MAMI. In addition, the computing time is about 1/9 of MAMI. We have confirmed that MS-MIST was useful than existing algorithms for early breast cancer detection. [C4638]

"Detection of low-speed ground moving targets using MIMO radar"

Summary form only given. For airborne radar systems, space-time adaptive processing (STAP) is the approach that is normally adopted to detect ground moving targets in ground clutter, but the technique becomes less effective if the speed of ground moving targets is very low because of the proximity of the Doppler frequency of

targets to that of ground clutter. Typical low-speed ground target detection scenarios include detecting ground troops and slowly-moving ground vehicles. Multiple-input multiple-output (MIMO) radar possesses multiple transmitting and receiving channels providing additional diversified reflections for fusion processing in target detection and measurements. MIMO radar has been extensively investigated, but the exact structure of MIMO radar is defined widely different. In this work, an innovative multi-level MIMO radar signal processing architecture is proposed for airborne systems to effectively detect low-speed ground moving targets. The new MIMO-based approach is demonstrated to be effective for detecting such low-speed ground targets in this work, and some simulation results are presented subsequently. [C4639]

"Implementation issues for the deployment of a WMN with a hybrid fixed/cellular backhaul network in emergency situations"

In this paper we present a research project of the research council of St-Joseph University (USJ) at its faculty of engineering (ESIB) in Beirut, Lebanon, in collaboration with professors at INRS-EMT, Montreal Canada. This project aims at addressing the issues of deployment of a Wireless Mesh Network (WMN) on parts of the Lebanese territory, supported by an already installed dense infrastructure of WiFi hotspots (in urban areas), cellular and fixed telecommunications networks. In particular, we wish to address issues of using such networks in emergency situations, where parts of the telecommunications infrastructure have been damaged, with the need to maintain predominantly voice communications and urgent data communications over any available telecommunications infrastructure that is still operational. The architecture that we look at is a two-tier WMN supporting VoIP and data communications between mesh clients and mesh routers (tier 1), with mesh routers either communicating directly between themselves or, in case of overload or priority traffic, via a backhaul network based on the cellular (GPRS/EDGE) or fixed telecommunications network (tier 2). In this paper, we discuss the issues to be addressed in such a scenario, particularly admission control and priorities with limited backhaul resources, radio interference between closely located mesh routers and clients, and other related issues. The structure of the paper is as follows: section the autho gives an introduction to ad hoc wireless networks and WMN; section II the author discusses the migration issues from independent WiFi hotspots to a fully connected two tier WMN, where the backhaul tier may use other types of networks; in section III, we address the issues for emergency scenarios with limited connectivity between mesh routers. In section IV, we present the simulation scenarios to be considered and the planned tests on a prototype network for a WMN that will be deployed at ESIB, Lebanon. We conclude in s- ection V. [C4640]

"Automated flight track taxonomy for measuring benefits from performance based navigation"

A flight track taxonomy is presented which decomposes a set of radar tracks according to their lateral, vertical, and conformance segments. These identifications are based upon a novel set of filtering, segment identification and track decomposition algorithms. These algorithms have been optimized such that they can batch process large data sets efficiently and robustly. Radar filtering algorithms rely upon a series of mixed nonparametric least squares filters, which are shown to isolate and minimize several sources of radar error. Next, a generalized change point analysis is described and used to identify lateral and vertical maneuvers within each radar track. Large collections of radar tracks are approximated by a reduced order module using Proper Orthogonal Decomposition (POD) and then a k-means clustering technique is applied to group these simplified tracks into common flows. In conjunction with a series of coordinate projections, this flow reduction is used measure conformance to existing procedures. In particular, deviations from nominal procedure paths due to radar vectors, direct-to clearance, and turn onto final may be identified and catalogued. This taxonomy provides numerous metrics which are valuable for measuring the benefits from performance based navigation. Two examples are demonstrated where the taxonomy is applied to the analysis of terminal descent profiles and the lateral conformance of an area navigation (RNAV) departure. [C4641]

"Numerical and experimental verifications of digital correlator model for random noise radar"

Design theory and efficient digital correlator model of a random FM noise radar was presented. The correlator model was developed with System generator blocksets in Simulink environment to include the discrete time base and quantization effect if it can be implemented by using the FPGAs available in the markets. Numerical simulation was conducted with the virtual noise signal and moving target signal generators, and the obtained results show good agreements with the expected values. For an experimental examination, a mm-wave random FM noise radar was implemented based on the obtained design parameters, and a field test was made for detecting a high-speed moving target. With the logging data, an off-line correlation and Doppler processing was made, and the obtained information was very close to the estimated one again. All the results fully validate the design theory and the developed digital correlator model. [C4642]

"Through wall ranging and imaging using UWB random noise waveform: System design"

considerations and preliminary experimental results"

In this work, a portable and real-time through-wall random noise radar is presented. The system is inherently covert and is immune from interference and jamming since a random noise waveform is used. By combining mature cross-correlation and SAR algorithm with FPGA-based receiver technology, the system is able to perform real-time range detection as well as imaging of targets, including human beings, behind a wall. [C4643]

"Frequency scanning antenna concept with random feed lengths"

A block diagram of a radar architecture to support a frequency scanning antenna with random length feed lines was developed. The feasibility of the architecture to perform target localization in position and velocity was investigated by analyzing 1-d antenna patterns and costs functions based upon an L2-norm. A large trade space exists between adding complexity to the radar system versus simplifying the signal processing. For this paper, a single realization of the system was selected, then simulated. The results indicate that the concept is feasible, but requires high SNR and a small number of targets for unambiguous results. This concept can be extended from a single array to multiple subarrays for improved performance and to reduced requirements on the delay line lengths and the percent bandwidth of the system with the cost of additional data acquisition hardware and increased computational complexity. [C4644]

"LMS based arrays with compressed sensing"

This paper examines the potential of reducing the computational complexity of adaptive antenna-array systems by reducing the number of measurements per antenna using compressive sensing techniques. Compressive sensing is particularly suited for signals that are K sparse on some basis Ψ . These types of signals are common in radar systems, multipath propagation, terrain scattered interference, etc. The idea is to take M observations (with $M \sim O(K \log(N))$) instead of the standard N observations dictated by the Nyquist sampling criterion and desired frequency resolution, thereby reducing the size of the covariance matrix, hence expediting the adaptive process and reducing the computational demand of the antenna-array system. The least mean squared (LMS) algorithm is thus applied to the reduced-size observation vector, and the original signal is reconstructed at the output of the array. This reduction in complexity is counterbalanced by the error incurred in reconstructing the array output from few observations. [C4645]

"Design of High-Speed DRFM System"

Digital Radio Frequency Memory (DRFM) has been widely used for the storage of radio frequency and microwave signals. As the frequency and bandwidth are large, the implement of DRFM is limited by the speed of digital devices. A design is proposed to solve this problem based on leading technology such as poly-phase filter, Parallel-decomposition convolution and Partition of the coefficient sequence, RapidIO technology. The design shown in this paper is useful in complicate radar echo signal simulation with broadband coverage and high-speed data rate. [C4646]

"Direction of arrival estimation in time modulated linear arrays"

Direction of arrival (DOA) estimation is a very important technology for smart antennas, which have been widely used in many applications such as radar, communication and sonar etc. Various techniques for DOA estimation have been proposed. The commonly used techniques for DOA estimation are subspace based methods, such as multiple signal classification (MUSIC) and its variations. However, these methods cannot be applied to TMLA directly due to that some channels in TMLA are forced to zero during a special time in a time modulation period. To overcome this difficulty, a method based on beamspace composed of sideband signals and center frequency signal for DOA estimation in TMLA with unidirectional phase center motion (UPCM) is proposed in this paper. [C4647]

"Synthesis of a pseudo-conformal multibeam K-Band array"

To assess the impact of pseudo-conformal geometry in the irradiative pattern of a K-band antenna array, a three-waveguide array was designed that allows the forward displacement of the outer waveguides in relation to the central element. The field pattern of the antenna array for different geometric configurations was simulated using the correct excitation reaching the individual waveguide through the beamformer. The variation in the number of beams, beamwidth of the main beam, and separation between beams with displacement distance of the external waveguides were calculated. Comparison of the simulated pattern with measurements is presented for this antenna to verify the accuracy of the radiation model. [C4648]

"Real-time method for human presence detection by using micro-Doppler signatures information at

24GHz"

A simple real-time method is presented in order to detect human presence in a changing environment extracting useful information from micro-Doppler signatures. A measurement campaign was performed in order to measure influence of speed, torso and direction of movement. This research line continues open and new approaches are under development at present. [C4649]

"Through wall imaging based on electromagnetic modeling using UWB noise waveform"

Different electromagnetic models using the UWB noise waveform as incident waveform are setup. For each model, imaging result is obtained using back projection algorithm after cross-correlation processing of every received echo with the transmit noise signal. [C4650]

"A novel beam scanning technique in time modulated linear arrays"

In this paper, a novel technique for electronic beam scanning in TM linear array is proposed. This technique is realized at the first positive sideband. By controlling the duration of "on" times of each element the desired pattern can be synthesized and by adjusting the switch-on time instant of each element, the electronic beam scanning can be realized. Differential evolution strategy (DES) is employed to control the SLL at the first sideband and improve the first SBL simultaneously. [C4651]

"A 26 GHz retro-reflective array for long-range RFID applications"

A unique design of series-fed grounded coplanar waveguide (GCPW) patch arrays for use in retro-reflective arrays is presented. For the current application, a planar retro-reflector which is capable of providing large radar cross-section (RCS) and signal modulation, and can also operate on metallic surfaces from 25.5-26.5GHz is desired. Linear, series-fed GCPW patch arrays are employed as the radiating elements. Using constituent arrays allows maximization of RCS using the minimum number of active components. Additionally, the unique orientation of the series-fed arrays provides beam squinting, allowing for ease of target identification and distinguishing the response from that of the array ground plane. The array design and results are briefly presented herein. Integration of the array in the intended system application is discussed in a separate conference submission. [C4652]

"Beamspace PM-Root-MUSIC for Uniform Circular Array Based on MST"

In this paper, we developed a novel version of PM-Root-MUSIC algorithm for uniform circular array (UCA) in order to avoid the performance degradation of DOA estimation when the number of elements in UCA is small. Based on the manifold separation technique (MST) and propagator method (PM), a beamspace DOA estimation algorithm for UCA was proposed. This method requires no eigen-decomposition calculation, therefore reduce the computational load significantly, and provide close to CRB performance even applied to UCA with limited number of elements. [C4653]

"Segment Clustering Radar Signal Sorting"

Radar signal sorting is picking-up pulse serial of same radar emitter from dense complex pulse signal flow. The tolerance of radar signal sorting is analyzed in modern electronic warfare. The complex and dense pulses environment makes it become a vital factor to restrict the efficiency of sorting of the conventional multi-parameters signal sorting system. A segment clustering radar signal sorting method is presented based on support vector clustering (SVC) according to the idea of statistics learning theory. It prevents tolerance from affecting radar sorting. The accuracy of sorting and the sensitivity of algorithm on parameter variation is analyzed. The experimental results show that the sorting method presented is effective to overcome the tolerance of radar signal sorting. [C4654]

"Method of radar detecting small signal based on adaptive genetic algorithm and neural network"

To perform effective radar small signal detection in low SNR, a signal-processing model is established. In the model, the feature factors that distinguish small signal from noise are defined with whitening process and feature decomposition frequency estimation, then the RBF parameters are optimized by using genetic algorithm and AGA-RBF neural network is formed to realize classification, thereby the small signal detection is completed. Results of simulation show that the detection probability is greatly increased as well as the performance of classification. [C4655]

"Radar Target Scattering Center Extraction Based on the Full-Polarization GTD Model"

To accurately describe the high frequency electromagnetic scattering of the radar objects, the full-polarization GTD model is established based on the combination of the full-polarization information and the geometric theory of diffraction model. Meanwhile, A novel method, MUSIC based on polarization linear variation method (PL-MUSIC) is proposed. The estimation accuracy is improved and the computational load is greatly decreased compared with the method extracting the parameters from every polarization channel. Compared with the parallel polarization MUSIC method (PP-MUSIC), the proposed method decreases the computational complexity of the smoothing process and has the close accuracy. Moreover, the spatial spectrum estimation method based on eigenspace is utilized to establish the spectrum function. Simulations and computational load comparison show the validity of the full-polarization GTD model and the advantage of the MUSIC based on polarization linear variation method. [C4656]

"Research of Automobile Speed Measuring System Based on Linear CCD"

One automobile speed measuring system based on linear CCD is designed. The linear CCD is the front detecting device, and the MCU processed the CCD output signal using the edge identification arithmetic to achieve automobile accurate localizing on one moment. In this way, the automobile speed can be measured accurately on slope. In this article, the architecture and principle of CCD have been elaborated in detail, one timing sequence driving design method of linear CCD based on the CPLD chip of EPM7128 is described, while the principle and composition of the speed measuring system are introduced as well. Through experiments, the speed measuring range of the system is 5 m/h~160 km/h and the error is less than 0.5 km/h. Right now this system has already been successfully used as an examine system for drivers driving with a ramp. It has been proved that it is accurate with sensitive responsiveness. [C4657]

"Research on DSS-Based MIMO Radar's Detection Performance"

The application of multi-input multi-output (MIMO) radar concept to DSS (Distributed Small Satellite) is considered to make best use of the cooperative mode of DSS and the spatial diversity of MIMO radar. The DSS-based MIMO radar system is introduced in this paper. Using the receiving signal's eigenvalue of covariance matrix, it analyses detection performance of MIMO radar, which can provide a full-diversity path. The detection performance of MIMO radar based on moving platform are discussed. We show the influence of DSS platform's movement on radar's detection performance, and discussed the feasibility of DSS-based MIMO radar system. [C4658]

"Asymptotics of Multi-Fold Vandermonde Matrices with Applications to Communications and Radar Problems"

We study the performance of signal estimation and reconstruction systems, that exploit the linear minimum mean square error (LMMSE) technique. This model often occurs in signal processing and wireless communications; some examples are radar applications, MIMO communications, or sensor networks sampling a physical field. Our performance analysis implies the characterization of a random matrix product, involving a multifold Vandermonde matrix with complex exponential entries. We therefore derive the LMMSE by computing the η -transform of this matrix product, which can be evaluated either by implicit as well as by explicit expression, using the matrix asymptotic moments. Finally, we show how our results can be applied in some cases of practical interest. [C4659]

"Blind source separation based on the array-averaged Fractional Fourier Transform"

In this paper, a novel blind source separation method based on the array-averaged Fractional Fourier Transform is proposed. This method can decrease the noise levels, and suppress the interactions of the source signals, which lead to better separation performance. Compared with the previous blind source separation techniques based on the time-frequency distributions, this proposed method produces little crossterms, and it does not require whitening, joint-diagonalization, and bilinear signal synthesis. The improved efficiency of the method is verified by the simulation. [C4660]

"Combining edge detection algorithms in intensity SAR images"

Edge-detection algorithms are applied to SAR images in order to generate different edge strength maps. The results obtained can be combined to improve the final output in order to get a more defined edge strength map. In this paper different combinations of methods are implemented and evaluated using a criterion based on the quality of the detected edges over the original image. The aspects considered are the false alarm rate, edge thickness and discontinuities inside the detected edges. The results obtained with the edge enhancement techniques are compared and conclusions about the best combination strategies are extracted. [C4661]

"A 3D laser scanner system for autonomous vehicle navigation"

Road segmentation, obstacle detection, situation awareness constitute fundamental tasks for autonomous vehicles in urban environments. This paper describes an end-to-end system capable of generating high-quality 3D point clouds from one or two of the popular LMS200 laser on a continuously moving vehicle. Road segmentation and crossing analysis have been performed on the basis of this newly developed 3D laser scanner. This system is cost-efficient and provides a circumferential view that makes it also applicable to mid-sized robotic platforms, like Volksbot robots. Field experiments from the DARPA Urban Challenge are presented. Our aim is to provide a level of hardware and algorithmic detail suitable for replication of our system by interested parties or to get a cheap 3D laser scanner for research for those who do not wish to invest in hardware development. [C4662]

"An approach for robust mapping, detection, tracking and classification in dynamic environments"

Understanding its environment remains a difficult problem for a mobile robot. Several intricate problems (localization, mapping, detection, tracking, classification) have indeed to be solved concurrently. However, most perception algorithms solve these issues independently leading to limited performances in highly changing environments. We present in this paper an original approach where the mapping, the tracking, the detection and the classification problems are addressed concurrently and where the perceptual knowledge of the robot is described using four recursively estimated discrete probability mass functions. Our first experiments based on simulated and real range data show that our approach is able to cope with complex outdoor situations. [C4663]

"A method to measure the 1090 MHz interference environment"

The 1090 MHz aviation surveillance frequency band is being used by a growing number of aircraft, applications and equipment types. The band is expected to soon reach critical interference levels. The frequency is used by aircraft transponders responding to interrogations from ground radar and from other aircraft. It is also shared by aircraft transmitting Automatic Dependent Surveillance-Broadcast (ADS-B) information, and by ground stations transmitting traffic information and cross-link ADS-B rebroadcasts. In the current protocols, information is transmitted asynchronously. Loss of information due to overlapping messages or garbling is acceptable in all protocols to a certain degree, but there is concern that this performance loss will soon become unacceptable as message densities increase. In order to quantify the problem, analyses and simulations are used, and they must make assumptions about the details of the interference environment. Therefore there is a strong need for measurements in the field to verify the models. This paper presents a new approach to measuring the 1090 MHz interference environment. [C4664]

"Satellite electronic attack of enemy air defenses"

Satellite electronic attack on enemy air defense radars is a pioneering use of orbiting radar emitters that were once used for remote sensing. Electronic attack is not the same as remote sensing, so a detailed design analysis of candidate space radar systems is required. The shuttle radar topographic mapper mission (SRTM) seems perfectly capable of electronic attack based upon ongoing engineering analysis. The electromagnetic propagation path is narrowly evaluated to answer the basic critique, "Isn't space too far away?". This evaluation establishes critical limits for key parameters: (1) number of satellites required in the enemy's field of view, (2) transmitter power, (3) transmitter gain, (4) transmitter bandwidth, and (5) assumed losses resulting in burnthrough ranges for various assumed design parameters. [C4665]

"Learning averages over the lie group of unitary matrices"

In the present paper, we treat the problem of learning averages out of a set of unitary matrices. We discuss a possible learning technique based on the differential geometrical properties of the Lie group of unitary matrices. We first recall some relevant notions from differential geometry, mainly related to Lie group theory, and then we propose a scheme for learning averages. Some numerical experiments will illustrate the features of the learnt averages. [C4666]

"ISAR Image Reconstruction of Accelerated Motion Using Matching Pursuits"

The problem of inverse synthetic aperture radar (ISAR) image reconstruction of accelerated motion is considered. As a result of accelerated motion experienced by the target during the image integration period, the ISAR image is distorted and the Doppler frequency of the radar echoes produces undesired change. In traditional ISAR imaging, uniform motion is usually assumed. When accelerated motions are present, it is not possible to obtain a focused image of the target. To solve this problem, the basic idea is to exploit the characteristics of the Doppler frequency of every range cell. The radar signal is decomposed by matching pursuit

with a three-parameter chirplet atom. Different point scatterers in cross direction can be separated in the parameter space. The proposed approach is applied to the point scatterer simulation and the result demonstrates that it can improve the smeary ISAR image better than what can be achieved by conventional Fourier transform methods and Winger-Ville Distribution. [C4667]

"Direct wave estimation of non-cooperative bistatic pulse radar using LMS adaptive filter"

In this paper, an adaptive inverse filter is applied to estimate the non-cooperative bistatic pulse radar transmitted waveform from a clutter-corrupted direct-path signal, given some a-priori knowledge of the transmitted waveform. Some experiments have been done to simulate the process of direct wave reconstruction using LMS adaptive filter. The simulation results show that the adaptive filter does a fairly good job of mitigating the corruption of the direct-path signal. [C4668]

"Modified criterion of hypothesis testing for signal sensing in cognitive radio"

Signal detection problems are traditionally viewed as statistical hypothesis testing. In absence of the a priori probabilities, such as in radar, the Neyman-Pearson criterion is used where a certain false alarm probability is set, and the probability of detection is maximised. In signal sensing problems of cognitive radio, the main constraint is to avoid the interference with the primary user. Once this constraint is met, a cognitive radio can maximise its own chance of finding an empty spectrum. In this paper we emphasise this view of the signal sensing problem and modify the criterion such that a maximum miss-detection rate is specified. We have reformulated the energy detector showing that the sensing results have more meaningful explanations under the modified criterion. The effects of measurement errors are also considered. [C4669]

"4G as a Next Generation Wireless Network"

User requirements are growing faster than ever and the limitations of the current mobile communication systems have forced the researchers to come up with more advanced and efficient technologies. 4G mobile technology is the next step in this direction. 4G is the next generation of wireless networks that will totally replace 3G networks. It is supposed to provide its customers with better speed and all IP based multimedia services. 4G is all about an integrated, global network that will be able to provide a comprehensive IP solution where voice, data and streamed multimedia can be given to users on an "Anytime, Anywhere" basis. At present we have many technologies each capable of performing functions like supporting voice traffic using voice over IP (VoIP), broadband data access in mobile environment etc., but there is a great need of deploying such technologies that can integrate all these systems into a single unified system. 4G presents a solution of this problem as it is all about seamlessly integrating the terminals, networks and applications. The race to implement 4G is accelerating as well as quite challenging. The aim of this paper is to highlight the benefits, challenges in deployment and scope of 4G technologies. [C4670]

"Design Methods of Multi-DSP Parallel Processing System"

In this paper, the cascaded topology of Multi-Digital Signal Processor (DSP) parallel processing system is presented, and the common architecture for multi-DSP parallel systems is summarized. In addition, according to the features of Field Programmable Gate Array (FPGA) and DSP, a parallel system based on 2-level bus structure has been proposed. Two parallel systems, respectively based on TMS320C641x and TS201, have been realized too. Having compared their advantages and performances, we finally conclude the design methods of multi-DSP parallel processing system. [C4671]

"Analysis and design of soliton oscillators using harmonic balance"

Soliton oscillators enable the generation of short-time pulses, applicable in sampling of fast signals or as probe signals in radar systems. The soliton oscillator is made up of a feedback loop containing an amplifier stage and a nonlinear transmission line. In this paper, an efficient technique for the harmonic balance design of these oscillators is presented. The bifurcation behavior of this kind of oscillators is analyzed in depth, with a detailed study of their oscillation modes. The sources of non ideality of the soliton-train waveform have also been investigated. The techniques have been applied to a first prototype at 1 GHz with very good agreement with the measured results. [C4672]

"Title Page i"

The following topics are dealt with: signal processing system; speech recognition; hidden Markov model; TDOA; DSP; Radon transform; iris recognition; wireless sensor network; watermarking; image registration; radar detection; genetic algorithm; routing protocol; OFDM; wireless channel; steganography; FPGA; adaptive filter; FIR

filter; video surveillance; target tracking; data mining; image processing; rough set theory; TCP; fuzzy inference rule; RBF neural network; MIMO system; case-based reasoning; encryption; P2P network and image compression. [C4673]

"A wafer-level diamond bonding process to improve power handling capability of submillimeter-wave Schottky diode frequency multipliers"

We have developed a robust wafer-level substrate bonding process that has allowed us to bond CVD diamond to GaAs membrane-based submillimeter-wave Schottky diode frequency multipliers. The high thermal conductivity of CVD diamond allows the chip to dissipate heat more efficiently thus increasing the power handling capability of the chips. This process has resulted in single-chip multiplier devices working in the submillimeter-wave range that can handle hundreds of milliwatts of input power. Output powers of 40 mW at 250 GHz and 27 mW at 300 GHz from a single chip have been demonstrated with this method. It is expected that by power combining these chips it is now possible to achieve a wideband 300 GHz signal with more than 100 mW of power. This represents a dramatic improvement in the current state of the art and allows one to begin realizing submillimeter-wave radar applications. [C4674]

"Multiple interrogation of phase-conjugating arrays"

The performance of a phase-conjugating array (PCA) in a multiple-interrogator environment is investigated. The PCA demonstrates the ability to properly retrodirect signals toward multiple interrogators to varying degrees, dependent on phase, angle of incidence, and amplitude differences between the interrogators. The effect of the three parameters is demonstrated for the 6-GHz array at interrogating angles of plusmn10deg and plusmn20deg. Agreement between the experimental results and theoretical simulations confirm the validity of the measurements; extrapolation of the simulations for additional cases is also presented. [C4675]

"A New Method for Recognizing Pulse Repetition Interval Modulation"

In a dense modern electronic warfare environment, there are a lot of radar signals. The identification of these radar signals is the main task of the electronic support measures systems. Pulse repetition intervals of signals received from radars can have various PRI modulations and levels. In this paper, a new method of recognizing PRI modulation type and its levels is proposed for ESM systems. The proposed method is based not only on the properties of the biased autocorrelation function of the PRI sequences but also on the development of a hierarchical clustering method for both classifying PRI modulation types and clustering the PRI levels. The performance of the proposed method has also been evaluated in a simulation scenario. [C4676]

"Implementation of Hardware IP in a System Level Environment"

In this paper we describe a methodology to do rapid hardware prototyping of a part of a digital signal processing system described in Simulink. It explains the main technical problems when trying to go to hardware from a pure functional description and the solutions proposed to solve them. The methodology is applied on a proven model, from the architecture co-simulation, to the real hardware implementation in the system model. [C4677]

"SAR Image Compression Using Wavelet Packets"

A SAR (Synthetic Aperture Radar) system usually collects huge amount of data, and focusing of the raw data acquires complex range varying phase compensation techniques, which are generally performed off-board. The large amounts of data generated have to be stored on-board or be transmitted to a ground station via a dedicated data link. Therefore, some form of compression on the raw data provides an attractive option for SAR systems. In this paper we investigate the usage of WPT (Wavelet Packet Transform), which performs uniform division of frequency spectrum, independently on real and imaginary parts of the complex SAR raw data along with scalar quantization for compressing SAR raw data. We propose another image coding algorithm which uses rate distortion optimized WPT. [C4678]

"A New Approach to Coherent Radar Detection in Non-Gaussian and Correlated Clutters"

In this study, a general approach to the detection problem of unknown-amplitude coherent signals in some practical groups of non-Gaussian and/or correlated clutters is investigated. Since there exist no closed-form analytical probability distributions in these contributions, an optimal likelihood ratio test is not applicable and we instead utilize the characteristic function and its estimate in order to perform the estimation and detection. We also extend this idea to the case of correlated K-distributed clutter observations. We assess the performance of the proposed detectors and make some comparisons through Monte-Carlo simulations. [C4679]

"Very High Resolution Digital Instantaneous Frequency Measurement Receiver"

The fine frequency estimation of received signal is very important in Electronic Warfare and communication systems. The performance of radar classification depends on the accuracy of frequency measurements. Since frequency measurement accuracy in Digital Instantaneous Frequency Measurement receiver is highly dependent on corresponding pulse detection technique, here we propose an improved approach which is able to detect pulses as narrow as 50 nsec. Simulation results confirm that this receiver is capable of detecting pulses with 50 nsec width over 1.2 GHz bandwidth with a major error within 43 KHz. [C4680]

"Camera and imaging radar feature level sensorfusion for night vision pedestrian recognition"

This contribution presents a robust pedestrian detection system at night that fuses a camera sensor and a scanning radar sensor on feature level. Each sensor defines an overdetermined set of features to be selected and parameterized using the supervised training algorithm AdaBoost. This technique assures an optimal selection and weighting of the features from both sensors depending on their discriminative power for the classification task. In the radar plane a new complex signal filter has been derived which describes a local similarity measure of velocity differences. In order to achieve realtime capability multiple classifiers are combined using a cascade. [C4681]

"Towards a proactive biologically-inspired Advanced Driver Assistance System"

Driver assistance functionalities on the market are getting more and more sophisticated, which will lead to integrated systems that fuse the data of multiple sensors (e.g., camera, Photonic Mixer Device, Radar) and internal system percepts (e.g., detected objects and their states, detected road). One important future challenge will be to find smart solutions in system design that allow an efficient control of said integrated systems. A promising way for achieving this is to get inspiration from known signal-processing principles in the human brain. This paper presents a biologically motivated Advanced Driver Assistance System (ADAS) that uses the generic principle of attention as common front-end of all visual processes. Based on the attention principle an early task-dependent pre-selection of interesting image regions is done, which decreases scene complexity. Furthermore, internal information fusion increases the system performance (e.g., the attention is used to improve the object tracking; road-detection results improve the attention). Based on streams of a challenging traffic scenario it is shown how the system builds up and verifies its environment-related expectations relying on the attention principle. The ADAS is controlled by a central behavior control module that tunes submodules and parameters. The behavior control module has a simple structure, but still allows for robustly performing various tasks, since the complexity is distributed over the system in form of local control loops mimicking human cognition aspects. [C4682]

"Probability estimation for an automotive Pre-Crash application with short filter settling times"

In this paper, the merits of incorporating covariance propagation into a real-time Pre-Crash application are investigated. The suggested Pre-Crash algorithm activates restraint systems, such as a reversible seat belt tightening system, before an unavoidable accident happens. Sensor fusion of two short-range and one long-range radar with a target-based fusion is used to realize this vehicle safety application. A powerful, yet applicable method for using not only state but also covariance information for triggering actuators is proposed. A comprehensive parameter study on simulated as well as on real data shows statistically significant improvements in detection rate. Further, the importance of covariance errors in terms of accuracy for Pre-Crash applications is demonstrated. Even with few detection cycles and short filter settling times, a good compromise between detection rate and false alarms can be deduced. [C4683]

"Optimized grid-based environment perception in advanced driver assistance systems"

This paper deals with environmental perception for automobile application using an optimized grid-based modeling method. An overview and the challenges of current methods, namely object-based and grid-based sensor data fusion, are presented. Based on this, an optimized grid-based method using mathematical modeling and fuzzy logic is suggested as one of the first step to overcome these challenges. Reconstructed 3D-information from a stereo camera system is used as input data for our grid-based method. In addition to this the first experimental results are illustrated. [C4684]

"A new algorithm for the ARMA model order via pivot-neighbors comparisons"

This paper presents a new algorithm for the determination of the ARMA model orders based on a rounding approach which is implemented to deal with the precision of binary words. The rounding approach uses the floor and the ceiling functions. The proposed algorithm is based on selecting a sequence of pivot cells values from

the well known minimum eigenvalue (MEV) method developed by Liang et. al. [6]. It uses the floor and the ceiling functions of the pivot cells values and the values of its neighbors to search for the corner that contains the estimates of the true orders. The observed sequence may be contaminated by additive Gaussian noise. Simulation examples are given to illustrate the effectiveness of the proposed technique for different signal to noise ratios. [C4685]

"A phased-array radar transmitter based on 77-GHz cascable transceivers"

A 77-GHz phased-array radar transmitter that is based on fully integrated, differential, cascable transceiver circuits is presented. The building blocks of the 77-GHz IQ transceiver are explained in detail, along with measurement results of the transmitter part. A demonstration of the beam-forming capability of the presented transceiver is given using a 4-channel phased-array radar demonstrator that incorporates the generation of PLL stabilized 77-GHz signals. [C4686]

"Recent advances in 94 GHz FMCW imaging radar development"

High resolution imaging radars have come a long way since the early 90's, starting with an FAA Synthetic Vision System program at 35/94 GHz. These systems were heavy and bulky, carried a price tag of about \$500K, and were only suitable for larger aircrafts at very small quantity production. Size, weight, and power constraints make 94 GHz still a preferred choice for many situational awareness applications ranging from landing in poor visibility due to fog or brown-out, to cable warning & obstacle avoidance and sense and avoid for unmanned aerial systems. Using COTS components and highly integrated MMIC modules, a complete radar breadboard has been demonstrated in 9 months in one line replacement unit with a total weight of 20 lbs. The new generation of this 94 GHz FMCW imaging sensor will be on the order of 15 lbs or less including the entire radar signal processor. The size and weight achievements of this sensor open up the potential market for rotorcrafts and general aviation. [C4687]

"Experimental assessment of the cross coupling and polarization effects on ultra-wide band see-through-wall imaging reconstruction"

A low-cost ultra-wide band see-through-wall imaging radar system was designed and implemented and has been used to assess common simplifying assumptions in its microwave imaging reconstruction. The typical simplifying assumption, it is assumed no mutual couplings exist between the array elements and no cross polarizations arise from the antennas, through wall propagation, or from the target itself. In this paper, we present our newly developed SAR system and experimentally investigate the effects of the two assumptions and said impact on radar imaging. [C4688]

"Beamforming and Monopulse technique on sequentially-fed circularly-polarized ultra-wideband radar array"

The paper describes how beamforming and monopulse techniques can be applied to an array of sequentially-fed, circular polarized, ultra-wideband array. By exploiting the same sequentially-fed antennas for beamforming and monopulse, we can achieve better target tracking, without increasing the antenna array size. The design equations of our proposed method, for the radar transceiver, are derived. To verify the design equations, a prototype radar transceiver is constructed, and the transmitted circularly polarized signals are measured, and compared with the equations. The ability of the array to accurately track radar target with monopulse technique is also demonstrated by measurements. [C4689]

"Sea clutter power reduction in radar measurement systems by feedforward multilayer perceptrons with medium input data integration rate"

In radio measurement systems, the backscatter from what is not a target, i.e. the clutter, is usually not desired. So, these systems try to incorporate clutter reduction techniques as efficient as possible. In this way, different signal processing techniques can be used. The case of study presented in this paper shows how to reduce the level of sea clutter measurements in a marine radar. Due to linear linear signal processing is not suitable in these cases, nonlinear signal processing is used, which is achieved by neural networks. In this way, 7 cells to evaluate the output of each cell under test of a radar image (medium input integration rate) are selected. The processed radar images show very promising results from a subjective point of view. On the other hand, objective measurements are used to analyzed the system performance. Those measurements are based on the mean square error and the clutter and target powers at the input and output of the proposed clutter reduction system. Minimum and mean clutter reduction power rates of 7 dB and 10 dB are achieved, respectively. [C4690]

"A New Method of Blind Beamforming Using Phase Correlation of Direction Vector"

A new method of blind beamforming with phase correlation of direction vector is proposed in this paper. Firstly, higher-order cumulant blind beamforming is expatiated. Then, a new method is put forward which integrates cumulant-based algorithm with phase correlation of direction vector. By dealing with underwater experimental data, the new method is proved valid and effective. [C4691]

"High frequency crystal monolithic filter with high power level in airborne application"

Radar and communications systems require frequency references with ultimate noise performance with the aim of improving the sensitivity of the advanced devices. In order to achieve a very low noise floor combined with a high level output, AR-Electronique has studied and developed a new filter generation. In this paper, we present a specific filter design using monolithic crystal resonators technology with a special cut angle and innovative metallization, allowing high input power. Combined with an oscillator, a very low phase noise floor is achieved at the output. [C4692]

"An update on multi-channel digital receiver development for the phased array radar at the National Weather Radar Testbed"

This paper describes the beginning states of a new project that will digitize radar signals coming from eight channels on the phased array antenna at the National Weather Radar Testbed (NWRT) in Norman, Oklahoma. At the current time, a single-channel digital receiver is operational to mimic the current capability. The multi-channel digital data will foster a new generation of adaptive/fast scanning techniques and space-antenna/interferometry measurements, which will then be used for improved weather forecasting via data assimilation. Differing from the conventional rotating radar, the phased array is suited for multi-mission capabilities so that a variety of targets may be observed simultaneously with a high degree of fidelity. The development of a multi-channel receiver will be the catalyst and an enabling tool for research in this area for the next decade. This collaborative project, which involves scientists and engineers from the University of Oklahoma and the National Severe Storms Laboratory in Norman, is the result of a recently funded a grant from the National Science Foundation (as described in the Acknowledgement section of this paper). [C4693]

"Refractivity Estimation from Radar Sea Echos"

This paper addresses the problem of estimating parameters of the height-dependent index of refraction over the sea surface. The parabolic approximation for numerical solution of the wave equation is used to formulate the forward model. Refractivity estimation is performed by a modified genetic algorithm(MGA). Simulation results are presented which demonstrate the ability of this approach to estimate refractivity parameters with high precision, which is likely to provide an effective method for the estimation of the duct effects from radar sea ehco. [C4694]

"Optimal Adaptive Waveform Selection Based on ADP in Cognitive Radar"

Cognitive radar is a new framework radar system proposed in 2003 and waveform selection is an important problem in this type of radar. In this paper, we design a knowledged-based (KB) waveform selector and use stochastic dynamic programming model to describe waveform selection problem. To solve the problem of curses of dimensionality, we use approximate dynamic programming (ADP) in our solution. This method is operative and efficient. [C4695]

"A Weak Signal Detection Method Based on Artificial Fish Swarm Optimized Matching Pursuit"

To detect weak signals is difficult in signal processing and is very important in many areas such as non-destructive evaluation (NDE), radar etc. Sparse signal decomposition from overcomplete dictionaries are technique in the signal processing community. In this paper, this technique is utilized to cope with ultrasonic weak flaw detection problem. But its calculation is huge (NP problem). A new improved matching pursuit algorithm is proposed. The mathematical model of searching algorithms based on artificial fish swarm is established; the artificial fish swarm with the advantages of distributed parallel searching ability, strong robustness, good global astringency, and insensitive preferences are employed to search the best matching atoms. It can reduce complexity of sparse decomposition and space of memory. Experimental results shows that the amplitude, frequency and initial phase parameters of ultrasonic signal blurred by strong noise can be estimated according to the proposed algorithm, and the expected weak signal can be then reconstructed. When this method is used in the ultrasonic flaw detection, compared with the wavelet entropy and wavelet transform, the results show that the signal quality and performance parameters are improved obviously. [C4696]

"Empirical Evaluation of the Limits on Localization Using Signal Strength"

This work investigates the lower bounds of wireless localization accuracy using signal strength on commodity hardware. Our work relies on trace-driven analysis using an extensive indoor experimental infrastructure. First, we report the best experimental accuracy, twice the best prior reported accuracy for any localization system. We experimentally show that adding more and more resources (e.g., training points or landmarks) beyond a certain limit, can degrade the localization performance for lateration-based algorithms, and that it could only be improved further by "cleaning" the data. However, matching algorithms are more robust to poor quality RSS measurements. We next compare with a theoretical lower bound using standard Cramer Rao Bound (CRB) analysis for unbiased estimators, which is frequently used to provide bounds on localization precision. Because many localization algorithms are based on different mathematical foundations, we apply a diverse set of existing algorithms to our packet traces and found that the variance of the localization errors from these algorithms are smaller than the variance bound established by the CRB. Finally, we found that there exists a wide discrepancy from what free-space models predict in the signal to distance function even in an environment with limited shadowing and multipath, thereby imposing a fundamental limit on the achievable localization accuracy indoors. [C4697]

"Experimental Evaluation of SZ-2 Phase Coding to Mitigate Range Ambiguity"

Range ambiguity is a inherent problem of Doppler weather radar. At present, the most usual methods to mitigate the range ambiguity are batch mode and split cuts. These methods are simple, but when powers of the overlaid echoes are close to each other, these methods will fail. Doppler velocity and spectrum width displays characterize these failures by encoding locations of such overlaid powers with a purple color. This article gives the theory of using SZ-2 phase coding algorithm to mitigate the range ambiguity. Firstly, explains the feasibility of using this algorithm to mitigate range ambiguity in theory. Secondly, using the data of X-band D-Pol Doppler weather radar echo signals, analyzes and compares the range ambiguity mitigation performance of batch mode and SZ-2 phase coding algorithm, gets following preliminary results: compared to the batch mode, SZ-2 phase coding produces a significantly smaller amount of obscuration due to overlaid echoes and this algorithm satisfies the request of real-time processing. [C4698]

"The application of the matrix pencil and beamforming to determine the presence of termites in situ EUROCON 2009"

The detection and location of termites in building structures involves near field sensing with RADAR arrays, where the plane wave assumption does not apply. In this paper, we explore a number of enhancements to the matrix pencil direction of arrival (DOA) algorithm, including augmentation with beamforming methods, which allow it to operate in the Fresnel Region, using a hybrid array which combines random and uniform planar array geometry. The results from simulations show that such a hybrid array can operate in the near field, even when there are coherent, interfering signals from other sources. [C4699]

"Ground moving personnel indication and tracking from airborne platforms"

Radar is valued for its ability to surveil large areas, day and night, in all weather conditions, with high revisit in order to provide detection and tracking of individuals and groups. Such radars operate either stand-alone or while networked and may generate cues for EO/IR sensors for identification and classification. In the security applications domain radar basing or siting has been predominately, if not exclusively, from fixed, ground-based positions (this includes mobile systems that must be stationary when employed). Airborne radar systems employing phased array antennas and advanced adaptive processing are investigated for their ability to detect and track individuals, in a security application, when integrated with small and medium unmanned air vehicles. Airborne surveillance radar overcomes many of the visibility issues of ground-based systems by operating at steeper grazing angles. We evaluate performance for two operating altitudes and in a variety of surface wind conditions, demonstrating high probability of detection against walking human targets. These results suggest the viability of UAV-based airborne radar as candidates for future surveillance architectures. [C4700]

"A survey on spectrum sensing techniques for Cognitive Radio"

Spectrum sensing is an important functionality of cognitive radio (CR). Accuracy and speed of estimation are the key indicators to select the appropriate spectrum sensing technique. Conventional spectrum estimation techniques which are based on short time Fourier transform (STFT) suffer from familiar problems such as low frequency resolution, high variance of estimated power spectrum and high side lobes/leakages. Methods such as multitaper spectrum estimation successfully alleviate these infarctions but exact a high price in terms of complexity. On these accounts, it appears that the filter bank spectrum estimation formulated by F. Boroujeny and wavelet based spectrum estimates are the most promising and pragmatic approaches for CR applications.

This article surveys and appraises available literature on various spectrum sensing techniques and discusses spectrum sensing as a key element of CR system design. [C4701]

"IEEE EUROCON 2009"

The following topics are dealt with: antennas; decentralized power systems; power control; renewable energy; electrical machines; drives; control systems; broadcast; image processing; signal processing; electromagnetic compatibility; power quality and radars. [C4702]

"Advanced laboratory methods"

Random phase fluctuations, referred to as phase noise and closely related to frequency stability, affect precision and accuracy of timing. Therefore phase noise impacts on numerous fields and applications, like metrology, physics, digital electronics, radars, telecommunications, optics, microwave photonics, gravitation measurements, particle accelerators, etc. [C4703]

"Analysis of two-stage passive vibration isolation system for crystal oscillator at high-frequency vibration"

In this paper, the influence of vibrations on the crystal oscillator is analyzed in theory and the function of SSB phase noise under vibrations is given. To restrain high-frequency vibration effectively, a two-stage passive vibration isolation system for crystal oscillator is presented. This kind of vibration isolation system has low displacement transmissibility at high-frequency vibrations. The simulations and experiments are carried out. Experimental results show that at the random vibration whose acceleration spectral density is $0.05 \text{ g}^2/\text{Hz}$ with frequency range 20 Hz to 2000 Hz, the SSB phase noise level of a 12.8 MHz AT-cut crystal oscillator (whose acceleration sensitivity is about $2 \times 10^{-9} \text{ g}$) is reduced approximately from -100 dBc/Hz to -120 dBc/Hz at 1 KHz offset by this vibration isolation system. [C4704]

"Effect of vibration on PM and AM noise of oscillatory and non-oscillatory components at 10 GHz"

The performance of microwave components is sensitive to vibrations to some extent. Among them, microwave cables and connectors, bandpass filters, mechanical phase shifters and some nonlinear components are the most sensitive. The local oscillator is one of the prime performance-limiting components in microwave systems ranging from simple RF receivers to advanced radars. The increasing present and future demand for low acceleration sensitive oscillators, approaching $10\text{-}13 \text{ g}$, requires a re-examination of sensitivities of basic nonoscillatory building block components under vibration. The purpose of this paper is to study the phase-modulation (PM) noise performance of an assortment of oscillatory and nonoscillatory microwave components under vibration at 10 GHz. We point out some challenges and provide suggestions for accurate measurement of vibration sensitivity of these components. We also study the effect of vibration on the amplitude-modulation (AM) noise. [C4705]

"Surface acoustic wave resonators as passive buried sensors"

Acoustic wave devices are well known passive transducers for probing through a wireless link a physical quantity. Amongst the two main classes of designs-resonators and delay lines-the former have the advantage of providing informations in a narrow band signal and are hence compatible with an interrogation strategy compliant with radiofrequency (RF) emission regulations, while the latter are probed by a short RF pulse with larger instantaneous energy and shorter response time. We here demonstrate the measurement of temperature using the two configurations, and more specifically for sensors buried in soil. While we demonstrate long term stability and ruggedness of packaged resonators, and signal to noise ratio compatible with the envisioned application, the interrogation range is insufficient for most purposes and we focus towards the use of delay lines. Indeed, the interrogation method of the latter is similar to that used by ground penetrating RADAR (GPR) which displays interrogation ranges in the meter to tens of meters in the lower RF range, depending on soil water content, permittivity and conductivity. [C4706]

"Emerging applications requiring precision time and frequency"

Numerous commercial and military applications utilize precision quartz oscillators and/or atomic frequency standards to generate super-accurate frequencies and time signals crucial to system performance. Examples where precise time and frequency is essential are telecommunications, drilling for natural resources, synchronizing railroads, satellite ground stations, laboratory standards and various others. In military applications precise time and frequency is essential for synchronizing communications, for radar applications, for emitter locators and other. In this paper, we will present precision quartz oscillator and/or rubidium vapor atomic

oscillator applications as well as data that demonstrates achieved performance for synchronizing DVB-T, UMTS-FDD, TDD, WiMAX and LTE communications, for seismic methods while drilling for natural resources in challenging environments, for beamforming in satellite ground stations, for synchronizing military communications that require time errors less than 500 ns in 24 hours holdover during severe temperature changes and for various other applications. [C4707]

"Weighted Sum-Rate Maximization Using Weighted MMSE for MIMO-BC Beamforming Design"

This paper studies linear transmit filter design for weighted sum-rate (WSR) maximization in the multiple input multiple output broadcast channel (MIMO-BC). The problem of finding the optimal transmit filter is non-convex and intractable to solve using low complexity methods. Motivated by recent results highlighting the relationship between mutual information and Minimum Mean Square Error (MMSE), this paper establishes a relationship between weighted sum-rate and weighted MMSE in the MIMO-BC. The relationship is used to propose a low complexity algorithm for finding a local weighted sum-rate optimum based on alternating optimization. Numerical results studying sum-rate show that the proposed algorithm achieves high performance with few iterations.

[C4708]

"Improved divided difference filter based on Newton-Raphson method for target tracking"

In this paper, improved divided difference filter, which will be called IDDF for brevity, is proposed for target tracking with nonlinear observation models. The new algorithm is derived from the Newton-Raphson method (or Newton's method) to approximate maximum a posteriori (MAP) estimation. We demonstrate the direct and intuitive relationship between the iterated extended Kalman filter and Newton-Raphson method and can extend the divided difference filter so that iteration is possible. Simulation results show that the proposed filter provides better performance in tracking accuracy when compared to standard DDF, iterated extended Kalman filter (IEKF) and extended Kalman filter (EKF) in presence of severe nonlinearity. [C4709]

"Two-stage tracking algorithm for passive radar"

Passive Coherent Location (PCL) radar measures the bistatic parameters of a target: the time difference of arrival and the Doppler shift. In order to localize a target in the Cartesian coordinates, the data from multiple transmitter-receiver pairs can be used. This task is, however, challenging due to the ambiguities in the measurements assignment. In the paper, a tracking algorithm is presented, which decomposes the complicated task of target localization into two stages: tracking in the bistatic domain and tracking in the Cartesian domain. The bistatic tracker is used only for plot-to-plot association. The Cartesian tracker, based on the extended Kalman filter, uses the raw plots associated by the bistatic tracker to calculate the Cartesian parameters of the target. [C4710]

"Performance-based sensor selection for optimal target tracking"

In current sensor management concepts sensor selection is usually based on the probability of detection of each sensor. Although this detection probability is based on certain environmental and sensor related parameters, it does not necessarily mean that the sensor with the highest detection probability also yields the best performance. A new sensor selection method was proposed for optimising the target tracking process that compares the available sensors by the best expected performance. This performance evaluation is based on the modified Riccati equation (MRE) and includes the detection probability and the sensor measurement accuracies. Also, different performance-based selection criteria are proposed, depending on the sensor task and the stage of a military operation. In this paper we allocate sensors for target tracking based on the outcome of the MRE selection algorithm and criteria. The results are compared with the current concept of selecting the sensor with the highest probability of detection. [C4711]

"On-road target tracking using radar and image sensor based measurements"

On-road target tracking using radar and image sensor based measurements is studied. A novel 2D road coordinate representation of an on-road moving target is introduced. A natural description of target longitudinal and lateral maneuvering behavior in 2D road coordinates is given using multiple models. An improved mean-adaptive acceleration model is utilized for describing longitudinal maneuver modes of motion. Three IMM-based estimators are developed that use different schemes for fusion of radar and image sensor based measurement data: centralized, distributed, and sequential. Simulation results are presented that illustrate the performance of the proposed estimators in general, and demonstrate their improved capabilities as compared with a known 1D road coordinate (mileage) estimator, in particular. [C4712]

"Multi-hypothesis based map-matching algorithm for precise train positioning"

For certain types of railway lines replacing the equipment for precise train positioning along the track by suitable low-cost sensors and a digital map on the train can result in a more cost-efficient railway operation. This contribution presents a multi-hypothesis based map-matching approach to fuse the data of a GPS receiver, a radar and an inertial measurement unit (IMU). Taking into account only GPS and radar data does not provide a track-selective positioning information on parallel lines, which is essential for safety-critical applications. However, the result of this contribution shows that analyzing additionally the curvature data obtained from an inertial measurement unit while the train passes a switch and comparing it to a reference pattern gained from the design parameters of the switch enables a track-selective positioning. [C4713]

"Multitarget tracking via joint PHD filtering and multiscan association"

A PHD (probability hypothesis density) filter and multiscan association are combined in a feedback fashion in order to provide robust and efficient multitarget tracking. The resulting hybrid tracker, thanks to the feedback connection, provides remarkable performance improvements with respect to both an open-loop PHD filter with estimate extraction via clustering and a traditional tracker equipped with a track formation logic. [C4714]

"Information analysis in passive radar networks for target tracking"

In this paper, the amount of information that can be extracted from a passive radar network is analyzed based on Fisher information. The study aims to present a measure of performance for target tracking with respect to varying sensor numbers and geometry. Adequate number and geometry of receivers for different locations of illuminators of opportunity have been proposed to achieve an estimated target state with predetermined level of error. Additionally, tracking zones where tracking error can be sustained below a predetermined level have been established. Obtained results could prove useful while designing a passive radar network based on tracking accuracy requirements. [C4715]

"Flexible ID association-based tracking algorithm"

For robust data association performance, tracking algorithms available in the literature utilize kinematic as well as non-kinematic information. These algorithms, however, do not provide a systematic way to utilize non-kinematic information to resolve severe and prolonged association ambiguities in the past. We propose a novel framework in which kinematic and non-kinematic information of potential targets are stored as different entities, respectively denoted as tracks and IDs. The dynamic association between tracks and IDs provides the mechanism for resolving past ambiguities and reporting any remaining ambiguity to the user. Simulation results are provided to show the effectiveness of the approach. [C4716]

"The FOI C4ISR demonstration 2008"

In this paper, we describe the C4ISR demonstration performed by FOI in 2008. The demonstration combined the results from research projects on surveillance, communication and information fusion. A scenario where Swedish forces conduct peace-support operations in a fictitious country was used. Both low and high-level information fusion was demonstrated. Data from synthetic-aperture radar, underwater surveillance systems, video surveillance and intelligence information was fused using Impactorium, which allowed users to sort and filter reports and perform a threat assessment. Forensic analysis using video data was also shown, as well as semantic queries using the semantic Milwiki. Evaluations of the demonstrations show that research in sensor, communication and fusion system is relevant to the current and future missions of the Swedish Armed Forces. [C4717]

"Impact of HRR radar processing on moving target identification performance"

Airborne radar tracking in moving ground vehicle scenarios is impacted by sensor, target, and environmental dynamics. Moving targets can be assessed with 1-D High Range Resolution (HRR) Radar profiles with sufficient signal-to-noise (SNR) present which contain enough feature information to discern one target from another to help maintain track or to identify the vehicle. Typical radar clutter suppression algorithms developed for processing moving ground target data not only remove the surrounding clutter but also a portion of the target signature. Enhanced clutter suppression can be achieved using a multi-channel signal subspace (MSS) algorithm which preserves target features. In this paper, we (1) exploit extra information from enhanced clutter suppression for automatic target recognition (ATR), (2) present a gain comparison using displaced phase center antenna (DPCA) and MSS clutter suppressed HRR data; and (3) develop a confusion-matrix identity result for simultaneous tracking and identification (STID). The results show that more channels for MSS increase ID over DCPA, result in a slightly noisier clutter suppressed image, and preserve more target features after clutter

cancellation. [C4718]

"Data fusion techniques applied to scenarios including ADS-B and radar sensors for air traffic control"

The perspectives of expansion in air traffic volume for the next years create important challenges in monitoring and control fields. In this scenario a new concept named ADS-B is rising based on cooperative aircrafts to provide air traffic control. The technique has been disseminated by regulatory agencies of all over the world and its popularity is increasing. It seeks for integration with the actual radar based sensors to provide information with better accuracy to traffic monitoring using parameters supplied by airborne position and navigation systems based on satellite communication. The present work evaluates the efficient use of both sensors data-radar and ADS-B-through the use of data fusion techniques. Centralized and distributed fusion are evaluated showing improvements in aircraft track estimation in both cases, when information from a simulated GPS system is used. The conclusions point to the fact that the system is able to accommodate the expected traffic growth with reduction in aircraft separation rules with greater predictability of its movement. [C4719]

"Calibration factor estimation based on statistical modeling of scattering coefficient"

The calibration factors of synthetic aperture radar (SAR) images are generally obtained by estimation of radar system parameters based on internal calibration and external calibration. In this paper, we propose a simple but efficient method to estimate the calibration factors based on statistical modeling of scattering coefficient. Taking expectation and variance on the linear form of calibration equation, we derive the analytical expressions of such estimator. Modeling the scattering coefficient as Rayleigh, heavy-tailed Rayleigh, log-normal, and Weibull distributions, respectively, we obtain the calibration factor estimators for two kinds of radar receivers: the linear receiver and the square-law receiver. Lastly, Monte Carlo simulation results are provided to demonstrate the efficiency of the proposed calibration factor estimator. [C4720]

"Adaptive target tracking for wideband sources in near field"

A novel adaptive signal subspace transformation for direction-of-arrival (DOA) estimation of wideband sources in the near-field is proposed in this paper. The method is composed of two transformations: signal subspace focusing (SSF) and far-field transform (FFT). SSF aligns the signal subspaces for different frequencies in the bandwidth of the sources based on focusing matrices. FFT transforms the near-field steering vector into the far-field steering vector with same direction-of-arrival (DOA) allocation. By the way, we simplify the location estimation of wideband sources in the near-field to be narrowband sources in the far field. The proposed method can track the DOAs and ranges of near-field wideband sources, simultaneously. Simulation results and water-tank experiments confirm the feasibility and efficiency of the proposed adaptive DOA estimation method in underwater environments. [C4721]

"Target tracking in heavy-tailed clutter using amplitude information"

Harbor surveillance above and below the sea surface depends on sensors such as surveillance radar and multibeam sonar. These sensors attempt to detect and track moderately observable targets such as small boats or human divers in environments which often are characterized by heavy-tailed backgrounds. Target tracking in heavy-tailed environments is challenging even for moderately strong targets due to the more frequent occurrences of target-like outliers. One strategy for increased robustness is to use the backscattered signal strengths together with the kinematic measurements in the tracking method. This paper proposes two new amplitude likelihoods for target tracking in heavy-tailed backgrounds. The first likelihood works by incorporating the uncertainty of the background estimate. The second likelihood explicitly treats the background as heavy-tailed using the K-distribution. [C4722]

"Performance analysis of the Probabilistic Multi-hypothesis Tracking algorithm on the SEABAR data sets"

The probabilistic multi-hypothesis tracking (PMHT) algorithm is a batch type multi-target tracking algorithm based on the expectation-maximization (EM) method. Unlike other more popular methods (e.g., multi-hypothesis tracking, MHT) the computational burden of PMHT grows linearly in the size of the batch, the number of clutter detections, and the number of targets tracked. The SEABAR sea trial was conducted by the NATO Undersea Research Center in 2007 to investigate the suitability of some experimental high gain deployed active sonar receivers for tracking underwater contacts of interest. The sea trial yielded several useful multi-static active sonar data sets. The purpose of the effort reported here is to assess the target tracking performance of PMHT using structured multi-static active sonar sea trial data collected during the SEABAR experiment. This study quantifies

the effects of batch size on the ability of PMHT to hold track on constant velocity and maneuvering contacts to determine the values that provide acceptable tracking performance. Situations involving contact maneuvers or temporary loss of detection (a.k.a., drop outs) are of particular interest. Specifically, the ability of PMHT to hold track as a function of batch size for two multi-static active sonar sea trial data sets containing contact maneuvers and drop outs will be assessed. [C4723]

"Estimation of crowd behavior using sensor networks and sensor fusion"

Commonly, surveillance operators are today monitoring a large number of CCTV screens, trying to solve the complex cognitive tasks of analyzing crowd behavior and detecting threats and other abnormal behavior. Information overload is a rule rather than an exception. Moreover, CCTV footage lacks important indicators revealing certain threats, and can also in other respects be complemented by data from other sensors. This article presents an approach to automatically interpret sensor data and estimate behaviors of groups of people in order to provide the operator with relevant warnings. We use data from distributed heterogeneous sensors (visual cameras and a thermal infrared camera), and process the sensor data using detection algorithms. The extracted features are fed into a hidden Markov model in order to model normal behavior and detect deviations. We also discuss the use of radars for weapon detection. [C4724]

"Performance of PDAF-based tracking methods in heavy-tailed clutter"

Harbor surveillance above and below the sea surface depends on sensors such as surveillance radar and multibeam sonar. These sensors attempt to detect and track moderately observable targets such as small boats or human divers in environments which often are characterized by heavy-tailed backgrounds. This paper provide simulation results which quantify the inevitable performance loss encountered in heavy-tailed environments. The results show that the performance loss can be reduced by accounting for heavy-tailedness in the detection and tracking processes, and by the utilization of Amplitude Information (AI). Two new amplitude likelihoods developed in a preceding paper come favorably out of this comparison. Furthermore, the evaluation of the Modified Riccati Equation (MRE) is outlined for the combination of AI and heavy-tailed clutter. The MRE can be used to decide the false alarm rate for the detection process preceding target tracking. [C4725]

"Organization based system for oceanographic monitoring"

A new organization based system for oceanographic monitoring (OBSOM) is presented in this paper. The OBSOM core system is based on the case-based reasoning methodology, and it is able to generate a prediction about ocean conditions in certain areas of the ocean. CBR uses historical data to create new solutions to current problems. The system employs a distributed multi-agent architecture so that the main components of the system can be accessed remotely. All the elements building the final system, can communicate in a distributed way, from different type of interfaces and devices. OBSOM has been applied to generate predictions in real oil spill situations. Results have demonstrated that the system can accurately predict the presence of oil slicks in certain areas zones. It has been demonstrated that using a distributed architecture can enhance the overall performance of the system. [C4726]

"Bias correction using background stars for space-based IR tracking"

This paper proposes a methodology for removing sensor bias from a space-based infrared (IR) tracking system through the use of stars detected in the background field of the sensor. The tracking system consists of several satellites each equipped with a narrow-view IR sensor that provides bearing observations of the target. As stars are detected the instantaneous sensor pointing error can be calculated as the difference between star detection reading and the known position of the star. The system utilizes a separate bias filter to estimate the bias value based on these detections and adjust the target line of sight measurements accordingly. The target state is estimated through a linearized Kalman filter (LKF). Mean error results are given for the period when the target is in view of the satellite IR sensors. The results of this research provide a potential solution to bias correction while simultaneously tracking a target. [C4727]

"Set JPDA algorithm for tracking unordered sets of targets"

In this article we show that traditional tracking algorithms should be adjusted when the objective is to recursively estimate an unordered (unlabeled) set of target state vectors, i.e., when it is not of importance to try to preserve target identities over time. We study scenarios where the number of targets is known, and propose a new version of the joint probabilistic data association (JPDA) filter that we call set JPDA (SJPDA). Simulations show that the new filter outperforms the JPDA in a two-target scenario when evaluated according to the mean optimal subpattern assignment (MOSPA) measure. [C4728]

"Bias estimation for evaluation of ATC surveillance systems"

This paper describes an off-line bias estimation and correction system for air traffic control related sensors, used in a newly developed Eurocontrol tool for the assessment of ATC surveillance systems. Current bias estimation algorithms are mainly focused in radar sensors, but the installation of new sensors (especially automatic dependent surveillance-broadcast and wide area multilateration) demands the extension of those procedures. In this paper bias estimation architecture is designed, based on error models for all those sensors. The error models described rely on the physics of the measurement process. The results of these bias estimation methods will be exemplified with simulated data. [C4729]

"GM-CPHD and MLPDA applied to the SEABAR07 and TNO-blind multi-static sonar data"

The Gaussian Mixture Cardinalized PHD (GM-CPHD) Tracker was applied to the SEABAR07 and to the TNO dataset from the MSTWG (Multistatic Tracking Working Group). The Maximum-Likelihood Probabilistic Data Association (MLPDA) batch tracker was applied to the TNO dataset only. The tracking results (plots and MOPs) are given. [C4730]

"Performance analysis and correlation selection with Doppler measurements"

In target tracking system, Doppler radar or active sonar can provide both range and range rate measurements. With some kinds of waveforms, the range and range rate measurement errors are correlated. It is pointed in [1] that the negative correlation can improve the steady state tracking performance greatly and the tracking performance under positive correlation will be worse than that under no correlation. With further simulation in this paper, it can be seen that the tracking performance under positive correlation is not always worse than that under no correlation. Under the assumption that the range and range rate accuracy are not affected by the correlation, the relationship between the tracking performance and the correlation is revealed through one-step analytical analysis. For better tracking performance, the absolute value of the measurement correlation coefficient should be as big as possible and its sign should use the opposite sign of the one step prediction covariance correlation. [C4731]

"Cancellation of Es layer clutter in a HF Surface Wave Radar using auxiliary horizontal Dipole antennas"

This paper presents the results of a preliminary study of an adaptive system using horizontal antennas for the cancellation of Es layer clutter in HF surface wave radar (HFSWR). Four horizontal dipoles, configured as two separate crosses, were added to a HFSWR system that normally uses vertically polarized antennas (VPAs). The data received from the horizontal antennas were correlated with the data received from the vertically polarized antennas (VPAs) to estimate and cancel the clutter adaptively in the VPAs. Suppressing the Es layer clutter after each coherent integration interval, about 25 dB signal-to-clutter ratio is expected with the experimentally derived data. The study also compared the effectiveness of the adaptive technique using one, two or four horizontal dipole antennas. This comparison indicates that the cancellation was more effective when all four horizontal dipoles were used. [C4732]

"Object recognition in 3D lidar data with recurrent neural network"

This paper introduces a new method for object recognition which is based on a recurrent neural network trained in a supervised mode. The RNN inputs 3-dimensional laser scanner data sequentially, in a natural temporal order in which the laser returns arrive to the scanner. The method is illustrated on a two-class problem with real data. [C4733]

"Adaptive UKF for target tracking with unknown process noise statistics"

With an application to target tracking with unknown process noise, adaptive UKF is presented. In this new algorithm, modified Sage-Husa noise statistics estimator is introduced to estimate the system process noise variance adaptively. By estimating the noise covariance online, the proposed method is able to compensate the errors resulting from the change of the noise statistics. Such a mechanism can improve the state estimation accuracy and enlarges its application scope. The simulations show that adaptive UKF can provide better performance in tracking accuracy than the standard UKF, especially in the case of unknown prior system noise statistics. [C4734]

"Multistatic tracking using bistatic range-Range rate measurements"

In this paper, we implement a multidimensional assignment based multistatic tracker and test it on a 3D

multitarget tracking scenario that includes crossing targets as well as targets moving in formation. We find that the assignment based multistatic tracker can successfully keep tracking initiated tracks accurately. However, efficient track initiation needs further study. [C4735]

"Exploitation of track accuracy information in fusion technologies for radar target classification using Dempster-Shafer Rules"

The surveillance of the littoral is required by applications in the defence, protection and security area. One might think about anti asymmetric warfare, harbour and coastal surveillance or the prevention of smuggling, illegal fishing, illegal immigration or acts of piracy. To establish situation awareness ground, sea and air targets must be detected and tracked in the littoral simultaneously. Also the detailed classification of targets is of extraordinary importance, e.g. persons vs. vehicles, helicopters vs. planes or buoys vs. ships. This classification can be overtaken by an operator, who listens to the Doppler sound of a target. Unfortunately, obligated to the classification issue an operator gets distracted from the tactical surveillance task. Further, an operator is only able to classify a limited number of targets. Hence, automatic target recognition is an important issue for radar systems applied to the littoral surveillance. Finally, automatic target recognition offers also a synergy with the multi target tracking of such a radar system. In this paper 2 Dempster-Shafer (DS) based fusion methods will be described. Both use tracks and track accuracy information to fuse with Doppler based classified targets, in order to provide a robust classification technique for distinguishes between different kinds of targets. The first classification technique uses a hierarchical tree structured decision method, integrated in a track-based classifier. The second classification technique uses a non-hierarchical decision method also integrated in a track based classifier. In this paper both kinds of DS methods will be compared. The results will be discussed especially with respect to the following performance criteria: track accuracy, classification confusion matrix, targets hit rate, targets rejection probabilities, DS topology requirements, convergence reliability, training duration and generalization efficiency. [C4736]

"Recurrent lobes reduction of stepped-frequency LFM pulse train using ambiguity function"

Stepped-frequency linear frequency modulation (LFM) pulse train is one of the well-known waveforms employed in modern wideband radar to efficiently achieve good range and Doppler resolution without increasing requirements on overall system cost and complexity. Unfortunately, this waveform associates with a drawback of undesirable spikes, known as dasiarecurrent lobes or grating lobespsila due to the fixed frequency step. We investigate a generic stepped-frequency LFM pulse train and analyze its significant characteristics by using ambiguity function in more details, especially for zero-Doppler cut and zero-delay cut. Then we propose a method that allows us to reduce grating lobes below a desired threshold level. Two special cases for reduction are discussed for the specific relationships among waveform parameters. Both the analytical and numerical methods for parameter design are given along with distinct examples, which show that selecting a certain larger overlap ratio makes no need to suppress these spikes. [C4737]

"Multiframe assignment tracker for MSTWG data"

In this paper, a multiframe assignment tracker is applied to the simulated data sets provided by the multistatic tracking working group (MSTWG). The multiframe assignment tracker solves the data association problem as a constrained optimization for fusing multiple sets of data to the tracks with an interacting multiple model (IMM) estimator. The challenges with these data sets are high false alarm rate, low probability of detection and multiple synchronous/asynchronous sensors. Multiframe data association is used to perform data association, which is the crucial part of the tracking. Centralized tracking is used to optimally fuse the information from multiple sensors. A track's status is updated using an m out of n logic rather than the track quality based logic that requires more accurate probability of detection values, which are not available and vary with time and geometry in the MSTWG data sets. The results obtained with the multiframe assignment tracker for all the data sets are given in the form of MSTWG performance metrics. [C4738]

"Extended object tracking based on combined set-theoretic and stochastic fusion"

In this paper, a novel approach for tracking extended objects is presented. The target object is modeled as a circular disc such that the center and extent of the target object can be estimated. At each time step, a finite set of position measurements that are corrupted with stochastic noise may be available. Each position measurement stems from an unknown measurement source on the extended object. In contrast to existing approaches, no statistical assumptions about the distribution of the measurement sources on the extended object are made. As a consequence, it is necessary to deal with stochastic and set-valued uncertainties. For this purpose, a novel combined stochastic and set-theoretic estimator that employs random hyperboloids to express the uncertainties about the true circular disc is derived. [C4739]

"Tracking of targets with state dependent measurement errors using recursive BLUE filters"

In this paper, optimal best linear unbiased estimation (BLUE) filters are derived for cases where measurement errors depend on the state of the target. The standard Kalman filter fails to provide optimal estimates in these cases. Previously applied measurement models are reformulated in order to apply BLUE filters, and two new measurement models with state dependent biases are proposed. It is shown how the higher order unscented transform may be used to approximate the terms in the BLUE filter when they are not available analytically. The BLUE filters are shown by Monte Carlo simulations to have better performance than other suboptimal filters.

[C4740]

"Distributed target tracking with propagation delayed measurements"

This paper presents a framework for making distributed target tracking under significant signal propagation delays between the target and the sensors. Each sensor considered makes estimation using its own measurements compensating for the involved signal propagation delay using a deterministic sampling based algorithm proposed previously. Since the individual sensor readings might not be enough to localize the target, the sensors have to share their estimates with each other at specific time instants and correct their individual estimates. This work is mainly related to how this estimate correction and fusion should be carried out. An internal covariance approximation which keeps consistency but at the same time bypasses the track correlation problem is proposed. The results are illustrated on a challenging two-sensor bearings-only tracking scenario.

[C4741]

"Hybrid Cramer-Rao lower bound on tracking ground moving extended target"

This paper deals with the problem of performance bound for ground moving extended target tracking with high range resolution ground moving target indicator (HRRGMTI). The system model is constructed for our proposed rectangular target tracking. On performance bounds for state and deterministic shape parameter estimation, a hybrid Cramer-Rao lower bound (CRLB) is proposed and its recursive form is derived. By comparison of radicCRLB curves for different accuracies of measurement of down-range-extent, the effect of this additional measurement on state and parameter estimation is analyzed. [C4742]

"Meta level tracking with multimode space-time adaptive processing of GMTI data"

Ground surveillance of the battlefield provides military analysts with information that is critical to the success of a mission; the type of the information includes the enemy force structure, enemy offensive combat formation, and maneuvering events. The conventional approach uses mainly the synthetic aperture radar (SAR) and electro-optical (EO) sensors to perform detection and identification of stationary targets on the battlefield. Ground moving target indicator (GMTI) radar with space-time adaptive processing (STAP), on the other hand, allows a more complete perception of the battlefield by adding the capability to detect moving objects over a large area. In particular, the simultaneous detection and estimation of angular location of a ground moving target via adaptive cancellation of ground clutter is demonstrated, where a single reflector antenna with a multimode feedhorn is used in a GMTI radar. Based on the GMTI radar output, we illustrate the use of stochastic parsing algorithm with stochastic context free grammar (SCFG) as an unifying framework for data association, target tracking, and situation awareness. [C4743]

"Fusion of Doppler Radar and video information for automated traffic surveillance"

Current Doppler radar speed measurement systems lack the ability to distinguish multiple targets within the microwave beamwidth. In this paper, a traffic surveillance system is presented that is capable of automatically monitoring vehicle speeds on roadways using sensor fusion on data acquired from a calibrated video camera and a continuous wave Doppler radar. The time-frequency resolution of the radar signal is improved by employing the method of time-frequency reassignment. Then, the 3D tracking information obtained from the calibrated video camera is augmented by the more accurate information from the Doppler radar to produce a position and velocity track of the targets within the surveillance region. [C4744]

"Use of prior information in active sonar tracking"

A Bayesian tracking model is proposed that uses measurement likelihood functions based on predicted signal-to-noise ratios (SNR) in active sonar data. The predicted SNR modeling can incorporate prior information, such as the presence of known discrete and persistent clutter objects. The likelihood model assumes an exponential distribution of returns with a mean based on the predictive model that incorporates assumed SNR of the targets, known clutter, and background clutter, and the beam response and waveform ambiguity functions. Two variations of an example based on simulated frequency modulated (FM) and continuous wave (CW) signals is used to

assess target detection and localization performance. Significant enhancements are observed when prior knowledge of clutter is incorporated into the measurement model in these idealized examples. [C4745]

"Time-Frequency Analysis of SAR Image Based on Generalized S-Transform"

A new time-frequency representation approach based on the generalized S-transform (GST) was developed to analysis synthetic aperture radar (SAR) images. At first, a SAR image is decomposed into one-dimensional (1-D) signals by choosing different scalable windows, rather than doing S-transform directly. Then, algorithm simulations and textural feature analysis are conducted using both basic S-transform (BST) and GST which has an adjustable time-frequency resolution. The simulation results show that the proposed method appears to work well and the GST spectrum can provide more complementary feature information than the BST spectrum for textural analysis of SAR images. [C4746]

"The Traffic-Flow Detection Based on Pseudo-Random Coded Radar"

A new traffic flow detection system based on pseudo-random coded (PRC) CW radar is studied and developed in this paper. The proposed system can measure the speed of vehicles at a high resolution. The speed can be measured by the Doppler principle, and in the system the good correlation performance of PRC is used to get a high resolution of range and eliminate the interference from nearby lane vehicles. The digital signal processor transforms and processes the signal in time-frequency domain, and gains the vehicle velocity and flow rate rapidly and accurately. [C4747]

"Research of CMLD-CFAR Detecting Algorithm in Radar Reconnaissance Receiver"

In radar signal reconnaissance digital receiver based on DFT (Discrete Fourier Transform), automatic CFAR (Constant False Alarm Rate) detection in frequency domain is necessary in processing of peak-seeking algorithm. A CMLD-CFAR (Censored Mean Level Detector CFAR) algorithm in frequency domain is presented. By researching the threshold generating algorithm of pulse radar signals spectrum under clutter background, a threshold generating algorithm based on the structure of CMLD-CFAR detector is provided, the detection probability and false alarm rate of the algorithm under the nominal factor T is derived in detail. At last, confirms the validity of the algorithm via computer simulation. [C4748]

"Study on Signal Processing of FMCW Ground Penetrating Radar"

In this paper, a frequency-modulated-continuous-wave (FMCW) ground penetrating radar (GPR) is developed and used to measure the thickness of concrete/asphalt layers of highways/airports. If the thickness of the layer is thin, measurement may be impossible using traditional DFT method since the frequencies of reflected waves are very close and the weak waves reflected from underground layers will be "submerged" by the strong one reflected from the pavement surface. An adaptive filtering method is presented to eliminate the strong wave reflected from the pavement surface and thus the weak waves reflected from the underground layer surfaces can be detected. Then the modified frequency estimation method is proposed to enhance the frequency estimation precision of FMCW GPR signal. Simulation experiment results have demonstrated the effectiveness of the proposed method. [C4749]

"Performance Analysis of Self-Calibration Algorithm for L-shaped Array"

A self-calibration algorithm (SAL: self-calibration algorithm for L-shaped array) is presented for L-shaped array in the presence of mutual coupling. The proposed algorithm utilizes special mutual coupling characteristic of L-shaped array to decouple the signal source information (DOA) and coupling coefficients of antenna array so that two kinds of parameter estimations can be realized without any calibration sources. This literature puts emphasis on the performance analysis of new proposed algorithm in the presence of unknown mutual coupling. Simulation results demonstrate that the proposed self-calibration algorithm can achieve the high resolution under the condition of unknown coupling. Meanwhile, it possesses a better performance when SNR is larger than 15 dB and snapshot is larger than 150, which mean the estimation of coupling matrix is close to the true value. [C4750]

"Likelihood Ratio Detection and Tracking"

Likelihood Ratio Detection and Tracking (LRDT) is an extension of Bayesian tracking that simultaneously estimates whether a target is present and its state if present. It is particularly suited to difficult detection and tracking situations involving low signal-to-noise ratios or high clutter density. LRDT extends the basic Bayes Markov single target recursion by adding a null state to represent the possibility of no target present. By converting to likelihood ratios, one obtains a recursion which is parallel to the Bayes Markov single target recursion and does not explicitly retain the null state as a separate state. This allows LRDT to use un-

thresholded or below-threshold sensor responses and to provide a natural and correct method of incorporating information from multiple sensors and disparate sensor types. LRDT performs incoherent integration of sensor responses over time by cumulating measurement likelihood ratios over possible target paths (tracks). When the cumulative likelihood ratio exceeds a specified threshold, a detection is called and a state estimate is extracted. LRDT is a recursive, Bayesian, Track-Before-Detect (TBD) system that does not require explicit association of sensor responses to target tracks. This allows LRDT to consider a vastly larger set of possible target paths than TBD systems based on multiple-hypothesis tracking or other track-based techniques. We give examples of the application of LRDT to (1) the detection of periscopes by surface ship radar, (2) the detection of submarines by multi-static active sonar, and (3) the automatic detection and tracking of acoustic sources by passive acoustic arrays. The similarity of certain forms of the LRDT recursion to those of the PHD and Multitarget Intensity filters is also discussed. We close by considering some non-traditional extensions of LRDT beyond classical detection and tracking such as monitoring the maritime supply chain to detect suspicious behavior. [C4751]

"Performance evaluation of MHT and GM-CPHD in a ground target tracking scenario"

Performance evaluations of multi-target tracking algorithms are often limited to consider comparisons within the same algorithm family. In this paper, two conceptually different multi-target tracking algorithms are evaluated, namely a multiple-hypothesis tracking (MHT) algorithm and the Gaussian mixture cardinalized probability hypothesis density (GM-CPHD) filter. As a reference, a conventional single-hypothesis tracking algorithm is included in the evaluation. The performance is assessed using the root-mean square error of the estimated number of targets, and the recently published optimal subpattern assignment (OSPA) measure. The scenario under consideration is tracking of nine closely spaced ground targets, using simulated measurements from an airborne radar. By observing the estimation of the number of targets, as well as of the target states, conclusions are drawn regarding the behavior of MHT and GM-CPHD. For example, GM-CPHD is more responsive to changes in the number of targets, whereas MHT is less responsive, but produces a more stable output. [C4752]

"The real world"

The mission of the Information Processing Techniques Office (IPTO) is to understand the world. From sensing to cognition, IPTO brings the future of computing to the warfighter. In a world where complexity and ambiguity reign, IPTO technologies lift the fog of war and enable timely, accurate decision-making. [C4753]

"The Urban Challenge"

The Urban Challenge was a robotic vehicle race through a simulated urban environment. Full size autonomous vehicles were required to complete a 60 mile course, while independently reasoning about other autonomous and human driven vehicles. The vehicles were required to safely handle intersections, multi-lane roads, parking lots and unusual situations. Teams from around the world attempted the competition with eleven qualifying for the final challenge. In this talk I describe the Urban Challenge and Boss, the vehicle that won the challenge. Boss is a modified Chevy Tahoe that fuses data from many sensors to interpret the world around it and drive safely. I will highlight how Boss incorporates radar and lidar data to track moving vehicles and how this information is used. I will also speculate on the future of autonomous vehicles and the critical open challenges. [C4754]

"A uniform uncertainty principle for Gaussian circulant matrices"

This paper considers the problem of estimating a discrete signal from its convolution with a pulse consisting of a sequence of independent and identically distributed Gaussian random variables. We derive lower bounds on the length of a random pulse needed to stably reconstruct a signal supported on $[1, n]$. We will show that a general signal can be stably recovered from convolution with a pulse of length $m \gtrsim n \log 5n$, and a sparse signal which can be closely approximated using $s \lesssim n/\log 5n$ terms can be stably recovered with a pulse of length n . [C4755]

"Markov Chain CFAR detection for polarimetric data using data fusion"

The paper proposes a new Markov chain based CFAR detector for polarimetric data using low level data fusion and high level decision fusion. The Markov chain based CFAR detector extends traditional PDF based CFAR detection to first-order Markov chain model by considering both correlation between neighboring pixels and PDF information in CFAR detection. With the additional correlation information, the proposed approach results in advancing the performance of conventional CFAR detectors. Moreover, to take advantage of full polarizations of polarimetric data, various data fusion methods are considered to improve detection performance, including polarimetric transformation, principal component analysis, and decision fusion. Our experimental results both show the superiority of the new Markov chain polarimetric CFAR detector over conventional PDF-based CFAR detectors. [C4756]

"Model and Algorithm of Dual Symmetrical Neural Networks and Its Application in Information Fusion"

General neural networks always converge to local optimal position when solving global optimal problem but dual symmetrical neural networks can overcome this shortcoming. The model and algorithms that dual symmetrical neural networks is used to solve direction finding (DF) and frequency measurement are presented in this paper, dual symmetrical neural networks can solve global optimal problem while general neural networks is used to solve global optimal problem always do not succeed because it always converge to local optimal position. Result of software simulation demonstrates this methods is viable. [C4757]

"Application Study of PS-DInSAR Technique Fusing Multi-metadata in Urban Ground Deformation Survey"

PS-DInSAR technique fusing multi-metadata and its basic flow are expounded considering limitations of conventional D-InSAR in atmospheric delay and space-time decoherence. It is held that multi-metadata helps to weaken the influence of systematic error and improve the surveying precision and model steadiness of PS-DInSAR. Tianjing City is surveyed in PS-DInSAR fusing ENVISAT ASAR from 2003 to 2007, GPS, SRTM3-DEM and leveling data, which greatly weakens the influence of atmospheric delay, space-time decoherence and systematic error. The precise deformation of the studied area in that period is obtained. [C4758]

"Real-time estimator of Laser Doppler Anemometer signal parameters based on Kalman filtering"

In order to develop a cheap and reliable way of measuring an aircraft's speed, the French aerospace laboratory, ONERA, has designed a new Laser Doppler Anemometer (LDA) based on coherent detection [10]. A laser beam is generated in the vicinity of the aircraft. An aerosol particle passing through the laser volume scatters light according to its velocity. Back-scattered signal consists of a Gaussian shaped time-varying amplitude modulated by a sinusoidal signal. Its envelope and its phase carry the speed information. Because of speed requirements signal processing, a simple real-time estimator, based on Kalman filtering, is proposed in this study. [C4759]

"Comparison of perceptual shaping techniques for digital image watermarking"

Digital watermarking is the process of embedding information into another signal like an image. Embedding a watermark results in modifications of the image, leading to a decrease of the perceived quality. Perceptual shaping uses perceptual information of the image to camouflage these modifications, thereby increasing the perceived quality. In this paper four perceptual models are evaluated: the empirical noise visibility function, the noise visibility function based on a stationary generalized Gaussian distribution, the noise tolerance model and the Watson model. These models are applied on two watermarking schemes: correlation-based watermarking and dither-modulated quantization index modulation. We describe how these schemes utilize the perceptual models for improving the perceived quality and experimentally compare their performance. We conclude that the noise tolerance model offers the best results regarding the perceived quality. The empirical noise visibility function was found to offer best robustness. [C4760]

"Seamless vertical handoff algorithm for heterogeneous wireless networks-an advanced filtering approach"

Next generation wireless networks are foreseen to be heterogeneous in nature. Wireless networks consisting of different access technologies with different bandwidth and coverage area will coexist to provide roaming users with their requirements. Handoff among heterogeneous networks, i.e. vertical handoff (VHO), has attracted enormous attention from researchers over the last couple of years. Absence of symmetry is the core distinction between homogeneous and heterogeneous networks, as one network has preference over the other network. Therefore a proficient handoff mechanism is crucial for making the experience seamless to the user, trim down the number of unnecessary handoffs, as well as to capitalize on the underlay network utilization. In this article, we propose an advanced filtering based VHO algorithm in 3G/WLAN and discuss its performance. Performance criteria are based on the number of handoffs. [C4761]

"SDR-based radar system for meteor detection"

The idea of monitoring atmospheric events using radio waves has been implemented in the past. The concept has also been employed to detect meteors, that is, ionized trails created by meteors. The approach exploits the property of ionized trails to reflect radio waves and the use of bistatic radar and forward scattering. In this paper we present a setup of a data acquisition (DAQ) system based on software defined radio. We provide results of processed signals obtained by our system. In a similar way, the concept may be extended to detect ultra high

energy cosmic rays. We discuss the challenges in upgrading the system for meeting the latter objective. [C4762]

"Range sidelobes blanking using contrasting mismatched filters"

Radar range sidelobes, associated with pulse compression, are often reduced through the use of mismatched filters. We propose to blank the remaining sidelobes by using two or more mismatched filters, whose sidelobes are designed to peak at different delays. Design methods and simulation results are presented. [C4763]

"Monaural sound-source-direction estimation using the acoustic transfer function of an active microphone"

This paper introduces an active microphone concept that achieves a good combination of active-operation and signal processing, where a new sound-source-direction estimation method using only a single microphone with a parabolic reflection board is proposed. A simple signal-power-based method using a parabolic antenna has been proposed in the radar field. But the signal-power-based method is not effective for finding the direction of a talking person due to the varying power of the uttered speech signals. In this paper, the sound-source-direction estimation method focuses on the acoustic transfer function instead of the signal power. The use of the parabolic reflection board leads to a difference in the acoustic transfer functions of the target direction and the non-target directions, where the active microphone rotates and observes the speech at each angle. The acoustic transfer function is estimated from the observed speech using the statistics of clean speech signals. Its effectiveness is confirmed by monaural sound-source-direction estimation experiments in a room environment. [C4764]

"Convoy detection processing by using the hybrid algorithm (GMCPHD/VS-IMMC-MHT) and Dynamic Bayesian Networks"

Convoys are military objects of interests in certain applications like battlefield surveillance, that is why it is important to detect and track them in the midst of civilian traffic as part of the situation assessment. Our purpose is a process in two steps. The first is an original tracking algorithm appropriate for ground moving target indicator (GMTI) data based on the hybridization of a labeled GMCPHD (Gaussian mixture cardinalized probability hypothesis density) and the VS-IMMC-MHT (variable structure-interacting multiple model with constraints-multiple hypothesis tracking): one is very efficient to estimate the number of targets and the other for the state estimates. Then, by using algorithm outputs and other data like video or SAR if they are available, vehicle aggregates are detected and their characteristic are introduced into a dynamic Bayesian network which processes the probability for an aggregate to be a convoy. Finally, the number of targets belonging to the convoy is evaluated. This process is tested on a complex simulated scenario, our tracking algorithm is compared to classical ones and used to compute the probability to have convoys. [C4765]

"PHD filters for nonstandard targets, II: Unresolved targets"

The probability hypothesis density (PHD) and cardinalized PHD (CPHD) filters were introduced in 2000 and 2006, respectively, as approximations of the full multitarget Bayes detection and tracking filter. Both filters are based on the "standard" multitarget measurement model that underlies most multitarget tracking theory. This paper is one of a series of theoretical studies that address PHD and CPHD filters for nonstandard multitarget measurement models. In this paper I derive the measurement-update equations for a PHD filter that presumes a model for unresolved targets based on the concept of continuous target number. [C4766]

"Maximum likelihood approach to HF radar performance characterization"

As part of NURC maritime surveillance research activities, there is a need to characterize the performance of HF radar vessel-detection processing, in support of subsequent automatic tracking as well as fusion with other available sensor data. In particular, HF radar detection and localization performance for a given contact SNR threshold must be determined. This paper examines two approaches to do so: one based on the maximum-likelihood criterion, the other using a localization threshold on target-originated contacts. The differences in and merits of the two approach are discussed with simulated and real maritime HF radar data. We introduce a multi-stage track-extract-track approach to HF radar tracking that is effective in a heavily-cluttered environment. Finally, we introduce scalar information metric for sensor characterization and discuss its relevance to sensor selection and detection threshold determination. [C4767]

"Using lateral length measurements in GMTI convoy tracking"

This contribution deals with tracking of convoys moving on ground by airborne GMTI radar. A technique based on generalized power estimators using multiple beams is used to estimate the lateral length component of an unresolved convoy. In combination with the conventional range measurement, the full length information can be

obtained in case of a linear convoy. The main focus of this paper is the exploitation of this attribute information in order to improve the tracking process. The Bayes algorithm based on our earlier work is improved and incorporated into a JPDAF framework to deal with multiple targets. The processing of Doppler measurements is also included. Numerical results are presented based on a simulation scenario. [C4768]

"Non-parametric laser and video data fusion: Application to pedestrian detection in urban environment"

In urban environments, pedestrian detection is a challenging task for automotive research, where algorithms suffer from a lack of reliability due to many false detections. This paper presents a multisensor fusion method based on a stochastic recursive Bayesian framework also called particle filter which fuses information from laser and video sensors to improve the performance of a pedestrian detection system. The main contributions of this paper are first, the use of a non-parametric data association method in order to better approximate the discrete distribution and second, the modeling of the likelihood function with a mixture of Gaussian and uniform distributions in order to take into account all the available information. Simulation results as well as results of experiments conducted on real data demonstrate the effectiveness of the proposed approach. [C4769]

"Unification of radar and sonar coverage modeling"

Radar and sonar are by tradition separate disciplines with different user communities. This situation is about to change as many navies are experimenting with reduced manning concepts. As a result, tomorrow's sensor operator is likely to monitor and control all available sensors on his own. In this situation operator overload is expected, especially due to less educated and less experienced personnel and the introduction of new and more complex sensor systems. A possible solution is a high level of automation in sensor management and the integration of tactical decision aids. To further assist the human operator, this work aims to unify sensor performance modeling for the complete sensor suite. The radar and sonar equations are compared and combined with a propagation model for complex environments. The analysis of a real-world scenario with both radar and sonar is shown to result in a unified visualization of predicted sensor coverage. [C4770]

"Performance of evaluation methods in image fusion"

Many algorithms and software tools have been developed for fusing panchromatic and multispectral datasets in remote sensing. Also, a number of methods has been proposed and developed for the comparative evaluation of fusion results. To this date, however, no papers have been published that analyze effectiveness and quality of the evaluation techniques. In our study, methods that evaluate fusion quality are tested for different images and test sites. This analysis shows that in most cases the tested methods perform well, but are sometimes inconsistent with visual analysis results. [C4771]

"Belief modeling for maritime surveillance"

In maritime surveillance, the volume of information to be processed is very large and there is a great deal of uncertainty about the data. There are many vessels at sea at every point in time, and the vast majority of them pose no threat to security. Sifting through all of the benign activity to find unusual activities is a difficult problem. The problem is made even more difficult by the fact that the available data about vessel activities is both incomplete and inconsistent. In order to manage this uncertainty, automated anomaly detection software can be very useful in the early detection of threats to security. This paper introduces a high-level architecture for an anomaly detection system based on a formal model of beliefs with respect to each entity in some domain of interest. In this framework, the system has beliefs about the intentions of each vessel in the maritime domain. If the vessel behaves in an unexpected manner, these intentions are revised and a human operations centre worker is notified. This approach is flexible, scalable, and easily manages inconsistent information. Moreover, the approach has the pragmatic advantage that it uses expert information to inform decision making, but the required information is easily obtained through simple ranking exercises. [C4772]

"A new nonlinear filtering method for ballistic target tracking"

Tracking a ballistic re-entry target from radar observations is a highly complex problem in nonlinear filtering. The paper adopts a one-dimensional vertical motion model with unknown ballistic coefficient, we present a square-root quadrature Kalman filter (SRQKF) algorithm for this ballistic target tracking problem. The proposed algorithm is the square-root implementation of the quadrature Kalman filter (QKF). The quadrature Kalman filter is a recursive, nonlinear filtering algorithm developed in the Kalman filtering framework and computes the mean and covariance of all conditional densities using the Gauss-Hermite quadrature rule. The square-root quadrature Kalman filter propagates the mean and the square root of the covariance. It guarantees the symmetry and positive semi-definiteness of the covariance matrix, improved numerical stability and the numerical accuracy, but

at the expense of increased computational complexity slightly. [C4773]

"Computing maximal track clusters for sensor resource management"

In this paper, we present an approach to clustering tracks into maximal groups for sensor resource management. The motivation is that sensor tasks include ones for revisiting existing tracks, and one would like to cluster these tracks into groups that are simultaneously observable. The sensor resource manager can then schedule the groups for observation. Note that the feasible groupings are constrained by the observable region of the sensor. We illustrate our approach for two different types of sensors with different observable regions: mechanically-steered sensors such as gimballed electro-optical or dish radars and electronically-steered radar arrays. Our numerical results demonstrate that our approach to clustering tracks into maximal groups reduces the number of tracks groups that need to be observed as compared to more conventional means for clustering tracks. [C4774]

"Track-Before-Detect for sensors with complex measurements"

Track before detect (TkBD) is a paradigm that combines the target detection and estimation processes that are usually sequentially applied to sensor data in a conventional system. Under TkBD the single frame detector is removed and the tracker is supplied with the whole sensor image. Detection decisions are then shifted to the output of the tracker which is able to use temporal correlation to improve the decision performance. A fundamental measure used by most TkBD approaches is the likelihood ratio of the sensor data and this is formed as the product over individual cell likelihoods under the assumption of spatially independent noise. However, that approach exploits only the envelope of the known sensor point spread function. This article presents an approach for determining the data likelihood ratio that also includes phase information. This alternative likelihood ratio formulation is shown to both improve the discrimination of targets from noise and reduce the computation overhead of the algorithm. [C4775]

"Suboptimal JPDA for tracking in the presence of clutter and missed detections"

A new heuristic for data association on multi-target tracking systems is presented. The algorithm is based on the existing JPDA (Joint Probabilistic Data Association) algorithm, more specifically, on the Suboptimal JPDA approximation. However, compared to Suboptimal JPDA, the presented method exhibits a significant improvement on tracking performance for scenarios in the presence of clutter and missed detections, at negligible increase of computation cost. In fact, it approaches the performance of the classic JPDA, requiring, however, drastically lower computational resources. It is also shown that the proposed method is more robust with respect to trajectory crossings than the original Suboptimal JPDA. [C4776]

"Geometric factors in target positioning and tracking"

In target positioning and tracking, most sensors provide measurements either as range or bearing or both. The measurements are used to update an a priori estimate either via a linearized least squares method or an extended Kalman filter. In either case, the resulting solution has two components, one is related to the measurement prediction errors and the other is an observation matrix obtained from linearizing the nonlinear measurement equations around the a priori estimate. This paper studies the geometric factors explicitly and relates the observation matrix to the line of sight (LOS) vector for a ranging sensor and the direction perpendicular to the LOS vector of a bearing-only sensor. As a result, the updating of estimation error covariance with range and bearing measurements can be intuitively assessed via the shaping of estimation error ellipse along LOS directions. It provides a valuable means for target positioning and tracking performance modeling and prediction and can thus be used in active management of distributed sensor resources and sensor path planning. [C4777]

"An application of DSMT in ontology-based fusion systems"

The aim of this paper is to propose an ontology framework for preselected sensors due to the sensor networks needs, regarding a specific task, such as the targets threat recognition. The problem will be solved methodologically, taking into account particularly non-deterministic nature of functions assigning the concept and the relation sets into the concept and relation lexicon sets respectively and vice versa. This may effectively enhance the efficiency of the information fusion performed in sensor networks. [C4778]

"PHD filters for nonstandard targets, I: Extended targets"

The probability hypothesis density (PHD) and cardinalized PHD (CPHD) filters were introduced in 2000 and 2006, respectively, as approximations of the full multitarget Bayes detection and tracking filter. Both filters are based on the $\text{Idquostandardrdquo}$ multitarget measurement model that underlies most multitarget tracking theory.

This paper is one of a series of theoretical studies that address PHD and CPHD filters for nonstandard multitarget measurement models. In this paper I derive the measurement-update equations for a PHD filter that presumes a Poisson model for extended targets due to Gilholm, Godsill, Maskell, and Salmond. [C4779]

"An assessment of hierarchical data fusion using SEABAR'07 data"

The results of processing selected runs from the SEABAR'07 multistatic sonar trials dataset through general dynamics Canada's multiple target tracker (MTT) hierarchical data fusion system are reported. The purpose of this exercise was to ascertain the performance potential of the MTT and, by inference, of hierarchical data fusion based tracking generally, against a real multistatic sonar scenario. Selected runs of the original SEABAR'07 dataset have proven themselves well suited to this purpose. Tracking results on these runs are quite positive. To compensate for the lack of a real target in these runs, the SEABAR'07 dataset also includes a modified version, in which the strong echo repeater returns have been replaced by much weaker returns computed using the basis bistatic target aspect model. Tracking results with this modified dataset proved less encouraging. These results suggest that the viability of multistatic sonar tracking using a hierarchical data fusion system like the MTT appears promising, but remains unproven; a calibrated trials dataset containing a real target is required to provide a definitive answer. [C4780]

"Model-based integrated HRR object tracking and classification"

Radar target classification based on 2D stochastic object model matching is studied in this paper. A network of high range resolution (HRR) radars provides range measurements at multiple time steps, while the extended object is moving in the surveillance area. Alignment of the multi-aspect HRR data in a common 2D coordinate system is required. For this reason, tracking of the extended object is integrated in the classification algorithm. The novelty of this work is the estimation of the object state, conditioned on the object class, by applying the HRR data on a particle filter. A coarse-to-fine multi-resolution data processing scheme is introduced in the filter update step. The reason is the experienced filter degeneracy, when working with HRR data. The proposed processing scheme achieves accurate auto-alignment of the HRR data. The classification system successfully distinguishes between very similar objects, by applying 2D object model matching. [C4781]

"Polarimetric radar performamnce test of signal processing for anti-active jamming"

A test system using Virtual Polarization Adaptation (VPA) technique to simulate the target return signals of variable-polarization radar is studied in this paper. This test system can be used to testify the performance of polarimetric radar signal processing and evaluate the effectiveness of polarization agile jammers. Several issues about typical polarization agile jammers are discussed along with their suppression methods. [C4782]

"Snow density estimation using Polarimitric ASAR data"

Remote sensing of radar polarimety has great potential to determine the extent and properties of snow cover. Availability of spaceborne sensor dual polarimetric C-band data of ENVISAT-ASAR can enhance the accuracy in measurement of snow physical parameters as compared to single fixed polarization data measurement. This study shows that the capability of C-band SAR data for estimating dry snow density over snow coverer rugged terrain in Himalayan region. The study area lies in Beas, Chandra and Bhaga catchments of Himachal state (India). For this investigation, the main assumptions are that the snow is dry and at C-band, total backscattering coefficient comes from snowpack and snow ground interface. An algorithm for estimating snow density has been developed based on snow volume scattering and snow-ground scattering components. Snow density estimation algorithm requires HH and VV polarization combination data. The radar backscattering coefficients of both HH and VV polarization and incidence angle are given as input to the developed algorithm. Finally, the algorithm gives the snow dielectric constant which can further be related to snow density using Looyenga's semi empirical formula. Comparison was done between algorithm estimated snow density and field value of snow density in the study region. The mean absolute error between estimated and measured snow density was 21.3 kg/m3. [C4783]

"Study on tobacco spatial agglomeration pattern based on remote sensing and GIS methods in Henan province, China"

Industry spatial agglomeration is a world-wide phenomenon. As the raw material of tobacco industry, tobacco is the only economic crop which is intensive produced in China at present. The statistic data is used to analyze the regional specialization and agglomeration of tobacco planting industry, but the spatial pattern of tobacco sown area is always neglected. In this paper, Henan province is chosen as the study area, and the distribution pattern of tobacco sown area has been studied using RS and GIS methods. According to the analysis of phenology characters of crops, the tobacco sown area and its growing condition were monitored using two-temporal data, which was in Jan and June 2008 respectively. Then the tobacco sown area of each county was calculated and

tobacco patch was derived using ARCGIS 9.0. According to the result, the regional Geordie coefficient which indicates industry agglomeration distribution status and the fragmentation index were studied. Results showed the higher regional Geordie coefficient means the higher planting scale at present, but does not totally equal the higher level of aggregation. The fragmentation index of tobacco sown area shows different trend. So both the economic coefficient and the fragmentation index should be considered during discussing the aggregation level. In order to increase the development potential of Henan tobacco industry, it should increase the planting scale of the central part of Henan province. [C4784]

"The results of preliminary measurements of snow and water ice microwave reflection and emission angular dependences at 5, 6GHz"

In this paper structural and operational features of C-band, dual-polarization, combined scatterometer-radiometer system and the results of preliminary, spatio-temporally collocated measurements of land snow cover's and experimental pool water surface ice cover's microwave reflective (radar backscattering coefficient) and emissive (brightness temperature) characteristics angular dependences at ~5.6 GHz are presented. [C4785]

"Evaluating snow depth in Western China based on passive microwave remote sensing"

In order to evaluate the accuracy of snow water equivalent (SWE) inversion algorithm for passive microwave sensor Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E) in Western China, we compared SWE got from AMSR-E daily SWE product with the ground measurements from 15 meteorological stations in Tibetan plateau. The results show AMSR-E overestimate SWE in this regions and the RMSE is 21mm Tibetan plateau. Through incorporating snow fraction factor, a new empirical algorithm estimate snow depth and SWE have been developed in Tibet. This new algorithm appeared higher accuracy than AMSR-E. Due to complex topography, shallow patchy snow and frozen grounds covered at the Tibetan Plateau, this technique didn't show good results. In future we will focus on how to evaluate and eliminate the effects of these factors quantitatively on SWE retrieval. [C4786]

"Survey of landslide activity and rockglaciers movement in the Swiss Alps with TerraSAR-X"

Four TerraSAR-X stripmap mode scenes acquired during the late summer of 2008 in the Oberwallis region in the Swiss Alps have been interferometrically analyzed for the survey of the activity of unstable slopes. Differential interferometry was applied using a high precision external Digital Elevation Model (DEM). Position, extent, contour, and approximate velocity of unstable slopes were determined for a large area. Selected results representing rockglacier movement and landslide activity are discussed and compared with in-situ information and interferograms derived from ENVISAT ASAR, JERS-1 SAR and ALOS PASLSAR data. This application strongly benefits from the higher spatial resolution of the TerraSAR-X data in comparison to the C- and L-band sensors used in the past, because many of the instabilities are of relatively small size. [C4787]

"Synthetic retrieval of aerosol optical depth and surface reflectance using Terra and Aqua platforms in semi-arid regions"

Aerosol quantitative retrieval from remote sensing over land surface is still a challenging task, especially for bright land areas such as desert, urban, coast, arid and semi-arid regions. A new aerosol optical depth (AOD) and surface reflectance remote sensing retrieval model is developed by exploiting a kernel-driven BRDF (Bidirectional Reflectance Distribution Function) model and the SYNTAM (Synergy of TERRA and AQUA MODIS) model, which considered the surface BRDF effect while retrieving AOD. After applying this new model to Terra and Aqua MODIS data in the Heihe River Basin of China, AOD and surface reflectance of this region are retrieved. Results show that the multiple correlation coefficient (R^2) between retrieved AOD from MODIS and in situ measurements of CIMEL CE318 Sun-photometers is 0.92 at 0.55/ μm . Using ASD Field Spec spectral radiometer measurements to validate retrieved surface reflectance, the RMSE values for band 1~3 are lower than 0.06. [C4788]

"Microwave satellite data applied for agriculture area-Case study-Poland"

The radar data have been used for establishing the proper crop information system in Poland. The objective of the study is to find an efficient method of crop classification based on satellite microwave data and to find the relationship of different soil-vegetation parameters on backscatter. There is a large demand of microwave images as due to often cloud effect these satellite data are available during a certain growth season. Wielkopolska region located in western Poland was selected for the research works. This region, characterized by intensive agricultural practices and diversified agricultural pattern, was equipped with ground truth information, which enabled to make properly the whole classification process. [C4789]

"A discrete interferometric model for a layer of random medium"

This paper presents a discrete interferometric model of random media. The forest is modeled by characterizing tree trunks, branches and leaves with randomly oriented, lossy dielectric particles whose area and orientation in a layer of random medium are prescribed. The model result is compared to the theoretical result in the literature and good agreement is found. [C4790]

"The coherent microwave emission of freezing soil: Experimental research and model simulation"

Interference effect happens in layered medium. The brightness temperature oscillation has been observed during the freezing process of over-saturated soil, which could be explained by interference effect and a three layer coherent model. The modeled BT is qualitatively in consistent with the measurement. It is shown that the interference must be considered when measuring frozen soil with ground based microwave radiometer especially when using the frequency is low. [C4791]

"A new blended snow product using visible, microwave and scatterometer satellite data"

For this blended product, snow cover extent, snow water equivalent (SWE) and snowmelt are mapped and measured globally on a daily or near-daily basis, initially at a resolution of 25 km, utilizing Moderate Resolution Imaging Spectroradiometer (MODIS), Advanced Microwave Scanning Radiometer for NASA's Earth Observing System (AMSR-E) passive microwave data and QuikSCAT scatterometer data. A snow algorithm referred to as the Air Force, NASA Snow Algorithm (ANSA) has been developed, and is still being fine tuned, to derive the above stated snow parameters. The algorithm results have thus far been evaluated in the lower Great Lakes area of North America, in Colorado (Cold Lands Project Experiment sites) in portions of Finland, and eastern Turkey. [C4792]

"Establishing field and base camp servers for remote sensing of ice sheets in ilulissat, Greenland"

The University of Indiana and Elizabeth City State University are working with the Center for Remote Sensing of Ice Sheets (CReSIS) to develop and deploy cyberinfrastructure grid computing resources and synthetic aperture radar (SAR) data storage capabilities for Greenland and Antarctic fieldwork. This paper will detail the Summer 2008 efforts of the Polar Grid team to configure and establish field and base camp servers. The base camp system consists of one eight-core server, three raid arrays with 34 terabytes (TB) of total storage in a RAID 10 configuration (13 TB useable), a custom designed compact peripheral control interface (CPCI) system, and 80 TB of external storage in the form of 40 two TB MyBook external hard drives. The field camp system also consisted of one eight-core server, but did not contain the raid arrays. Multiple SATA hard drives were used to store the data. [C4793]

"Coseismic surface deformation caused by the Wenchuan M8 earthquake from InSAR data analysis"

The D-InSAR technology is used to aquired seven belts of coseismic surface deformation of Sichuan M8 earthquake of 12 May 2008 from the ALOS/PALSAR satellite data of Japan. The result covers Yinxu, Dujiangyan, Wenchuan, Moxian, Beichuan, Pingwu and Qingchuan county, each 500 km in north-south and 70 km in east-west. The investigation indicates that the surface rupture zone caused by the earthquake coincides the Beichuan-Yingxiu fault, extending from nearby the epicenter southwest of the Yingxiu town to north of the Suhe, Qingchuan county for about 230 km. The northwest wall of the seismogenic fault has uplifted, exhibiting a dominant thrust motion. The maximum relative LOS displacement at the epicenter reaches 260 cm. A swell of LOS 120-180 cm displacements is present from Beichuan to Pingtong. Another uplifted belt of displacements 70-80 cm occurs nearby north of Suhe, Qingchuan. Around Ya'an and Mount Emeishan, and from Shehong to north of Chongqing, there is a large area of subsidence. In Chongqing and its south is seen a small uplifted area of 20-30 cm. From Qingchuan, eastward to Guangyuan and Ningqiang, uplift amplitudes are 60-70 cm. The whole area of the deformation filed is fairly large, even in the Sichuan basin occurs surface deformation of different degrees. [C4794]

"Constellations: A new paradigm for earth observations"

The last decade has seen a significant increase in the number and the capabilities of remote sensing satellites launched by the international community. A relatively new approach is the launching of heterogeneous satellites to form constellations. Constellations provide scientists a capability to acquire science data, not only from specific instruments on a single satellite, but also from instruments on other satellites that fly in close proximity. Constellation design is driven primarily by science requirements. Scientists from each member satellite choose the orbit that enables their science and concurrent observations with the other satellites. Although the satellites

are controlled by different organizations around the world, the teams cooperate and coordinate operations to ensure safety. This paper presents the benefits of joining an on-orbit constellation and ideas for the longterm evolution of constellations. [C4795]

"Derivation of glacier velocity from SAR and optical data with feature tracking"

Monitoring temperate glacier activity has become more and more necessary for economical and security reasons and as an indicator of the local effects of global climate. The most studied variable in ice dynamics in the literature is ice velocity. From remotely sensed images, mainly two types of methods have been used for the estimation of glacier flow velocities: feature tracking and differential interferometry (DInSAR). In this paper velocities of the Keqikaer glacier are acquired from ALOS (Advanced Land Observing Satellite) optical and SAR data respectively with feature tracking. We show that different window size in correlation calculation of feature tracking leads to different flow field. We also developed a new method to determine the best window size, and the method is testified by the two kinds of data. [C4796]

"Ground based SAR survey of Basal interface at NEEM drill site"

In August of 2008 a radar survey was conducted at the NEEM site in Greenland. An example echogram showing internal layers all the way to the bed, a digital elevation map around the drill site, and a side looking synthetic aperture radar image will be presented. The echogram appears to show a fairly continuous Eemian layer where predicted by modeling. Additionally the area around the drill site is very flat although some slope variation is observed. Finally side looking SAR images show reflected power variations that need more analysis to determine their source. [C4797]

"Potentials of RADARSAT-2 data to monitor freezing/thawing cycles over agricultural lands in Canada"

The target decompositions technique of Freeman-Durden is used to monitor freeze/thaw cycles, with fully polarimetric RADARSAT-2 images acquired over agricultural areas. In this paper is presented a preliminary analysis of the scattering mechanisms derived from three RADARSAT-2 acquisitions during the fall of 2008, over agricultural sites located in Saskatchewan, Ontario and Quebec. AMSR-E brightness temperatures data is also used in the analysis. Contrary to expectations, results indicate that surface scattering represents the main contribution to the signal over frozen soils. [C4798]

"The glacier movement estimation and analysis with InSAR in the Qinghai-Tibetan plateau"

The glacier is important factor in climatological and hydrological investigations, especially in the western China. Glacier changes are among the clearest signals of on-going warming trends existing in nature. In view of environmental changes, combined with the high thermal sensitivity of earth's mountain glaciers, especially in Qinghai-Tibetan Plateau, is of growing interest. SAR systems have an important ability to observe the earth's surface, independent of cloud conditions. Particularly, the SAR interferometry provides a useful tool for monitoring the velocity of glacier movement. For accurate measurement of glacier movement with InSAR data, the suitable method of retrieving velocity of glacier motion need be considered for the different type of glaciers in case of the difference of the characteristics of surface and movement velocity. In this paper, we use the SAR interferometry to derive the movement of several types of glaciers and analyze the characteristics of different glaciers type, such as continental glacier, sub-continental glacier and maritime glacier, and demonstrate the method and results for the glacier motion in the Qinghai-Tibetan plateau. [C4799]

"Sea ice concentration and type analysis from dual pol Radarsat-2 and Modis images in the Baltic Sea"

A sea ice classification technique is introduced. The classification was performed on Radarsat-2 dual polarization image (07.02.2009) and MODIS images (09.02.2009) that covered coastal area in the western part of Baltic Sea. The classification on SAR image was based on Shannon entropy differences that occur on various ice types. Analysis showed that four ice types (water, fast ice, ridged ice and deformed ice) were identifiable. Also two independent analysis were performed on MODIS image. The spectral classification enabled to separate ridged ice regions and fast ice areas. Using histogram analysis ice concentration map was created. The analysis of Modis image enabled to identify regions where water was covering ice surface. The same phenomena was also detected from SAR data. [C4800]

"Image quality and calibration of RADARSAT-2"

RADARSAT-2 has 177 operational imaging modes. Versions of each of these modes are available either for left-

or right-looking imaging, and most modes allow images to be generated for any of the four linear polarization combinations (HH, VV, HV, VH). To support these modes there are currently 1816 sets of beam coefficients and 16 digitized pulse forms stored on the spacecraft. The radar employs a number of SAR techniques besides the established Stripmap and ScanSAR of RADARSAT-1, including alternating transmit polarization, Dual-Receive (separately on the two antenna wings) and Stitched Pulse. All these factors that provide the versatility for the system also increase the complexity of the task to establish and maintain image quality and calibration. This paper covers work that was undertaken to achieve an efficient image quality and calibration campaign during the first four months of the mission, and to maintain and upgrade imaging capabilities and quality since that period.

[C4801]

"TanDEM-X DEM calibration: Correction of systematic DEM errors by block adjustment"

This paper gives an overview of the DEM adjustment within the TanDEM-X mission. The DEM adjustment estimates residual, systematic height offsets and deformations of each single interferometric DEM acquisition. The challenge of calibrating the TanDEM-X DEMs lies in the magnitude of the systematic errors: these errors are in the same order like the random error of about 2 m. For the estimation of the corrections a least-squares adjustment of adjacent, overlapping interferometric DEMs over a certain earth region is described in this paper. Adjustment results on simulated DEM data are shown to validate the approach. The tests are carried out for different dense ground control point configurations. Further the improvements by a combined adjustment of the two coverages are demonstrated. [C4802]

"On the value of high-resolution weather models for atmospheric mitigation in SAR interferometry"

Atmospheric delay is one of the major error sources in In-SAR, hindering the accurate monitoring of ground motion. Here we use the WRF (Weather Research and Forecasting) weather model to hindcast atmospheric delays at SAR acquisition times over both mountainous and flat regions. The performance of the model is evaluated by comparing it to interferograms formed using acquisitions with short temporal baselines (Г,Ві4 months). Our results show that for flat regions the model not only misestimates atmospheric delay in magnitude and location but also largely underestimates the (horizontal) spatial variation (turbulent mixing) of the delay. In mountainous areas it can model the height dependent (vertical stratification) part of total delay correctly in some cases but not always. By removing the height dependent part we find again that the model may underestimate the spatial variation of the delay. Therefore, we conclude that the WRF weather model is in general not reliable for the operational mitigation of atmospheric delay in interferograms. [C4803]

"RADARSAT-2 initial system operations and performance"

Following launch on SOYUZ in December, 2007, the RADARSAT-2 Satellite went through intensive Launch and Early Orbit Phase (LEOP) appendage deployment and attitude configuration activities. The first SAR data, including a remarkable Quad Pole image of Greenland, was acquired on-board on Day 4 of the mission as part of an extensive system commissioning campaign. The initial period of system operations saw introduction of a new high resolution imaging mode, demonstration of rapid tasking capabilities, successful operation through the first annual eclipse season, implementation of a new regulatory framework for control of user access to imagery, and continuous system improvement through tuning and enhancement of performance and to improve operations robustness. This paper provides a summary of the achievements and status of system operations and performance. Comparisons with pre-launch expectations, specifications, and plans are made to draw lessons from the flight experience. Plans for sustaining and enhancing system operations performance are outlined.

[C4804]

"Processing system and algorithms for the TanDEM-X mission"

In 2009, the German radar satellite TerraSAR-X will be supplemented with the TanDEM-X satellite to form the first bi-static single pass interferometer in space. TanDEM-X will fly close to TerraSAR-X in a controlled helix configuration for 3 years to jointly acquire interferometric SAR data in bistatic mode. The primary TanDEM-X mission goal is to generate a global Digital Elevation Model (DEM) with a relative point-to-point height accuracy of 2 meters for moderate terrain at 12 m posting. This paper outlines the SAR data workflow from quality check screening through to bistatic focusing and interferometric processing to raw DEM generation. [C4805]

"Sea surface transport derived by frequent revisit time series of COSMO SkyMed SAR data"

The surface transport of 'SAR detectable' features on sea is accurately estimated by couples of overlapping COSMO SkyMed ScanSAR images acquired with a very short time lag (below the hour). Tests performed with the two satellites constellation during 2008 (4 operative by 2010) provided pairs of overlapping images with a time shift of 48 minutes and with a repeat time from 12 to 24 h. The short time lag acquisition has two

advantages: the first is that the pair of overlapping images is a sort of time derivative from which an accurate estimate of the surface transport can be extracted, the second is that the deformation of the 'tracked features' in the short time interval is minimal and a large number of objects can be tracked, even with the only automated processing. The sea surface transport is a crucial data in case of marine emergencies and the accurate estimate greatly improves the surveillance and the forecasting capability. Overlapping and short time lagged SAR imagery provide surface transport data of detectable objects with all-weather conditions. [C4806]

"Swell influence on ocean surface roughness and radar scattering from the ocean surface"

Swell effects of surface roughness spectral properties, including their wind speed dependence and modification of components characterizing Bragg resonance and surface tilting in radar application, are investigated. Computations of radar cross sections are performed with four different spectral models with various degrees of swell consideration. Swell impact on the resulting radar return is illustrated. [C4807]

"Ensuring globally the TanDEM-X height accuracy: Analysis of the reference data sets ICESat, SRTM and KGPS-tracks"

The TanDEM-X mission will derive a global digital elevation model (DEM) with satellite SAR interferometry. Height references play an important role to ensure the required height accuracy of 10 m absolute and 2 m relative for 90% of the data. In this paper the main height reference data sets ICESat (for DEM calibration), SRTM (for phase unwrapping) and kinematic GPS-Tracks (KGPS-for DEM verification) are analyzed regarding to their accuracy. For the ICESat data a reliable quality measure is developed. For SRTM an improved version adjusted to reliable ICESat data is presented and a concept for collecting and evaluating decimeter-precise kinematic GPS tracks is proposed. [C4808]

"COSMO-SkyMed mission status: Three out of four satellites in orbit"

COSMO-SkyMed is a Dual-Use (Civilian and Defence) end-to-end Earth Observation System aimed at establishing a global service supplying provision of data, products and services relevant to a wide range of applications, such as Risk Management, Scientific and Commercial Applications and Defence Applications. The system consists of a constellation of four LEO mid-sized satellites, each equipped with a multimode high-resolution SAR operating at X-band. Three out of four COSMO-SkyMed satellites have been successfully launched, while the remaining satellite will be deployed within 2010. COSMO-1 and COSMO-2 completed their Commissioning phase to test, verify and qualify the overall System and from the 1st of August both satellites are in the operational phase. The third satellite is performing its commissioning and it is expected to enter in operation in the second half of 2009. In this paper will be presented the current status of the mission and future objectives. [C4809]

"Passive real-time localization through wireless sensor networks"

The rapid progress of wireless communication and embedded systems has made wireless sensor networks a valuable backbone for numerous applications, mainly with monitoring purposes. In this field, the need for location aware systems has growth rapidly in the last few years. Most research efforts have been done in node localization but less attention has been paid on the localization and tracking of passive (that do not belong to the network infrastructure) objects. In this paper, the problem of passive object localization is dealt with an innovative methodology based on support vector machine exploiting the received signal strength indicator measured by the nodes. Some preliminary results chosen from the assessment of the proposed approach are presented. [C4810]

"On sensitivity of Kuroshio modeling in the Luzon Strait with ERS-1/2 wind field forcing"

In this presentation, it is studied that the response of the Kuroshio to forcing provided by three wind products: Comprehensive Ocean-Atmosphere Data Set (COADS); Hellerman & Rosenstein objective analysis data set (HR) and observations made by the ERS radar scatterometer. The sea surface currents of the Kuroshio in the Luzon Strait in winter and summer simulated by the Princeton Ocean Model with the three kind of wind fields are compared with the 20-year (1984-2003) mean surface drifter tracks from MEDs/GTS (Marine Environmental Data Service/Global Telecommunications System, Canada). The simulated surface currents from COADS and ERS wind fields are found to be closer to the mean surface drifter tracks in winter. However, the surface current from HR wind field cannot present the surface current pattern of the drifter tracks. And the model results from ERS wind field show a more accuracy surface current which can be seen from the remote sensing data analyzed by Yuan and Han (2006). In summer, the three wind products all can provide a good wind stress and the surface currents from them show the major features of the current field patterns of the drifter tracks. The distribution of the eddies driven by the three kind of wind fields are analyzed in winter and summer time, respectively. [C4811]

"Combined use of Cassini Radar active and passive measurements to characterize Titan morphology"

This paper focuses on the Titan surface parameters retrieval with emphasis on a combination of passive and active microwave measurements from Cassini spacecraft on the areas characterized by large liquid surfaces and neighboring land areas. The methodology consists of a combination of direct modeling and inversion algorithms. First, these surfaces have been described by means of a double layer model which considers an upper liquid hydrocarbons layer and a lower layer compatible with the radar response of the neighboring areas. This model is introduced into a Bayesian framework for the purpose of inferring the likely ranges of some parameters, in particular the optical thickness of the hypothesized liquid hydrocarbons layer and the wind speed. Second, the optical thickness information is used as an input to a forward radiative transfer model calculation to obtain simulated brightness temperatures. Comparison of the observed and computed brightness temperatures allows addressing the consistency of the observations from the two instruments. [C4812]

"Study on the backscattering characteristic of typical earth substances in northwest of China"

The S-band and C-band FM-CW land-based radar scatterometers were used to measure the backscattering coefficient of a variety of typical earth substances in northwest of China, including: bare soil, frozen soil, bulrush and maize etc. under the different time and different wave band and different polarized condition. First of all, the measurement principle and performance parameters of scatterometer were introduced, the detailed experimental plans and measurements specifications were developed. Based on them, the various units of measurement were completed successfully. The measurement process of scatterometer was briefly introduced in this work. according to different scattering mechanisms, features are divided into two categories: surface scattering and volume scattering, and analyzed these Scattering Characteristics and the reasons for these differences; combining with the corresponding earth substances scattering model, quantitative studying a function between the backscattering coefficient and surface parameters, getting different surface parameters of features by inversion, and analysis of a variety of influencing factors by comparing the measured datas. [C4813]

"A vegetation correction methodology applied for soil moisture retrieval from C-band radar observations"

This research presents a methodology to correct backscatter (Γ_{Bio}) observations for vegetation effects. The proposed methodology is based on the concept that the ratio between the surface scattering over the total amount of scattering ($\Gamma_{Bisurface}/\Gamma_{Bisoil}$) is affected only by the vegetation and can be described as a function of the vegetation water content. The data set used in this study was collected at USDA's Optimizing Production Inputs for Economic and Environmental Enhancement (OPE3) experimental site in Beltsville, Maryland (USA) over a corn growth cycle in 2002 and includes C-band (4.75 GHz) HH- and VV-polarized observations acquired at incidence angles of 15, 35 and 55 degrees. During this period the corn crops reached peak biomass of 6.6 kg m⁻² and a soil moisture range varying from 0.02 to 0.26 cm³cm⁻³. The results show that through application of the proposed vegetation correction methodology the soil moisture retrieval accuracy can be improved from 0.033 to 0.032 cm³cm⁻³, 0.049 to 0.033 cm³cm⁻³, and 0.079 to 0.047 cm³cm⁻³ at incidence angles of 15, 35 and 55 degrees, respectively. [C4814]

"Microwave scattering behaviour analysis of typical targets with SAR image"

As the high resolution radar satellite's has been successfully launched, its ability of the typical target's recognition monitor enhances a lot. This article mainly does analysis based on the RADARSAT2 quad-polarimetric data, compared scattering properties of typical target feature with two temporal full polarized data, and used the measured data to drive MIMICS (Michigan Microwave Canopy Scattering model) model and carry on the multi-wave band full polarization backscattering simulation about the farmland and forest. Then we carried on the comparison between X, C band SAR image gain's actual scattering value and simulation value in order to infer the typical target feature' scattering properties rule of S band. With anticipation of HJ-1-C satellite soon launched by China and then we can carry on the comparison with the fact. Along with the full polarized data's development, the typical target feature's scattering properties analysis will be more perfect. [C4815]

"Correction of target data taking into consideration the troposphere refractivity"

In presented paper the aspects of correction of target data are discussed. It is proposed to determine the atmosphere refractivity and correct the distance and angles of target which are measured with microwave radar. The determination of atmosphere refractivity it is proposed to carry out with the measurements of phase progression of microwave on a separate testing link. The phase progression adequately represents the

atmosphere refractivity. [C4816]

"Temporal variation of simulated rice backscattering of S-band HJ-1 SAR"

Rice is a major food supply in the southeast of China, which is very important for this region's rapid and sustainable development. Synthetic Aperture Radar (SAR) provides a powerful tool for rice monitoring in these regions because of its all-weather, day-and-night imaging and canopy penetration capabilities. HJ-1 small satellite constellation of China has been designed for environment and disaster monitoring, and HJ-1-C satellite has a SAR system working in S-band with incidence varying from 31° to 40° , VV polarization. Scattering model is helpful to better understand the temporal behavior of rice backscatter in S-band before HJ-1 SAR satellite is launched. In this paper, Zhaoqing test site in Guangdong province was selected as the test site, and 9-temporal field measurements acquired during the rice growing period in 1997 were used for analysis. Then rice backscattering and seasonal variation in S-band and VV polarization were simulated and analyzed based on radiative transfer model and ground measurements. [C4817]

"Polarization plane rotation effects on SAR polarimetric attributes"

The polarization plane rotation effects on SAR polarimetric attributes are analyzed. This analysis is carried out by simulating a polarimetric SAR image containing four regions with different electric characteristic. The simulation process is based on an electromagnetic scattering model. Employing a rotation model is generated a image set having 361 images, where each image has its polarization plane rotated by a different angle. From all images of the set are computed the covariance matrix and six polarimetric attributes of each image region and compared with their correspondent parameter in the image without rotation. From this evaluation it could be seen that the rotation angle influences differently all polarimetric attributes. The effects of rotation angle can lead to a misunderstanding of the target scattering mechanism. [C4818]

"High-compacted FM-CW SAR for boarding on small UAVs"

In this paper a compact, lightweight, low power consumption airborne SAR sensor able to be fitted in an UAV is presented. The Air-Based Remote Sensing (ARBRES) system is based on the previous experience acquired in developing GB-SAR sensors for subsidence and landslide monitoring. Prior to the in-flight evaluation of the developed SAR, different tests were performed boarding the hardware on a car to evaluate its performance. After this debugging step, tests of the system in an airborne platform were carried out and the results are presented. GPS and INS systems are used to record the aircraft position, velocity, and attitude for future Motion Compensation (MoCo) Techniques. [C4819]

"Topography of sand covered bedrock using two-frequency airborne interferometric SAR measurements"

This paper presents the application of Interferometric Synthetic Aperture Radar (InSAR) to estimate the height of the sand layer on top of the bedrock in deserts. This is anticipated to greatly increase the efficiency of oil field search and can have several applications for environmental and archaeological studies. The extension of InSAR processing to estimate the covered bedrock height through an iterative algorithm is introduced. The sensitivity of the proposed algorithm to system errors is investigated and its application to a common type of sand dunes is also presented. [C4820]

"Investigation on the applications of decorrelation analysis in Polarimetric SAR Interferometry"

Interferometric coherence is a key quantity in Polarimetric SAR Interferometry (Pol-InSAR), but it is usually decreased (named decorrelation) by the decorrelation sources, such as polarization type, volume scatterers, instrument settings and processing errors. The analysis of decorrelation has been used to system performance assessment and vegetation parameter estimation. This paper presents two other applications of the decorrelation analysis. One is the derivation of Pol-InSAR system and processing requirements. It is based on quantitative expressions of the decorrelation as a function of system and processing parameters. The other is compensation of the decorrelation that cannot be eliminated by optimizing system and processing parameters. It is implemented by using dual-baseline Pol-InSAR data. The Pol-InSAR requirement on noise equivalent backscattering coefficient and the compensation of temporal decorrelation are shown to demonstrate and validate these two applications respectively. [C4821]

"New processing approach and results for bistatic TerraSAR-X/F-SAR spaceborne-airborne experiments"

Following the success of the first bistatic spaceborne-airborne experiment between TerraSAR-X and F-SAR

carried out in November 2007, DLR has performed a second bistatic experiment in July 2008 with new challenging acquisitions. Furthermore, the existing bistatic processing chain has been updated with two significant improvements: a) clock offset synchronisation is now performed without the use of reference targets, and b) SAR imaging is done using a fast focussing technique. The new SAR imaging algorithm, based on the fast factorised backprojection algorithm, has proved very good focussing qualities while dramatically reducing (up to a factor 100 with respect to direct backprojection) the overall computational load. The new processing chain is tested using the image of the first TerraSAR-X experiment. Results of a dualpol acquisition performed during the second TerraSAR-X/F-SAR experiment and showing the first dual-pol bistatic spaceborne-airborne images are also presented in this paper. [C4822]

"Repeat-pass interferometry using a fixed-receiver and ERS-2/ENVISAT as transmitters of opportunity"

The presented work discusses the processing of repeat-pass interferometric data acquired with SABRINA (SAR Bistatic Receiver for INterferometric Applications), where the receiver is fixed and the baseline is due to the two different satellite orbits. The paper addresses the particularities of bistatic interferometry like the coregistration of the images and the decorrelation factors affecting the interferometric phase. Theoretical developments are complemented with the first repeat-pass results. The characteristics of the scene and the 35 days temporal baseline have caused the interferogram to be severely affected by the temporal decorrelation. This first result opens the discussion of what kind of targets are seen in a bistatic geometry and which of them can be coherent along time. [C4823]

"Recent developments in the MODTRAN® atmospheric model and implications for hyperspectral compensation"

Recent developmental efforts involving in the MODTRAN® atmospheric radiative transport model and derivative codes have led to advancements with important implications for hyperspectral imaging. New MODTRAN® features include (a) direct computation of diffuse transmittance and spherical albedo data, (b) two options for computing multiple line-of-sight (MLOS) radiances using a single DISORT scattering calculation for each spectral wavelength or channel and (c) enhancements to the treatment of Earth's curvature effects on scattered radiances. [C4824]

"Spatially adaptive classification of hyperspectral data with Gaussian processes"

Automated classification of land cover types based on hyper-spectral imagery often involves a large geographical area, but class labels are available for only small portions of the entire area. Moreover, the spectral signature of the same land cover class may vary substantially over different locations. When a classifier is trained on a specific geographical location and applied to other areas, it often performs poorly because of such spatial variation of spectral signatures. In this paper, we propose a novel framework for classification of hyper-spectral data: a Gaussian-Process Maximum-Likelihood (GP-ML) model where the mean of each spectral band is spatially modeled using a Gaussian process. Our framework provides a practical and effective way to model spatial variations of high dimensional data such as hyperspectral images for classification problems. [C4825]

"Monitoring of snow cover properties during the spring melting period in forested areas"

As space-borne C-band SAR observations are used for monitoring the snow cover during the spring melt period, temporal changes in backscatter from forest cover disturb the mapping of snow cover. This paper presents an analysis of snow backscattering properties in eight test areas situated around weather stations. Test areas represent open and forested landscapes in Northern Finland. Analyses are carried out using an extensive multitemporal ERS-2 C-band SAR data set from the snow melt period. We validate the (1) forest backscattering model for forest compensation, (2) TKK fractional snow-covered area (SCA) method with in situ observations and (3) inversion of a combined forest/snow/ground backscattering model in an application to yield estimates of the relative changes of snow wetness during full snow cover conditions. The results show that the semi-empirical TKK backscattering model describes the average C-band backscattering properties of all test regions well as a function of forest stem volume. Comparison of SCA estimation results with available ground truth data also shows a good performance. The retrieved relative snow wetness values agree well with temperature observations. [C4826]

"Analysis of the mean raindrop shape model for dual polarization radar rainfall estimation"

Information about the shape of raindrops is critical for estimating rainfall rate with dual polarization radar. As described in the literature, the relation describing drop oblateness as a function of its equivolumetric diameter is

nonlinear. There are several relations that express the shape-size dependence as nonlinear fourth-order polynomials. In fact, there is still no consensus regarding the most appropriate equation to use to describe the shape-size relation. Moreover, while non-linear equations are important for studying raindrop shape, it is not clear that they are needed to estimate an integral quantity such as rainfall rate. The validity of using a simple equivalent linear shape-size model based on the principle of the mean value theorem for estimating rain from dual polarization radar measurements is examined. Proposed rain algorithms based on the estimation of the drop shape are compared with algorithms that assume specific a-priori fixed drop shape-size relations expressed by a fourth order polynomial. Reconstructed rain and radar measurement profiles obtained from real radar observations were used to this purpose. Results show that the proposed rain algorithms perform better or at least equal to the algorithms derived assuming a priori fixed shape-size models, demonstrating that the prevailing model directly derived from data is suitable for rainfall retrieval purposes. [C4827]

"A unified polarimetric approach for SAR sea oil slick observation"

In this study, a novel unified theoretical framework to describe the polarimetric sea surface scattering with and without surface slicks, entirely based on the Mueller scattering matrix, is proposed. Dealing with slick-free or weak-damping-slick-covered sea surface a Bragg scattering mechanism is expected, while, a non-Bragg scattering mechanism is expected in case of oil-covered sea surface. Following this rationale, the Mueller scattering matrix is physically read in terms of slick-free and slick-covered sea surface scattering mechanisms, through the analysis of some Mueller based polarimetric descriptors, i.e. the degree of polarization, the statistics of the phase difference and the pedestal height. Experiments accomplished on Level 1.1 full polarimetric L-band ALOS PalSAR data confirm the effectiveness of the proposed approach. [C4828]

"Preliminary Terrasar-X observations for temperate glaciers on the Chamonix Mont Blanc test site"

Due to their high temporal variability, monitoring temperate glaciers by in-situ measurements is quite hazardous. The new TerraSAR-X (TSX) sensor provides high resolution SAR data which can be acquired every 11 days in the same configuration and can cover the whole surface of several glaciers in a studied area. Their potential for temperate glacier monitoring by remote sensing has to be investigated. This paper presents some early results on the Argentière glacier test site in the Mont Blanc massif to estimate the surface velocity using some texture tracking methods. After having evaluated the Differential Interferometric SAR (DInSAR) potential with TSX Stripmap data, correlation and Maximum Likelihood (ML) based methods are performed on the texture variable extracted from the Spherically Invariant Random Vectors (SIRV) estimation scheme. [C4829]

"Comparison of helicopter-borne thin sea ice thickness profiles with polarimetric signatures of dual-pol Terrasar-X data"

In this paper first results of a sensitivity study using dual polarimetric TerraSAR-X data for ice thickness estimation are presented. The sea ice thickness reference data set was measured, coincident to the SAR data take, by means of a helicopter-borne EM sounding device on April 28, 2008 in the Russian Arctic. For some of the signatures, namely the complex correlation coefficient, a relation to ice thickness could be found that is theoretically predicted for L-band SAR. The first results show, that the new generation of polarimetric space borne SAR sensors like TerraSAR-X may open a new opportunity for thin sea ice thickness monitoring from space. [C4830]

"L-band and C-band InSAR studies of African volcanic areas"

Radar interferometry has proven to be a very suitable, low-cost and accurate tool to measure surface displacements. We investigate several data fusion or time-series analysis strategies which aim to mitigate C-band InSAR restrictions for volcano deformation monitoring applications. The focus is on active African volcanic areas. Firstly, data fusion of C-band ENVISAT/ASAR and L-band ALOS/PALSAR sensors helps the determination of a rifting event sequence that took place in summer 2007 in Lake Natron area. The second strategy investigated is a new Wavelet Based InSAR time series applied on ERS-2 data covering the Nyiragongo-Nyamulagira area. It allows new ground displacements identifications outside the local rift valley. Lastly, PALSAR Quad-Pol POLInSAR applicability is explored for La Palma Island. [C4831]

"Synthetic aperture radar data employed for soil moisture estimation in the Piketberg region, South Africa"

Information on the distribution of surface soil moisture is important for a number of applications. Due to the high temporal and spatial variability, and consequently the cost of monitoring by field observations, a means of remote monitoring of soil moisture content using remote sensing data is needed. The aim of this study was to test soil

moisture retrieval algorithms based on synthetic aperture radar data (SAR). This includes the use of Envisat ASAR and ALOS PALSAR data, which was provided by the European Space Agency. Both linear regression and multiple-polarization models were applied for soil moisture quantification. The results could not be validated due to a lack of distributed field-based measurements but were compared to rainfall figures over the same period. Though inconclusive, the results suggest that the techniques show promise in their ability to quantify surface soil moisture. [C4832]

"Radio base network and tomographic processing for real time estimation of the rainfall rate fields"

In this paper, we propose a novel remote sensing method that is adequate for rainfall rate measurements in real time by means of tomographic processing applied to power attenuation measurements made across the microwave links defined by radio base station networks for mobile communication systems. A description of the tomographic algorithms we developed is presented together with some simulation results. These concern rainfall rate estimation applying such algorithms to the current radio base station arrangement over the city of Florence, Italy, while the rainfall field is simulated through weather radar data. [C4833]

"Bistatic experiment with the UWB-CARABAS sensor-First results and prospects of future applications"

Bistatic SAR experiments are in focus in recent years. We will present first results of an airborne bistatic experiment conducted 2007 in Switzerland with the Swedish ultrawideband sensor CARABAS, operating at 28-73 MHz (UWB). The acquired bistatic data include HH and HV polarization with different bistatic elevation angles, various transmitting flight tracks-including non-linear tracks-and fixed receiving antennas (horizontal and vertical) installed on a mountain top. We will place an emphasis on the processing, improving and evaluating of the data and give an overview of future applications which are made feasible by this bistatic dataset. [C4834]

"Results and analysis of hybrid bistatic SAR experiments with spaceborne, airborne and stationary sensors"

Bistatic SAR is a promising and useful supplement to a classical monostatic SAR system. Since transmitter and receiver are spatially separated, additional information of a scene may be provided. Further, as shadowing, layover, and foreshortening depend on the bistatic geometry, which can be quite different to the monostatic case, they can contribute to image analysis and classification. The transmitter and receiver are located on different platforms, which may either be close together or hundreds of kilometers apart. Typical platforms are satellites, UAVs, aircrafts, and towers. This paper presents recent bistatic SAR experiments with spaceborne, airborne, and stationary sensors, which have been conducted at FHR or in cooperation with Defence Research & Development Canada. Image results are presented and analyzed with respect to scattering behavior and resolution and compared to monostatic images. [C4835]

"TerraSAR-X observations of the recovery glacier system, Antarctica"

We present a comparison of 1997 RADARSAT Antarctic Mapping Project (RAMP) SAR data with 2008-09 TerraSAR-X observations of a tributary glacier that is part of the Recovery Glacier drainage network in Coates Land Antarctica. The Recovery Glacier system is of scientific interest because of its role in discharging East Antarctic ice to the sea and because it has been subsequently learned that the flow of the glacier is likely controlled by the presence of subglacial lakes near the onset of faster glacier flow. [C4836]

"Determination of variations in glacier surface movements through high resolution interferometry; Bylot Island, Canada"

Interferograms were generated from 10 TerraSAR-X image pairs, with the objective of obtaining estimates of winter surface motion for a slow-moving polythermal arctic glacier. Flow directions were computed using both ascending and descending-pass interferograms for each period, with the median value being adopted as the final direction. The weighted average flow was computed, with weighting based on the inverse of the difference between the ascending and descending-pass displacement estimates for each date. This study uses multiple interferograms with different imaging geometries to provide estimates of down-glacier flow. The methodology adopted minimizes the effects of glacier / satellite track alignment and those resulting from vertical motion of the glacier surface. Current velocities were compared with flow estimates derived from a 1992 ERS-1 image pair. The velocities were similar over most of the glacier, but current velocities were found to be 30% to 50% lower on the lower glacier. [C4837]

"Automated extraction of building geometric features from raw LiDAR data"

In recent years, with new services expected, such as navigation systems, location based services, and augmented reality, the need for automatically, efficient 3D building reconstruction systems becomes more urgent than ever. As a new spatial information technology, airborne LiDAR is widely used for the acquisition of 3D objects on the earth. The automatic reconstruction of 3D buildings from airborne LiDAR data has been a topic of research for decades. However the lack of 3D building reconstruction methods is still the bottleneck for the further development of airborne LiDAR. Since the 3D geometry feature is extremely important for many applications such as urban planning, car navigation, or environment monitoring etc., this paper introduces an automated method for implementing building geometric features extraction from raw LiDAR data in details. The outlines of 3D buildings are generated by using discrete curvature analysis according to the building geometry features. In the experiment, 3D building models are automatically reconstructed by using a model-driven approach according to their geometry features derived from raw LiDAR data. [C4838]

"Simulation of 3D laser systems"

This paper deals with modeling of new optical non-conventional imaging with laser systems. In this paper, we present the simulation of the 3D lidar sensor including physics based modeling of laser backscattering from complex rough targets, reflectance modeling of porous occluders, development of 3D scenes and reconstruction algorithms for identification. We shall focus on tomography algorithms for reconstructing optical three-dimensional scenes. [C4839]

"Characterization of soil surface roughness from terrestrial laser scanner data"

The surface roughness parameters commonly used as inputs to forest radar backscatter models are the root mean square heights (RMS) s and auto-correlation length l . These parameters were traditionally estimated from a one-dimensional surface profile with limited length. The complexity of natural surfaces makes it very difficult to explicitly describe the soil roughness. Terrestrial Laser Scanner (TLS) provides a new approach for the characterization of soil surface roughness. In this paper we address the issue of soil roughness characterization from terrestrial laser scanner data. The RMS height s was calculated using TLS data and compared with field measurements. The results showed that the proposed method can be used to make soil roughness measurement so long as the data sampling frequency was high enough. The relationship between required sampling frequency and the wave length of Microwaves was derived. In addition to the soil roughness parameters, a high resolution three dimensional digital elevation model (DEM) was constructed. [C4840]

"Spectral ratio lidar for objects detection"

In this paper a new technique of objects measurement based on spectral ratio lidar system has been proposed and developed to make horizontal-path laser measurements of objects. The two or more wavelengths laser transmitter operates within and adjacent to the sensitive bands exhibited by the characteristics of each object, the result could be used to establish inversion models of the laser transmitting backscatter signals. The application value and the key techniques of the spectral lidar are analyzed. The laser spectral ratio model is established and the lidar system is designed, the lidar measurements were down to testify its feasibility. Also issues to approach the final goal of this new technique are discussed. [C4841]

"3D coastal bathymetry reconstruction using TOPSAR data"

Coastal bathymetry is considered to provide key parameters for coastal engineering and coastal navigation. In this paper we address the question of reducing the effect of speckle on the accuracy of depth determination in coastal waters using TOPSAR multi-polarized data without needing to include any sounding data values. In doing so, two three-dimensional surface models, the Volterra model and a fuzzy B-Spline model, which construct a global topological structure between the data points, were used to support an approximation to the real surface. The statistical differences between real bathymetry map, CVVband and LHHband showed that the best reconstruction of coastal bathymetry was obtained with polarised L and C bands SAR acquired with HH and VV polarizations, respectively. With 10 m spatial resolution of TOPSAR data, bias of -0.04 and the standard error mean of 0.05 m in depth determination was obtained with LHHband. [C4842]

"Sea surface simulation for SAR remote sensing based on the fractal model"

Based on the fractal ocean surface model, electromagnetic scattering model under Kirchhoff Approximation and the raw signal simulation procedure of dynamic scene based on time domain, the sea surface of the SAR remote sensing has been simulated. The images of the wave and complex fractal sea surface are in accordance with the hydrodynamic modulation, the tilt modulation and the velocity bunching modulation. The simulation has been developed in the Matlab programming language. [C4843]

"A technique to derive the spatial distribution of rain intensity from NWP data"

Numerical weather predictions provided by world meteorological organizations like ECMWF are unique sources of valuable information about the meteorological situation on a global scale. This paper introduces a technique to derive the spatial distribution of rainfall rate for a given area and time interval, in terms of complementary cumulative distribution function, $PS(R)$, from the knowledge of the corresponding total rain amount, M_t , and of the ratio between convective and total rain amounts Γ_{By} . The performance of the method is tested against a large database of radar derived rain field data, from which both the inputs to the algorithm and the associated output $PS(R)$ s are obtained. [C4844]

"Radar signal retrodiffusion by water surface"

To prepare the future altimetry space missions at Ka band, a measurement campaign has been done with ONERA BUSARD platform and DRIVE radar. Particularity of the campaign was the use of steep incident angles, in Ka band, with a SAR instrument. Area of interest was the Camargue region in south of France. Three flights were planned on dry, wet and sea surfaces. In this paper, we describe the context of the campaign, and sensor's configuration that has been used. We then present the areas that have been measured and expose an example of aircraft's trajectory. Finally, we present some results as SAR images that have been acquired and some extracted backscattering coefficient profiles, figured as a function of the incident angle. Nadir backscattered levels are close to the literature values, and specular behavior is found on pond surfaces while more diffuse returns are observed over sea surfaces. [C4845]

"Finite difference model for modeling sea surface current from RADARSAT-1 SAR data"

This study introduces a new approach for modelling sea surface current variation using synthetic aperture radar (SAR). SAR Doppler frequency shift was computed by the ambiguous estimation and Wavelength Diversity Ambiguity Resolving algorithm (WDAR) and Multi Look beat Frequency (MLBF) RADARSAT-1 SAR standard mode data. In situ current measurements have been collected by using wave rider buoy (AWAC). The current velocity then estimated by conversation of residual Doppler Centroid by performing second order polynomial model. The second-order accurate dispersive Lax-Wendrof was used to determine the spatial variation of sea surface current in RADARSAT-1 SAR data. The study shows that there is a significant relationship between in situ current measurements and sea surface current estimated by WDAR and MLBF techniques. The high accuracy is shown with mean root mean square error (RMSE) of $\Gamma_{\text{B}} \pm 0.11$ m/s. It can be concluded that the integration between WDAR and MLBF techniques and Euler finite element model is good tool for modelling sea surface current variation in RADARSAT-1 SAR images. [C4846]

"Application of SAR remote sensing data to lithological mapping: A case study in railway geological survey"

The interpretation and application of optic remote sensing images, including aerial photos and satellite images, had become the indispensable tool for railway engineering geological survey. But microwave remote sensing images, mainly SAR images, were rarely used in the application. In the paper, SIR-C SAR remote sensing data were used to identify different rocks and survey the lithological distribution around Qinghe River in the north part of Xinjiang Province. Firstly, the multi-frequency and multi-polarization data were used to produce the false color composite image for visual interpretation and lithological mapping by remote sensing digital image processing and enhancement. Secondly, the various backscattering data of containing abundant information about rock's characteristics were input into the computer Neural Network Classifier. The overall accuracy of lithological classification is 62.6%. [C4847]

"Fast extracting and change detection of dammed lakes using highresolution SAR images: A case study of Tangjiashan Dammed Lake"

Wenchuan Earthquake has caused many huge landslides in the rivers in Sichuan Province. Synthetic Aperture Radar (SAR) technology played an irreplaceable role in rapid response to Wenchuan Earthquake monitoring and damage assessment. In this paper, Tangjiashan Dammed Lake was taken as a case study area for fast extracting and change detection with continuously acquired multi-temporal high-resolution SAR images. By June 12, 2008, we had identified dozens of dammed lakes in the area heavily affected by the Wenchuan Earthquake using high-resolution SAR images. In order to make a scientific evaluation of the disaster situation and provide efficient and instantaneous rescue action in the future, an effective method was developed for rapid extraction and change detection of dammed lakes. [C4848]

"The PARIS in-orbit demonstrator"

Mesoscale ocean altimetry remains being a challenging area for satellite observations. Conventional nadir looking radar altimeters can make observations only along the satellite ground track and many of them are needed to sample the sea surface at the required spatial and temporal resolutions. The Passive Reflectometry and Interferometry System (PARIS) using GNSS reflected signals was proposed as a means to perform ocean altimetry along several tracks simultaneously spread over a wide swath. The present paper describes such an instrument specially conceived to fully exploit the GNSS signals for best altimetric performance, and to provide multi-frequency observations to correct for the ionospheric delay. Instrument calibration strategy is also discussed. Furthermore an in-orbit demonstration mission is proposed that would prove the expected altimetric accuracy suited for mesoscale ocean science. [C4849]

"Connecting the dots between laser waveforms and herbaceous biomass for assessment of land degradation using small-footprint waveform LiDAR data"

Measurement and management of vegetation biomass accumulation in ecosystems typically involves extensive field data collection, which can be expensive and time consuming, while leaving the user with relatively crude inputs to intricate biomass models. Light detection and ranging (LiDAR) remote sensing, which provides extensive height measurements of terrain and vegetation, has become an effective alternative to characterize vegetation structure. In this paper, we report on ongoing efforts at developing signal processing approaches to model herbaceous biomass using a new generation of airborne laser scanners, namely full-waveform LiDAR systems. Structural and statistic-based feature metrics are directly derived from LiDAR waveforms at the pixel level and related to plot-level field data. Initial results reveal a definite correlation between the LiDAR waveform and herbaceous biomass. Ongoing research focuses on the links between fractional cover estimated from imaging spectroscopy and woody biomass. [C4850]

"Using permanent scatterer InSAR to detect land subsidence and ground fissures: A case study in Xi'an city"

The Permanent Scatterers (PSs) SAR Interferometry has become an operational tool in the context of spaceborne SAR interferometry for monitoring surface deformation with millimetric accuracy. In this contribution we presented a case study in Xi'an city for land subsidence monitoring and ground fissures detection by using PS InSAR. We applied a linear regression model to retrieval land subsidence velocity by using a series interferometric phase of the coherent target. For the displacement of ground fissures monitoring, which caused by the nonuniform displacement of land subsidence and fault motion, a time series interferometric analysis of coherent target has been carried out to retrieve the history of displacement. The results archived from ENVISAT ASAR images acquired from 2005 to 2008 has demonstrated the distribution and the magnitude of the land subsidence and ground fissures. We compared the result from PS InSAR with the field surveying data and the results shown good agreement. [C4851]

"Earthquake intensity estimation and damage detection using remote sensing data for global rescue operations"

In order to support global rescue operations, we propose a new earthquake damage detection method based on a combination of both the result estimated by using earthquake information (magnitude, location of source, detailed ground conditions, and distance attenuation equation), and change detection using multi-temporal SAR data. First, to find collapsed buildings and houses on the earth's surface, we adopt a difference image calculated from multi-temporal SAR images observed before and after the earthquake. Next, to estimate seismic intensity and probability of destruction caused by the earthquake, we apply an earthquake engineering model. Finally, damaged area is calculated using a logical AND of difference image and the destruction probability. In order to show that we can obtain a damage detection map which corresponds with the actual damage of houses, we applied the method to simulations of the 2008 Sichuan earthquake in China. [C4852]

"CSIR-NLC mobile LIDAR for atmosphere remote sensing"

A mobile LIDAR (Light Detection And Ranging) system is being developed and employed for atmosphere remote sensing at the Council for Scientific and Industrial Research (CSIR) National Laser Centre (NLC), Pretoria (25.45 S; 28.16 E), South Africa. In this paper, we describe the results obtained using the CSIR-NLC mobile LIDAR in a 23 hour field campaign at the University of Pretoria. [C4853]

"Estimation of seismic intensity due to the 2008 Wenchuan Earthquake"

The great earthquake that occurred in Sichuan, China on May 12, 2008 claimed about 70, 000 precious lives. It is necessary to quickly pinpoint the areas where extensive damage is expected when such a big earthquake

occurs and quickly input limited resources. As an attempt to instantaneously pinpoint the areas where extensive damage is expected, we classified landform of Sichuan Province, China using SRTM-3 and estimated the amplification factor and distribution of seismic intensity of Great Wenchuan Earthquake(2008) based on our results. [C4854]

"The January 2002 eruption of Nyiragongo volcano (DRC) captured by InSAR"

On 17th January 2002, Nyiragongo erupted along an approximately 20 km long fracture network extending from the volcano to the city of Goma and its airport. The event was captured by InSAR data from the ERS-2 and RADARSAT-1 satellites acquired in three different geometries. These data show complex ground displacements, with several overlapping fringe patterns, associated to a combination of sources of magmatic and tectonic origins. A combination of 3D numerical modeling and inversions is used in order to interpret these displacements. Synthetic tests indicate that with one to three InSAR geometries, the best fit and mean models are within the confidence intervals whether the source of displacements is a single dike, a dike combined with a west dipping normal fault or a dike combined with an ellipsoid. Increasing the number of InSAR geometries makes the confidence intervals smaller and the inversions faster. At this stage of the study, only the area close to the eruptive fissures was analyzed assuming displacements were caused by a single dike. The best-fit dike model obtained with a simultaneous inversion of the three InSAR geometries is subvertical, and has a low overpressure. Both characteristics are consistent with the rift context. [C4855]

"Improving sea states monitoring of nautical radar using dispersion relation of nonlinear ocean waves"

The purpose of this study is to discuss the influence of nonlinearity upon X-band radar observations. For simplicity, the analytical dispersion relationship of finite amplitude ocean wave theory was applied and discussed. We found that the shallow water dispersion relation curve covers more ocean wave energy than deep water and linear dispersion relationship. However, the shallow water dispersion relationship filter can not derive the ocean spectrum from radar image spectrum. The accurate measurement of ocean wave amplitude and water depth may be contributed to the results. More data are needed to analyze the reasons. [C4856]

"Sub-canopy ground characteristics retrieval of PolInSAR using spectral analysis technique"

The advances in Polarimetric SAR Interferometry (PolInSAR) techniques provide a promising way to recover ground characteristics such as sub-canopy soil moisture and roughness using SAR data. Spectral analysis techniques have been applied to extract the vegetation and building parameters. Yamada et al proposed the ESPRIT algorithm to estimate vegetation height; Sauer et al apply the spectral analysis techniques to estimate building heights and extract physical properties from Multi-baseline (MB) PolInSAR data. In these applications, the parameters are mainly estimated from the phase information or phase center, but the validity of the sub-canopy soil backscattering or reflectivity estimation from polarimetric spectral analysis technique is not investigated. In this paper, the ground scattering center is first located by polarimetric MUSIC algorithm and then the ground reflectivity is recovered using a polarimetric least-square method. The validity of the polarimetric spectral analysis technique for the sub-canopy ground reflectivity estimation is demonstrated using simulated and real SAR data. [C4857]

"The RADARSAT Constellation Mission: Meeting the government of Canada's needs and requirements"

In this paper, we describe the high level RADARSAT Constellation Mission (RCM) concept and how it is being designed to meet Government of Canada user requirements. The constellation concept is designed primarily as a wide area monitoring system, offering medium resolution information on a daily basis, as well as high resolution imaging functionality. We briefly discuss the unique capabilities of the constellation particularly related to coverage and revisit as it pertains to meeting the needs of each of the three Core Use Area applications. Finally, we outline the approach and activities being undertaken in the development of a Data Utilization Plan to ensure that the Canadian user departments and agencies will be ready to use data from the RCM on Day 1 of the launch of the first satellite. [C4858]

"Parameter-free clustering: Application to fawns detection"

Many fawns and other wild animals are killed by mowing machines every year. To prevent them from being killed or injured, a sensor system is being developed to detect the fawns hidden in meadows under mowing. Beside a microwave radar system, two cameras (thermal infrared and RGB) take a picture at the mower's current location. This contribution focuses on the compression-based algorithm that will be adopted to detect the locations

containing a fawn hiding in the grass: such approach, being parameter-free, allows performing a fully unsupervised clustering by exploiting the intrinsic properties of data compression to estimate the amount of shared information between two images. [C4859]

"Surface parameters retrieval from alluvial fan in Ejina area of Inner Mongolia using multi-polarization SAR data"

This paper presents the method of retrieving surface parameters of alluvial fan using multi-polarization SAR data based on Genetic Algorithm combined with backscattering models. The comparison of simulated results and field measurements shows that the method is efficient for surface parameters retrieval from alluvial fan. This method presented that the cross function of surface parameters inversion could be variable with the amount of data acquired. The data used for surface parameters inversion must be more than two scenes. The more data could generate the more accurate results. Then the surface parameters of alluvial fan in Ejina area of Inner Mongolia were estimated using ENVISAT ASAR and ALOS PALSAR data. The estimation results shows the ground surface of Ejina alluvial fan is very flat, so the range of its roughness is small, and the root mean squared heights in most party of the alluvial fan are no more than 1.0cm. The roughness in the area along Heihe River is big, and it is very small in the other areas far from Heihe River. The estimation result of soil moisture shows this area is very arid, and the soil volume moisture in most party is no more than 10%. [C4860]

"A programmable true piecewise approximation logarithmic amplifier"

This paper describes the operation theory, mathematical analysis and simulation of parallel summation type of the true piecewise approximation logarithmic amplifiers. It also reports a programmable logarithmic amplifier to have a desired logarithmic characteristic in special applications. To design the programmable structure, mathematical analysis of parallel summation type of the true piecewise approximation logarithmic amplifier is performed and based on it, a new method for improving its characteristic and some methods for adding flexibility and programmability to the structure is described. The presented programmable logarithmic architecture can be used in applications with variant and uncertain input signal range such as wide range wireless receivers and radar applications and some analog signal processing applications. [C4861]

"Modeling the multidimensional & fiscal impacts of storm surge & sea level rise: A compelling view through a powerful interactive 4D data integration, analysis and visualization tool"

Nearly one third of the world's population live in coastal areas, and ten of the fifteen most populous cities in the world lie on a coast. Inhabitants of the Low Elevation Coastal Zone (LECZ)-defined as the contiguous area along the coast that is less than 10 meters above sea level-make up 10% of the world's population and 13% of the world's urban population. Sea level rise, coastal inundation and associated shoreline retreat have emerged as one of the primary threats to these populations and the resources located near the coastal fringe. To meet the needs of governments, planners and managers, researchers are continually faced with the challenge of integrating large volumes of complex environmental and spatial-temporal data. Typically the spatial and temporal components of data sets are underutilized because methods for effectively handling these data have not been available. To address these issues, Eonfusion, a 4-Dimensional software solution, is easily incorporated into the geospatial workflow to significantly enhance the ease with which we can now integrate and explore complex spatially and temporally variant data sets. This paper explores case studies along prominent coastal regions in which, as example, models are developed to predict the impact of rising sea levels on low-lying coastal areas focusing on: (1) Coastal Inundation (2) Coastal Vulnerability (3) Property Devaluation. The inundation is spatially modeled as a function of time and enables the visualization of sea level rise scenarios to assess the extent and impact. The coastal vulnerability mapping highlights the analytical power of Eonfusion, through the efficient integration of inundation and vulnerability models to demonstrate the universal application of the software to the field of climate change research. The third model fuses the cadastral layer and a simple property valuation model to complete the scenario, thus demonstrating a powerful pathway for the estimation and visualization of the impact of these climate change events. The data for these case studies include: (1) Sea level rise scenarios from IPCC stage 4 (2) LID AR Elevation Data (3) Cadastral Parcels and Value Indicators (4) Storm Surge Information (5) Vulnerability Mapping. The processing steps required to integrate, analyze and visualize these models are: (1) Generation of 3D terrain model from LID AR data (2) Adjustments for any Height Data (AHD) discrepancies (3) Integrate IPCC sea level rises and storm surges into Sea level rise timeseries (4) Identification of sinks using Eonfusion API application (5) Calculate inundation levels and tipping points at which sinks get filled (6) Fuse Cadastre and value model with 3D surface-value decreases as % of title flooded (7) Airphoto drape (8) Set up visualization scene with integrated graph for all scenarios. The outcomes from this work include the identification of powerful pathways through the employment of new visualization and spatial-temporal analysis tools for: (1) Dynamic scenario based modeling for assessing cost and environmental impacts from climate change; (2) The provision of a mechanism enabling the visualization of the complex spatial and temporal

patterns from a wide range of data derived empirically and from models. This enables key stakeholders to rapidly assess scenarios and their likely impacts (3) Modeling of this type could be used in a number of areas including fire, flood, tsunami, hurricanes, etc. [C4862]

"Automated change detection using Synthetic Aperture Sonar imagery"

When resurveying a seafloor area of interest during change detection operations, an automated method to match found bottom objects with objects detected in a previous survey allows the surveyor to quickly sort new objects from old. The change detection system developed at the Naval Research Laboratory contains modules for automatic object detection, feature matching using shadow outlining, scene matching using control-point matching, and visualization capabilities. This system was developed for sidescan sonar surveys using instrumentation such as the high-frequency Marine Sonic Technology sidescan sonar. In this paper, the authors describe modifications to the sidescan-based system required to perform change detection using Synthetic Aperture Sonar (SAS) bottom imagery. [C4863]

"Adaptive Matching Fourier Transform for Nonuniform Sampled Signal Analyzing"

For nonuniformly sampled signal, the paper proposed adaptive matching Fourier transform to get the spectrogram. The procedure is presented. And the astringency and the consistency of the transform are verified. The data based on simulated signal and radar signal shows that adaptive matching Fourier transform can get the signal spectrogram with good performance. [C4864]

"Spectrum Sensing for Cognitive Radio"

Cognitive radio is considered as a promising approach to improve the utilization efficiency of radio spectrum resources. One of the key technologies of cognitive radio is spectrum sensing. A survey of spectrum sensing methodologies for cognitive radio is presented in the paper. The advantages and disadvantages of several spectrum sensing algorithms are analyzed and the challenges of spectrum sensing to be realized are also proposed. [C4865]

"Fusion of hyperspectral and lidar remote sensing data for the estimation of tree stem diameters"

The estimation of stem diameters can be very useful in the study of forests, as together with height and tree specie, it is one of the most important parameters used in forest inventories. In this paper a system for the estimation of stem diameters with LIDAR and hyperspectral data (both separately and combined in a data fusion framework) is presented. An analysis on the effectiveness of these data in the estimation process and on the accuracy and robustness of different estimation algorithms is presented. Experimental results point out the effectiveness and the properties of the proposed system. [C4866]

"Case studies of frozen ground monitoring using PALSAR/ALOS data"

Frozen ground is a sensitive indicator of how our home planet is changing. In the meantime, new spaceborne SAR systems have been launched, such as the polarimetric PALSAR sensor onboard ALOS in January 2006. In this paper, the relevance of L-band polarimetric SAR data for extracting information on frozen ground is presented. Dealing with ground assessments, the necessity for a validated Electromagnetic (EM) model is of importance. The adequation between Oh's po-larimetric EM model and PALSAR data is first studied over agricultural bare fields in Hokkaido, Japan. The assessment of residual liquid water can be realized by means of bare soil EM backscattering model. Over natural wildland area, an approach is proposed in order to tackle the effect of the vegetation or other irrelevant effects. The monitoring of permafrost active layer is performed over the ANWR, Alaska. [C4867]

"Hierarchical segmentation of Polarimetric SAR images using heterogeneous clutter models"

In this paper, heterogeneous clutter models are introduced to describe Polarimetric Synthetic Aperture Radar (PolSAR) data. Based on the Spherically Invariant Random Vectors (SIRV) estimation scheme, the scalar texture parameter and the normalized covariance matrix are extracted. If the texture parameter is modeled by a Fisher PDF, the observed target scattering vector follows a KummerU PDF. Then, this PDF is implemented in a hierarchical segmentation algorithm. Segmentation results are shown on high resolution PolSAR data at L and X band. [C4868]

"Parametric versus non-parametric complex image analysis"

In this paper we compare parametric and non-parametric method for the analysis of complex valued high-

resolution SAR data. Gauss-Markov Random Field (GMRF) model with a quadratic energy function as a parametric analysis parameterizes the spectrogram of the signal, whereas nonlinear short time Fourier transform (STFT) method, the method based on time frequency analysis (TFA) as a non-parametric approach exploits the signal's non-stationarity in the time-frequency domain for information extraction. This comparative analysis helps to understand, characterize and analyze complex valued SAR data. [C4869]

"Polarimetric ice sounding at P-band: First results"

For polar ice sheets valuable stress and strain information can be deduced from the crystal orientation fabric (COF) and its prevailing c-axis alignment. Polarimetric radio echo sounding is a promising technique to measure the anisotropic electromagnetic propagation and reflection properties associated with the COF. In this paper, dual-polarized P-band data acquired with the airborne POLARIS system near the ice divide of the Greenland ice sheet are analyzed. The internal layers in the uppermost few hundred meters of the ice sheet look the same at HH and VV polarizations, whereas the layering differs further down. Accordingly, the magnitude of the complex HH-VV correlation coefficient decreases with depth and, interestingly, the phase gives evidence of polarization dependent reflection and birefringence effects. [C4870]

"Airborne imaging differential optical absorption spectroscopy: Trace-gas measurements from the suburbs to the sub-continent"

A remote sensing instrument for high-resolution measurement of two dimensional trace-gas distributions from an aircraft has been built. The instrument has been tested during three measurement campaigns over the South African High-veld region. The resolution achieved is less than 100 metres, allowing point sources to be clearly identified. Measurements have been interpreted with respect to emission flux and oxidation of species in the atmosphere. The high speed of the aircraft also allows measurements to be made on a regional scale. [C4871]

"Selectable target detector using the polarization fork"

A new target detection methodology is described that makes novel use of the polarization fork of the target. The mathematical formulation is general and can be applied to any kind of single target as long as its expression in the target space is known. Aim of this paper is to present a standard procedure to set the detector parameters for any target of interest. The algorithm makes use of the Gram-Schmidt ortho-normalization in order to set the appropriate basis for the polarimetric space. Validation against real data shows significant agreement with the expected results based on the theoretical description. [C4872]

"Surface velocity and variations of outlet glaciers of the Patagonia Icefields by means of TerraSAR-X"

An incoherent amplitude correlation approach is used to derive ice motion fields of three major outlet glaciers of the Patagonia Icefields. High resolution repeat pass TerraSAR-X data of 2008 and 2009 were analyzed. The strong gradients in ice velocity of the terminus of San Rafael glacier, ranging from 2 to 16 m d⁻¹, were captured well. Significant acceleration of the ice flow and losses in mass were observed for Upsala glacier. [C4873]

"Mapping Canadian wetlands using L-band radar satellite imagery S"

Previously, we have developed a robust algorithm for mapping boreal wetlands using L-band satellite radar imagery, and in particular have used the method to produce a complete vegetated wetlands map of Alaska using the JERS radar data. In this work, we apply this algorithm to produce a static map of Canadian wetlands from the 1997-98 era JERS radar data at 100-m resolution, to be followed in the future by 2007-era ALOS/PALSAR maps. [C4874]

"Experiments in coherent change detection for synthetic aperture sonar"

Automatic Change Detection (ACD) compares new and stored terrain images for alerting to changes occurring over time. ACD techniques, long used in airborne radar applications, are just beginning to be applied to sidescan sonar. In Coherent Change Detection (CCD) the cross-correlation of multi-temporal complex data collected from coherent imaging sonars detects changes in the transduced amplitudes and phase of image pixels which, under the right conditions, can be used to detect new objects or disturbances on the seafloor. Synthetic aperture sonars (SAS) produce range-independent, fine resolution seafloor images. With centimetric resolution demonstrated out to hundreds of meters, these coherent systems can classify small manmade objects at long ranges, and should be suitable for CCD. This paper describes experiments testing CCD with data from synthetic aperture sonars mounted on autonomous undersea vehicles and actively navigated tow bodies. A noncoherent example carried out with data collected from an AUV-mounted SAS demonstrates the utility of correlation-based

automatic change detection. CCD tests were carried out with repeat pass data collected using a SAS mounted on a dynamically controlled tow vehicle. While simple image pair co-registration procedures failed to provide sufficient coherence in the overall scene required for CCD, preliminary tests of image warping techniques used for airborne radar applications show promise of transitioning successfully into the SAS signal processing chain.

[C4875]

"Underwater optical ranging: A hybrid LIDAR-RADAR approach"

A hybrid LIDAR-RADAR system is applied to optical ranging in order to achieve centimeter-type range accuracy over the distance of meters with high range resolution. The experiment is performed for NIR 830 nm, red 660 nm, green 532 nm using photomultiplier tube, interference filter, RF demodulator. An optical wavelength in the NIR region helps to protect the system against the effects of changing turbidity levels of water because NIR wavelengths absorb quickly in clean water without being affected by scattering, the components that make total attenuation. The modulation frequency of 66 MHz for NIR wavelength allowed a theoretical maximum range measurement of 1.71 m within the unambiguous range, which drops to 1.61 cm at 70 Mhz. A scheme involving chaotic modulation techniques (CLIDAR) will be studied in future. [C4876]

"Coincident observations, with QuikSCAT and ASCAT, of the effects of rain-induced sea surface stress during hurricanes Gustav and Ike"

The use of satellite scatterometers to probe the winds in and near strong storms and hurricanes is a valuable tool for weather forecasters. The presence of widespread rain in these storms makes the estimates of surface winds from the satellite data problematic. A motivating question here is: "Is there a substantial influence of rain on the air-sea momentum exchange in Hurricanes". Satellite scatterometer measurements were made for Hurricane Gustav (C-Band), which affected New Orleans on September 1 and Hurricane Ike (Ku-band) which impacted the Texas coastline near Houston, on September 13, 2008. The NEXRAD rain reflectivity images (available every 6 minutes) show that there was wide rain coverage throughout these storms. The sustained surface wind estimates from NOAA/ AOML/ HRD show a maximum of 90 kts, and a wide inhomogeneity even within 50 km areas. The broad swath coverage of the NEXRAD radar enables us to select and compare NRCS effects in both rain and non-raining areas. The methodology to be presented here demonstrates how the atmospheric influence can be removed to observe the total surface NRCS. [C4877]

"HFR surface currents observing system in lower Chesapeake Bay and Virginia coast"

Surface currents are measured using high frequency (25 MHz and 5 MHz) radar in the lower Chesapeake Bay and offshore in the Mid-Atlantic. The data have become quite reliable and of high quality over the past couple of years. This paper describes the existing system, the dataset, the quality of data and some examples of how it is being used. It also presents results of recent analysis of mean currents within the lower Bay. [C4878]

"Evaluating connectivity between marine protected areas using CODAR high-frequency radar"

To investigate the connectivity between central California marine protected areas (MPAs), back-projections were calculated using the network of high-frequency (HF) radar ocean surface current mapping stations operated along the California coast by the member institutions of the Coastal Ocean Currents Monitoring Program with funding provided by California voters through Propositions 40 & 50 and administered by the State Coastal Conservancy. Trajectories of 1 km resolution grids of water particles were back-projected from ten MPAs each hour, out through 40 days in the past, from each day in 2008, producing a map of where surface waters travel over a 40-day period to reach the MPAs-and visualizations of the length of time the waters travel along these paths. By comparing the travel times of those back-projected track-points that crossed between MPA regions, the connection time between MPAs along the State's central coast was assessed. Repeating these calculations resulted in a connectivity matrix between the MPAs in the region, and may be useful for assessing connectivity for the important invertebrate and fish larvae that are restricted to the surface ocean during a fraction of their lifecycle. [C4879]

"Coherent microwave marine radar measurements of directional ocean wave spectra and mean radial current fields"

Results of measurements of ocean waves using a coherent marine radar are presented. Data were collected in a coastal environment, at the U.S. Army Corps of Engineers Field Research Facility, Duck, N.C. Measurements of ocean wave spectra derived from maps of radial components of orbital wave velocity are used to measure directional ocean wave spectra, using three-dimensional FFT algorithms. Wave height spectra can be derived directly from such measurements, without the need for a modulation transfer function (MTF) that is used for

traditional marine radars. The MTF approaches can suffer from wind speed variability and wind-wave relative direction effects, and are typically robust only for equilibrium wind-wave conditions. A discussion is presented of how one might use such data to provide a real time wave profile map of the coverage area. Such a map of wave height profiles is useful in ship motion response prediction for real-time applications such as safe helicopter landings under high sea conditions. [C4880]

"Interferometric measurements using redundant phase centers of synthetic aperture sonars"

Interferometric sonars with multiple horizontal rows of elements have been used routinely to produce swath bathymetry. However, interferometric sonars are larger more complex, and consume more power than arrays with a single row of elements. Synthetic aperture sonar (SAS) systems often require the use of redundant phase centers (RPC), where the aft sonar element positions overlap in space with the forward element positions of the previous ping. Considering that a vehicle carrying a SAS array would likely have non-zero pitch, the use of RPC provides sonar data from receivers at the same along-track position with some vertical displacement. This data is similar to that of interferometric systems with the exception that the distance between receiver pairs can vary with vehicle motion and the received signals are not collected concurrently. This paper evaluates the possibility that an interferometric capability could be achieved using RPC data collected from a SAS system consisting of a single horizontal row of elements. An error analysis was conducted to determine the effect of errors in relative receiver position on swath bathymetry. Results show that errors in receiver vertical displacement result in similar percent errors in elevation. Therefore, errors in swath bathymetry can be reduced by designing the array to increase vertical displacement between RPC pairs. Results also show that increasing vertical displacement between RPC pairs can also reduce the impact of data phase measurement errors on swath bathymetry. Swath bathymetry measurements are very sensitive to errors in across-track displacements, but the predictable nature and scale of the error may indicate that accurate across-track displacements could be calculated from phase measurements. Swath bathymetry images produced from data acquired by an existing SAS consisting of a single horizontal row of elements are shown and illustrate viability of the technique depending on the required resolution of the system. [C4881]

"A toolbox dedicated to the analysis of airborne SAR sea clutter data"

The characterization of the sea clutter spatial and statistical properties is a challenging problem for improving the detection performances of any radar system confronted with strong sea clutter perturbations. On the one hand, the use of radar scatterometry made it possible to precisely determine the behavior of the sea surface backscattering coefficient and to confirm electromagnetic models. On the other hand, the imaging of the ocean by radar has been studied extensively and has led to a mature theory of synthetic aperture radar (SAR) imaging of the ocean. Nevertheless the manipulations of SAR data are handicapped by the size of data. In order to analyze SAR data, we need a very flexible tool well adapted to these data. This paper briefly presents the inner functioning of a software (i.e. the different choices of class organization and how it is convenient to use them) based on a multilook philosophy (spectral sub bands processing) and on Octave script. Then we specify the type of operations and processings, we can perform using this software. Two examples of use are presented which show the easiness of use of this software. [C4882]

"Coherent microwave marine radars for deterministic wave profile mapping, decameter-scale coastal current mapping and ocean wave spectra measurements"

Two different approaches in development of a coherent marine radar for ocean remote sensing applications have been designed, assembled, and tested: a fully coherent radar (COHrad) and a coherent-on-receive radar (CORrad). These radars operate similar to standard marine radars, with rotation revisit rates of either 0.4 or 0.8 Hz, suitable for measuring ocean wave frequencies of half these values. They allow repetitive maps of radial velocity, primarily orbital wave velocity of ocean waves, and thus can provide a map of ocean wave height directly, without the need for a modulation transfer function as is used with non-coherent radars. When averaging of a large set of consecutive images, slower time scale phenomena can be mapped, such as mean area currents and localized rip current features. Two radars illuminating a common area could thus provide the vector current field for all such processes in that area. A string of such radars along a coast with overlapping coverage could provide continuous coastal maps of ocean currents. A description of both radars is provided, the signal processing involved, and some preliminary examples of displays that are available for data from these systems. [C4883]

"Toward a complete system for surveillance of the whole EEZ: ScanMaris and associated projects"

There is currently an undeniable increase of maritime goods exchanges. As a consequence, maritime threats and risks are also rising. Innovative solution has to be developed to improve the security of this huge economic

activity. Future generation of maritime surveillance system should allow: permanent and all weather coverage of maritime border areas, continuous collection of heterogeneous data provided by various sources, automatic detection of abnormal vessel behaviors, understanding of suspicious events, and early identification of threats. No equipment and information system deployments are at present able to answer all these requirements. We propose here an integrated system with relevant innovative technologies and capacities. The integrated system includes existing conventional and innovative sensors networks as well as new functionalities to track vessel movements and activities or detect abnormal vessel behaviors. The proposed high level engineering architecture is able to generate documented alarms using abnormal events. Those events are extracted from our intelligent maritime traffic picture. Thus, we aim to validate an end to end surveillance chain for future operational sea border surveillance. [C4884]

"Bi-static and multi-frequency experiments of HFSWR"

High Frequency Surface Wave Radar is currently a well-known surveillance system for the Exclusive Economic Zone. We are still trying to improve their performances and reliability. In this new research step, we are trying to assess the benefits of multi-static as well as multi-frequency configuration. The global ambition is obviously to overcome clutter issue and to increase the coverage for small target. Results presented here highlight the significant contribution of the proposed configuration. [C4885]

"Synthetic Aperture Sonar low frequency vs. high frequency automatic contact generation"

Synthetic aperture sonar (SAS) bottom mapping sensors are on the verge of entering operational use. Here we examine the utility of both the low and high frequency output of SAS systems recorded from trials to determine their utility in the automatic contact generation scheme described in the companion paper "Automated Change Detection using Synthetic Aperture Sonar Imagery" [1]. The survey area covered by the trial has contacts called separately by the high and low frequency SAS output. The results are compared with a manual survey of the data to determine accuracy. The two frequency results are also compared by processing time. The data are then used to determine how merging the two outputs may yield an improved contact calling algorithm. [C4886]

"Surveying coastal ship traffic with LANDSAT"

A semi-automated algorithm was developed to detect ships in LANDSAT 7 images. The algorithm combines multispectral and pattern recognition methods to discriminate ships from ocean clutter. Automated processing enables us to process a large number of images and gather a statistical picture of ship traffic patterns. As a test case we applied the algorithm on 54 LANDSAT images in the area of Jacksonville, FL, from the period 1999-2003. The area and time period are the same as an earlier ship traffic study by Ward-Geiger et al. using ship reports in the Mandatory Ship Reporting System (MSRS). The similarities between the two studies suggest that LANDSAT is a good alternative for surveying nearshore ship traffic. [C4887]

"USACE National Coastal Mapping Program and the next generation of data products"

The U.S. Army Corps of Engineers (USACE) has been monitoring coastal change for decades. Each coastal district has the duty to maintain the federal navigation channels to insure safe passage for commercial and private vessels. In addition to these navigation channels, monitoring coastal change and regional sediment management rank high in both importance and financial expenditures. Acoustic boat surveys have been and will continue to be a viable way to accomplish these goals. For the past 15 years these surveys efforts have been assisted by the Joint Airborne Lidar Bathymetry Technical Center of expertise (JALBTCX). The JALBTCX has in-house survey capability using the U.S. Naval Oceanographic Office's Compact Hydrographic Airborne Rapid Total Survey (CHARTS) system. The CHARTS system collects bathymetric lidar, topographic lidar, RGB imagery, and hyperspectral imagery. CHARTS is mounted on a Beech King Air 200 which provides a platform capable of surveying the federal navigation projects and the areas between to support regional sediment management. In 2004, USACE Headquarters funded JALBTCX to map the sandy shoreline of the continental U.S. on a recurring basis. This mapping effort falls under the National Coastal Mapping Program (NCMP). In addition to the NCMP, JALBTCX performs emergency response surveys following natural disasters. Since 2004, JALBTCX was surveyed after every category 2 (or greater) hurricane that makes land fall within the U.S. As the survey capabilities increase it becomes more difficult for the local engineers to process the large volumes of data and the demand for analysis ready products became a necessity. JALBTCX took on this challenge and is currently delivering a suite of products to meet the needs. With the addition of new sensors, JALBTCX has also been able to develop new data fusion products to assist in monitoring the engineering, economic, and environmental changes to the coastal zone. [C4888]

"Simulated OVW retrievals in tropical cyclones for the next generation Dual Frequency"

Scatterometer"

The purpose of this study is to investigate the potential of the next generation Dual Frequency Scatterometer (DFS) proposed to fly onboard the Japanese Aerospace Exploration Agency (JAXA)/GCOM-W2 future mission to measure surface ocean vector winds. An end-to-end simulation was performed to retrieve ocean vector winds in extreme weather conditions, where high winds are usually associated with high rain rates. Both C-and Ku-bands DFS active measurements were combined in the retrieval algorithm. The simultaneous observations of JAXA's Advanced Microwave Scanning Radiometer (AMSR) were used to passively model both the atmospheric attenuation and rain volume backscatter to correct for rain effects and to further improve the retrievals range for tropical cyclones beyond that exhibited by the current operating scatterometers. [C4889]

"Long-term deployment of liquid-cooled High Frequency (HF) radar"

A liquid cooling system has been incorporated into a 5 MHz (long-range) SeaSonde HF radar system from CODAR Ocean Sensors. The cooling system consists of commercially available heat exchangers, connected in series and applied to various heat sources within the system. These include the central module within the transmitter chassis, as well as four locations within the receiver chassis. In addition, heat exchangers were also installed on the processor, northbridge, and hard drive of the Apple Mac mini computer used to govern the system. Bench testing showed that these heat exchangers are sufficient to effectively dissipate the roughly 200 W of heat generated by the radar equipment. We also designed and built a cooling reservoir for the dissipation of this heat to the external environment. In order to minimize power consumption, a passive cooling reservoir was developed. Four 55 gallon high-density polyethylene barrels are used to store the water, which is cooled by ambient air and wind. Water is circulated through the system by a single 39 W pump operating off of 24 VDC. This system was field-deployed for one year at Matagorda Island, located in Texas off the coast of the Gulf of Mexico. This is a remote site at which commercial power is unavailable. Instead, the system is powered by a photovoltaic array. Air conditioning at this site would more than double the total power requirements of the installation. In contrast, the water cooling system requires less than 20% of the total electrical power. From August 2008 to August 2009, the system operated with high reliability, producing surface current radial data which was transmitted in near real-time via a cellular signal to the National HF Radar Network and is publically available via the World Wide Web. [C4890]

"Microwave-acoustic water level sensor comparisons: Sensor response to change in oceanographic and meteorological parameters"

The Center for Operational Oceanographic Products and Services (CO-OPS) of the National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, conducts thorough evaluations of new environmental measurement sensors through its Ocean Systems Test & Evaluation Program. New water level sensors that employ microwave (MW) radar technology are now being evaluated and compared with other devices including the Aquatrak acoustic (AC) sensor that presently serves as the operational standard for the National Water Level Observation Network (NWLON). While no part of a MW radar gage has contact with the water and radar transmission in the GHz range is insensitive to temperature and humidity change, the beam measuring distance to the water surface is allowed to transmit in open air with no confining hardware such as a wave guide or stilling well. Further study is therefore needed to fully understand the effect of a dynamic air-water interface on MW radar measurements. Four MW radar sensors (Sutron RLR-0002, Miros SM-094, Design Analysis H3611 and Ohmart/Vega Vegapuls 62) were mounted on the U.S. Army Corps of Engineers Field Research Facility (FRF) pier at Duck, NC where oceanographic and meteorological data were used to evaluate MW radar sensor performance under open ocean conditions. Water level 6-minute series from each MW sensor were compared with 6-minute series recorded by the NWLON AC sensor at Duck during September-October, 2008. MW-AC zero-mean difference series contained power (variance) at certain frequencies and cross-power (covariance) at these same frequencies with parameters such as wave height, wave steepness, longshore current speed, and air/water temperature ratio. MW-AC differences for all MW sensors showed noticeable change when Hmo wave heights exceeded 2 meters and marked change when Hmo wave heights exceeded 3 meters during storm events. Wave steepness increased abruptly at the onset of these events followed by a prolonged roll-off toward lower values. MW-AC differences for the Sutron and Miros sensors responded first negatively then positively to steepness episodes while the Design Analysis and Vegapuls sensors responded positively but with a noticeable lag during larger events. Coherence analyses for MW-AC difference versus wave height and wave steepness underscore similarities between the Sutron and Miros sensors in one group and between the Design Analysis and Vegapuls sensors in another group, each characterized by a set of distinctive frequencies. The same analyses involving longshore current speed and air/water temperature ratio hint at weaker associations at lunar diurnal and semidiurnal periods for the former and solar diurnal and semidiurnal periods for the latter. [C4891]

"Target coherence analysis using canonical correlation decomposition for SAS data"

This paper analyzes the connection between the canonical correlations of sonar signals captured using two linear hydrophone arrays and the spatial coherence of the sources that are observed. Analysis of this connection allows for the use of a canonical correlation decomposition (CCD) framework for performing synthetic aperture sonar (SAS)-like processing. In particular, it can be used to extract correlation features of the targets in the frequency domain, which can then be used as a measure for target detection and classification. Results on real and simulated data indicate that coherence patterns are different in the presence of a target when compared to background clutter, and this pattern also changes as a function of the number of sensors on the array. [C4892]

"CASA Phased Array Radar System description, simulation and products"

This paper discusses the systems architecture of the CASA Phased Array Radar System, the Phase-Tilt Escan Radar System, for deployment in a CASA DCAS network of low power, solid-state phased array radars. The paper highlights the high-level system's architecture accompanied by measured data from the subsystems. [C4893]

"3D topography and forest recovery from an L-BAND single-pass airborne PolInSAR system"

Polarimetric InSAR (PolInSAR) using repeat-pass L-Band has generated interest in recent years because of its potential for extraction of forest height and of bare-earth topography beneath the canopy. However temporal decorrelation remains a problem. In previous papers a single-pass system has been demonstrated which removes the temporal issue. In this paper we extend the single-pass PolInSAR work previously described and show results for forests in which tree height maps and corresponding DTMs have been generated and compared to lidar truth. [C4894]

"Monitoring turbidity and suspended sediment concentration of coastal and inland waters using satellite data"

A method for retrieving water turbidity and suspended sediment concentration of inland and near-shore coastal waters using high resolution remote sensing satellite data is described. Backscattering coefficient at the near infrared band is first derived from the satellite images using a quasi-analytical algorithm after applying a simple atmospheric correction routine. A turbidity map is obtained by applying an empirical relation derived from laboratory experiments to convert the backscattering coefficient to nephelometric turbidity units (NTU). This method can be operationalized for global water quality monitoring using currently operating satellite sensors such as those on Landsat, SPOT and Terra / Aqua MODIS. [C4895]

"Analyzing radar backscatter of land within the TRMM footprint using high resolution SAR"

Spaceborn precipitation radars acquire atmospheric measurements using beams that scan through nadir. Naturally, the reflection from the surface is typically quite strong, especially at nadir. This surface observation can be used to estimate the attenuation caused by precipitation provided there is a reasonable value of the non-attenuated surface return leading to an estimate of the rain rate. Over land, the backscatter characteristics are usually very dynamic and change in the presence of water due to its high dielectric constant. In addition, the viewing geometry results in very large beam footprints on the ground containing highly variable scattering mechanisms. Using a high resolution Synthetic Aperture Radar, the surface characteristics within this footprint can be examined with respect to how precipitation changes the backscatter. This research investigates both of these radar types, plus ground based weather radars, to quantitatively analyze surface dynamics within the footprint of a precipitation radar. [C4896]

"3-D characterization of buildings in a dense urban environment using L-band Pol-InSAR data with irregular baselines"

Diverse spectral estimations methods, i.e. MUSIC, Maximum Likelihood (ML), Weighted Subspace fitting (WSF), are proposed and applied to the estimation of building height dense urban environments and to the retrieval of scatterers' physical properties. Compared to other estimators, the polarimetric WSF estimator is optimally model adaptive and results in reduced sidelobes induced by irregularly sampled baselines. [C4897]

"Evaluation of the single reference image snow-covered area estimation method for the boreal forest zone"

Spaceborne Synthetic Aperture Radar (SAR) data have been utilized for regional scale snow-covered area (SCA) monitoring for several years. Different methods have been developed and demonstrated for different

geographical regions. A method utilizing a single reference image for SCA estimation has been shown to function well on mountainous and non-forested regions. For the boreal forest zone a method using two reference images and a forest compensation procedure has been previously utilized. The single reference image method is evaluated here for the boreal forest zone and its performance is compared with the Helsinki University of Technology (TKK) SCA method that is specifically developed for boreal forest regions. The SCA evaluations are carried out using Radarsat-1 data for the snow-melt seasons of 2004-2007. The SCA estimation accuracies for the radar-based methods are determined using optical satellite based SCA data as reference. The results show that SCA estimation using a single reference image is usable for the boreal forest zone, although the accuracy is significantly weaker than that of the TKK-developed, boreal forest specific SCA method. The best accuracy obtained shows a root-mean-square error (RMSE) of 0.176 for the single reference image method and an RMSE of 0.123 for the TKK SCA method. [C4898]

"RADARSAT-1 AND -2 government calibration activities"

This paper examines the calibration activities assumed by the Canadian government within the RADARSAT program, from RADARSAT-1 commissioning in 1996 to the current period, more than one year into the RADARSAT-2 mission. Concepts, operations and results of the RADARSAT-1 calibration plan are reviewed, including the eleven-year image quality measurement history. Government calibration monitoring activities and results for RADARSAT-2 are also presented, indicating that image quality and calibration measurements are better than the specifications. [C4899]

"RADARSAT constellation, project objectives and status"

The RADARSAT Constellation is an evolution of the RADARSAT program with the objective of assuring C-band data continuity in the next decade with improved operational use of Synthetic Aperture Radar (SAR) and improved system reliability. This paper describes mission's main objectives and user requirements, as well as its concept and current status. [C4900]

"Tomographic 3D reconstruction from airborne circular SAR"

The study of data acquired over a circular trajectory has raised an increasing interest in the SAR community. Two main reasons summarize the interest in such geometry. First, sub-wavelength resolution can be achieved, as the targets in the spotted area are observed under a 360° aperture. Second, the use of the information from different azimuthal directions allows one to obtain information of the scene in the third dimension, making possible a 3D target reconstruction. In any case, both applications require certain target reflectivity homogeneity. This paper shows several processing results and analyzes the potentials and limitations of circular SAR to perform tomography of semi-transparent media. Special processing aspects, like the estimation of residual motion errors due to inaccuracies in the navigation data, are also addressed. Data acquired at L-band by DLR's E-SAR system are used to demonstrate the high resolution and tomographic imaging capabilities of circular SAR. The results include the tomogram of a Luneburg lens, as well as preliminary results over man-made targets and vegetation. [C4901]

"Joint SAR imaging and DEM reconstruction from multichannel layover-affected SAR data"

In this paper a methodology for the reconstruction of height profile of earth surface starting from layover affected Synthetic Aperture Radar data is presented. The proposed approach is based on classical statistical estimation techniques, in particular using Maximum Likelihood Estimator, together with a Gaussian model for the point target response. Multi-channel configuration has been exploited in order to solve the solution ambiguity and to increase the reconstruction accuracy. The performances of the proposed estimator have been evaluated in comparison with the Cramer Rao Lower Bounds for the considered model, showing the effectiveness of the method. The height reconstruction procedure has been tested on a simulated realistic scenario, providing interesting and promising results. [C4902]

"Scientific requirements and feasibility on an L-band mission dedicated to measure surface deformation"

DLR is currently studying a space borne mission based on two L-band satellites to map Earth surface deformation and vegetation structure from space. In this study the scientific requirements for deformation measurements are collected, traded off versus technical feasibility and a mission concept is investigated that provides a global monitoring capability of geo-tectonic threats. [C4903]

"Mission design and performance for systematic deformation measurements with a spaceborne

"SAR system"

Tandem-L is an L-band SAR satellite mission currently under study at DLR. It is intended to serve a number of geophysical applications in several domains, like solid Earth, ecosystems and cryosphere. The various applications compete for the system resources and the mission design optimization requires that a performance model is developed for each application in order to allow motivated choices. We describe the adopted approach for deformation measurements, which is based on recent formulations of the Cramer-Rao bound for multi-image SAR interferometry and on the a-posteriori combination of the measurements from different lines of sight. We also discuss the limitations that the use of a reduced set of interferograms would entail. [C4904]

"COSMO-SkyMed contribution in oil spill monitoring of the Mediterranean Sea"

High resolution Cosmo-SkyMed SAR images are used for oil spill detection and ship identification on the Mediterranean Sea, in the framework of PRIMI Pilot Project currently developed by Italian Space Agency (ASI). The system consists of four components, two of them devoted to the analysis of the SAR and Optical satellites images for the slicks detection, an oil spill forecast subsystem and a central archive that provides web-gis services; a preliminary version of the system is already operational. Besides the slicks relevant information and detected ships on the analyzed scene, the system also provides meteorological and oceanographic information. The architecture of the system, the operational scenario and the preliminary results are presented. [C4905]

"18 Years of interferometry, as seen from POLIMI"

The progressive expansion of the applications of Synthetic Aperture Radar from airborne or satellite platforms is due to its capabilities of imaging through clouds and during the nights; further, the coherent character of the images has allowed the onset of interferometry, namely the use of the phases of the radiation. The goal of this contribution is to recollect some episodes of the development of the technology, as viewed from our observatory, namely the Politecnico di Milano. Inevitable bias will follow. [C4906]

"Deformation monitoring using the ALOS/PALSAR"

Because of the higher interferometric coherence, ALOS/PALSAR data are often used for monitoring the deformation caused by the disaster events (i.e., earthquakes, volcanoes, land subsidence by water and oil pumping, land slide, etc) using the interferometric data analysis. JAXA has been a member of the international charter, and responds to the charter calls for the emergency call. In this paper we will introduce the responses to the charter call events and the data examples generated and distributed to the disaster event as the interferometric SAR products. [C4907]

"Comparison between electromagnetic scattering by a rain induced sea surface roughness and field data"

Scattering cross-sections for a rough sea surface in presence of wind and rain are simulated at oblique incidences and for various environmental conditions. They are compared with Ku-band radar signatures available from the literature. [C4908]

"Stable Coherent Area in SAR interferometry"

Synthetic aperture radar images have been a tool of interest in many land cover studies for their night and day, all weather conditions operability. The classic InSAR technique is often limited by temporal and geometrical decorrelation, especially in the context of long time series analysis. Indeed, one of the major drawback of radar images is that some surfaces such as vegetated areas have a varying backscattering coefficient over time. While two images are acquired in multipass interferometric mode, this leads to a partial or sometimes complete loss of correlation of the data. This paper deals with coherence measurements based on 83 ERS images of a large area which is particularly remarkable due to the temporal stability of its interferometric coherence. This area is located on the Serre-Poncon dam, France. Longitudinal observations based on seven years frame ERS interferograms show an expected complete loss of coherence of the scene over vegetated and mountainous areas, excepted on the Serre-Poncon dam for which coherence degree remains high despite the long time span between these acquisitions. An experimental qualitative analysis is lead on the measured coherence of this Stable Coherent Area (SCA). As classic coherence estimators are biased on small averaging windows, a specific method is thus proposed to improve the results, by measuring the global coherence of the dam. This requires a compensation of the topographic and orbital phase components. [C4909]

"Impact studies of AMSR-E ocean surface wind speed data in NWP at JMA"

The impact of assimilation of Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E) ocean surface wind speed data was investigated in Japan Meteorological Agency (JMA) global four dimensional variational data assimilation system. Japan Aerospace Exploration Agency (JAXA) produces ocean surface wind speed data from AMSR-E measurements as a standard level 2 product using 37 GHz vertical and horizontal polarized channels in no rainy area. As a research product, all weather ocean surface wind speed data are also produced by including AMSR-E low frequency (6.925 and 10.65 GHz) information. AMSR-E all weather ocean surface wind speed data were utilized in this study. A case study of cyclone Nargis in Myanmar 2008 was performed to examine the impact of microwave imager radiance data and AMSR-E all weather ocean wind speed data. Although there were no significant improvements in the cyclone track forecast by adding all weather ocean wind speed data, the assimilation of the data inside the cyclone strengthened the intensity and the maximum wind speed in the forecast realistically. [C4910]

"Modeling of roughness effects on electromagnetic waves propagation above sea surface using 3D parabolic equation"

This paper deals with effects of sea surface roughness on electromagnetic waves propagation in a three-dimensional domain. The 3D Parabolic Equation method is used to solve the wave equation. A new approach is presented to model the propagation above rough sea surface. Numerical results of electromagnetic waves propagation are presented to highlight the sea surface roughness influence. [C4911]

"Impact of atmospheric water vapor on the design of a Ku band geosynchronous SAR system"

We consider a geosynchronous Ku band system, and the defocusing effects due to the temporal and spatial variability of the atmospheric water vapor. Due to the very slow formation of the spatial chirp (minutes or even hours), the temporal change of the local water vapor content could be significant, thus preventing a correct image focusing and the formation of a coherent image. Using GPS and ground based radar data, we estimate and model the spatial temporal correlation function of the water vapor delay. Then, for a given spatial scale, we estimate the maximum time within which the temporal evolution of the water vapor should be carried out, to be able to track its temporal evolution. This requisite constrains both the EIRP and the apparent velocity of the satellite. Then, we evaluate the possibilities of real time ground motion analyses, as a function of the spatial and temporal resolution and the EIRP. [C4912]

"Analysis of SAR image time-series with a time-frequency method"

Time-frequency analysis (TFA) is an efficient tool to jointly detect point scatterers in SAR images and determine their backscattering properties. In this paper, we focus on TFA in multi-image context (for instance, interferometric stacks or multi-temporal series). A new TFA algorithm is proposed based on Γ, B spectrograms Γ, B which are 4D hyper images representing the behaviour of each pixel with respect to range and azimuth frequencies. Spectrograms are analyzed in a multi-image context: they are combined to select pixels with stable behaviour over time (persistent scatterer detection) or unstable behaviour (change detection). Spectrograms characterize short term variations, whereas, in this paper, we characterize long term variations based on spectrogram properties. Preliminary results obtained with Spotlight interferometric TerraSAR-X images are discussed. [C4913]

"Retrieval of soil moisture with airborne and satellite microwave sensors"

Experimental campaigns with airborne and satellite microwave sensors have been carried out on an agricultural area in Northern Italy with the main purpose of gathering a suitable set of data to validate two operational algorithms developed to retrieve soil moisture from passive and active microwave sensors at different spatial scales. The algorithms will be used in a pilot project based on the use of Earth observation data in forecasting and monitoring the risk of floods and landslides. Radiometric data have been collected with the airborne IFAC instruments and the AMSR-E, while ENVISAT/ASAR images have been acquired for high resolution estimate of soil moisture at field scale. [C4914]

"Extrapolation of airborne polarimetric and interferometric SAR data for validation of bio-geo-retrieval algorithms for future spaceborne SAR missions"

This paper describes a methodology to extrapolate spaceborne quality SAR image products from long wavelength airborne polarimetric and interferometric SAR data. The methodology is applied to E-SAR data of DLR, partially acquired under ESA contract especially for the development and validation of bio/geo-retrieval algorithms in forested regions. For this purpose not only system (sensor) related parameters are altered, but also those relating to the propagation path (ionosphere) and to temporal decorrelation. Examples for future

spaceborne products are presented and the potential of Pol-InSAR methods for the retrieval of forest heights from these data is discussed. [C4915]

"3D analysis of scattering effects based on Ray Tracing techniques"

The side-looking geometry of SAR sensors hampers the interpretation of SAR images of urban areas. Simulation tools for illuminating 3D models of man-made objects by means of a virtual sensor support the interpretation of scattering effects by providing artificial images in the azimuth-range plane. In this paper, a simulation approach is presented which extends SAR simulation to three dimensions in order to focus detected intensity contributions in azimuth, range and elevation. Based on the simulation output, a concept for creating scatterer histograms displaying the number of scatterers within one resolution cell is introduced. Methods for analyzing simulated elevation data by means of selected slices are presented for an urban test site. Eventually, the number of scatterers extracted for a selected pixel by tomographic analysis, using a stack of spotlight TerraSAR-X images, is confirmed by results provided by the simulator. [C4916]

"Differential Reflectivity (ZDR) calibration for CASA radar network using properties of the observed medium"

The Center for Collaborative and Adaptive Sensing of the Atmosphere (CASA) has deployed a Distributive, Adaptive and Collaborative Sensing (DCAS) network of four radars in central Oklahoma working as a closed-loop system since 2006. The radars operate at the X-band frequency and are capable of polarimetric and Doppler measurements. The radar network is being evaluated for Quantitative Precipitation Estimation (QPE). QPE algorithms based on radar power measurements (e.g. ZH and ZDR) require bias correction. ZDR calibration is required prior to any application of the self-consistency principle. Two different methods were evaluated for ZDR bias correction. The intrinsic properties of dry aggregated snow present above the melting layer and light rain measurements close to the ground are used for the study. Results show a ZDR calibration accuracy of 0.2 dB or less for both analyzed events when both methods are compared. [C4917]

"Coverage comparison of short range radar networks vs. conventional weather radars: Case study in the northwestern United States"

The West Coast of Washington and the NE and SW comers of Wyoming are regions of the contiguous United States where NEXRAD coverage is incomplete. One approach to addressing these gaps is to install additional NEXRAD-class radars. Another potential approach is to install small radar networks of the type being investigated in the CASA project. This paper compares these two approaches. We provide a meteorological and user-need assessment of present radar coverage in these regions (based on a recent feasibility study led by J. Brotzge) as well as an objective assessment of the radar-coverage that would be achieved using the large radar and small radar approaches. For this evaluation we consider two classes of radar: long-range radars having similar attributes to the WSR-88D (i.e., 10 cm wavelength, >250 km maximum range, 1 degree beamwidth, -500 kW peak power); and short-range radars having attributes similar to those operating in CASA's Oklahoma prototype network (i.e., 3 cm wavelength, 40 km maximum range, 2 degree beamwidth). We first establish the number of both types of radar that would be needed to provide coverage over a given rectangular ground-domain. Next, we quantify the coverage-versus-altitude for both weather-event detection and precipitation estimation over these regions, considering the blockage caused by both the curved earth and the local terrain. [C4918]

"Satellite ground deformation measurements: An on-demand GRID-InSAR processing system exploiting the SBAS algorithm"

We present the results of the first experiment to plug the Small Baseline Subset (SBAS) DInSAR algorithm into a GRID-based system; the key idea is to combine the robustness of the exploited advanced interferometric SAR approach with the high computing capability provided by a GRID environment. In particular, we have exploited the low-resolution SBAS algorithm and we benefited of the availability of the ESA Grid Processing-on-demand environment. The presented results, carried out on ENVISAT data, provide an overview of the main characteristics of the implemented SBAS-GRID processing solution. [C4919]

"Attenuation margin requirements in a networked radar system for observation of precipitation"

In recent years, it becomes increasingly possible to move the operating frequency of weather radar systems from non-attenuating lower frequencies, such as at S-band, to attenuating higher frequencies, such as at X-band. However, wave is more easily extinct in rain at higher frequencies in which case there will be missing observations. Therefore, rain attenuation is one of the important metrics in radar system design and an extra

attenuation margin needs to be applied to the allocation of power budget to meet the required sensitivity. The NSF Engineering Research Center (ERC) for Collaborative and Adaptive Sensing of the Atmosphere (CASA) is advancing a new sensing paradigm using networked short-range radar systems to avoid problematic earth curvature blockage. The CASA ERC has developed a networked radar test bed-Integrated Project 1 (IP1)-in southwestern Oklahoma, using 4 X-band radar of 40 km range to cover an area of 7, 000 km². In this paper the attenuation margin performance are analyzed in the network context and the metric to design a networked radar system is formed. [C4920]

"RBX: The new X-band radar from INTA"

This paper describes the architecture and main characteristics of the new synthetic aperture radar system which is being developed at Spanish National Institute of Aerospace Technology. The new prototype will support submetric resolution and interferometric and polarimetric capabilities, similar to other research SAR systems. The system architecture was designed taking into account an easy upgrade procedure and a continuous mount and dismount requisite. Hence, the system has just a few units and external interconnections. In addition, a feature which focused a significant design effort was data quality, thus the system supports calibration procedures like calibration loops or the acquisition of a replica from the transmitted signal. [C4921]

"Development of X-band airborne polarimetric and interferometric SAR with sub-meter spatial resolution"

These days, the space-borne SAR becomes one of the powerful instruments to observe the earth surface. On the other hand, a airborne SAR is also important for development of SAR system and analysis technique. Moreover, airborne SAR is able to make immediate observation of disaster area. The National Institute of Information and Communications Technology (NICT) has been developing the new airborne synthetic aperture radar: Pi-SAR2 since 2006. The Pi-SAR2 is an airborne X-band polarimetric and cross-track inter-ferometric SAR with sub-meter spatial resolution. The spatial resolution is measured less than 0.5m using some corner reflectors. The Pi-SAR2 system were completed and began the operation in autumn 2008. [C4922]

"TerraSAR-X and RADARSAT-2 for crop classification and acreage estimation"

This research outlines a preliminary assessment of the use of TerraSAR-X data for classifying agricultural crop land in Canada. X-Band data were able to identify crops (pasture-forage, soybeans, corn and wheat) to accuracies of 95% once a post-classification filter was applied. These accuracies were achieved using six TerraSAR-X images from 2008 and a decision-tree classification algorithm. Acquisitions began only mid-season and consequently a second full season TerraSAR-X data set is being collected in 2009. C-Band classification accuracies were about 10% lower in comparison. These results clearly demonstrate the potential of X-Band data for crop identification. [C4923]

"F-SAR-DLR's new multifrequency polarimetric airborne SAR"

The Microwaves and Radar Institute of the German Aerospace Center (DLR) is known for consistent work on the field of airborne synthetic aperture radar and its application. In April 2008 the 20th anniversary of the maiden flight of the well-known E-SAR system was celebrated. E-SAR has been maintained well over the time. It provided valuable knowledge to the science community, especially in the past 10 years. However, it became more and more obvious that a technological renewal was inevitable. Consequently the development of a new SAR system was put on line under the name 'F-SAR'. [C4924]

"INTASAR Program"

This paper describes the INTASAR Program of Spanish National Institute for Aerospace Technology (INTA) which goal is to research in Synthetic Aperture Radar technology area. INTASAR constitutes an INTA's long-term program, which basis is the development of airborne SAR prototypes, working presently in three complementary lines: SAR prototypes on-board CASA-212 platform, SAR developments in small platforms and participation in PAZ Program-Spanish radar satellite. [C4925]

"The OPERA project: EO-based flood risk management in Italy"

This paper illustrates some applications of COSMO-SkyMed (CSK) observations for rapid mapping of flooded areas and damages in small to medium size catchments. The results presented here have been obtained within the framework of the project "OPERA Civil protection from floods" funded by the Italian Space Agency and run by a team of scientific research centres and private companies. The project aims to the systematic evaluation of the added value of the use of Earth Observation techniques into operational flood prediction chains. Due to the

specific geomorphology of Italy, the focus is mainly on flash floods on small sized river catchments. Monitoring and modelling processes at proper space-time scales in this environment raise several issues to be solved, compared to applications in larger river basins. Here we address some related to the suitable use of CSK imagery. [C4926]

"Using COSMO-SkyMed data for flood mapping: Some case-studies"

The COSMO-SkyMed mission is expected to give a fundamental contribution for flood mapping, because of the high revisit time and throughput achieved by the four satellites that form the constellation. To study the potentiality of COSMO-SkyMed radar data for this purpose, two inundation events are analyzed in this paper, namely the flood occurred in Myanmar in May 2008 and the event that took place in the city of Alessandria (Italy) in April 2009. For the first event, two radar images were considered, one temporally close to the peak of the event, and the other one acquired one week later. As for the Alessandria flood, a time series of images was available, so that an attempt to monitor the temporal evolution of the inundation was accomplished. [C4927]

"Use of Cosmo-SkyMed data for seismic risk management in the framework of the ASI-SIGRIS project"

The scope of the SIGRIS pilot project is the development of an infrastructure to provide value-added information services for the seismic risk management, using satellite Earth Observation data. The project is funded by the Italian Space Agency (ASI) and will exploit Cosmo-SkyMed SAR data to generate various information products to support the activities of the Italian Civil Protection Department. We show the first achievements of the project obtained using Cosmo-SkyMed imagery to generate products for the April 6th, 2009 L'Aquila earthquake in Central Italy. [C4928]

"Quantitative analysis of stripmap and spotlight SAR interferometry with COSMO-SkyMed constellation"

This work is focused on the phase validation of interferograms obtained by combining COSMO-SkyMed SAR images acquired by a single satellite (temporal baseline coincident with the orbital repeat cycle) or even by two satellites of the SAR constellation in equi-phased configuration on the orbital plane (temporal baseline: 8 days), thus minimizing the temporal decorrelation. Both qualitative and quantitative analyses have been therefore carried out for HI (HIMAGE: stripmap, single polarization) and S2 (enhanced spotlight) imaging modes, in order to proof whether or not COSMO-SkyMed constellation is well suited for SAR interferometry. [C4929]

"Retrieval of suspended sediment concentration in the Pearl River Estuary from MERIS using support vector machines"

With the rapid industrialization and urbanization, more and more solid have been emitted into the Pearl River Estuary. The suspended sediment concentration is one of the most important water quality parameters. With in-situ optical data and suspended sediment data collected on four cruises from 2004 to 2006 in the Pearl River Estuary, analysis shows that with the increasing of the total suspended sediment (TSM) concentration, the intensive bands which have the best correlation relationship with the TSM concentration shift from Rrs(620) to Rrs(778). When the mean suspended concentration is 14.5 g.m⁻³, the Rrs(620) has best correlation with the suspended concentration. However, when the mean suspended concentration becomes more than 40g.m⁻³, the most correlated band shifts to 778nm. It seems that all of the Rrs(620), Rrs(665), Rrs(681), Rrs(708), Rrs(753), Rrs(760), Rrs(778) may be the most sensitive band for the different TSM concentration. This work investigates the possibility of using a new universal approximator-support vector machines (SVMs)-as the nonlinear transfer function between TSM concentration and remote sensing reflectance in the Pearl River Estuary. Experimental results show that the SVM performs better result than general empirical algorithms or the piecewise algorithm. The correlation coefficient between the in-situ and modeled TSM of the test dataset is 0.91 and the root mean squared error (RMSE) is 0.145. The algorithm based on the SVM is applied to MERIS satellite data in January 31, 2007. The distribution of TSM concentration was obtained and it shows that the algorithm could be a useful tool for the study of TSM distribution in Pearl River estuary. [C4930]

"Fusion of ALOS Palsar and Landsat ETM data for land cover classification and biomass modeling using non-linear methods"

This work demonstrates the utility of reduced resolution ALOS PALSAR data for biomass mapping and land cover classification over the tropical forests of Indonesia. This study is important because we processed the ALOS PALSAR mosaic, which is made freely available within K&C initiatives project and will be updated regularly. We first used 38 sample plots collected on the ground during dry season in September 2004, to

develop a tree diameter (dbh)-biomass model. The HH, HV, HV/HH and HH-HV backscatters of ALOS PALSAR data allowed the empirical estimation of forest above ground biomass (AGB). Each band of PALSAR data was separately used to estimate the biomass, and we found HV band resulted in better correlation with the AGB compared to other SAR bands. Validation of the prediction results was carried out by comparing the biomass estimates with those predicted from an existing allometric equation. Optical data are sensitive to the physical properties of the reflectors whereas SAR data are more influenced by the geometric properties of the scatterers. Therefore, the second part of this study concerned the integration of mosaic SAR textures and ETM data for land cover classification. The classification was conducted using ETM data and variations of ETM, SAR bands, and SAR textures calculated using GLC Matrix. The image classifications were carried out using a Machine Learning based classifier, so-called Support Vector Machine (SVM), and a conventional Maximum Likelihood method. An ensemble of neural networks method using Kalman filter and scaled conjugate gradient algorithm was applied. The classification accuracy was assessed using confusion matrices and Kappa statistics. We show that the introduction of SAR textures significantly enhanced the classification accuracies. This study showed that the joint processing of SAR and multispectral data increased the accuracies of biomass estimation and landuse classifications. The efficiency of the method at medium spatial resolutions allows its application of global datasets. [C4931]

"Subsurface microwave remote sensing and scattering modelling on hyper-saline soil: Example of Lop Nur"

Subsurface microwave remote sensing is a direction of Synthetic Aperture Radar (SAR) research. With the penetration capability, SAR is capable of detecting the subsurface targets and materials, especially in arid environment. Lop Nur Lake is located at the east of Tarim Basin in Xinjiang province of China, which is described as "the driest core of the world", and it can provide conditions for SAR penetration. This paper presents preliminary analysis about Lop Nur, and gives out an abstract subsurface structure about it. Then, the major scattering processes are concluded and a two-layer scattering model is developed. Based on parameters of soil samples, some rules about Lop Nur evolution will be figured out. With Genetic Algorithm (GA), an inversion procedure is constructed. All the attempts are viewed as the basis of future comprehensive interpretation about Lop Nur phenomenon. [C4932]

"Detection subsurface hyper-saline soil in Lop Nur using full-polarimetric SAR data"

This paper presents the research results about Lop Nur using full-polarimetric technology. Lop Nur Lake is one of the driest places in the world and finally lost its last drop of water in 1972. It is well known for its "Earth Ear" feature in optical remote sensing images. Likewise, "Earth Ear" feature is shown in Synthetic Aperture Radar (SAR) images, and even larger because of penetration effect. With the penetration capability SAR is capable of detecting the subsurface targets and materials, especially in arid environment. As for SAR images, both C-band and L-band, there are two key features about Lop Nur area. One is the whole Lop Nur area is high-bright that means the backscattering is much stronger than other sites, such as Gobi, desert and so on. The other feature is the "Earth Ear" pattern formation. polarimetric analysis about these two questions will be conducted based on past research results and field investigations. [C4933]

"Mapping and monitoring clear-cuts in Swedish forest using ALOS PALSAR satellite images"

This study presents results for observing forest changes in Sweden using multi-temporal L-band satellite data and is a part of the JAXA's ALOS Kyoto and Carbon Initiative. An extensive dataset of images acquired by the Advanced Land Observing Satellite Phased Array type L-band Synthetic Aperture Radar (ALOS PALSAR) is investigated for clear-cut detection in boreal forests in northern Sweden (Lat. 64°14' N, Long. 19°50' E). Strong forest/non-forest contrast and temporal consistency were found for the Fine Beam Dual HV-polarized backscatter during unfrozen conditions. Thus, a simple thresholding algorithm that exploits the temporal consistency of pair-wise HV-backscatter measurements has been developed for clear-cut detection. When applied to an image pair acquired during favorable weather conditions, the detection algorithm identified 76% of the clear-cut pixels within a reference layer, with zero erroneously detected pixels. With further refinement the developed methodology can be an option to present operational alternatives for clear-cut detection. [C4934]

"Detecting V-Storms using Meteosat Second Generation SEVIRI image and its applications: A case study over Western Turkey"

The present study focused on storm top observations utilizing the Meteosat Second Generation (MSG) data. The Spinning Enhanced Visible and Infrared Imager (SEVIRI) instrument aboard MSG provides image data with high spatial resolution (approximately 3 km) and high temporal resolution (15 minutes). This study used the thunderstorm event of 5 November 2007 over the Çameli town in Western Turkey to provide an analysis of

the enhanced-V satellite signature using MSG data. This signature was an important indicator of severe weather which can be used during weather warning operations to augment radar information. [C4935]

"Uncertainties in phase and frequency estimation with a magnetron radar: Implication for clear air measurements"

Radar systems with a drifting transmitter frequency (such as those employing magnetron transmitters) typically use an Automatic Frequency Control system to keep the receiver down-conversion settings tuned to the transmitted frequency. This paper presents a method to incorporate the Automated Frequency Control information in measurements affected by changing receiver frequency down-conversion settings, such as phase measurements to obtain change in refractivity fields. [C4936]

"Backscatter properties of multitemporal TerraSAR-X data and the effects of influencing factors on burn severity evaluation, in a mediterranean pine forest"

TerraSAR-X dual-polarized (HH and HV polarization) backscatter data have been investigated to assess the temporal backscatter stability of a burn scar in Spain. Analysis of the main factors influencing burn severity evaluation has been also carried out. The temporal stability of the backscatter was strong, unburned areas showing differences of less than 0.6 dB. For increasing burn severity the backscatter varied by up to 2 dB in highly burned areas located on slopes tilted towards the sensor. Heavy rainfall or moist vegetation increased the backscatter up to 1 dB. Steeper look angles resulted in significantly higher backscatter coefficients for HH polarization, while for HV polarization only marginal increase was observed. Association strength between backscatter and burn severity estimates improved with the size of the multi-look window, at the expenses however of spatial resolution. Even better results could be achieved at higher spatial resolution by applying a multi-temporal speckle filtering algorithm. [C4937]

"Forest type discrimination using polarimetric Radarsat 2 data"

In the south of China, synthetic aperture radar (SAR) provides a powerful tool for forestry inventory because of its all-weather and all-day capabilities. Nevertheless previous single or dual polarization SAR data cannot meet the requirements of forest type classification. Polarimetric SAR data contained more information of targets and in this paper we investigated the capability of polarimetric Radarsat 2 data for forest type discrimination. Taking Zhazuo forest farm of Guizhou Province as study area, an 8-temporal field experiment was designed and used for polarimetric backscattering signatures analysis based on MIMICS model. Then two-temporal polarimetric Radarsat 2 data was analyzed to extract polarimetric variables for forest species discrimination, and then polarimetric decomposition and classification were carried out. Experiments prove that forest type can be discriminated using polarimetric Radarsat 2 data, but it is not very effective for forest species identification mainly due to the spatial resolution limitation. Polarimetric SAR data with higher resolution and more complicated classification methods are needed in the future. [C4938]

"Paleoterrain model of the Yamato Marsh, Palm Beach County, Florida"

A modeling technique has been produced by combining remote sensing with geologic history for building a paleoterrain model that enables visualization of topography prior to anthropogenic development. The model's foundation is comprised of LIDAR data and stratigraphic sequences for describing the local geologic history. The Yamato Marsh, located in Palm Beach County, Florida, is a paleowatershed that was chosen for this study. The paleoterrain model of the marsh site can be utilized further in understanding land-use impacts on the surrounding environment. In conclusion, the final model of the Yamato Marsh successfully offers insight as well as a glimpse at a geomorphic feature that no longer exists. [C4939]

"Urban dynamic change detection in southeastern China based on interferometric SAR"

Synthetic Aperture Radar is the only instrument that can provide consistent remote sensing data for south China with persistent cloud cover and rain. In this paper, the potential of multi-temporal ERS, ENVISAT-1 and PALSAR data for land cover/land use classification and urban change detection was investigated at a test area in Fuzhou city, the capital of Fujian province in southeastern China. Both SAR backscatter intensity characteristics and interferometric data were analyzed. Two methods were carried out in the urban dynamics change detection: one was post-classification comparison, and the other one was multi-temporal image ratioing. The results from both classification and urban change detection were validated by field survey data and showed promising application of PALSAR and ESA SAR data in southeastern China. [C4940]

"A study on land cover classification based on HJ-1 CCD image"

Remote sensing technique has become one of the most effective means to acquire land cover information. The CCD cameras onboard the environment and disaster monitoring and forecasting satellite constellation (HJ-1 satellites) are advanced in spatial resolution, image coverage and revisit frequency. Thus, it can be very efficient to do land cover classification using their images. Taking Zhongshan County in Guangxi province as the study area, this paper studies on the best method of land cover classification based on HJ-1 CCD image and other assistant data. In order to test the general applicability of this land cover classification method, this paper also applies the method to another place. [C4941]

"Unsupervised segmentation of agricultural regions using TerraSAR-X images"

The framework of this study is focused on automatic fast recognition of agricultural interest for TerraSAR-X images. The intended goal is to label regions in an image as fast as possible, into classes significant for a given application, like crop classification. First, a filtering technique is applied to obtain the restored image. Then, two different methods of unsupervised segmentation are used. The Otsu's method which is based on the optimum threshold of histogram and the k-means method which is based on the Euclidean distance. [C4942]

"Monitoring slow ground movements around Tunis City by different SAR interferometric measures"

This paper presents an application of DInSAR techniques for the assessment of ground subsidences around Tunis City. A longterm analysis using two interferometric techniques were carried out to attempt reliable measurements. In this work, some aspects of interferometric processing softwares are reviewed and possible improvements are proposed in order to get better results. The convergence of the two different interferometric techniques done simultaneously and independently confirms results accuracy. [C4943]

"Use of Radarsat-2 images to develop a scaling method of soil moisture over an agricultural area"

Our objective is to describe and evaluate the spatial variability of the surface soil moisture at small scales using Radarsat-2 images acquired over an agricultural area. To reach this aim, a geostatistical analysis is applied to up scale the soil moisture from ground measurements to the resolution of radar images and also from retrieving soil moisture at different spatial resolution. To conduct this study, four RADARSAT-2 images acquired at different modes during the summer of 2008 over agriculture fields located in Saskatoon (Saskatchewan, Canada) were used. The available data are ground measurements of soil moisture, surface roughness and vegetation characteristics. The comparison between retrieval and ground soil moisture showed average absolute relative errors of about 35% and 55% for fine and ScanSAR mode images respectively. Indeed, a weak amelioration was obtained from the up scaling of the ground soil moisture data to the spatial scale of the different radar image. [C4944]

"Derivation of surface soil moisture using multi-angle ASAR data in the middle stream of Heihe river basin"

Radar remote sensing has shown its potential for retrieving soil moisture from soil surfaces. Since the backscattering process is also influenced by soil roughness, the characterization of this roughness is crucial for an accurate estimation. The algorithm proposed in this investigation aiming to obtain the roughness parameters for every SAR pixel which could facilitate the derivation of soil moisture in virtue of multi-angle ASAR images, and combined with a semi-empirical calibration for the correlation length. An application of the means was performed in the middle reaches of the Heihe river basin and achieved satisfactory results (RMSE less than 6 vol %). [C4945]

"Multiple Crop Yield prediction using dual-polarimetric TerraSAR-X stripmap imagery"

This paper presents the results of an experiment carried out to relate the yield from various crops to TerraSAR-X dual polarimetric imagery. X-band wavelength has higher sensitivity to smaller crop structures, especially stem and head density making it suitable for relating yield to backscatter. The coherent dual-polarimetric mode of TerraSAR-X was also used to emphasize the volume scattering through dual-polarimetric entropy/alpha decomposition. Good correlations to yield data as gathered by harvester telemetry were obtained. [C4946]

"Preliminary measurements of bare soil and waved water surface microwave reflection and emission angular dependences at 5, 6GHz"

In this paper structural and operational features of C-band, dual-polarization, combined scatterometer-radiometer system and the results of preliminary, spatio-temporally collocated measurements of bare soil and waved pool water surface microwave reflective (radar backscattering coefficient) and emissive (brightness temperature) characteristics angular dependences at ~5.6 GHz are presented. [C4947]

"TerraSAR-X Dual Receive Antenna mode-Channel reconstruction and impact on the GMTI performance"

TerraSAR-X is a high resolution synthetic aperture radar (SAR) satellite which provides the option to split the antenna in along-track direction and sample two physical channels separately. This so-called dual receive antenna (DRA) mode is implemented by use of a Magic-T hybrid junction which provides the sum and difference channel data instead of the fore and aft channel data. One way to exploit this spatial degree of freedom is to reconstruct the fore and aft channel data in the processing. The critical issue with the fore and aft channel reconstruction is the fact, that for space-based radar systems very high precision calibration is required. This is even more difficult since the wide bandwidth pulses employed by the radar makes the receive hardware transformation frequency dependent. In this paper a fore and aft channel reconstruction approach is described based on an estimation of the receive hardware transformation matrix by use of internal calibration pulses and calibration beams. The quality gain of the fore and aft channel reconstruction is demonstrated with experimental data and results on the ground moving target indication (GMTI) capability are shown. [C4948]

"Multi-path correction model for multi-channel airborne SAR"

This paper analyzes the multi-path component effect in the airborne SAR context, proposing a model as an approach to correct the generated disturbances in the processed phase and amplitude images. The method assumes along-track interferometric or polarimetric data to estimate the unknowns of the model. Airborne data acquired by the F-SAR system of DLR are used to evaluate the performance of the proposed approach. [C4949]

"Statistical characterization of the Sinclair matrix: Application to polarimetric image segmentation"

This paper focuses on the flexibility of a multidimensional model of probability density function (pdf) to describe distribution of complex data in polarimetric SAR images. This model is based on Copulas Theory for characterizing the dependence between the polarimetric channels (HH, VV, HV, VH). This corresponds to finding a model based on multidimensional copulas to describe the behavior of the target vector. The advantage in using copulas theory is to extend correlation concept to a wider dependence one, which may be non-linear, especially when processing high-resolution data. So, from this point of view, the model is more flexible than the classical Wishart distribution since no speckle filtering is required as preprocessing step to model accurately the pdfs. The other advantage of copulas is to split dependence concept and marginal distributions. Then, this multidimensional characterization may be linked to pdf which are not necessary of circular Gaussian law. So, specific parametric distribution may be chosen to fit each component (modulus and phase) of the Sinclair matrix. It yields a flexible model, for characterizing statistical behavior of the polarimetric SAR data, that may be derived to produce a segmentation algorithm. [C4950]

"Analysis of ASAR/Envisat polarimetric backscattering characteristics of Doñana national park wetlands"

Doñana National Park wetlands, in southwest Spain, undergo yearly cycles of inundation and drying out. These cycles, together with great extensions of annual helophytes, make of Doñana a rapidly changing environment. 43 ASAR/Envisat images of Doñana in HH, VV and HV polarizations were acquired throughout the hydrological year 2006/07 with the aim to monitor in detail an entire flooding cycle. The images were ordered in the seven ASAR swaths to achieve high observation frequency. Backscattering temporal signatures of two main land cover types were obtained in the three polarization configurations and six ASAR swaths. Polarimetric behavior of the signatures is analyzed with the aid of extensive site data, such as a precise digital elevation model and continuous records of water level and meteorological parameters. Conclusions on the feasibility to discriminate emerged versus flooded land are derived for the different incidence angles, land cover types and phenological stages. [C4951]

"Digital beam-forming for spaceborne reflector- and planar-antenna SAR-A system performance comparison"

The trend in the conception of future spaceborne radar remote sensing is clearly towards the use of digital beam-forming techniques. These systems will comprise multiple digital channels, where the analog-to-digital converter is moved closer to the antenna. This dispenses the need for analog beam steering and by this the used of transmit/receive modules for phase and amplitude control. Digital beam-forming will enable Synthetic Aperture Radar (SAR) which overcomes the coverage and resolution limitations applicable to state-of-the-art systems. On the other hand, new antenna architectures, such as reflectors, already implemented in communication satellites, are being considered for SAR applications. The paper compares the system

architecture and SAR performance of a planar and a reflector antenna SAR. [C4952]

"PALSAR CALVAL updated 2009 and change detections at the forest and the Polar regions"

This paper describes the updated results of the PALSAR CALVAL activity conducted for last three years using the PALSAR calibration archives and the connected ground truth data. The results show that PALSAR has pretty good stabilities on the geometric and radiometric accuracies. Using PALSAR data, change detection on the forest in Indonesia and the polar regions (North Pole region, Antarctica region, and Greenland region) are in progress tracking the change of the sigma-naught and/or the phases. [C4953]

"First assessment of the permanent scatterer linear displacement model in airborne InSAR time series"

This paper presents the very first assessment of the permanent scatterer (PS) technique for airborne data. A data set of 14 SAR images at L-band, acquired over the Oberpfaffenhofen area on the same day with the E-SAR system of the German Aerospace Center (DLR), is used for the first airborne time series analysis with PS. The paper shows the importance of mitigating the residual motion errors through the use of precise motion compensation strategy before PS analysis. The target velocity and DEM error results are obtained by a periodogram-based estimation considering the linear displacement model. Due to the small number of images in our data set, the displacement velocity and DEM error results are presented on a PS basis. Target structures related to selected reliable PSs are shown and the corresponding periodograms highlighted. [C4954]

"Observing littoral waves by Doppler radar"

The offshore observation of the wavefield with coherent radar systems consist a common practice for the study of the electromagnetic waves probing the sea surface waves and for the extraction of information of the sea waves. In this investigation, a Dopplerized, horizontally polarized, nautical radar is utilized for the monitoring of the wavefield evolution in the littoral zone. The radar datasets are globally unique and cover different geophysical conditions; therefore the impact of the bathymetry on the Doppler spectra is discussed, the horizontal velocity towards the shore is calculated and the properties of the radar deduced quantities are compared with in situ measurements. [C4955]

"Using HF surface wave radar and the ship Automatic Identification System (AIS) to monitor coastal vessels"

We compare the ship detection capabilities of the automatic identification system AIS (installed on some ships) and coastal, surface wave HF radars, showing how to use both systems together to enhance ship detection performance in coastal regions. Practical reasons to want better real-time awareness of the location, velocity and type of vessels along coasts include vessel safety, protection of the coastal environment and national security. Our model for the HF radar aspect uses an example radar with significant power and aperture, similar to the Pisces radar. The AIS model is for the high power (12.5 W) AIS unit and a significantly elevated receiver (~ 250 ft asl). The HF system show good capability to ranges of ~ 150 km for small ships to 250 km for large ships. The AIS system shows excellent capability out to a typical horizon of ~ 50 km with irregular coverage beyond using ducted propagation to several hundred km and more. Use of both systems allows monitoring of both AIS and non-AIS equipped ships and enhances probability of detection for situations where both systems are functional. [C4956]

"Airborne radar depth sounding of fast flowing glaciers"

Sea-level rise will affect populations worldwide with considerable and lasting consequences in the not-too-distant future. Accurate measurement of fast flowing outlet glaciers in Greenland and Antarctica are of vital importance to ice sheet models that predict the course of sea-level rise. The Center for the Remote Sensing of Ice Sheets (CReSIS) has developed a suite of tools designed for use with data collected by CReSIS depth sounding radar platforms. This suite includes algorithms for removing clutter and noise from coherent radar data, and the results show successful sounding of some of these fast-flowing glaciers for the first time. [C4957]

"Accuracy improvement of maximum likelihood inversion of forest height with PolInSAR"

Polarimetric synthetic aperture radar interferometry (PolInSAR) technique has been intensively used for extracting forest heights. Among the forest height inversion algorithms, maximum-likelihood estimate computes the maximum-likelihood estimate of the vegetation parameters based directly on the sample coherency matrix. The estimation of the sample coherency matrix is of great importance in this inversion process. A coherency matrix estimation method with adaptive averaging window derived from coherence region shape parameters is

presented. Then the estimated coherency matrices are applied in the maximum likelihood inversion algorithm. In order to confirm the validity of the proposed method, simulated L-band PolInSAR data provided by ESA is used. Experiment results suggest that this method can help improve the accuracy of maximum likelihood inversion of forest heights. [C4958]

"Cloud amount and aerosol characteristic research in the atmosphere over Hubei province, China"

Although the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIPSO) has been widely used in aerosol research, the classification of aerosol and cloud still presents some problems. The traditional classification method used by NASA is probability distribution functions (PDFs), but in reality, when we want to realize this algorithm, we find it is difficult to describe the multi-modal distribution of cloud backscatter coefficients. Further, because ice cloud and dust aerosol have some similar properties, it is not easy to identify them. In this paper, we introduce a classification method which is based on a support vector machine (SVM), and we add another characteristic. Then according to the result of classification inversion of the aerosol characteristic, the height of cloud top, at the same time, is combined with CloudSat data to calculate other cloud characters. These data will be helpful for further climate research. [C4959]

"Distributed targets detection based on local spectral histograms and agents"

To detect the distributed targets in SAR images of the sea, an algorithm based on local spectral histograms (LSH) and agents is proposed. The filter banks consist of the intensity filter and 36 Gaussian derivative filters at 6 orientations and 3 scales. After picking out the background images of the sea, the distribution of the difference value based on LSH is obtained. Given a probability, a threshold is achieved which will be used in judging behavior of the agent. Then an agent system is proposed, and a group of behaviors are introduced, including judging, moving, communicating, breeding, inheriting and dying behaviors. So the detection could be performed through the evolution of the agents. Several examples show that our algorithm is effective for different distributed targets. [C4960]

"Use of neural networks and SAR interferometry for the automatic retrieval of tectonic parameters"

The basic idea of this paper relies on the concurrent exploitation of the capabilities of neural networks and SAR interferometry for the characterization of a seismic source and the estimation of its geometric parameters. When a moderate-to-strong earthquake occurs we can apply SAR Interferometry (InSAR) technique to compute a differential interferogram. The earthquake has been generated by an active, seismogenic, fault having its own specific geometry. Therefore each differential interferogram contains in principle information concerning the geometry of the seismic source the earthquake comes from. To perform the inversion operation an approach based on neural networks can be considered. The paper illustrates such a methodology and its assessment on experimental data. [C4961]

"Classification of a reference image using auxiliary images"

This work does an extension of the Maximum A Posteriori (MAP) multidimensional image classification for the case that each image in a set of images can have different number of predominant classes. These different classes can be related to the sensor characteristics, which can detect different aspects of the same scene. In the proposed classification processes one image of the image set is choose as the reference image to be classified and the others images are considered complementary information. Simulations of two SAR amplitude images are used to evaluate the classification method. [C4962]

"Three-component decomposition for polarimetric SAR"

An improved three-component decomposition for polarimetric SAR data is proposed in this paper. The reasons of the emergence of negative powers in the Freeman decomposition have been analyzed, and two improvements are included. Firstly, the deorientation process is applied to the coherency matrix before it is decomposed into three scattering components. Then, the coherency matrix with the maximal polarimetric entropy, i.e, the unit matrix is used as the new volume scattering model instead of the original one adopted in the Freeman decomposition. The E-SAR polarimetric data acquired over the Oberpfaffenhofen area in Germany are applied for experiment to demonstrate the effectiveness of the new model. [C4963]

"Comparison of Gaussian and Rayleigh noise models in inversion of subsurface parameters of layered rough surfaces using simulated annealing"

This work addresses the noise sensitivity of the simulated annealing method in inversion of subsurface parameters of layered rough surfaces to measurement noise. We consider two different noise models and

assess the noise response of the inversion algorithm for each of the models. Conclusions are made based on the calculated average and standard deviation of the output error in the retrieved model parameters. [C4964]

"Target tracking enhancement using a Kalman filter in the presence of interference"

In this paper we present a new target tracking enhancement system that uses a Kalman filter in the presence of interference. If the radar (seeker) is affected by different types of interference, this will affect the missile trajectory towards the target and may cause inaccurate tracking. In the new system a six-state Kalman filter is utilized to perform the tracking task and to carry out smoothing to the corrupted trajectory. This also provides good information about the target velocity in three dimensions which is very important information about the target. A three dimensional scenario between target (with high manoeuvre) and missile is used to illustrate the performance of the system in the case when (i) no interference is present and (ii) interference is present. The performance of the filtered trajectory using the Kalman tracker will be assessed for different guidance methods: including (i) proportional navigation (ii) pure pursuit and (iii) constant bearing. The Kalman improvement for the tracking for the three guidance method will be analysed. [C4965]

"Pulse Coupled Neural Network for automatic features extraction from COSMO-SkyMed and TerraSAR-X imagery"

In this paper we test an unsupervised neural network approach for extracting features from very high resolution X-band SAR images. The purpose of this study is buildings recognition in images of low density urban areas, acquired by COSMO-SkyMed and TerraSAR-X satellites, by means of Pulse Coupled Neural Network (PCNN), a relatively novel unsupervised algorithm based on models of the visual cortex of small mammals. The features retrieved from geo-referenced SAR images are compared against the ground truth provided by corresponding optical images. The accuracy yielded by PCNN is quantitatively evaluated and critically discussed, also in comparison with commonly used feature extraction techniques. [C4966]

"Multisensor SAR analysis for forest monitoring in boreal and tropical forest environments"

For many aspects of the human life the world's forests are crucial. Only microwave remote sensing provides the means of all day weather independent monitoring of those pristine areas. Multi-temporal ENVISAT ASAR and ALOS PALSAR data for mapping boreal forest in central Siberia proved to be quite successful in diverse research projects. So far, TerraSAR-X High Resolution Spotlight images have been effectively used in the verification process of the resulting land cover area maps. Part of this knowledge will be transferred within the framework of the Remote Sensing Survey of the next global Forest Resources Assessment. Altogether 350 TerraSAR-X scenes all over the cloudy tropics will be analysed in a project called FRA-SAR 2010. The combined analysis of ALOS PALSAR, ENVISAT ASAR and TerraSAR-X on five areas inside the project will foster the expertise on forest structure parameters. [C4967]

"Polarimetric signatures and classification of tropical land covers"

Polarimetric signatures for different tropical land covers were extracted from RADARSAT-2 data. Subsequently, the data were classified. The objective of this work was to assess the potential of RADARSAT-2 polarimetric C band data on land cover mapping. RADARSAT-2 data were acquired over Tapajos National Forest, a tropical forest reserve in Brazil, and surroundings, in September 2008. A field campaign was conducted during the same week of the SAR data recording. Polarimetric signatures for the different land covers were extracted for co- and cross-polarised bands and results indicated the variety of scattering mechanisms in the study area. Following that, the coherence and covariance matrices were used for the Freeman-Durden target decomposition, which decomposed the image targets in new bands representing the main scattering mechanism in the resolution cells-corner reflection, volumetric and superficial. Data were later classified by a k-means-Wishart classifier. The bands representing volumetric and superficial scattering helped discriminating vegetated and non-vegetated areas. Classification accuracy reached around 80% for forest and pasture/bare soil classes. For the remaining classes, the classification accuracy results did not reach 50%. [C4968]

"Polarimetric coherence optimization for interferometric differential applications"

In this paper, the potentials of polarimetric coherence-optimization techniques for differential interferometric SAR (DInSAR) applications are examined. For this purpose, the cutting-edge approaches available in the literature are considered. First, synthetic PolSAR data simulating homogeneous distributed scatterers are employed to demonstrate the convergence of the optimized differential phase to the deformation phase information. Then, real X-band ground-based PolSAR acquisitions concerning an urban environment are analyzed. The relation between optimum coherences and corresponding optimum phase in terms of deformation on retrieval is carefully analyzed using two zero-baseline fully-polarimetric data sets. In the end, general conclusions about the advantages and

drawbacks of the alternative maximization approaches are drawn. [C4969]

"Determination of scattering mechanisms inside rice plants by means of PCT and high resolution radar imaging"

3-D high-resolution radar images have been produced for a mature rice crop sample by using wide-band fully polarimetric data collected at the EMSL, JRC-Ispira (Italy). These images have been compared with the 1D vertical density profiles produced by the Polarization Coherence Tomography technique on the same rice sample. In order to obtain a 1D vertical reflectivity profile from the 3D SAR images, several slices at certain ground-range positions have been selected and then all the horizontal cross-range contributions have been summed up. As expected, very similar qualitative results are obtained when comparing these profiles with the PCT ones. The ground exhibits the highest response for all three polarization channels up to C-band, and also for the HH channel at X-band. In addition, at X-band the VV channel decreases significantly at ground level but the HV channel remains high. Finally, an important contribution from the upper layers is observed at C-band and more notably at X-band for all three polarization channels. [C4970]

"Karst forest type discrimination in southwest China using spaceborne polarimetric SAR data"

Karst forest physiognomy occupy a large area of Guizhou, southwest China. It is a rare forest resource in the earth and urgently needed to carry out protection. Due to synthetic aperture radar (SAR) data's ability to acquire images through clouds, it was tested as an alternative to optical data to map changes of land use/land cover, to estimate biophysical parameters of vegetation types, and to detect deforestation. The main goal of this paper is to analyze the potential of the spaceborne full polarimetric data in distinguishing the different types of forest in southwest China. Different polarimetric target decompositions, such as eigenvector-based decomposition (Cloude-Pottier's decomposition and Touzi Decomposition) and scattering model-based decomposition (Freeman decomposition), were used in this paper to extract forested areas from the scene. To further divide the extracted forested area into deciduous and coniferous forest., Supervised polarimetric classification procedures based on Freeman decomposition is presented in this paper. [C4971]

"Damage analysis of 2008 Wenchuan earthquake using SAR images"

On May 12, 2008, Wenchuan earthquake (Ms 8.0) occurred in Sichuan, Southwestern China. This catastrophe caused severe damage of constructions in urban and rural areas, and fundamental infrastructure, such as those facilities of factories, electrical power, telecommunication and transportation, etc. The earthquake also resulted in many geological phenomena, i.e. landslide, debris flow, landslide lakes, etc. which also triggered off damage and threat. The airborne campaigns were performed after the earthquake with high-resolution SAR system for rescue and relief effort and damage assessment. In this study, damage of various facilities was described and analyzed using airborne SAR images acquired during the campaigns. The results were verified with ground truth investigation. The results showed the role of SAR data in earthquake damage assessment. [C4972]

"Needs and applications for data mining in large series of remotely sensed images"

Recent years have shown an increase in image availability at decreasing cost, as focus changed from $\Gamma, B_{\text{maximum profit}}, B_i$ to $\Gamma, B_{\text{maximum use}}, B_i$. This puts analysis and mining of time series of images within reach of a wider audience, promoting development of suitable techniques. This paper focuses on four generic types of mining of large series of images: a) presence and location; b) temporal patterns; c) spatio-temporal patterns; d) moving objects. For each type it is described which group of algorithms are used for mining and how uncertainty can be modeled. The four generic types can be used to find adequate algorithms for data mining and to describe uncertainty for new applications. Further developments are to be expected for tracking of fast moving objects, image mining of mixed archives and irregular time steps. Communication tools for uncertainty in image mining, targeted at users outside the geo-information sciences should be further developed. [C4973]

"The ALOS PALSAR mosaic over the African continent-A reference baseline dataset for forest- and land cover change monitoring"

Within the framework of the ALOS Kyoto & Carbon Initiative, the European Commission Joint Research Centre (JRC) is in charge for the generation of a 50 m pixel spacing L-band SAR mosaic over the African continent. The mosaic is generated from full resolution (20 m), dual polarisation (HH + HV) ALOS PALSAR data, acquired from June through October 2007. The mosaic is scheduled for release in the autumn of 2009, and will be made available free of charge to scientific users worldwide through the JRC and JAXA. This paper provides a brief overview of the K&C Initiative, and a short description of the procedures employed by the JRC for the Africa mosaic generation. [C4974]

"SAR monitoring of suburban areas based on an electromagnetic scattering model"

Cylindrical-shape tanks are typical of any suburban area and often contain dangerous gases or fluids. In this paper, we suggest a way to monitor them by means of high resolution Synthetic Aperture Radar (SAR) images and a scattering model able to quantitatively consider how the radar signal interacts with this kind of structures and how they appear in the SAR images. Adopting the model, geometrical information as the tank height is retrieved from the SAR images in a non-conventional way that is exploiting the information content contained in the double reflection contribution to the radar cross section. Results are compared with more traditional methods and discussed. [C4975]

"Local, nonlinear adaptive co-registration of master and slave interferometric SAR complex image data for high quality digital elevation map generation"

Interferometric synthetic aperture radar (InSAR) is a key technology in geoscience. In the generation of a digital elevation map (DEM), the elimination of singular points (SPs) is the most important process besides the phase unwrapping (PU). A SP means a point where the phase rotation is not zero in the interferogram obtained by InSAR. What yields the SPs? One reason is a big cliff actually existing in the observation region. Empirically, such cliff-generated SP pairs (positive and negative SPs) are located at a distance from each other. Contrarily, other SP pairs, which make up the majority of the SPs, emerge closely to each other. Such close pairs arise from the autointerference caused by the diffraction in electromagnetic-wave propagation including the local permittivity fluctuation effect related to moisture vapor density in the air and other effects. We call the former the global SPs, while we do the latter the local SPs. [C4976]

"Capon/APES based SAR processing: Practical considerations"

This paper discusses the use of Capon's Minimum Variance Method (MVM) and Amplitude and Phase ESTimation APES spectral estimation algorithms to SAR range-azimuth focusing. The rationale of the algorithms is explained. An implementation of a Capon or APES processing chain is described. Results using RADARSAT-2 Quad Pol data over Barcelona are used to qualitatively study the real-life performance of these algorithms. [C4977]

"Rough thin pavement thickness estimation by GPR"

In civil engineering, usually the methods used to estimate the thickness of thin pavements consider flat interfaces for simplification. In this paper, the roughness of the surfaces is taken into account. First, the amplitudes of the first two echoes from the rough thin pavement are calculated from a rigorous electromagnetic method, the PILE method. A comparison is then made with the flat interface case, and their differences in the electromagnetic backscattering are highlighted. Eventually, the influence of the pavement roughness on the pavement thickness estimation is investigated by using the Maximum Likelihood Method. [C4978]

"Processing multiple SAR modes with baseband azimuth scaling"

This paper presents an efficient phase preserving processor for the focusing of data acquired in sliding spotlight, TOPS (Terrain Observation by Progressive Scans) and ScanSAR imaging modes. They share in common a linear variation of the Doppler centroid along the azimuth dimension, which is due to a steering of the antenna (either mechanically or electronically) throughout the data take for the first two modes, and due to the burst mode in the ScanSAR case. Existing approaches for the azimuth processing can become inefficient due to the additional processing to overcome the folding in the focused domain. In this paper an azimuth scaling approach is presented to perform the azimuth processing, whose kernel is the same for all three modes. Data acquired by TerraSAR-X in sliding spotlight, TOPS and ScanSAR modes are used to validate the developed algorithm. [C4979]

"Calibration of spaceborne polarimetric SAR data using a genetic algorithm"

Calibration method for spaceborne polarimetric SAR data using a genetic algorithm is discussed in this paper. Recently some satellites which have polarimetric synthetic aperture radar were launched, and the polarimetric data analysis techniques are being developed for terrain classification, forest biomass and soil moisture estimations, etc. Thus, polarimetric calibration becomes an important issue for accurate polarimetric analysis. However, typical polarimetric calibration methods have some restrictions. For example, Freeman method requires the polarimetric data which satisfy reflection symmetry and does not estimate cross-talks. Thus, it is desired that a polarimetric calibration method is needed to estimate all polarimetric calibration parameters by using polarimetric data without considering reflection symmetry. In this report, a polarimetric calibration technique based on a genetic algorithm (GA) is proposed. This proposed method can estimate cross-talks, channel

imbalances and Faraday rotation angle using one trihedral corner reflector and the measured polarimetric SAR data with non-reflection symmetry. [C4980]

"Scattering component decomposition for POL-InSAR dataset and its applications"

The three-component scattering model decomposition based on the scattering mechanisms corresponding to single-bounce, double-bounce, and volume scattering, is one of the powerful tools to classify terrain for fully polarimetric SAR data. However, the conventional scattering component decomposition technique with POLSAR image requires several assumptions to obtain a unique solution. This paper presents scattering component decomposition technique with Pol-InSAR image pair. The proposed technique based on the ESPRIT can decompose without any assumptions when a suitable set of candidates for volume scattering covariance matrix is prepared. In this report, we show the concept of the proposed method with the POL-InSAR image pair and the role of the ESPRIT in the volume scattering estimation. Experimental results of SIR-C/X-SAR are also provided as an example. [C4981]

"Detection and analysis of urban areas using ALOS PALSAR polarimetric data"

Due to their large scale of observation and their relatively high revisiting frequency, spaceborne SAR systems offer interesting possibilities for the systematic monitoring of urban areas. Several techniques have been developed to analyze urban areas from single-polarization spaceborne SAR data, based on the statistical properties of the reflectivity of such complex media and its spatial variations (texture). The reduced resolution of the data, compared to the airborne SAR case, is a particularly limiting factor. Polarization diversity offers an interesting and powerful alternative mean to detect and characterize urban areas. In this paper, we propose to use po-larimetric SAR acquired by the ALOS sensor at L band, to monitor urban areas. The proposed technique uses three complementary approaches to discriminate urban structures using detectors adapted to the complex polarimetric features of this medium, to isolate specific coherent responses from a Time-Frequency analysis of the coherent SAR signal, and finally to characterize built-up areas from the coherence properties of their Polarimetric and Interferometric SAR (POL-inSAR) response. [C4982]

"A new approach to improve the accuracy of baseline estimation for spaceborne radar interferometry"

The 'baseline' is one of the most important parameters in Interferometric Synthetic Aperture Radar (InSAR). The quality of InSAR products is significantly affected by the accuracy of baseline estimation. In this paper, a new approach to improving the baseline estimation is proposed. The main advantage of estimating baseline by the proposed method is that the calculation can be performed without the need for phase unwrapping and ground control points (GCPs). The final result shows that a better differential interferogram can be generated using the proposed baseline estimation method. [C4983]

"Polarized point scatterers: An algorithm for detection using ALOS-PALSAR data"

This paper deals with a new class of localized point targets we call polarized point scatterers (PPS). They can be detected from Quadpol SAR data by using a two-dimensional filter, employing an eigenvalue/alpha threshold. They can then be used to estimate the dielectric constant of the target using a simple scattering model. We first consider the basic performance of the filter based on selection of thresholds and data window size to keep false alarms to a desired low level. We then illustrate application of the filter to sample data sets from the ALOS-PALSAR archive, showing its important application to urban areas. [C4984]

"Soil moisture retrieval from HUT-2D synthetic aperture radiometer data"

We have studied usage of our airborne L-band 2-D synthetic aperture radiometer HUT-2D for estimation of soil moisture. Measurements were conducted over three sites in Northern and Southern Finland in August 2007. Good results were achieved for bare soil and low vegetation, whereas soil moisture retrieval for forested areas requires further studies. [C4985]

"Analysis of multi-temporal land observation at C-band"

The availability of reliable land cover information is crucial for a wide range of applications, like for example monitoring of land use change and land degradation as well as administrative matters in global, regional and local scales. In this paper the potential of SENTINEL-1 C-band SAR data for land cover applications, e.g. generating level-2 land cover classification products has been investigated. Therefore, the planned short revisit and dual polarization concept of SENTINEL-1 has been simulated using multi-temporal ERS-2 and ENVISAT ASAR AP C-band backscatter intensity data. For classification, several multi-temporal metrics and the minimum

amount of SAR data acquired during one growing season have been analyzed to derive five basic land cover classes with accuracies greater than 85%. [C4986]

"Waveform considerations for dual-polarization Doppler weather radar with solid-state transmitters"

Adequate sensitivity of weather radars using low-powered solid-state transmitter is achieved by using pulse compression waveforms. However, pulse compression waveforms have drawbacks of blind zone and range side lobes. In this paper, we present a methodology to address the major challenges in designing the waveforms for an X-band dual polarization Doppler radar operating with a solid-state transmitter. Here, frequency diversity wideband waveforms are proposed to mitigate low sensitivity of solid-state transmitters and the range eclipsing problem associated with pulse compression. An analysis of the performance of pulse compression using mismatched compression filters is reported. The performance of the proposed system is also quantified using signal and system simulations. [C4987]

"Microwave soil moisture retrieval under trees using a modified tau-omega model"

During 2007-2009 field experiments have been conducted using the ComRAD microwave truck instrument system with a goal of optimizing microwave soil moisture retrieval algorithms for small to medium deciduous and coniferous trees. A joint effort of NASA / GSFC and George Washington University, ComRAD consists of a quad-polarized 1.25 GHz radar and a dual-polarized 1.4 GHz radiometer sharing the same antenna. In the current study, ComRAD microwave data and ground truth measurements of soil moisture, temperature, soil texture, and vegetation water content and geometry statistics have been used to assess whether the zero-order tau-omega model can be employed successfully to retrieve soil moisture under tree canopies using effective values for tau (the vegetation opacity) and omega (the single scattering albedo). In addition, the tau-omega model has been modified to include a first-order scattering term, which will be discussed in a companion paper. [C4988]

"Fusion of SAR and optical data for urban extent extraction improvement"

This paper presents two methods to fuse SAR and optical data for urban extent extraction. The two methodologies build over single sensor's procedure in order to improve the efficiency of the characterization of the urban environment when more data is available. Results over Pavia and Al Fashir conform the effectiveness of the proposed procedures. [C4989]

"Research on oil spill identification based on texture features-a case study of "Hebei Spirit" accident"

For single-band and single-polarized SAR, its capability to monitor oil spill is limited based on image intensity. Texture features are suggested to improve accuracy of oil spill surveillance. Texture measures, extracted from GLCM (gray-level co-occurrence matrices), are analyzed, which indicates that mean, contrast, variance, entropy, and dissimilarity are effective for oil identification. SAR image is characterized by high resolution and speckle noise, which limits pixel-based approaches. In this paper, object oriented image analysis is used to extract oil slick. This algorithm typically incorporates both spectral and spatial information in the image segmentation phase. Results indicate that texture features extend features of interested objects, and help to improve oil spill surveillance. [C4990]

"Operational applications of RADARSAT-2 for the environmental monitoring of oil slicks in the Southern Gulf of Mexico"

PEMEX has used RADARSAT-1 operationally for the environmental monitoring of oil slicks in the Southern Gulf of Mexico for almost a decade (2000-2008). In this time RADARSAT-1 data has become fully integrated into PEMEX's environmental response strategy. To move towards the future; PEMEX decided to transition to RADARSAT-2 when the data became commercially available in April 2008. The purpose of this paper is to discuss the steps made in the move from RADARSAT-1 to RADARSAT-2 and how the advanced capabilities of RADARSAT-2 have improved operational processes. [C4991]

"Land subsidence monitoring and Flood Simulation using multitemporal digital elevation models"

The over capacity use of the ground water usually results in the serious problems of land subsidence along the southwestern area in Taiwan. Therefore, how to monitor the land subsidence effectively will be an important study issue. The digital elevation models (DEMs) obtained by photogrammetry and remote sensing technologies provides more extensive height information on regular grids than traditional ground-based methods. However, it is not easy to perform the analysis of land subsidence when using the different DEM data sets with different resolution and accuracy. In this study, the least squares collocation (LSC) is proposed to adjust the low-precise

DEM data to high-precise leveling observations. The experimental results showed that the systematic errors of DEM data can be reduced using LSC, than the corrected DEM data can reveal more information of land subsidence in local areas. [C4992]

"Exploring the potential of MODIS visible and thermal channels in monitoring and assessing the impact of desalination plant discharges in the Arabian Gulf"

Sea water desalination has experienced an unprecedented growth in the GCC countries to meet the ever growing demand of water for household consumption as well as for industrial and agricultural purposes. However, the current technologies used in water desalination are also accompanied by negative environmental impacts especially on the surrounding marine ecosystems. Since major seawater desalination plants are located by the shoreline, the main environmental considerations in desalination are water intakes and sea outfall discharges. We intent through this study to evaluate the potential of current polar orbiting satellites in evaluating the impact of desalination plant discharges, usually used to dispose of brine waste stream, on surrounding ecosystems and water quality. The objective of this project is to develop an automated approach for monitoring water quality and temperature (thermal properties) surrounding the discharges of desalination plants in the UAE coastal areas. Visible and thermal measurements provided by MODIS sensors on board of Terra and Aqua satellites are used in this project. The first four bands (visible) and band 31 & 32 (thermal) were selected. Future multi-spectral data from DubaiSat-1 (5-m resolution) will be also used to detect small changes in water color that cannot be detected with the MODIS data (250 m). [C4993]

"A GPU based time-domain raw signal simulator for interferometric SAR"

A novel GPU based time-domain raw signal simulator for InSAR is proposed in this paper to exploit the parallel computation of GPU using CUDA language. This simulator combines the advantages of both time-domain and frequency-domain InSAR simulator, i.e., it considers the baseline oscillation and real orbit, and it is also very efficient. Experimental results show the effectiveness of the simulator in varieties of conditions. [C4994]

"Bayesian restoration of interferometric phase through biased anisotropic diffusion"

In this paper a new Bayesian algorithm for interferometric phase restoration is presented. Based on a non-linear anisotropic extension of Orientation Diffusions, the inherent directionality of the fringe structure is introduced into its prior model. It also accounts for the periodicity of the phase representation. A fidelity term derived from the anisotropic metrics and the InSAR phase statistics deviates diffusion towards the acquired phase value. It acts as an adapted likelihood of the diffused phase. Hence, phase restoration is a trade-off between directionality and reconstruction fidelity, prior and likelihood. Results are provided on a High Resolution Spotlight scene acquired by TerraSAR-X. [C4995]

"Calibration of radargrammetric DEMs from RADARSAT-2 high-resolution and fine-quad modes"

The new high-resolution and full polarimetric modes of RADARSAT-2 are evaluated for digital elevation model (DEM) generation using stereo-radargrammetry with Toutin's 3D physical model. The stereo-radargrammetric DEMs were evaluated with accurate Lidar data. Results on a test site north of Québec City, Canada showed good accuracy: (2 m 1 σ horizontal and vertical) for Ultra-Fine mode (better than the resolution), and 5 m and 11 m (1 σ horizontal and vertical, respectively) for the Fine-Quad polarimetric mode (about the resolution).

[C4996]

"Using geometric accuracy of TerraSAR-X data for improvement of direct sensor orientation and ortho-rectification of optical satellite data"

The very high geometric accuracy of geocoded data of the TerraSAR-X satellite has been shown in several investigations. It is due to the fact that it measures distances which are mainly dependent on the position of the satellite and the terrain height. If the used DEM is of high accuracy, the resulting geocoded data are very precise. This precision can be used to improve the exterior orientation and thereby the geometric accuracy of optical satellite data. The technique used is the measurement of identical points in the images, either by manual measurements or through local image matching using mutual information and to estimate improvements for the attitude data through this information. By adjustment calculations falsely matched points can be eliminated and an optimal improvement can be found. The optical data are orthorectified using these improvements and the available DEM. The results are compared using conventional ground control information from GPS measurements. [C4997]

"A new algorithm for the phase unwrapping of interferogram stacks"

Phase unwrapping is a key step in DInSAR stack analysis: it allows restoring the phase values starting from the restricted ones to extract the deformation time series of the observed area. Most of the available interferogram stack phase unwrapping techniques unwrap each interferogram separately. Based on a strategy proposed in the literature, in this work we discuss an unwrapping procedure that exploits both the temporal and spatial characteristics of the interferogram stack. In particular we propose a technique that allows carrying out a temporal unwrapping step with a generic set of interferograms. The validation of our method is carried out by processing simulated data. [C4998]

"Polarimetric analysis from compact-pol measurements: Potential and limitation"

Global warming is now known to be the major environmental issue mankind will have to face in the next decade. Monitoring of vegetation and biomass is clearly an essential piece of information required at all levels ranging from the scientific studies to understand and forecast, to the political actors and government leaders responsible for drafting remediation policies and evaluating their impact. Microwave remote sensing with the low-frequency SAR technique can provide a useful characterization of forest (spatial coverage, species, density, height...) at a global scale, relying on the all-weather imaging capabilities of SAR linked with the significant penetration of the low-frequency EM wave in the canopy. The published techniques for forest characterization from low frequency SAR data include radiometry inversion, polarimetric inversion based on the anisotropy parameters and PolInSAR Random Volume Over Ground inversion. In this paper, we will more specifically concentrate on the PolSAR technique and the impact of ionospheric effect. [C4999]

"Soil moisture estimation using a multi-angular modified three component polarimetric decomposition"

In this paper a modified three component polarimetric decomposition incorporating multi-angular acquisitions is developed to estimate soil moisture under vegetation cover over agricultural areas. The approach is applied on fully-polarimetric L-band data acquired by DLR's airborne E-SAR sensor in the frame of the OPAQUE campaign conducted in May 2008 in the Weißeritz catchment area, near Dresden, Germany. The results for the estimated soil moisture from the overlapping area of the flight strips demonstrate a significant increase of the inversion rate, if more than one acquisition is used. The inverted soil moisture values are validated against in situ measurements for five test fields with different crop types resulting in an RMSE of approximately 7vol.% for different incidence angle constellations. Finally the results show how topographic effects in the soil moisture retrieval can be compensated by multi-angular constellations. [C5000]

"One-dimensional radar interferometry for line infrastructure"

Here we present an efficient algorithm to analyze the deformation behavior of line infrastructure, such as water defense structures and railways, using radar interferometric time series. Due to the limited amount of pixels and the consistent reflection properties, a detailed analysis can be performed. By considering neighboring pixels, the influence of a large part of error sources is reduced. However, the strong correlation between pixels should be considered. The algorithm is applied to dikes in the Netherlands, showing global as well as local deformation effects. [C5001]

"InSAR permanent scatterers selection using SAR SVA filtering"

Permanent scatterers (PS) approach allows the identification of radar targets not affected by decorrelation noise then suitable for reliable SAR interferometric measurements. This paper introduces a new technique allowing the selection of stable scatterers based on adaptative SVA (Spatially Variant Apodization) filtering. Indeed, SVA filters identify SAR pixels with strong reflectivity (maximum of the mainlobe) over a long temporal series of interferometric SAR images which is the main feature of Permanent Scatterers pixels. A comparison between PS candidates pixels and selected SVA pixels is discussed in this study. [C5002]

"Simulation and optimization of the performance of space-borne radar ocean wave spectrometer"

In this paper, a simulation method is presented to analyze and to optimize the performance of a real aperture radar system for measuring oceanic directional wave spectra, taking into account of data processing parameters. The results show that spaceborne radar ocean wave spectrometer (SB-ROWS) can measure spectra of fully developed waves with significant wave heights (SWH) over approximately 2.0 meter and swell surface under low wind conditions. The minimum detectable wavelength in the study is about 40 m. The wavelength resolution for a wavelength of 200 m is better than 30 m, and the directional resolution after averaging is better than 20°, [C5003]

"Investigation of Radarsat-2 and Terrasar-X data for river ice classification"

To date, monitoring of river ice using remote sensing has mainly focused on the use of mono-polarized and multi-polarized C-band radar data only. In this paper, Support Vector Machine (SVM) classifications using polarimetric parameters are tested to identify types of river ice. Classification algorithms are validated on the newly available C-band Radarsat-2 and X-band Terrasar-X data to investigate the potential of this new imagery, acquired in winter 2009. An electromagnetic model is improved to simulate the polarimetric response of a river ice cover to understand the interactions of the radar signal with the ice cover. At C-band, using dual-polarized data over mono-polarized data increases by 23.9% the final classification producer accuracy. Furthermore, the best producer accuracy is 91.6% when using dual-pol data at C-band, which stand for a gain of 2.2% compared to dual-pol data at X-band. [C5004]

"Multi-thematic exploitation of TerraSAR-X images in the context of the kalideos reference datasets"

This paper presents the use of TerraSAR-X images in the context of the Kalideos programme, which aims at providing the user community with time series of multi-spectral (optical and radar) and multi-resolution remote sensing imagery. 120 TerraSAR-X acquisitions are scheduled for three distinct thematics: volcano monitoring (Reunion island site), sugarcane crop monitoring (Reunion island site) and forest monitoring (Arcachon/Landes forest site). We describe here the advancement of these studies, focusing on sugarcane crop monitoring which is the most advanced one. These studies will serve as typical examples of multi-thematic use of TerraSAR-X imagery and demonstrate the relevance of TerraSAR-X imagery for the development of scientific reference datasets. [C5005]

"Analysis of first Terrasar-X along-track InSAR-derived surface current fields"

The potential of the along-track interferometric SAR (along-track InSAR, ATI) modes of TerraSAR-X for high-resolution imaging of surface current fields has been discussed in several publications. In this paper we show first results based on actual TerraSAR-X ATI data, explain our data processing procedure, and give an update on the status of the instrument and on upcoming developments. [C5006]

"Monitoring a tunneling in an urbanized area with Terrasar-X interferometry-Surface deformation measurements and atmospheric error treatment"

We present results from a deformation monitoring to demonstrate potential and limitations of TerraSAR-X interferometry to measure vertical displacements due to the tunneling of main sewerage pipes along the river Emscher in Germany. In spite of higher sensitivity for deformation gradients the potential for deformation monitoring benefits from high spatial and temporal resolution of the TerraSAR-X data. We analyzed a large stack of TerraSAR-X stripmap scenes to derive regional pattern of vertical displacements with differential SAR Interferometry and small-scale displacements and deformation of objects (infrastructure and houses) in time series of SAR-scenes with Persistent Scatterer Interferometry (PSI). First results from PSI are promising with a great number of detected PS. We show deformation measurements with Artificial Corner Reflectors. Short-time interferograms (11 or 22 days) show high coherence for large areas and therefore are likely less infected by unwrapping errors. Atmospheric errors are important for X-Band SAR. Expected deformation in our application is in the range of mm to cm, similar to tropospheric delay features in their spatial and temporal extent. The atmospheric phase screen in PSI and stacking procedures are smoothing the nonuniform deformation history of progressing tunneling. [C5007]

"Experimental results with bistatic SAR tomography"

This paper gives a quick overview of inversion methods for bistatic tomographic processing. The methods are tested over simulated and real data. The real data has been acquired from a set of indoor experiments carried out in the Radiation Laboratory (RadLab), at the University of Michigan. A scale model with a house, some trees and a rough surface on the ground has been built to reproduce an urban scenario. [C5008]

"A GPS signal based numeric range migration algorithm of space-surface bistatic SAR"

In this paper, we present a new numeric bistatic range migration algorithm (RMA), specifically designed for GPS signal based space-surface bistatic SAR(SS-BSAR). It can be applied to any arbitrary trajectory BSAR imaging system. Based on the principle of stationary phase and the geometric relationship of the SS-BSAR, a two dimensional (2-D) precise analytic response expression of point targets in frequency domain is deduced first. Then a numeric RMA is proposed which match function and interpolation function are derived numerically. The proposed RMA can process wide SAR scene at once and the shape distortion can be corrected at the same

time. Simulation results illustrate the validity of the proposed approach. [C5009]

"Chirp scaling algorithm for parallel bistatic SAR data processing"

This paper discusses parallel bistatic synthetic aperture radar (SAR) processing using chirp scaling algorithm. The key step is to use an analytical form of the signal spectrum derived by the geometry-based bistatic formula (GBF) method. With the above formula, a chirp scaling (CS) algorithm is proposed for azimuth-shift-invariant bistatic SAR processing. The presented algorithm can well resolve the range variation of motion through range cell (MTRC) for bistatic SAR, and requires no interpolate; it requires only FFTs and complex multiplies, these attributes lead to efficient implementations of FFT-based signal processors and high speed parallel processors; it can be used for high resolution image formation. [C5010]

"Study on bistatic SAR ocean wave imaging mechanism"

In order to develop bistatic SAR ocean investigation, the first issue is the study of bistatic SAR ocean surface imaging mechanism. And velocity bunching mechanism is a SAR inherent modulation. Thus, the intensity expression in the bistatic SAR image plane is derived in this paper. The expression describes quantitatively the displacement of the scatter elements in the image plane and a degradation in radar resolution in azimuthal direction. In addition, a bistatic SAR linear velocity bunching transfer function is obtained in the linear parameter regime. Finally, this paper analyzes qualitatively the effects that various platform observation conditions have on the bistatic SAR linear imaging range of wave spectrum. [C5011]

"A new calculation method of NuSAR for translational variant bistatic SAR"

Processing bistatic SAR image all through numerical calculation is the concept of NuSAR. In this paper, the block scheme of NuSAR is modified to handle the translational variant case. Then a new calculation method of NuSAR is provided, which saves half of the memory compared with the existing calculation method. The provided new NuSAR is practical and can handle the spaceborne-airborne configuration. [C5012]

"On the accuracy of scatterers LOS rotation estimation procedures in radar polarimetry"

The Line-of-Sight (LOS) rotation angle of scatterers can be estimated using polarimetric radar measurements. Exact estimation is unrealistic since noise and clutter are almost always present in the data. The paper presents the derivation of an approximated distribution, mean bias and variance analysis, of the scatterers LOS rotation angle using polarimetry, when estimated for the high-coherent (quasi-deterministic) scattering case. Example of scatterers fulfilling such condition are the so-called Coherent Scatterers (CSs). [C5013]

"Validation of RADARSAT-2 Polarimetric SAR measurements of ocean waves"

Four C-band fully polarimetric synthetic aperture radar (POLSAR) images of ocean waves from the RADARSAT-2 SAR are used to measure ocean slopes and wave spectra. A new technique has been developed to measure wave slopes in the SAR azimuth and range directions. The POLSAR ocean wave parameter measurements were validated with in situ observations from an NOAA National Data buoy Center (NDBC) buoy. The results show that wave parameters measured using the new method are in good agreement with in situ NDBC measurement products. [C5014]

"Backscatter and interferometry for estimating above-ground biomass of sparse woodland: A case study in Belize"

Tropical savannas cover 20% of the Earth's land surface and are important ecosystems in the global carbon cycle due to their high productivity. This paper evaluates the use of SAR for estimating above-ground biomass of the woody vegetation in heterogeneous tropical savanna woodland in Belize, Central America. Single-pass shortwave InSAR data used are X-band (Intermap) and C-band (AIRSAR and SRTM). L- and P-band SAR backscatter data are from AIRSAR. Results show that SAR backscatter has a relatively low correlation to above ground biomass in the sparse savanna woodlands. Retrieved canopy heights from both X- and C-band InSAR give a better representation of the spatial distribution of AGB, but cannot be used to estimate biomass directly due to the heterogeneity of the canopy. [C5015]

"Assessment of urban extent and imperviousness of Cape Town using TerraSAR-X and Landsat images"

The worldwide urban growth leads to an increase in impervious surface, which in turn has many negative consequences for the environment. For an assessment of these phenomena in this study first TerraSAR-X radar

data are classified using a knowledge-based approach to detect the extent of urban areas. Subsequently within this area the percentage of imperviousness is estimated by using a Support Vector Regression model with optical Landsat images and high resolution aerial pictures. These methods were developed for urban areas in Germany and transferred to Cape Town, South Africa. The overall accuracy of the settlement detection is 82.3 % and the mean error of the percentage of imperviousness is 14.1 % with a local regression model. It was also possible to apply a model generated for the German city of Munich for Cape Town but the absolute mean error increased to 32.8 %, indicating the necessity to further improve the radiometric adjustment. [C5016]

"Curvelet-based change detection for man-made objects from SAR images"

In this article we present a technique for fast and robust change detection based on the curvelet transform. The curvelet transform is a two dimensional further development of the well-known wavelet transform that reconstructs the original image by ridge-like features, called ridgelets, in different scales, directions and positions. Geocoded SAR amplitude images from TerraSAR-X are compared by differentiating the coefficients of both images in the curvelet coefficient domain. Before the difference image is transformed back to the spatial domain, the influence of the single ridgelets on the resulting image can be manipulated to suppress noise and to intensify structures. Two examples were chosen to show the potential of this approach: a construction site in Germany and an open cast mining area in Chile. Our prototype version is able to compare time series without any interaction of an operator so that the implemented algorithms can easily be embedded into an automatic processing chain. [C5017]

"Geological mapping in the zone of Chotts, Tunisia, using ALOS sensors"

The three sensors onboard the Advanced Land Observing Satellite (ALOS) are the Phased Array L-band Synthetic Aperture Radar (PALSAR), the Panchromatic Remote-Sensing Instrument for Stereo Mapping (PRISM), and the Advanced Visible and Near-Infrared Radiometer type 2 (AVNIR-2). Each of them has been evaluated for the geological mapping of the Zone of Chotts, Tunisia. Both the endoreic basins and the surrounding ranges have been studied. The 10 m-resolution AVNIR-2 sensor is a good trade-off for geological mapping. The 2.5 m-resolution PRISM sensor with its stereoscopic capability is very useful for the detailed study of sedimentary layers. Copolarized radar data are relevant for the study of the flat itself but the C-band is more accurate for sensing the roughness of the finer sediments (sand veneers, evaporites, etc.). The HV polarization is suitable for identifying the presence of halophytic plants that fringe the upper part of the flat. [C5018]

"Extraction of traffic flows and surface current information using Terrasar-X Along-track interferometry data"

TerraSAR-X offers different possibilities for Along-track Interferometry (ATI) SAR data acquisition. This enables to test new SAR applications for the detection and measurement of moving ground objects from space. In this paper we demonstrate space-borne traffic flow measurements using TerraSAR-X ATI data and an automatic traffic data extraction processor. The obtained results evidence the potential of space-borne SAR for this particular application. The traffic information can be derived in near-real time, which underlines the practicability of the method. Another application of TerraSAR-X ATI is the measurement of water surface currents, of which we also show a first example. [C5019]

"Synergetic use of multi-temporal ALOS PALSAR and ENVISAT ASAR data for topographic/land cover mapping and monitoring at national scale in Africa"

The use of Synthetic Aperture Radar (SAR) data in large parts of the African countries, in particular for those close to the equator, is often conditio sine qua non, simply due to the fact that optical data are severely hampered by clouds, especially during the raining (corresponding to the crop) season. The objective of this paper is to present a methodology-and the related results-for the generation of land cover maps and changes over large areas by fusing single-date or interferometric ALOS PALSAR Fine/Dual Beam data with multi-temporal ENVISAT ASAR Image Mode/Alternating Polarization intensity. In synthesis, the method is based on data fusion by exclusively considering-in the prior knowledge-based classifier that requires neither user-defined parameters nor reference samples-the data characteristics and related acquisition modes. Results clearly show that the synergetic use enables the reliable identification of key land cover types (in particular cropped areas, bare soil areas, forestry, forest clear cut, forest burnt areas, water bodies) and their evolution over time, providing basic information on the land cover status. Finally, it is shown that using the same 46-days interferometric ALOS PALSAR data set, a Digital Elevation Model (DEM) with higher quality than the Shuttle Radar Topographic Mission (SRTM) one can be generated in those nearly equatorial-non dense forest-regions. [C5020]

"Exploitation of ALOS-PALSAR SAR full-polarimetry data to the mapping of an African region"

Due to their large scale of observation and their relatively high revisiting frequency, spaceborne SAR systems offer interesting possibilities for the systematic monitoring of land cover. Several techniques have been developed to analyze land cover areas from single-polarization spaceborne SAR data, based on the statistical properties of the reflectivity of such complex media and its spatial variations (texture). The reduced resolution of the data, compared to the airborne SAR case, is a particularly limiting factor. Polarization diversity offers an interesting and powerful alternative mean to characterize land cover areas. In this paper, we propose to use polarimetric SAR acquired by the ALOS sensor at L band, to monitor land cover of an African region. [C5021]

"Advanced paris altimeter based on delay compensation of Doppler Waveforms"

Measuring ocean mesoscale variability is one of the main objectives of next generation satellite altimeters. Among the alternative solutions proposed to overcome the limitations of conventional altimeters, the PARIS concept has been proposed, which exploits GNSS signals reflected from the ocean surface and allows performing altimetry along several points simultaneously over a wide swath with sub-decimeter accuracy in spatial scales of 50-100 Km. The present paper proposes to adopt for a PARIS altimeter a multilook unfocused Doppler processing in order to improve height precision and accuracy. The proposed processing concept is a simplified extension to PARIS of the delay/Doppler processing adopted in conventional radar altimetry. The analyses reported in the paper show that, for open access GPS L5 navigation signal, an improvement of height precision up to 30% could be achieved without modifications to the RF front-end. [C5022]

"Comparing wind speed retrievals from GPS reflectometry with SFMR surface wind speeds in Hurricane Ike (2008)"

Recently, a compact system, able to record raw GPS intermediate frequency (IF) samples has been designed and tested by the research group at the CU/Aerospace Engineering Sciences Department. Such an approach provides the most fundamental measurement, enabling the most advanced and complete post-processing, with data volumes on the order of 1GB/minute. In 2008 this system was flying on board the NOAA WP-3D aircraft which collected research-mission data on Hurricane Ike. During two flights there was collected about 800 GB of raw data for flight legs that transverse the hurricane eye and away from it. After the flights the correlation waveforms for both direct and reflected signals were retrieved from the raw data for all available satellites and sea surface roughness estimates were produced. Those retrievals were compared with the Step Frequency Microwave Radiometer (SFMR) measurements of the surface wind speed. As expected, the data show a high sensitivity of the GPS bistatic radar signals to ocean surface roughness. However, the system of swells generated by various parts of the hurricane complicates the picture and makes the problem of wind retrieval non-trivial. [C5023]

"Performance analysis of a cross-frequency detector of pulsed sinusoidal RFI in Microwave Radiometry"

The performance of a cross-frequency detector against pulsed sinusoidal Radio Frequency Interference (RFI) is analyzed theoretically. The effects of duty cycle and RFI strength are examined, and the detection performance of the cross-frequency algorithm is compared with that achieved by pulse and kurtosis detectors. The performance loss that occurs in the cross-frequency algorithm when an RFI source is not centered in a frequency channel is also quantified, and a computationally simple model for this loss is described. [C5024]

"Sea ice SAR classification based on edge features"

In addition to the areal backscattering, the information in sea ice SAR images is in the edges. Here we propose some novel features for sea ice SAR classification. The features are mainly based on the information extracted from the edges detected by an edge detection algorithm, and segment edges at segment boundaries. [C5025]

"Simulation of GNSS-R returns for delay-DOPPLER analysis of the ocean surface"

We present a new approach to the retrieval of sea surface roughness using GNSS-R. The steps through the simulation of the whole end-to-end microwave scattering of GNSS signals from the sea surface are explained, with emphasis on how to generate a linear sea surface and to implement the Kirchhoff Approximation (KA), as the large-scale part of the full scattering model. We illustrate some examples of radar cross sections calculated using the Kirchhoff scattering model, and how they change with respect to different polarizations. Their variations with geometry, sea state and spatial resolution are investigated and discussed. [C5026]

"Three-dimensional woody vegetation structure across different land-use types and -land-use intensities in a semi-arid savanna"

Factors influencing woody savanna vegetation structure across a land-use gradient of intensity (highly and lightly utilized communal rangeland) and type (national protected area, private game reserve and communal rangelands) were investigated. Small-footprint discrete return LiDAR data (1.12 m point spacing) from the Carnegie Airborne Observatory (CAO) 'Alpha system' were used to measure three-dimensional vegetation structure across the different treatments. A volumetric pixel (voxel) approach was used to characterise the vertical distribution of LiDAR returns, i.e., vegetation density, in one metre increments for comparison using descriptive statistics across the land-use type and intensity gradient. Vegetation structure in the national protected area was most similar to the lightly utilized rangelands, and the private game reserve was most similar to the highly utilized rangelands with low levels of structural diversity present. Current trends in structural diversity can be related to harvesting, regeneration, herbivory and fire. [C5027]

"The use of ALOS PALSAR for supporting sustainable forest use in southern Africa: A case study in Malawi"

Malawi is facing a forest loss crisis with demand far outstripping sustainable supply. Recent projections suggest that there will be no primary forest left in Malawi by 2020. One possibly method to support forest protection has come from the proposed introduction of REDD (Reductions in Emissions from Deforestation and Degradation) schemes into the next international climate protocol. This study aims to assess the ability of ALOS PALSAR for providing biomass estimates in miombo woodland in Malawi. No correlation has been found between ALOS PALSAR backscatter and a number of different forest parameters including biomass, stem diameter at 1.3 meters (dbh), stem volume, and the BCI (Biomass Consolidation Index). [C5028]

"Detailed structural characterisation of the savanna flux site at Skukuza, South Africa"

A detailed structure and composition dataset has been assembled for a 200 m Γ B— 200 m area surrounding the eddy covariance flux measurement tower near Skukuza in the Kruger National Park. The information includes (by species) individual stem mapping, biomass and leaf area, canopy cover and height. Several different techniques were used for most of the attribute estimates, allowing a comparison of methods and an estimation of their accuracy. At the same time that the in situ information was collected (April 2008) using manual, photographic and ground-based laser scanning techniques, hyperspectral reflectance and lidar canopy structure information was gathered at 0.5 m resolution for this patch and a larger surrounding area, using the Carnegie Airborne Observatory sensors. The site has a nine-year record of water, energy and CO₂ fluxes, phenology and various other ecological measurements. Initial findings relating to measurement techniques and basic structural parameters for the site are presented. The intention is to make the data available as a standard calibration site for remotely sensed products. [C5029]

"Tree cover, tree height and bare soil cover differences along a land use degradation gradient in semi-arid savannas, South Africa"

High resolution airborne hyperspectral and discrete return LiDAR data were used to assess bare soil and tree cover differences along a land use transect consisting of state-owned, privately-owned conservation areas, and communal areas in South African savannas. The results show that tree cover is higher in conservation areas as compared to communal areas where local people use fuel wood for personal consumption. Low impact communal sites (limited use) tend to have higher tree cover than higher impacted communal sites. Generally communal areas have altered tree height distribution but in diverse way depending on the geology or the level of human utilization. Bare soil cover was generally found to be quite low (< 10%) in all different land uses, suggesting that the degradation level in communal areas might not be as high as generally perceived. [C5030]

"Development of a simple scattering model for vegetation canopies and examination of its validity with scatterometer measurements of green-onion fields"

A simple scattering model for radar backscattering from vegetated surfaces is developed based on the radiative transfer technique. The number of input parameters of the model is minimized to simplify the scattering model. The validity of the model is examined by comparison between the computation outputs and scatterometer measurements for the backscattering coefficients of green-onion (scallion) fields. [C5031]

"Numerical modeling of a spiral-antenna GPR system"

To better study the ground penetrating radar (GPR) problem, an important step is to develop an accurate simulation of the fields induced by the radiating antennas. In this work, a finite-difference time-domain (FDTD)

model of a spiral-antenna GPR system was developed and verified against measurements of a prototype system. The paper discusses difficulties in modeling the antenna elements and presents evidence that the model properly predicts the response of the antennas to scatterers in the presence of the ground. [C5032]

"Hybrid of the method of moments/ Monte Carlo technique and a surface scattering model for estimating the radar backscatters OF harvested farm fields"

The method of moments/Monte Carlo technique is used to numerically compute the Mueller matrix for radar backscattering from stem-cut cluster sections of a harvested farm field, and a semi-empirical surface scattering model is employed for estimating the radar backscatter of a rough soil surface. The full-wave numerical technique and the surface scattering model are combined to compute the Mueller matrix and consequently the backscattering coefficients of a harvest farm field. This hybrid technique is verified comparing the numerical computations with the experimental measurements for the backscattering coefficients of harvested rice fields. [C5033]

"A fast numerical method for scattering from dielectric rough surfaces"

In this paper we propose a fast numerical method for EM scattering from one-dimensional dielectric rough surfaces. we first employ a new impedance matrix splitting scheme for the associated iterative system. We further develop a block operation method to accelerate computation, which transform a $2N \Gamma_B \rightarrow 2N$ problem to a $N \Gamma_B \rightarrow N$ one. Due to block operation, run time can be saved about 1/3. Through extensive numerical simulation, our proposed method has demonstrated much improved speed over FBM, and considerably improved convergence behavior over FBM-SA. [C5034]

"Wiener prediction-based change detection for locating mines in multilook SAR imagery"

In this paper, we present a Wiener-based change detection method and compare its performance with several other methods for a pair of multi-look synthetic aperture radar (SAR) images of the same scene. We implement and compare several techniques which vary in complexity. Among the simple methods that are implemented are differencing, Euclidean distance, and image ratioing. These methods require minimal processing time, with little computational complexity, and incorporate no statistical information. We also implemented methods which incorporate second order statistic calculations in making a change decision in efforts to mitigate false alarms arising from the speckle noise, misregistration errors, and nonlinear variations in SAR images. These methods include a Wiener prediction-based method, Mahalanobis distance measure and subspace projection method. We compare the performance of these methods using multi-look SAR images containing several targets (mines). We present results in the form of receiver operating characteristics (ROC) curves. [C5035]

"Comparison with CLPX II airborne data using DMRT model"

In this paper, we considered a physical-based model which use numerical solution of Maxwell Equations in three-dimensional simulations and apply into Dense Media Radiative Theory (DMRT). The model is validated in two specific dataset from the second Cold Land Processes Experiment (CLPX II) at Alaska and Colorado. The data were all obtain by the Ku-band (13.95 GHz) observations using airborne imaging polarimetric scatterometer (POLSCAT). Snow is a densely packed media. To take into account the collective scattering and incoherent scattering, analytical Quasi-Crystalline Approximation (QCA) and Numerical Maxwell Equation Method of 3-D simulation (NMM3D) are used to calculate the extinction coefficient and phase matrix. DMRT equations were solved by iterative solution up to 2ndorder for the case of small optical thickness and full multiple scattering solution by decomposing the diffuse intensities into Fourier series was used when optical thickness exceed unity. It was shown that the model predictions agree with the field experiment not only co-polarization but also cross-polarization. For Alaska region, the input snow structure data was obtain by the in situ ground observations, while for Colorado region, we combined the VIC model to get the snow profile. [C5036]

"Estimation of snow water equivalant using a parameterized snow model"

Snow Water Equivalent (SWE) is a crucial parameter in the studies of hydrology and climatology. Estimating SWE by using high-resolution radar systems, especially those capable of providing high-frequency observations, is an important task in the microwave studies. In this paper, a parameterized snow scattering model was first developed to provide the model basis for the snow inversion problems. A scheme based on the parameterized model, analysis on the depolarization factor as well as the scattering and extinction relationships between X and Ku-band snow backscattering signals was then developed for SWE inversion. Initial evaluation on the technique was made through theoretically simulated database. The estimated SWE is found to be well correlated with simulated SWE with an acceptable accuracy. [C5037]

"Contribution of the inter-channel polarimetric coherence for soil classification"

Fully polarimetric SAR (POL-SAR) images provide a large amount of information through the four channels HH, VV, HV and VH. They proved to be useful in many applications such as delimiting homogenous areas. Such large amounts of data require robust processing algorithms with minimal supervision and low complexity, especially for classification purposes. Most existing classification algorithms (H/A/ α for instance) use combinations of some or all the channels as features for classification. In this paper, we present a new approach for polarimetric images classification. We are interested in the information of the inter-channel polarimetric coherence as a feature element for the classification algorithm. The coherence information is known for being used in multi-temporal acquisitions for its advantage of detecting changes in the scenes during time. It is commonly used in interferometry. We want to profit from this information in the case of polarimetric images in order to take advantage of the multi-channel property of the data. This coherence classification approach (reading images, computing the coherence and the classification) will be implemented within the OTB (ORFEO ToolBox), the free software which is dedicated especially for remote sensing imagery processing. The approach is tested using images acquired by the CV-580 airborne near Ottawa, Ontario, Canada. [C5038]

"Retrieval of snow parameters from Ku-band and X-band radar backscatter measurements"

Techniques for the retrieval of snow properties from Ku- and X-band radar backscatter measurements were investigated. The work contributes to feasibility studies for the CoReH2O satellite mission of ESA for which a dual frequency SAR, operating at Ku-band (17.2 GHz) and X-band (9.6 GHz), VV and VH polarizations, is proposed. A main parameter to be measured is the snow water equivalent (SWE). For the retrieval of SWE it is necessary to separate the backscatter contributions of the snow volume and the background target and to account for effects of snow grain size. The current version of the SWE retrieval algorithm applies the maximum likelihood approach matching radiative transfer forward computations with measured backscatter data. An application example for SWE retrieval is shown for the Cold Land Processes Experiment (CLPX-II) in Alaska, using Ku-band data of the NASA-JPL PolScat and X-band data of the TerraSAR-X satellite as input. [C5039]

"Polarimetric analysis over African savanna woodland using ALOS/PALSAR"

This paper presents polarimetric analysis over African Savanna woodland using ALOS/PALSAR to investigate the trend between backscatter and biomass levels. An extensive field inventory was carried out combining Differential GPS and conventional topographic mapping techniques. Geographic position, basal diameter and height of trees in sampled plots were measured. Plot level biomass quantities were obtained using established allometry for the region. Geocoded ALOS/PALSAR level 1.1 and 1.5 data is checked for accuracy against existing geospatial data for the case study area. Sigma nought, Freeman and Pauli component are extracted for the sampled plots to investigate the relationship between biomass, volume and double bounce scattering. Finally a comparison of sigma nought, Freeman and Pauli components is carried out to analyze trend against volume and double bounce scattering. [C5040]

"Polarimetric scattering feature estimation for accurate vegetation area classification"

This paper proposes an accuracy improvement of the vegetation area classification based on the POLSAR image analysis, when vegetation and man-made areas are both included in the radar target region. Here we introduce a simple compensate polarimetric marker, T13 or T31, to accurately distinguish the unexpected scattering from the obliquely oriented man-made targets and the complex volume scattering generated from vegetation area. T13 or T31 is the (1, 3) or (3, 1) elements of the 3×3 averaged coherency matrix ($[T]$), and has not been effectively utilized in the general scattering power decomposition scheme. By appropriately utilizing T13(T31), one can extract only the vegetation area from the mixed target region. It is verified from the detailed analysis that the proposed marker T13(T31) works well not only for Pi-SAR data but also for ALOS/PALSAR data. [C5041]

"Subsatellite experiments in the north-eastern part of the Black Sea"

Space-time variability of current field characteristics, surface waves, and parameters of the near-surface atmospheric layer above the shelf zone of the Black Sea in the Gelendzhik-city region are studied. A joint analysis of the field measurement data obtained on August, 2007, September, 2008 and of the synchronous SAR images made by the Envisat satellite of the European Space Agency is carried out. [C5042]

"Soil moisture and vegetation height retrieval using GNSS-R techniques"

Global Navigation Satellite Signals Reflections (GNSS-R) techniques are currently being used for remote sensing purposes retrieving geophysical parameters over different types of surfaces. Over the ocean, sea state

information can be retrieved to improve the ocean salinity retrieval. Furthermore, over land these techniques can be used to retrieve soil moisture. This paper presents the theoretical and experimental results of using GNSS-R to retrieve soil moisture when vegetation is present. The particular technique being applied in this study is the Interference Pattern Technique (IPT) that measures the interference pattern of the GPS direct and reflected signals, after reflecting over the surface. [C5043]

"Combining SAR and optical features in a SVM classifier for man-made structures detection"

The increasing quality of satellite images has generated interests in extracting man-made structures in urban areas, such as buildings and roads. A classification adapted to urban areas can help to identify these structures. In this paper, SAR information are used to improve land-cover classification. We proposed a classification process using both radar and optical data, a segmentation and a classification with Support Vector Machines (SVM). [C5044]

"Non-linear internal waves in the Banda Sea on satellite synthetic aperture radar and visible images"

Comprehensive study of non-linear internal waves (IWs) in the Banda Sea was carried out. IWs were detected on quick look and full-resolution SAR images acquired by ERS-1, ERS-2, Envisat and ALOS as well as on Terra and Aqua MODIS and Landsat ETM images. IWs were generated by a sill between Alor and Atauro Islands in Ombai Strait connecting the Banda Sea with the Savu Sea. The IWs form packets, propagating northward into the Banda Sea and have the classic appearance of rank ordered non-linear waves that depress the pycnocline. The length of the wave packets reached 100 km and more and packets could consist of 15-20 and more solitons. The maximum wavelength was approximately 12-15 km. The phase speeds of the waves varied from approximately 2.2 m s⁻¹ to 3.1 m s⁻¹ for the leading solitons in the packets. Wave crests in the packets formed semicircles, the length of which exceeded 350 km. [C5045]

"Techniques and examples for the 3D reconstruction of complex scattering situations using TerraSAR-X"

The German radar satellite TerraSAR-X was launched in June 2007. Since then, it is continuously providing high resolution space-borne radar data which are perfectly suitable for sophisticated interferometric applications. I.e. the mission concept and the SAR sensor support the coherent stacking of radar scenes which is the basis for advanced processing techniques e.g. Persistent Scatterer Interferometry (PSI) and SAR tomography. In particular, the short repeat cycle of eleven days and the highly reproducible scene repetition of the spotlight acquisitions support the stacking and consequently the time series analysis of the radar data. Furthermore, the sensor's orbital tube is precisely controlled to be in the order of 200 m which basically allows to utilize the baseline spread of the stacked acquisitions. However, this small spread is actually limiting the resolution in the SAR tomography. Interferometric applications could be demonstrated already in a very early stage of the TerraSAR-X mission. Because the resolution is 0.6 m in slant range and 1.1 m in azimuth in the high resolution spotlight mode the PSI and the SAR tomography processing results were impressive. Urban areas and single buildings could be mapped from space in three dimensions. Even the structural stress of single buildings caused by thermal dilation could be demonstrated. However, extended layover areas are caused by typical buildings and as a consequence complicated scattering situations need to be resolved. DLR's operational In-SAR processing system GENESIS had already been adapted to cope with the new sensor modes of TerraSAR-X and their new specific spectral characteristics. Now, the new image characteristics e.g. the extended layover areas and the long time coherent distributed scatterer need better to be supported. Subject is to optimally exploit the available information e.g. the radar reflectivity. Several algorithms of the processing system can take advantage of this, e.g. the scatterer-configuration detection. As a matter of fact, the scatterer configuration has now become a very important characteristic for each resolution cell. It influences e.g. the estimation data extraction, the estimation of the 3D location and basically the estimation precision. A typical resolution cell can be composed of a single dominant point scatterer surrounded by clutter, two or more dominant point scatterers in clutter and of distributed scatterers with a specific phase stability over time. The paper provides technical details and a processing example of a newly developed algorithm to retrieve the 3D location of point scatterers from the scene's intensity which finally also provides the information on the scatterer configuration in a resolution cell. [C5046]

"Method of persistent scatterer pairs (PSP) and high resolution SAR interferometry"

Synthetic aperture radar (SAR) interferometry is an effective technology for detection and monitoring of slow terrain movements with millimetric resolution. This information is extracted by means of complex techniques from the phase of the signal, which is wrapped modulo 2π and affected by noise and systematic terms. We have recently proposed a new method, named persistent scatterer pairs (PSP), aimed at overcoming some limitations

of standard persistent scatter interferometry (PSI) techniques. The method is characterized in that it works only with pairs of nearby pixels both for selecting and analyzing the persistent scatterers (PS), thus being intrinsically not affected by artifacts slowly variable in space, like those depending on atmosphere or orbits. Moreover, the method does not require an initial selection of PS based on the radar backscattered amplitude. In this work, after resuming the main ideas of the PSP method, we show some results obtained in extensive applications with ERS/ENVISAT data, and the first results obtained with high resolution COSMO-SkyMed images. [C5047]

"Classification of polarimetric SAR data over wet and arid regions of India"

Polarimetric SAR data from ALOS PALSAR, SIR-C and ENVISAT ASAR over wet and arid regions were processed for classification and soil moisture estimation. HH and HV dual polarized ALOS PALSAR could classify wetlands of Mumbai coastal area with an accuracy of 96%, whereas fully polarized SIR-C data over Kolkata gave 92% accuracy. The accuracies are based on selected training areas and not based on test areas. ALOS PALSAR could clearly discriminate water, mangrove forest and ocean water. With Dual polarized data, discrimination between Ocean water and wetlands is not possible. Several features in arid data can also be classified using PALSAR data in addition to the estimation of soil moisture. [C5048]

"Investigation of multiple frequency polarimetric SAR signal backscattering from tidal flats"

The tidal flats are largely developed along the western and southern coast of Korean peninsula. The simulation results of tidal flats through analytical scattering models could not be fully assessed by using only surface roughness (RMS height and correlation length) and soil moisture. The tidal flats are usually saturated with saline sea water and partially covered with remnant water in depressions. This may cause lower backscatters in SAR images due to the partial specular reflection. [C5049]

"Uncertainty in scatterometer derived vorticity"

A more versatile and robust technique is developed for determining area averaged surface vorticity based on vector winds from swaths of remotely sensed wind vectors. This technique is discussed in detail and compared to two previous studies that focused on early development of tropical systems. The error characteristics of the technique are examined in detail. Specifically, three independent sources of error are explored: random observational error, truncation error and representation error. Observational errors are due to random errors in the wind observations, and determined as a worst-case estimate as a function of averaging spatial scale. The observational uncertainty in vorticity averaged for a roughly circular shape with a 100 km diameter, expressed as one standard deviation, is approximately $0.5 \text{ fB} \cdot 10^{-5} \text{ s}^{-1}$ for the methodology described herein. Truncation error is associated with the assumption of linear changes between wind vectors. Uncertainty related to truncation has more organization in QuikSCAT data than observational uncertainty. On 25 km and 50 km scales, the truncation errors are very large. The third type of error, representation error, is due to the size of the area being averaged. This type of error is analogous to over-smoothing. Tropical and sub-tropical low pressure systems from three months of QuikSCAT observations are used to examine truncation and representation errors. Representation error results in a bias of approximately $1.5 \text{ fB} \cdot 10^{-5} \text{ s}^{-1}$ for area averaged vorticity calculated on a 100 km scale compared to vorticity calculated on a 25 km scale. The discussion of these errors will benefit future projects of this nature as well as future satellite missions. [C5050]

"Velocity estimation of moving targets on the sea surface by azimuth differentials of simulated-SAR image"

Since the change in Doppler centroid according to moving targets brings alteration to the phase in azimuth differential signals, one can measure the velocity of the moving targets using this. In this study, we will investigate theoretically measuring velocity of an object from azimuth differential signals by using range compressed data which is the interim outcome of treatment from the simulated Synthetic Aperture Radar (SAR) Raw data of moving targets considering sea clutter. Also, it will provide evaluation for the elements that affect the estimation error of velocity from a single SAR sensor. In the concrete, by making RADARSAT-1 simulated image, the research includes comparisons for the means of velocity measurement classified by directions of movement as in the four following cases. 1. A case in which the object that becomes the target exists independently, 2. When there is a tidal current of 1 m/s, 3. When there exists moving targets of different velocity on the azimuth, 4. When the target is contiguous to the land where it has high back scatter factor. As a result, when the object, which becomes the target, independently exists on SAR image in the range of 128 pixels, the velocity of object could be measured with high accuracy. However, when there existed other moving targets in the range of 128 pixels or when the target was contiguous to the land of high back scatter factor, the velocity was in error by 10% at the maximum. This is because in the process of assuming the target's location, an error occurred due to the disturbed signals affected by the scatterers. [C5051]

"Polarimetric analysis of the dependency of backscattering from ocean surface on wind direction"

The dependencies of the backscattering from the ocean surface on the wind direction are analyzed by using the Pi-SAR under weaker wind condition (5 m/s) than the former analysis under stronger wind as 14 m/s. In the X-band HH polarization, the dependency of the normalized cross section (NRCS) on wind direction depends on the incidence angle, differently from the former analysis. In the X-band VV polarization, the NRCS represents weak incidence angle dependency as same with the former analysis. As a result, the dependency of the polarization ratio (PR) in the X-band on the wind direction also depends on the incidence angle. In the L-band, the dependencies of the NRCS and the PR are also weak, same as the former analysis. [C5052]

"The development of a C-band Advanced Scatterometer (ASCAT) geophysical model function at NOAA/NESDIS"

Validation of the ASCAT wind vectors show that the ASCAT wind speed errors are within 2 m/s RMS error for wind speeds up to 15 m/s, however they exhibit and increasing low bias beyond 15 m/s. An examination of the ASCAT Г, Bi0 revealed some additional sensitivity at the higher wind speeds that was not adequately represented by the current geophysical model function (GMF). A revised GMF is empirically derived using a near-real-time QuikSCAT as a surface truth. A new DC term in the GMF is derived and replaced in the operational CMOD5.5 GMF. Validation of the revised GMF shows that the wind speed retrievals are closer to QuikSCAT for wind speeds > 15 m/s than the operational retrievals, while wind direction retrievals remain the same for all wind speeds as expected. [C5053]

"Weather hazard interpretation and nowcast by radar"

A method for modeling and tracking convective clouds within radar images is presented. An object modeling approach is used, based on the extraction of grayscale skeletons from 2-dimensionnal cross-section of 3-dimensional radar data. Grayscale skeletons are appropriate shape descriptors for non-rigid and heterogeneous objects, in which gray-level local maxima correspond to regions of interest. The modeling scheme is enhanced by linking meta-data to some chosen points of the skeleton; this provides a good representation of the weather scene in terms of hazards for an aircraft. Skeletons are stored within a graph structure and tracked among successive pictures by means of relaxation labeling processes. The deduced advection field is used to nowcast the clouds evolution. Preliminary results are satisfying concerning advection forecast. [C5054]

"Scale decomposition of precipitation patterns and nowcasting in a high-resolution X-band radar network"

Shortterm weather forecasting (nowcasting) performance can be improved by spatially filtering radar images of precipitation patterns and either predicting only those precipitation scales most representative of pattern motion or removing unpredictable scales after prediction. Previous research has shown that improvement in nowcasting precision can be obtained by first applying an elliptical spatial filtering procedure to observed WSR-88D Vertically Integrated Liquid water data to predict larger-scale features believed to better represent the motion of precipitation patterns. Another study used the wavelet transform to develop measures of predictability at each scale and designed adaptive wavelet filters to remove perishable scales from predicted continental-scale reflectivity data. This study investigated the adaptation of both approaches and Fourier filtering to examine the effects of scale filtering on nowcasting performance using a spectral-based nowcasting method and high-resolution Collaborative Adaptive Sensing of the Atmosphere radar reflectivity data. [C5055]

"Salient features of the radar nodes in the Puerto Rico tropical weather testbed"

A tropical weather testbed, inspired by the CASA IP1 radar network, is to be constructed on the western coast of the island of Puerto Rico. This new radar network testbed will address Quantitative Precipitation Estimation (QPE) in a tropical environment. The testbed will consist of three low-power, short-range, dual polarized X-band Doppler radars. Special considerations were taken in the design of the radar, as related to the tropical seaside environment of the proposed site locations, where high temperatures, humidity, and elevated salinity in the air are common. The goal of the network is to study tropical weather events in the lower 2 km of the troposphere, where reduced accuracy of precipitation estimates by conventional weather radar can occur. This paper will describe the characteristics of the network radar nodes. [C5056]

"Surface manifestations of non-tidal internal waves in the north-eastern Black Sea as viewed by satellite sensors"

In present paper the satellite remote sensing data (obtained by Envisat ASAR, Terra and Aqua MODIS, and

NOAA AVHRR instruments) is used to study coastal dynamics of the north-eastern Black Sea. Surface manifestations of internal wave (IW) packets were registered in ASAR images of the sea surface. Possible factors leading to the generation of non-tidal IWs are determined on the basis of joint analysis of available satellite remote sensing data of the sea surface in microwave, visual and IR ranges complemented by contact measurements. A mechanism of IW generation is suggested. The coherence between occurrence of IW surface manifestations and location of the density pycnocline layer is established. [C5057]

"Exploiting Markov random fields in Microwave tomography"

3D microwave tomography is an ill-posed and nonlinear inverse problem whose reconstruction performances may be impaired from the complexity of the scenario to be considered in the real world applications. The joint adoption of convenient regularization schemes and a suitable rewriting and linearization of the pertinent scattering model can allow to achieve satisfactory solutions in many cases of practical interest. In this communication, an innovative inversion approach which takes definite advantage from the joint use of the linearized contrast source-extended Born model (CS-EB), and from a Markov random field (MRF) based regularization scheme is proposed. [C5058]

"Multi-baseline POL-inSAR statistical techniques for the characterization of distributed media"

This paper presents principles and robust techniques to estimate physical parameters of natural environments using Multi-Baseline Polarimetric and Interferometric SAR (MB-POL-inSAR) data. The first part of this paper concerns the abstract topic of MB-POL-inSAR coherence optimization. The second part is dedicated to the general estimation of the coherence line model parameters [1]. It is demonstrated that the line parameters can be estimated in an analytical and robust way by using the whole available POL-inSAR information. [C5059]

"K-way tree classification based on semi-greedy structure applied to multisource remote sensing images"

In this paper we present a new supervised classification method, referred to as the k-way tree semi-greedy (KTSG) classifier, for the classification of multisource remote sensing images. The generalized positive Boolean function (GPBF) classifier scheme is recently proposed based on minimum classification error (MCE) criteria to improve classification performance. It makes use of MCE criteria to apply positive and negative samples as training parameters. Unfortunately, the classification performance of GPBF is limited when the number of classes increases. This is occurred in training phase by the unbalanced numbers of positive and negative samples caused by the use of a large number of classes. The proposed KTSG overcomes this drawback by modifying the scheme from the perception of pattern-node based semi-greedy (bottom-up scheme used in GPBF) to the conception of region-based semi-greedy (also known as the top-down scheme in KTSG). It is organized by a k-way tree in which every node is composed of a set of k-dimensional positive and negative labeled samples as represented as a percentage, i.e. the corresponding ratio of number of a specific (positive) class samples to the total number of the other (negative) classes. It iteratively divides the d-dimensional hyperplane into 2d subspaces according to the centroids of the labeled (training) samples of all classes. The statistical ratios between different classes are then compared as a basis for stopping the new subspace separation and identifying which subspace belongs to which class. By delivering both positive and negative samples of different classes to KTSG learning modules, KTSG outperforms GPBF and traditional classifiers in terms of classification accuracies. The effectiveness of the proposed KTSG is evaluated by fusing MODIS/ASTER airborne simulator (MASTER) hyperspectral images and airborne synthetic aperture radar (AIRSAR) images for land cover classification during the Pacrim II campaign. [C5060]

"Estimation and segmentation in non-Gaussian POLSAR clutter by SIRV stochastic processes"

In the context of non-Gaussian polarimetric clutter models, this paper presents an application of the recent advances in the field of Spherically Invariant Random Vectors (SIRV) modelling for coherency matrix estimation in heterogeneous clutter. The complete description of the POLSAR data set is achieved by estimating the span and the normalized coherency independently. The normalized coherency describes the polarimetric diversity, while the span indicates the total received power. Based on the SIRV model, a new maximum likelihood distance measure is introduced for unsupervised POLSAR segmentation. The proposed method is tested with airborne POLSAR images provided by the RAMSES system. [C5061]

"An algebraic approach to ground-volume decomposition from multi-baseline PolInSAR data"

In this paper, an algebraic methodology is described for the separation of ground and volume contributions basing on multi-baseline and multi-polarimetric acquisitions. As a result, a new general procedure is defined that encompasses single-baseline PolInSAR as a special case, and allows to proceed to ground/volume separation

not only through model based approaches, but also through model free and hybrid approaches. Furthermore, it will be shown that such a methodology yields the best solution in the Least Square sense. [C5062]

"Semi-supervised learning for classification of polarimetric SAR-data"

Supervised learning algorithms are important methods to automatically interpret image data in general as well as PolSAR data in particular. However, they suffer from the need of a training set, which has to contain manually labelled data. Un-supervised methods do not demand this kind of data, but cannot be directly used to assign user-defined class labels to image regions. This paper proposes a semi-supervised method to overcome both shortcomings. The data is analysed by an un-supervised clustering algorithm under the usage of all available information. Simultaneously each pixel is classified by a supervised method using the information available at the current phase of clustering. [C5063]

"Full-resolution adaptive differential tomography"

Recently, a new interferometric mode crossing the differential SAR interferometry and multibaseline SAR tomography concepts, termed differential SAR tomography, has been proposed. Its potentials, coming from the joint elevation-velocity resolution capability of multiple scatterers, have been demonstrated both theoretically and with real data. Processing is cast in a two-dimensional baseline-time spectral analysis framework, with sparse sampling. The use of adaptive two-dimensional spectral estimation has been shown to allow joint baseline-time processing with reduced sidelobes and enhanced elevation-velocity resolution. However, this method requires coherent multilooking processing, thus does not produce a range-azimuth full resolution differential tomographic product. In this work a new single-look adaptive differential tomographic processor is presented, to allow range-azimuth full resolution together with the good elevation-velocity sidelobe and resolution capabilities of adaptive processing. Simulated results are reported for different baseline-time acquisition patterns, both monostatic and multistatic, and different motion conditions of layover scatterers. [C5064]

"Cross-comparison and validation of MODIS AQUA cloud mask by using CLOUDSAT and CALIPSO datasets"

This paper presents a cross-comparison of the data acquired by the MODIS, CLOUDSAT and CALIPSO sensors in order to understand the limit of the developed cloud-mask algorithm and to provide a quantitative validation assessment by using exclusively remotely sensed data. The comparison has been carried out by considering both the cloud mask and the intermediate levels such as the brightness temperatures and the reflectance values for different channels from which the cloud mask is derived. The preliminary analysis indicates a general good agreement among the different sources. A main underestimation of cloud cover is present on the sea and especially for high thin clouds. First results indicate that in order to increase the cloud cover accuracy the threshold for the intermediate levels (brightness temperature and reflectance values) may be changed by taking into account also the cloud vertical profiles. [C5065]

"An end-to-end error model for classification methods based on a SAR intensity ratio"

This paper aims at defining the expression of the probability of error of classification methods using a Synthetic Aperture Radar (SAR) intensity ratio as a classifier. The two SAR intensities involved in this ratio can be measurements from different dates, polarizations or possibly also frequency bands. Previous works provided a baseline expression of the probability of error addressing the two-class problem with equal a priori class probabilities and no calibration error. This study brings up a novel expression of the error, providing the possibility to assess the effect of class probabilities and calibration errors. The effect of calibration errors such as channel gain imbalance and radiometric stability is assessed in the general case. Results indicate that channel gain imbalance is generally not a decisive parameter, but that radiometric stability is more critical in methods based on the temporal change. This error model can be used to test the impact of other SAR system parameters (time-lapse between repeat-pass orbits, ambiguity ratio, number of looks) and constitutes a tool for the design of future SAR missions and for the development of robust classification methods using existing SAR instruments. [C5066]

"Detection of double scatterers in SAR Tomography"

Multi-Dimensional (3D/4D) SAR imaging (SAR Tomography and Differential SAR Tomography) allows the localization and monitoring of ground scatterers, even interfering in the same azimuth-range pixel. Indeed, the presence of multiple scatterers has shown to affect even the performances of high resolution radar systems. In this paper we discuss two strategies for the detection of interfering scatterer pairs. The first one is based on the extension of the GLRT test already proposed for the detection of single scatterers, the second one is based on

the BIC criteria commonly used in the contest of model order selection. Performances of the two decision schemes are evaluated on simulated data. [C5067]

"A preliminary study on deforestation monitoring in Sumatra Island by PALSAR"

An L-band normalized radar cross section (NRCS) characteristic derived from the Phased Array L-band Synthetic Aperture Radar (PALSAR) 50-m resolution dual-polarization mosaic and the land cover database in Riau province, Sumatra Island, represent that HV signals of natural forests are 2-3 dB larger than those of cleared and many plantations, indicating the usefulness of HV measurements for the detection of new deforestation. The 2007 and 2008 mosaic series, in fact, elucidates 3dB decreases in the HV channel for major deforested areas. On the other hand, HH shows no significant changes. 46-day repeat ScanSAR observations clarify common HH signal changes for the deforestation: they once increase departing from the annual cycle of natural forests and reach a peak in a rainy season. The result suggests the availability of the ScanSAR-derived HH time series for near-real-time deforestation monitoring. A HH signal variation on an acacia plantation cycle represents a similar characteristic to that for the deforestation: HH anomalously increases during the subsequent rainy season after the plantation. The increase level depends on an incidence angle, suggesting the dominance of surface scattering component over young acacia areas. With analogy with deforestations, it is suggested that the incidence angle dependency seems to be considered for the deforestation monitoring by ScanSAR. [C5068]

"Aspects of 3D tomography for multiple-pass spotlight-mode airborne SAR"

Three-dimensional SAR tomography makes use of radar data acquired at different depression angles to synthesise an aperture in elevation and thereby undo layover and resolve along height. Focusing on one tomographic method appropriate to a spotlight-mode airborne collection system, the details of spatial bandwidth usage and point-spread function are described, and the phase modulation effects of the initial two-dimensional image formation stage are analysed in terms of the impact on the tomographic processing. Finally, an adaptive beamforming approach is investigated for the improvement of height resolution. [C5069]

"Multiple scatterers identification in complex scenarios with adaptive differential tomography"

In the last few years, the interest is increasing in the interferometric processing of multibaseline/multitemporal SAR data from complex urban or infrastructure areas. In order to locate and monitor a high number of ground structures with the lowest signal misinterpretation, the identification, i.e. the detection and height and deformation velocity estimation, of both single and multiple layover scatterers is an important step. This issue is addressed here by extensively experimenting the technique of adaptive differential tomography, a recent interferometric framework which allows to resolve multiple moving scatterers at different heights in the same SAR cell. To this aim, adaptive differential tomography is augmented with an automated information extraction algorithm. The technique has been applied to real C-band spaceborne data over an urban area. Corresponding results are discussed. [C5070]

"On the ability of the ERS scatterometer to detect vegetation properties"

The ability of the active microwave remote sensing to complement existing optical vegetation indices has been explored by variety of studies. To demonstrate these complementarities, we investigate synergies between the slope parameter from the ERS scatterometer (ERS-SCAT) and the Normalized Difference Vegetation Index (NDVI). While the NDVI is strongly linked to the absorption of photosynthetically active radiation (PAR), the active microwave signal has the ability to penetrate partially a vegetation canopy, bouncing back from its stalks and stems and so returning a signal (i.e. backscatter) that is influenced by the canopy structure. While this interaction is rather complicated and not fully understood, this study suggests the ability of the ERS-SCAT slope parameter to differentiate between varieties of structural vegetation properties and complement so to existing optical vegetation indices. [C5071]

"A three-dimensional imaging algorithm for tomography SAR"

The three-dimensional image quality of tomography SAR is limited by the non-uniform track distribution in repeat-pass data acquisition. In order to overcome the drawbacks of known methods caused by the non-uniform track distribution, a new three-dimensional imaging approach is proposed based on backprojection for tomography SAR in this paper. Raw data of tomography SAR in X-band is simulated and three-dimensional image is achieved. The imaging result is analyzed, and simulation results confirm the validity of the proposed method. [C5072]

"Model-based statistical analysis of PolSAR data"

In this paper, we consider statistical analysis of PolSAR data in the framework of the multivariate product model. The complex scattering vector is here considered as a double stochastic circular Gaussian variable, in which the variance is linearly scaled by a common stochastic scaling factor z . The scaling factor is associated with texture. We discuss various parametric probability density functions for z , and indicate how model parameters can be estimated from data by a simple moment based method. Experimental analysis shows that for some surface covers, certain texture distributions fit better than others. Then, polarimetric covariance matrix data analysis is addressed in the framework of product models, and we propose a processing scheme which perform image segmentation using a stochastic EM approach. [C5073]

"PolSAR and PolInSAR model based information estimation"

Speckle for multidimensional SAR data may be modeled as the combination of multiplicative and additive noise sources. As demonstrated, the use of this noise model does not corrupt the estimation of physical information from PolInSAR data. The definition of a model based PolInSAR filter allows also the computation of relative errors for estimated heights of forested areas from PolInSAR data. [C5074]

"An assessment of ALOS L-band polarimetry for land-use monitoring in Malawi"

In this paper we investigate the advantages of using full quadpol low frequency radar imaging data for large area land-use classification and forest biomass estimation. We employ multiple PALSAR data sets over test sites in Malawi, Africa, where we have extensive in-situ measurements and ground campaigns for validation. We show how L-band PLR modes show great potential for quantitative land use applications and important sensitivity to above ground biomass. [C5075]

"Decadal change in northern wetlands based on differential analysis of JERS and PALSAR data"

We have been developing a continental-scale map of the North American boreal wetlands based on L-Band SAR imagery collected in 1997-1998 by the Japanese Earth Resources Satellite (JERS). The map currently covers the entire state of Alaska, identifying up to nine wetlands classes and two uplands classes. We have also recently obtained and classified a region of L-Band SAR imagery collected in 2007 by the Advanced Land Observing Satellite (ALOS) Phased Array L-Band SAR (PALSAR). Herein, we compare the results of the PALSAR classification to those of the JERS classification in order to detect changes in wetlands type or extent during the decade-long interval between the two sets of SAR imagery. [C5076]

"A tile-based system for the rapid display of symbolized Digital Nautical Chart data"

For efficient retrieval and display of Digital Nautical Chart (DNCГ, B®) imagery, a tiled-based approach is presented. By preprocessing the data into persistent image tiles, the presented method can minimize or eliminate image processing steps during the retrieval process. Tile-based approaches define constant image sizes and scales for geographic regions, therefore tiles can be pre-generated and stored in a format needed for transmission to users. This greatly improves the performance of applications that visualize DNCГ, B® data and allows for advanced caching of DNCГ, B® imagery tiles. In addition, the evenly-spaced and commonly-sized images are stored in files that are easily indexed allowing for simple and fast lookup of DNCГ, B® imagery tiles for a given geographic area. [C5077]

"Low-observable target detection in sea clutter based on fractal-based variable step-size least mean square algorithm"

This paper introduces fractal-based variable step-size least mean square (FB-VSLMS) algorithm and proposes a model for radar target detection in sea clutter. FB-VSLMS algorithm deals with a specific class of fractal signals and except one parameter requiring time-varying constraints, the constraints on the remaining parameters are time-invariant. And the step-size matrix is determined completely with the knowledge of the deterministic Hurst exponent. The model based on this algorithm is suited for tracking signals from the family of fractal signals that are inherently nonstationary. In the end, the performance of the novel model is analyzed. By the verification of X-band real sea clutter, the model is shown to be effective for low-observable point target detection in sea clutter. [C5078]

"Range resolution of unequal strength targets"

This paper examines the problem of resolving targets whose amplitudes may differ. A common metric used for resolution that assumes targets of equal strength is modified for the subject scenario. An expression for range resolution that accounts for the difference in target strength is also developed. Computational results are presented to depict how resolution performance is affected by various parameters. [C5079]

"A new pulse deinterleaving algorithm based on Multiple Hypothesis Tracking"

The main function of ESM is to receive, measure, deinterleave pulses and then identify alternative threaten emitters, among which pulse deinterleaving process is significantly difficult and important. Dense electromagnetic environments cause an ESM to receive a seemingly total random pulse stream with large noise. The traditional algorithms have behaved weak and unstable under the rather severe situation, so we propose a new pulse deinterleaving approach based on Multiple Hypothesis Tracking method in target tracking system. Simulation results have shown that the algorithm can perform PRI estimation and pulse recognition with high precision. Moreover, the algorithm is proved to be considerably robust and reliable even with large observation noise and PRI jitter at a missing rate up to 25%. [C5080]

"Modeling of radar scattering from oil films"

Oil films on the sea surface damp the capillary waves of the surface height spectrum. This hydrodynamic damping influences the normalized radar cross section (NRCS) of contaminated seas, comparatively to clean seas. First, a simple appropriate damping model is presented with parameters that match experimental results. Second, the two-dimensional bistatic NRCS of the contaminated sea surface is presented by comparison with that of a clean sea. [C5081]

"New results on convoy tracking by airborne radar. Part II: Tracking performance"

This paper deals with tracking of convoys by airborne radar. In [1, 2] a technique was presented to estimate the lateral length component of a convoy. In combination with the conventional range measurement, the full length information can be obtained in case of a linear convoy. The BAYES tracking algorithm presented in [1], which incorporates the length information, is now extended to multiple targets and also handles Doppler measurements. Here we present first numerical results. [C5082]

"Transient UWB radiation with beamforming capacity: Multielement array design"

This paper deals with the architectures which can be envisaged with regard to antenna arrays for UWB applications. Firstly, the advantage of a system fed by n generators, in opposition with a system fed by one generator, is presented. Then, the system which permits an easy beam steering is the subject of an optimization study concerning the delivering of high power radiations. A technique making the augmentation of the front to back ratio possible is also described. [C5083]

"GRADAR: A radar propagation modelling tool for frequencies from VHF to microwave"

Effective radar modeling requires consideration of the propagation effects of both surface topography and the atmosphere. This paper describes a propagation modeling tool that was developed to handle such effects. The tool is based on a Kirchhoff integral approach and the paper includes several examples that illustrate its capability. In particular, the paper shows that the approach can be very effective in the littoral environment. [C5084]

"Change detection for road condition mapping based on dry and rainy season VHR dual-pol radar imagery over tropical areas. Application to Chad"

New Very High Resolution dual-polarization radar sensors in X-band (TerraSAR-X and Cosmo-SkyMed) are offering technical opportunities for the detection of road condition changes between dry and rainy period in tropical areas. We applied classification methods (fuzzy logic and learning algorithms), multi-incidence and optical-radar combination in order to estimate surface elements (relief, flooded areas), soil properties (wetness, surface roughness) and road conditions from multi-date acquisitions over SW Chad. These estimations are calibrated with data measurements on the field. They are included in a road condition service designed for military, humanitarian and industrial logistics. [C5085]

"The Sentinel-1 radar mission: status and performance"

The ESA Sentinels constitute the first series of operational satellites responding to the Earth Observation needs of the EU-ESA Global Monitoring for Environment and Security (GMES) programme. The GMES space component relies on existing and planned space assets as well as on new complementary developments by ESA. This paper describes the Sentinel-1 mission, an imaging synthetic aperture radar (SAR) satellite constellation at C-band. It provides an overview of the mission requirements, its applications and the technical concept for the system. [C5086]

"A Gaussian beam shooting algorithm for radar propagation simulations"

Gaussian beam shooting is proposed as an alternative to the Parabolic Equation method or to ray-based techniques, in order to compute backscattered fields in the context of Non-Line-of-Sight ground-based radar. Propagated fields are represented as a superposition of Gaussian beams, which are launched from the emitting antenna and transformed through successive interactions with obstacles. In this paper, we present an outline of this 3D algorithm and propose a beam re-expansion scheme to address the problem of beam widening. Realistic scenarios will be used to test the ability of Gaussian beam shooting to accommodate typical propagation environments for ground-based UHF radar, including buildings. [C5087]

"Wide band frequency synthesis"

Radar systems, operating for SAR (Synthetic Aperture Radar) for ground observation or for surveillance, need very high resolution. The achievement of very high resolution in the range of 15 cm or less, that enables stationary targets analysis, requires wide instantaneous bandwidth, accurate and programmable waveforms. On the other hand, low velocity moving targets to be discriminated from stationary ones are demanding in low spurious and low phase noise. This paper presents a low noise and flexible digital frequency synthesizer for wide band application suitable for very high-resolution Radar. [C5088]

"Normalized Radar Cross Section of a cylinder above an ocean-like surface from an efficient fast numerical method"

For a two-dimensional problem, this paper presents the Normalized Radar Cross Section (NRCS) of a cylinder above an ocean-like surface. This kind of problem involves a high number of unknowns and can not be solved easily with a classic Method of Moments (MoM). Thus, a recently developed fast numerical method called E-PILE+FB-SA is used. After generating several surface realizations, a Monte-Carlo process is applied on the scattered fields in order to discuss on the NRCS. [C5089]

"Precisely beam steering for frequency diverse arrays based on frequency offset selection"

The beam direction of a frequency diverse array (FDA) is range dependent. If the beam is desired to steer toward a target with fixed range and angle parameters, the frequency offset must be properly selected. In this paper, the radiation properties of FDAs are analyzed. The range dependent beam can also be frequency offset dependent if the parameter range is fixed. A frequency offset selection strategy is derived to precisely steer the beam toward a fixed range with a desired angle. [C5090]

"Wide band frequency synthesis"

Radar systems, operating for SAR (Synthetic Aperture Radar) for ground observation or for surveillance, need very high resolution. The achievement of very high resolution in the range of 15 cm or less, that enables stationary targets analysis, requires wide instantaneous bandwidth, accurate and programmable waveforms. On the other hand, low velocity moving targets to be discriminated from stationary ones are demanding in low spurious and low phase noise. This paper presents a low noise and flexible digital frequency synthesizer for wide band application suitable for very high-resolution Radar. [C5091]

"Micro-Doppler analysis in ISAR-review and perspectives"

Micro-Doppler analysis concerns the extraction and exploitation of time-varying Doppler frequency shifts produced by mechanical oscillations of a target or target components. Examples of oscillatory motion include mechanical displacements or vibrations of target surfaces, rotations of target components, target spin, precession, or nutation. Such periodic motion modulates the Doppler frequency shift produced by translational motion and manifests itself as localized and time-varying Doppler frequency sidebands. In this paper, we will discuss methods for analyzing, visualizing, and exploiting these micro-Doppler signatures, and present examples of micro-Doppler signatures resulting from both rigid and nonrigid body micro-motion. Appropriate physical motion models will be described and applied to computational electromagnetic tools that generate simulated radar backscattering. Joint time-frequency signal representations will be used to visualize these signatures. We will also discuss challenges, research efforts and our perspectives on the utility of radar micro-Doppler exploitation. [C5092]

"Characterization of the performance of generalized monopulse estimation"

The generalized monopulse procedure is a tool to estimate parameters by maximizing a beamforming-type objective function. It can be applied to angle estimation (classical monopulse), but also to space-time array

processing of any dimension. The performance of this procedure is characterized in this paper by conditional means and covariances for all models of target fluctuation (Swierling 0 to 4). From these the performance of all kinds of parameter estimates with the generalized monopulse formula can be calculated. Applications are presented for a planar array with adaptive beamforming and for space-time adaptive processing for broadband interference suppression leading to some interesting conclusions. [C5093]

"Combining modern spectral estimation with Time-Frequency representation"

With Joint Time-Frequency Analysis (JTFA), one can estimate the speed of moving targets from Synthetic Aperture Radar (SAR) images. These targets are usually compact. JTFA estimation of water surface speeds is more difficult since the radar returns are weak and generated by Bragg scattering patches, randomly distributed within the radar's footprint, both in time and space. To increase the signal strength, JTFA is applied to multiple range lines, which requires a generalization of the Time-Frequency representation (TFR). To do this, modern spectral estimation (MSE) techniques, which depend on estimating the data covariance matrix, are weaved into the framework of a TFR. The resulting TFR formed along azimuth-lines naturally integrates the data across multiple range-lines. We discuss and illustrate this technique on simulated data and then apply it to estimate the speed of moving water in a single-phase center SAR image. This method also enhances the signal-to-clutter ratio (SCR). [C5094]

"Study on the scattering characteristics of stable-stage wake vortices"

The present paper decomposes the study of wake vortex's scattering characteristics into three key problems. Based on the study of these three problems in detail, we obtained the scattering characteristics of the wake vortex, which include the frequency characteristic of RCS, the radiation pattern, the relation between RCS and the detection range, and the time evolution characteristic of RCS. Research findings can provide supports for the development of radar detection technology on wake vortex. [C5095]

"Study of effect of room window on through wall imaging in UWB range"

In through wall imaging (TWI), detection is possible due to dielectric contrasts between target and room environment. Complexity increases if room consists of furniture's and other objects beside desired target. Further detection of desired target becomes complex with the presence of window in back wall of room. Thus in this paper, effect of presence of window in back wall of room is investigated on detection and imaging. A detection technique is proposed in which signal processing technique is applied to extract the target information from clutter signal. A back projection imaging technique is applied to image the target. For this purpose, indigenously a TWI system based on step frequency continuous wave (SFCW) principle is developed in ultra wide band (UWB) range of frequency (i.e., 3.95 GHz to 5.85 GHz), plywood considered as wall and metallic plate is considered as target behind the plywood wall. The results are quite encouraging. [C5096]

"Design of dual wide band CPW-fed fractal antenna"

This paper presents CPW -fed Square Shaped fractal antenna. The Antenna has been designed on FR4 substrate $\epsilon_r = 4.3$ and thickness 1.53 mm. The antenna has been fabricated and tested using VNA. The experimental result exhibits dual bands i.e. from frequency 0.79 GHz-2.24 GHz and from frequency 3.53 GHz to 12.29 GHz. This corresponds to 1.45 GHz and 8.76 GHz respectively. The lower end frequency of antenna is shifted to 0.79 GHz in comparison to simple convention coaxially feed microstrip patch resonant 1.44 GHz. This reveals the size reduction of fractal antenna. The experimental radiation pattern of this antenna has been observed nearly similar at all frequencies. This type of antenna can be useful for GPS, PCS, Vehicular radar and imaging system applications. [C5097]

"Title page"

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First Page of the Article [C5099]

"Study of vegetable Okra by microwave remote sensing at X- band"

Okra commonly known as lady finger is one of the important vegetable cultivated in India. Today Remote sensing is an important tool for monitoring the crop production. For this purpose we use bistatic microwave scatterometer working at X-band (9.5 GHz). Biomass factor and leaf area index is calculated within this period.

Scattering coefficient (s) and their dependence on look angle were analyzed. In this way by using the Biomass, Leaf area index and scattering coefficient an idea is developed which is helpful for radar sensors and also helpful for the production monitoring of this vegetable. [C5100]

"CDMA and FSCW surface acoustic wave temperature sensors for wireless operation at high temperatures"

This paper reports on the successful operation of surface acoustic wave (SAW) devices at high temperature, including wireless measurements of SAW devices up to 750Г,B°C. Two types of SAW devices and corresponding systems were investigated: (1) 15-bit code-division multiple-access (CDMA) SAW tags, interrogated using a device-specific direct sequence spread spectrum (DSSS) binary phase shift key (BPSK) code; and (2) multi-track reflective delay lines, interrogated using a frequency-stepped continuous-wave (FSCW) radar signal. The SAW devices used in this work were fabricated on langasite (LGS, La3Ga5SiO14) using Pt/Rh/ZrO2electrodes, which can withstand temperatures up to 1000Г,B°C. A FEM/BEM simulation package using both the Pt/Rh/ZrO2thin film and LGS properties was used to simulate the interdigital transducers (IDTs) used in the fabricated structures. The two classes of SAW sensors were first directly wired and characterized at high temperature. The FSCW system was then used to test the wireless operation of LGS SAW devices up to 750Г,B°C. [C5101]

"Synthetic aperture focusing technique for high-resolution imaging of surface structures with high-frequency ultrasound"

In this paper, an approach for the imaging of planar surface structures with high-frequency ultrasound in the 20 MHz frequency range is presented and evaluated. Planar material samples are placed in the far field of a single element transducer, and echo signals are acquired in a monostatic, side looking configuration during one or more scans along the azimuth direction. Synthetic aperture focusing is utilized for the reconstruction of B-mode images, which represent the echogenicity along the two-dimensional planar surface. The concept has been evaluated with a spherically focused transducer under the assumption of a virtual point source and under the approximation that spherical waves emanate from the transducer focus. Results from both, simulated echo data and measurement data from test objects, are presented and discussed. [C5102]

"Frequency domain low time-bandwidth product chirp synthesis for pulse compression side lobe reduction"

Coded signals are commonly used in communication and radar systems. However, in ultrasonics the use of coded signals is still relatively uncommon. Linear frequency modulated chirps, employed to improve signal to noise ratio (SNR), exhibit autocorrelation sidelobes whose amplitude increase with decreasing time bandwidth product. This is important in pulse-echo ultrasonics where the chirps need to be short. The side lobes can be attenuated by windowing the chirp amplitude with a suitable window function, but this broadens the main lobe which lowers the resolution. We describe an alternative method for chirp generation in the frequency domain. The chirp is generated by applying a quadratic phase shift into a signal with predefined spectrum. The autocorrelation side lobes of these chirps are nearly identical with the original unchirped pulse. A sum of four sine modulated Gaussians were used to provide the initial spectrum for evaluating the frequency domain chirping. This method holds potential for use in NDT pulse-echo measurements and medical ultrasonics where short codes to improve SNR are needed. [C5103]

"A least-squares vector flow estimator for synthetic aperture imaging"

This paper presents a least-squares (LS) vector flow estimator that is intended to calculate axial and lateral velocities using aperture-domain Doppler data from multiple transmit point sources and multiple receive apertures realized via the synthetic aperture (SA) technique. Our new estimator comprises two main stages. First, for each transmit point and receive aperture, we obtain aperture-domain Doppler ensembles and use them to compute a frequency estimate (via the lag-one autocorrelator) for every spatial point in imaging view. Subsequently, by noting that each transmit point and receive aperture deviates in flow angle, we estimate flow vectors through creating a set of Doppler equations with two unknowns (i.e. axial and lateral velocities) from the frequency estimates and solving this equation set as an over-determined LS problem. To evaluate the performance of new estimator, Field II simulations were performed for a scenario with a 5 mm-diameter steady flow tube (tube angle: 0Г,B°-90Г,B°, center velocity: 0-25 cm/s). For these simulations, a 5.5 MHz linear array with 128 elements was used; pre-beamform data was acquired for 97 virtual point sources (0.3 mm spacing, 32 elements), and 12 two-cycle pulses were fired through each point source (PRF: 5 kHz). Our LS estimator was then applied to a few different transmit-receive SA imaging configurations (e.g. 97 transmit points and 3 receive apertures). Results show that, if a multi-transmit configuration is used, the LS estimator is more capable of providing vector

flow maps that roughly resemble the theoretical profile. [C5104]

"SAR image quality and calibration operations for the RADARSAT satellites at the Canadian Space Agency"

This paper describes the role of the Canadian Space Agency (CSA) in calibration monitoring activities of the SAR on-board the two RADARSAT satellites currently in orbit. First, the performance of the RADARSAT-1 SAR since commissioning in 1996 is reviewed, along with the calibration systems and methodologies in the context of the mission's eleven-year calibration history. Calibration monitoring activities at the CSA for the privately-owned RADARSAT-2 are also presented. This successor mission was declared operational on April 25 2008, and Government measurements so far indicate that image quality and calibration indicators are generally better than the specifications. [C5105]

"A novel moving target indication strategy for traffic monitoring using SAR"

This paper presents a novel moving target indicator which is selective with respect to a direction of interest. This selectivity may be useful for traffic monitoring in civil environments where the target area contains, simultaneously, traffic moving in several different directions, besides that of interest. The developed MTI obtains results more accurate than those obtained by the classical methods. Furthermore, it has low computational requirements and provides accurate results using data from single channel SAR.. [C5106]

"Improving airborne radar performance using multiple conformal receive apertures"

Adaptive airborne processing has mainly focused on planar arrays with equally spaced elements and equally spaced sub-apertures. However, current airborne platforms could provide greater capability with limited system impact, if their current radars were complemented with multiple receive-only conformal apertures. Because of aerodynamic constraints, these receive-only apertures must be unevenly spaced. Simulation results demonstrate the degradation in space-time adaptive processing (STAP) performance caused by the unevenly spaced sub-apertures. The impact of overall antenna distortion is also investigated. A STAP compensation algorithm is developed and its performance quantified. [C5107]

"SUMATRA, a W-band SAR for UAV application"

Based upon most recent advances in millimeterwave technology, especially monolithic integrated low noise or medium power HEMT amplifiers and an integrated receiver containing an LNA, Mixer and IF Amplifier, a miniaturized experimental radar at 94 GHz was designed with the aim to be used on board of a remotely piloted model aircraft. This highly advanced front-end technique was combined with of-the-shelf model aircraft hardware and miniaturized GPS and data transmission equipment which is readily available. Goal of the project is to demonstrate, that using modern 94-GHz front-end technique combined with achievable back-end components it is possible to set up a versatile SAR system usable for a wide range of remote sensing applications at medium range. The paper describes the current state of the research project SUMATRA-94 and gives some perspectives for future applications. [C5108]

"Effects of wind power plants on passive radar operation"

The effects that wind power plants pose on passive radar operation are described and measurements with a passive radar system for DAB and DVB-signals are presented. [C5109]

"Multiple target Doppler estimation under possibly moving radar clutter"

Multi-target detection for pulsed Doppler radars under land/moving clutter characterized by antenna scanning modulation is analyzed using linear prediction based Tufts-Kumaresan's method. Comparison between this method and other line spectra estimation algorithms such as MUSIC and ESPRIT is performed. A technique to determine the model order required by the frequency estimation algorithms, which does not distinguish between targets and clutter, is presented. The clutter region concept is then introduced to identify targets from the clutter. [C5110]

"Residual-based discrimination method of exoatmospheric active decoys"

Aiming at dealing with exoatmospheric active decoys, a residual-based discrimination method is proposed. Firstly, dynamics models of active decoys are derived theoretically and the inherent motion differences between warhead and decoys are analyzed. We point out that these motion differences can be reflected by maximum likelihood (ML) estimate residuals of initial state parameter. Secondly, for solving the ML problem, a Levenberg-

Marquardt (L-M) algorithm is employed. Finally, the discrimination threshold is designed based on normalized residual sum of square (NRSS). Theoretical analysis and experimental results indicate that the discrimination method is valid and feasible. [C5111]

"Modular design principles for missile defence early warning radar"

This paper focuses on the innovative architecture of the ground-based UHF Deployable Early Warning (DEW) radar. First, the early warning functions of the radar with the main requirements are presented. Then the surveillance principles and the global radar functional architecture are depicted. The central part of the paper shows how the mission requirements can be met through an innovative modular and digital antenna architecture based on software radar technology, Building Blocks and standard interfaces concepts. The Building Block design principles are described. This approach is demonstrated through examples emphasising the modular design flexibility. Furthermore, the proposed Building Block can be used for creation of other UHF radar products. [C5112]

"Mitigating the effect of direct signal interference in passive bistatic radar"

Passive bistatic radar uses target illuminations by transmitters of opportunity (often commercial broadcasts). Unfortunately, the strength of the direct signal interference (DSI) can often be so strong as to mask target returns. Furthermore, when illumination is provided by a DAB (Digital Audio Broadcasting) network, the problem can be exacerbated by several transmitters operating on the same frequency. The present paper discusses strategies for reducing DSI and, in particular, the use of array nulls, cross polarization and shielding by topography. The effectiveness of these strategies is investigated through modelling. [C5113]

"UHF alerter intended for the protection against mortar"

Detection of rocket and mortar firings, evaluation (calculation) of launching and impact points, then warning of troops deployed in the likely impact area are now major causes for concern for our forces in a theatre of operation. It is vital to seek out a solution offering a sensor for the protection against mortar in the short run. A radar alerter operating in UHF band could meet this requirement. Small targets (such as 60 mm rounds) could be detected depending on the emission of a low power because of the optimization of the RCS with regards to this frequency band. [C5114]

"Application of the multiresolution wavelet representation to Non-Cooperative Target Recognition"

In this paper, the problem of efficient representation of large database of target radar cross section is investigated in order to minimize memory requirements and recognition search time, using wavelet representation. Synthetic RCS of large aircrafts, in the HF-VHF frequency bands, are used as experimental data. Many parameters are evaluated like mother wavelet, decomposition level, and classification parameters. Criteria used to determine the efficiency of multiresolution representations are compression scores, false identification rate and search time. [C5115]

"Relation between the peak to average power ratio and Doppler sidelobes of the multi-carrier radar signal"

The performance of the multi-carrier radar signal is investigated using the ambiguity function. The multi-carrier waveform under consideration is modulated by random phase coding, with the intention to combine radar and communications and at the same time solve the Doppler ambiguity. The connection between the instantaneous power of the waveform and the Doppler sidelobes of the ambiguity function are explored. The variance of the Doppler sidelobes, which arises from the random phase coding of the carriers, is connected to the peak to average power ratio of the waveform. [C5116]

"Radar high resolution range & micro-Doppler analysis of human motions"

In radar imaging it is well known that relative motion or deformation of parts of illuminated objects induce additional features in the Doppler frequency spectra. These features are called micro-Doppler effect and appear as sidebands around the central Doppler frequency. They can provide valuable information about the structure of the moving parts and may be used for identification purposes [1]. Previous papers have mostly focused on ID micro-Doppler analysis [2-4]. In this paper, we propose to emphasize the analysis of such "non stationary targets" using a 2D imaging space, using both the micro-Doppler and a high range resolution analysis. As in 2D-ISAR imaging, range separation enables us to better discriminate the various effects caused by the time varying reflectors. We will focus our study on human motion. We will see how micro-Doppler signature can be used to extract information on pedestrians gait. We will show examples on simulated and experimental data.

[C5117]

"MEMS technology for Radar front end modules"

This paper reports on the potential of RF-MEMS technology to improve and miniaturize new functions in Radar front end and antenna modules. The insertion of new MEMS components and subsystems, using RF-MEMS switches, filters and phase shifters, in radar front end are reported in this article and their characterization results are discussed. [C5118]

"A new change detection algorithm for SAR images"

This article addresses the problem of SAR (synthetic aperture radar) images non-coherent change detection. Here, we use a multi-scale registration technique based on mutual information and we introduce a novel preprocessing algorithm to get rid of the corruptive multiplicative noise (also called speckle) on SAR images. The change detection is then easily and accurately performed with a local comparison between pixels. [C5119]

"The insertion of ISAR targets into pre-existing SAR scenes"

For the training of automatic target recognition algorithms, and of scene understanding in image intelligence, it is important to have the largest possible data base. This can be achieved by inserting targets that were measured in a tower/turntable configuration, into pre-existing SAR scenes. The blending has to be performed in exactly that stage of the SAR processing chain that produces a result corresponding to that as if the target had been present in the scene during the SAR overflight. [C5120]

"Probability distribution mixture model for detection of targets in high-resolution SAR images"

In this paper, the detection of close targets in heterogeneous clutter in high-resolution SAR images is investigated. We adopt a probability distribution mixture model where each pixel intensity image is characterised by two probability density functions: one related to the targets and one related to the background clutter. A specific detection threshold, based on the estimates of the mixture parameters, is used. The statistical characterisation of SAR images modeling is a key issue for detection. The clutter is modelled using the K distribution that is a flexible tool over non-homogenous areas. We show that our method is able to detect close targets at constant false alarm ratio without making any assumptions about their size and their spatial configuration. [C5121]

"About the use of bistatic measurements for higher object localization accuracy in multisite radar systems"

Object localization in Multisite (Multistatic) Radar Systems (MSRSs) is possible using only target range measurements relative to spatially diverse stations (antennas). However, bistatic range sums can be measured in MSRSs too. Taking into account that implementation of bistatic measurements often require overcoming certain serious technical difficulties, it is important to reveal whether bistatic measurements can significantly enhance Target Localization Accuracy (TLA). This paper is devoted to this problem. [C5122]

"ISAR imaging of ground moving vehicles using PAMIR data"

The airborne system PAMIR is able to acquire inverse synthetic aperture radar (ISAR) data for imaging of ground moving vehicles with very high resolution. The processing sequence contains both steps specifically developed for PAMIR and universal steps. The paper presents the image generation process based on PAMIR data of moving vehicles, which were recorded in spotlight mode. Target motion information is gained in different stages by range-Doppler tracking and a Kalman filter based approach incorporating a road map. [C5123]

"2D parametric target model estimation using HRR data from a radar network"

Estimation of a parametric 2D spatial target model is proposed in this paper, with ultimate goal to support radar target classification. Limited number of multi-aspect High Range Resolution (HRR) data from a radar network are used as source of information. Back-projection in 2D space and mixture model fitting is applied for the estimation. The ghosts are progressively resolved and unambiguous retrieval of the 2D target model is achievable using data at consecutive time steps, while the target is moving. [C5124]

"Fast characterization of radiation patterns of conformal array antennas in the Presence of Excitation Errors"

A multilevel algorithm for the statistical characterization of the radiation patterns of beam steered conformal arrays is presented. The algorithm can be used to obtain average complex field patterns and power patterns in the presence of random amplitude and phase excitation errors. The computational scheme is based on a hierarchical decomposition of the array into smaller sub-arrays. At the finest level of decomposition, the radiation patterns of single element arrays are computed or measured over a sparse grid of directions. The subsequent computational sequence comprises interpolations and aggregations of sub-array contributions repeated until obtaining the radiation pattern of the array. The proposed algorithm attains a computational complexity substantially lower than that of the direct computation and thus can be employed for Monte Carlo type statistical simulations. [C5125]

"Local unified models of backscattering from ocean-like surfaces at moderate incidence angles"

In the context of electromagnetic wave backscattering from ocean-like surfaces, by using the SSA-1 model, Bourlier et al. proposed a technique to reduce the number of numerical integrations to two for easier numerical implementation. To be consistent with microwave measurements, closed-form expressions of the Fourier coefficients of the backscattering RCS are obtained. For Gaussian statistics, previous work is extended to kernels of unified models expanded up to the order two, like the SSA2 and LCA2. [C5126]

"Study of the modeling of radar sea clutter using the KA distribution and methods for estimating its parameters"

Effective threshold signal detection in airborne radar systems operating above sea requires an accurate and tractable statistical modeling of the scattered returns from the sea surface, namely the sea clutter. When high resolution radars operate at small grazing angles, the statistics of the signal-generated clutter are highly non-Gaussian. When this is not taken into account, it leads to poor signal detection performance. This paper emphasises on the statistical description of the sea clutter using the KA distribution. The description includes the ambient noise as well as the effect of the wave surface structure. The KA distribution lies on an appropriate combination of the Class A model, established by Middleton, and the description of the wave structure through the Gamma distribution. The use of the KA distribution as an accurate and tractable model for the scattered returns from the sea surface, embedded in the ambient noise, has been established in an article by Middleton and in another one by Ward. However, the probability distributions of the two articles exhibit some differences on which the first issue of this paper is to shed light. The second issue of this paper is to illustrate that the KA distribution of Middleton, as it is now distinguished from Ward's, shows an excellent agreement with real experiments. This is done using airborne radar records in rough sea conditions. To estimate the distribution's parameters, an optimization algorithm is used as suggested in. An additional result is the derivation of the even moments of Ward's KA distribution. This result is given in the appendix because it is needed for the comparison of the KA distributions. [C5127]

"An Ultra-Wideband radar concept for the detection of buried victims beneath building rubble"

The deployment of Ultra-Wideband (UWB) radars could dramatically improve the efficiency of rescue teams after a building collapse. UWB radars would provide a reliable and fast localization of alive victims buried under thick layers of rubble. This paper introduces a concept of UWB radar for the detection of buried victims beneath building rubble. After a theoretical approach dealing with the propagation of electromagnetic waves through the rubble, the UWB radar architecture and concept are introduced. First experimental results are finally presented. [C5128]

"Low loss multifunction building block panel for S-band radar"

The purpose of this paper is to present a low loss multifunction building block panel. It's composed of an array of radiating elements which is working in 500 MHz frequency bandwidth in S-band. The calibration, filtering and routing layer functions are integrated into this panel; the structure is optimized for overall low losses. The panel can work in transmission and/or in reception for large scanning angles in azimuth and elevation planes. [C5129]

"The use of SAR-ATI for maritime surveillance and difficult target detection"

This paper discusses the detection of low scatter cross-section maritime targets in a high clutter background using SAR multi-channel along track interferometry. Statistical arguments are presented based on the covariance matrix which enable the determination of the channel weights required to achieve maximum attenuation of false alarms produced by breaking waves. An example is shown of a target (a buoy) with scatter cross-section comparable with the false alarms. A false alarm attenuation of up to 16.1 dB relative to the target is demonstrated for a three-beam interferometer with no a priori knowledge of the target or false alarms. Applications include detection of small stealthy boats and other difficult maritime targets. [C5130]

"Target tracking in forward scattering radar with multi-beam transmitting antenna"

The paper deals with a problem of moving target tracking in forward scattering radar in particular case when target trajectory is close to the transmit position. It is shown that target angular coordinate should be measured relatively to the transmit position to provide high accuracy of tracking. For this purpose, multi-beam transmitting antenna with frequency division of beams is used. [C5131]

"A robust adaptive detector for steering phase uncertainties"

This paper deals with adaptive detection of a signal with unknown complex amplitude and whose steering vector presents angle uncertainties. The background environment is assumed homogeneous and Gaussian with unknown covariance matrix. At the design stage, we devise a robust receiver accounting for the aforementioned uncertainty. To this end, we prove that the maximization of the concentrated likelihood function over the phase parameter shares an hidden convexity property. Specifically, exploiting some recent results concerning trigonometric polynomials, we formulate the apparently non-convex maximization over the phase as a Semidefinite Programming (SDP) convex optimization problem. At the analysis stage, we assess the performance of the new receiver in comparison with some classic detectors available in open literature. [C5132]

"Space-time adaptive algorithms for track-before-detect in clutter environments"

In this paper we propose and assess TBD strategies for radar systems adopting STAP. At the design stage we consider a radar system equipped with a linear array of Nasensors that illuminates the surveillance area by transmitting M coherent pulse trains, each consisting of N pulses, before deciding whether or not a target is present over L adjacent range cells. As a preliminary step we introduce the target and noise models. Then, resorting to GLRT and ad hoc procedures, we derive adaptive CFAR detectors for both stationary and scan-to-scan varying clutter scenarios (a point better clarified in the body of the paper). The proposed detectors guarantee the CFAR property with respect to the unknown spectral properties of the clutter. The preliminary performance assessment, conducted resorting to Monte Carlo simulation, shows that proposed procedures might be a viable means to implement early detection and track initiation of weak moving targets. [C5133]

"Sea Spikes Suppression for high range and high Doppler resolution radars"

High resolution in range and Doppler are recommended to border surveillance X-band radars for the detection of small RCS ground targets in a severe clutter environment. This kind of radars can also be employed for sea border control. However, in this case the radar processor should suppress the sea spike echoes that can be otherwise mistaken with small boats. In this paper a solution for mitigating the problem connected with sea spikes is proposed. A 2D CFAR that uses the information from both the range and Doppler characteristics of the echoes is presented. The performance of this algorithm is compared with the one of a classical CFAR which can instead be efficiently employed in a ground environment. [C5134]

"Bat-pollinated plants: feature extraction for target recognition in the natural world"

In recent years, with the development of high range resolution radars, the desire to be able to identify targets under all weather and clutter conditions has become of great importance. Bat-pollinated plants have evolved flowers to ease classification by nectar feeding bats even in a dense clutter environment. In this paper we analyze three real images of a *Cobaea scandens* corolla. These were collected by means of an acoustic radar capable of very high range resolution. The features of these flowers that allow high classification performance by bats are exploited. Results are discussed and related to the task of classification in radar systems. [C5135]

"FMCW ultra-wideband radar for through-the- wall detection of human beings"

An FMCW ultra-wideband radar concept for through-the-wall detection of human beings is presented. Propagation modeling through different types of walls and radar cross section measurements of human beings are given. Power budget and dynamic range are computed and discussed for different situations. The realized UWB FM-CW radar is presented and some fast trials of human beings tracking are shown. This radar system will enable large stand-off distance capabilities. [C5136]

"New results on convoy tracking by airborne radar"

In this contribution the authors continue their work on convoy tracking supported by estimating the lateral width of the convoy. New results on the impact of the array size and the data sample size are presented. It is shown that the ML estimator is the most suitable tool for estimating the apparent target length. In a companion paper

the tracking performance is analysed. [C5137]

"Tracking and plot-to-track association for surveillance of busy inland river traffic"

River Surveillance systems employ primarily radar sensors, which completely cover an area of interest. Based on the raw videos provided by these radars, plot extraction, plot-to-track association and tracking are then carried out. However, the task of successfully supervising congested traffic areas needs to address ambiguous cases due to vessel maneuvers, radar shadow zones, vessel crossings, etc. This paper deals with the relevance of filtering and data association techniques to resolve these confusing cases. [C5138]

"On MIMO waveform design for non-Gaussian target detection"

We consider a multiple-input multiple-output (MIMO) detection problem with M widely-spaced transmit antennas and L widely-spaced receive antennas (not necessarily co-located), and we study the problem of designing the signal waveforms transmitted by each source node under non-Gaussian target scattering and temporally-correlated Gaussian clutter. Two figures of merit are investigated for space-time code optimization under a semi-definite rank constraint and a received signal-to-clutter ratio constraint: 1) the lower Chernoff bound (LCB) to the detection probability for fixed probability of false alarm, and 2) the mutual information (MI) between the observations available at the receive nodes and the $M \times L$ channel matrix \mathbf{H} generated by a target, assumed present throughout. If the scattering distribution possesses some suitably defined properties of exchangeability and unitary invariance, we show that MI-optimal and LCB-optimal space-time coding admit a simple closed-form solution. Finally, a case study of relevant practical interest is examined in depth so as to compare the proposed design criteria and to assess the impact of signal non-Gaussianity on the detection performances. [C5139]

"Unscented Kalman Filter (UKF) applied to FM band passive radar"

This paper shows that innovative tracking algorithms improve the state estimation performance of a Passive Covert Radar (PCR) exploiting a single non co-operative frequency modulated (FM) commercial radio station as its transmitter of opportunity. In particular in [1] and [2], it has been stated that particle filtering (PF) is the right choice for tracking the targets of interest in the Cartesian domain. This paper aims at showing that Unscented Kalman Filter (UKF) gives practically same performance with respect to the PF with extremely reduced computational load and unproblematic algorithm setting up. [C5140]

"High resolution mapping of the environment with a ground-based radar imager"

The aim of this paper is to show the potential of the microwave radar as a sensor dedicated to outdoor perception. A new radar sensor named K2PI, based on the principle of Frequency-Modulated Continuous Wave (FM-CW) is presented here. An application in simultaneous localization and mapping using scan matching of radar images (R-SLAM algorithm) has been developed and first results in different environments are presented. Trajectories obtained by the R-Slam algorithm are compared with GPS positioning. The results show the ability of the microwave radar to build maps even in unstructured environment. [C5141]

"Advances in Bistatic Inverse Synthetic Aperture Radar"

Bistatic geometries are enabled in scenarios where multiple separated transmitters and receivers are employed as well as when illuminators of opportunity are exploited. Bistatic Inverse Synthetic Aperture Radar (B-ISAR) becomes the radar imaging tool for obtaining non-cooperative target images in arbitrary bistatic configurations. Theoretical aspects and real data experiments have been conducted in recent years that have proven the effectiveness of B-ISAR. A review of both theory and results is provided in this paper and new perspectives are indicated. [C5142]

"A real-time RFC system for radar coverage prediction"

This paper introduces a real-time Γ -Birefractivity from clutter Γ -Birefractivity RFC system. Its aim is to predict the radar coverage by the inversion of the sea clutter in open sea. The method introduced here renders a real-time approximation of the refractive conditions with respect to the distance and the azimuth angles visible from the radar. Using this system, the radar coverage can be modeled in real-time on all the azimuths taking into account the refractive conditions. The inverted refractive conditions are an approximation of the real conditions. This system has been tested and validated on data from the Wallops '98 measurement campaign. This paper shows the effect of the azimuthal variation of the refractive conditions on the radar coverage and how the developed system renders a result coherent with the azimuth. [C5143]

"Mitigation of wind turbine clutter in C-band weather radars for different rainfall rates"

Wind farm installations relatively near to radar systems cause clutter returns which can affect the normal operation of these radars. In this paper a parametric study of the dependence of the rain characteristics in wind turbine clutter (WTC) mitigation for C-band weather radars is presented. For this aim, several realistic simulations of weather conditions have been performed. [C5144]

"Optical functions for microwave signal processing in radar, communications and surveillance systems"

The optical-microwave technologies have appeared as promising for the next generations of radar, communications and surveillance systems. The new concepts and demonstrations show the improvements of optoelectronic links and the capability to perform processing functions, in the optical domain, like the local oscillator distribution for both ground/ship based and airborne radars, or the radar receive mode processing with optical architecture dedicated to radar beamforming and to down/frequency mixing. [C5145]

"A radar signal simulator for DAB based passive radar"

This paper describes a simulator for a digital audio broadcast (DAB) based passive radar system. Sample scenarios comprising a receiver, a target and several illuminators are given. DAB transmission signals are simulated, and an estimate of the signal arriving at the receiver is calculated. The received signal is made up of weak target returns and strong direct signal interference (DSI). Simulated autocorrelation and cross-correlation displays are given. [C5146]

"Waveform design and processing for multichannel MIMO radar"

In MIMO radar several transmitters broadcast independent waveforms which must be separated at the receivers. Typically waveforms having low auto- and cross-correlation values are used. This study proposes the transmission of several waveforms across multiple independent channels by each transmitter. Waveform sets formed from mutually-orthogonal complementary codes are shown to provide perfect resolution of returns with no cross-transmitter interference when separated in time. Square-complementary waveforms separated in frequency and subject to nonlinear processing can also resolve targets but introduce cross terms instead of correlation sidelobes. Cross terms are mitigated with frequency agility and pulse-Doppler processing. [C5147]

"Detection and direction finding performance of hybrid bistatic radar"

The conventional phased-array radar provides coherent processing gain while the MIMO radar exploits spatial diversity gain to improve the system performance. We investigate a hybrid bistatic radar combining these two configurations to take advantage of both gains. The probability of detection of the hybrid system is derived, and the CRB and the MSE of the maximum likelihood estimation for both angle of departure and angle of arrival are evaluated to assess the direction finding performance. [C5148]

"Compact scalable multifunction RF payload for UAVs with FMCW radar and ESM functionality"

This paper describes a concept for a scalable RF sensor payload for small UAVs that can perform multiple RF functions such as synthetic aperture radar (SAR), ground-moving target indication (GMTI) and ESM. Essential to the scalable multifunction RF payload concept is the digitization of the antenna signals on transmit and receive at the antennae element level. The architecture of a technology demonstrator that can perform radar and ESM functions is described and first results of some of the various radar and ESM modes are shown. [C5149]

"Range Doppler and image autofocusing for FMCW Inverse Synthetic Aperture Radar"

Inverse Synthetic Aperture Radar (ISAR) is a well known technique for obtaining high resolution radar images. ISAR techniques have been successfully applied in the recent past in combination with pulsed coherent radar. In order to be more appealing to both civilian and military fields, imaging sensors are required to be low-cost, low-powered and compact. Coherent pulsed radars do not account for these requirements as much as FMCW radars. However, FMCW radars transmit a LMF sweep in a relatively long time interval. During such an interval the assumption of stop&go is no longer valid, that is the target cannot be considered stationary during the acquisition of the entire sweep echo. Therefore, the target motion within the sweep must be taken into account. Such a problem, which has been considered and solved for SAR systems, is reformulated and solved for ISAR systems, where the target cooperation is removed and additional unknowns are added to the signal model. Specifically, in the present work, the authors define a complete FMCW-ISAR received signal model, propose an ISAR image formation technique suitable for FMCW radar and derive the Point Spread Function (PSF) of the

imaging system. [C5150]

"Hilbert transform pitfalls and solutions for ultrasonic NDE applications"

Hilbert transform (HT) is a classical tool used to obtain complex analytical signal representation, which is useful for instantaneous frequency and envelop estimation of bandpass signals. However, noise has a significant adverse impact on the performance of HT. Furthermore, the narrowband signal condition in Bedrosian identity makes it problematic to analyze ultrasonic scattering signal using HT. In this investigation, two key issues related to Hilbert transform are addressed for enhanced instantaneous frequency (IF) estimation. First, in order to minimize the effect of the noise, ultrasonic signals are decomposed to multiple narrowbands and instantaneous frequencies within these bands are estimated. Second, a weighted estimated of IF based on envelop estimate of each narrowband is introduced. These methods are applied to various experimental ultrasonic data sets and utilized to examine microstructure scattering, effects of attenuation in large grained materials, and flaw detection in presence of high scattering noise. Simulation studies and experimental results support accuracy of the IF estimation. Enhanced IF estimation techniques provide tractable frequency estimation and makes it possible to quantify spectral shifts due to attenuation, scattering and dispersion effects. [C5151]

"On proportionate-type NLMS algorithms for fast decay of output error at all times"

Recently, we have proposed three schemes for gain allocation in proportionate-type NLMS algorithms for fast decay at all time. The gain allocation schemes are based on: (1) maximization of one-step decay of the mean square output error, (2) maximization of one-step conditional probability density for true weight values, and (3) adaptation of Γ , Bi-law for compression of weight estimates using the output square error. Scheme (1) implies sorting and time consuming calculations that can restrict its ability to work in real-time. We will propose usage of computationally simplified schemes and show that the loss in performance is negligible. Scheme (3) needs calculation of a logarithmic function that we will replace by calculation of a piecewise linear function and show that there is no significant loss in performance. Schemes (1) and (2) use fast-converging biased estimates to calculate gain allocation. The performance deterioration because of the biased estimates is especially noticeable in the steady-state regime. We are going to consider combining the fast-converging biased estimates with slow-converging unbiased estimates. The combination will be related to the magnitude of the output square error. Comparison between the original and modified algorithms in sparse echo-cancellation scenarios will be presented for white input, color input, and voice inputs. [C5152]

"MIMO radar, SIMO radar, and IFIR radar: a comparison"

This paper focuses on a simple beamforming problem and compares the MIMO and SIMO radar systems for the case where the transmitter and receiver are collocated. The simplicity of the application allows one to see clearly where the advantages of MIMO radar come from, and what the tradeoffs are. The comparison also includes a third system called the IFIR radar (interpolated FIR radar). The MIMO radar offers advantages in terms of clutter reduction, especially when the extra coherent integration time can be exploited, but it does not offer an SNR advantage-in fact the SNR is worse than that of the SIMO radar when extra integration cannot be performed. The IFIR radar, which is essentially a simple variation of phased array radars, has an advantage over the SIMO radar in terms of clutter reduction, and does not compromise SNR in order to achieve this. The multiple orthogonal waveforms used in MIMO radar typically require extra bandwidth for fixed range resolution but the IFIR radar does not require extra bandwidth. [C5153]

"Elephant censusing via geophone arrays: A visual approach for linear arrays"

The problem of censusing elephants via geo-phone recordings of their footsteps along a linear array positioned along a path leading to a watering hole is considered. We propose an intuitive and graphically motivated technique that delineates passages of herds of elephants. Additionally, a measure of dispersion of the localization estimates is proposed that correlates to the size of the passing herd. We illustrate the methods using both real data and a simulation study. [C5154]

"Polarimetric MIMO radar with distributed antennas for target detection"

Distributed antenna radar systems provide spatial diversity gain by viewing the target from different angles. Polarimetric radar offers improved performance over conventional radar systems by exploiting polarization diversity. We propose a radar system that offers both spatial and polarimetric diversity gains for detecting stationary point-like targets. The receive antennas of the proposed system use 2D vector sensors, each measuring the horizontal and vertical components of the received electric field separately. We design the Neyman-Pearson detector for this proposed system and analyze its performance. This analysis is used to select the optimal transmit polarizations for this system. Using simulations, we demonstrate the improvement offered by

the optimal choice of polarizations. We also show the spatial diversity offered by MIMO radar. [C5155]

"Generalized frequency modulated waveform libraries for radar tracking applications"

The aim of this paper is to produce a methodology for discussing the design of small efficient waveform libraries. We will need two building blocks for the methodology. The first is a generic collection of waveforms from which the small library will be chosen. In this instance, we represent the generic waveforms as generalized frequency-modulated pulses, though in fact this collection is quite general and able to encompass most practical waveforms used in radar. [C5156]

"MIMO field directionality estimation using orientation-diverse linear arrays"

This paper addresses the estimation of power versus azimuth and elevation using a sparse sensor array. In MIMO radar, clutter and noise field directionality can be measured both from the transmit array and to the receive array. In applications where sparse arrays must be used, however, often substantial ambiguities in the field directionality map occur due to spatial under-sampling and/or sidelobe leakage. In this paper, we propose an alternative field-directionality mapping approach which incoherently combines the outputs of several uniform linear arrays with different orientations. The proposed orientation-diverse multi-line array (ODMA) treats the 1-D field directionality estimate from each line array as a projection of a 2-D spatial spectrum. Two methods for reconstruction from these projections are presented: 1) least-squares estimation subject to a positivity constraint, and 2) maximum likelihood estimation using the EM algorithm. Simulation results suggest both methods achieve ODMA field directionality maps with improved ambiguity resolution and sidelobe performance versus conventional beamforming techniques. [C5157]

"Construction of unimodular sequence sets for periodic correlations"

Sequence sets with good periodic correlation properties can be used in many areas, including communications, medical imaging, radar (such as over-the-horizon radar) and sonar. Practical hardware constraints, such as power amplifiers, usually require the transmitted waveforms be unimodular. We present herein new computationally efficient algorithms that can be used for the design of unimodular sequence sets with essentially zero auto-correlation sidelobes and cross-correlations in a specified time lag zone, as well as of sequence sets with good correlations over all time lags. The proposed algorithms start from random phase initializations and can generate many different sequence sets (including very long sequence sets) possessing similarly good correlation properties. [C5158]

"Target detection in MIMO radar using Golay complementary sequences in the presence of Doppler"

In this paper, we present a method for detecting a point target using multiple antennas when the relative motion between the receivers and the target induces a non-trivial Doppler shift. We consider a 4 ГГВ— 4 system employing sets of unitary waveforms. In case of a non-trivial Doppler shift induced by the target motion, the waveforms are no longer unitary, and unambiguous target ranging is not possible. To solve this problem, we adopt a subspace based approach where we show that the unitary waveforms used have a non-empty null-space under certain conditions, and by processing the waveforms with vectors from the null-space, we can significantly improve the detection performance. [C5159]

"Sensor scheduling with waveform design for dynamic target tracking using MIMO radar"

Multiple-input, multiple-output (MIMO) radar systems have gained significant attention as they can enhance target detection, identification and parameter estimation performance. In this paper, we consider the problem of optimizing the target tracking performance of a widely-separated MIMO radar system by scheduling the transmitter sensors and adaptively designing their waveforms. Specifically, for a tracking scenario consisting of a large number of MIMO radars, we propose: (a) a transmitter scheduling algorithm to achieve tracking performance gains based on resource constraints; and (b) an adaptive waveform optimization algorithm that further improves tracking performance. Under an ideal receiver assumption, we evaluate the predicted tracking mean-squared error using the derived CrameГ, BГr-Rao lower bound (CRLB) on the estimation of the target states. The scheduling algorithm is then formulated as a mixed boolean-convex optimization problem to minimize the CRLB. The optimum waveform parameters are adaptively obtained using sequential quadratic programming. The effectiveness of combining the MIMO radar technology with adaptive waveform design and sensor scheduling was demonstrated with simulations. [C5160]

"Reduced complexity angle-Doppler-range estimation for MIMO radar that employs compressive

sensing"

The authors recently proposed a MIMO radar system that is implemented by a small wireless network. By applying compressive sensing (CS) at the receive nodes, the MIMO radar super-resolution can be achieved with far fewer observations than conventional approaches. This previous work considered the estimation of direction of arrival and Doppler. Since the targets are sparse in the angle-velocity space, target information can be extracted by solving an ℓ_1 minimization problem. In this paper, the range information is exploited by introducing step frequency to MIMO radar with CS. The proposed approach is able to achieve high range resolution and also improve the ambiguous velocity. However, joint angle-Doppler-range estimation requires discretization of the angle-Doppler-range space which causes a sharp rise in the computational burden of the ℓ_1 minimization problem. To maintain an acceptable complexity, a technique is proposed to successively estimate angle, Doppler and range in a decoupled fashion. The proposed approach can significantly reduce the complexity without sacrificing performance. [C5161]

"Exploiting correlation in target detection using MIMO radar with angular diversity"

Multiple-input multiple-output (MIMO) radars utilize multiple waveforms simultaneously to improve performance. A MIMO radar in which angular diversity is achieved by using widely distributed antennas has been proposed before. This type of system is also known as the statistical MIMO radar. Typically, it has been assumed that the signals received by different antennas are either fully correlated or independent depending on the configuration. We make a more realistic assumption of partially correlated scattering from the target. In this paper, we show that taking the correlation of the scattered signals into account can improve the probability of detecting the target. It is shown that the scattering statistics do not need to be known, but can be estimated reliably from the received signal if a certain type of scattering model is assumed. In this paper, the GLRT using the maximum likelihood estimates of the unknown parameters is proposed for target detection. [C5162]

"Performance and complexity issues in noncoherent and coherent MIMO radar"

Joint target position and velocity estimation is considered when a MIMO radar system employs either coherent or noncoherent processing and a suitable antenna placement for the processing employed. A theorem is presented for the case of orthogonal signals in temporally and spatially white noise-plus-clutter which shows that the MSE for the estimate of the noncoherent system approaches that of the coherent system as the product of the number of transmit and receive antennas is made sufficiently large. Numerical examples are also provided. Initially, we study systems without constraining the complexity and energy, where each added transmit antenna employs a fixed energy so that the total transmitted energy is allowed to increase as we increase the number of transmit antennas. Later we also look at constrained systems, where adding a transmit antenna splits the total system energy and the total number of antennas employed is restricted. [C5163]

"Waveform design for MIMO radar using an alternating projection approach"

Revisiting an earlier examined multiple-input multiple-output (MIMO) radar waveform design problem which optimizes both minimum mean-square error estimation (MMSE) and mutual information (MI), we formulate a new waveform design problem and provide some further results in this paper, which complements the previous study. More specifically, we present an iterative optimization algorithm based on the alternating projection method, to determine waveform solutions that can simultaneously satisfy a structure constraint and optimize the design criteria. Numerical examples are provided, which illustrate the effectiveness of the proposed approach. In particular, we find that the waveform solutions obtained through our proposed algorithm can achieve very close and virtually indistinguishable performance from that predicted in the previous study. [C5164]

"A MIMO radar system approach to target tracking"

In this paper, tracking performance of MIMO radar systems with distributed antennas and non-coherent processing is studied. The Bayesian Cramer-Rao bound (BCRB) on target location and velocity tracking is derived and the effect of the radars geometric layout and the target location on tracking accuracies is analyzed. The impact of the number of radars on the estimation errors is examined and the contribution of the target reflectivity and path loss to tracking performance is evaluated. [C5165]

"On MIMO radar transmission schemes for ground moving target indication"

We compare several multiple-input multiple-output (MIMO) radar transmission schemes, including code division, time division and Doppler frequency division multiplexing approaches, for ground moving target indication (GMTI). To utilize probing waveforms with low sidelobe levels for range compression, we transmit sequences specifically designed to have low correlation levels. At the receiver side, we apply the iterative adaptive approach

(IAA), which uses only the primary data, to form high resolution angle-Doppler images. To mimic real world scenarios, we apply our algorithms to a simulated dataset which contains high-fidelity, site-specific, simulated ground clutter returns. By combining the usage of intelligent transmission schemes, probing waveforms with good correlation properties, and the adaptive angle-Doppler imaging approach, we show that slow moving targets can be more clearly separated from the clutter ridge in the angle-Doppler images and potentially more easily detected by MIMO radar than by its conventional single-input multiple-output (SIMO) counterpart. [C5166]

"Session TP5: MIMO radar"

{no data available} [C5167]

"Target tracking in widely separated non-coherent multiple-input multiple-output radar systems"

In a widely separated multiple-input multiple-out (MIMO) radar system with non-coherent receivers, the maximum likelihood estimator (MLE) of target location and the corresponding CRLB matrix are derived. Further, two interactive signal processing and tracking algorithms are developed based on the Kalman filter and the particle filter respectively. For a system with a small number of elements and a low SNR value, the particle filter outperforms the KF significantly. In both methods, the tracker provides predictive information regarding the target location, so that the matched filter can match to the most probable target locations, reducing the cost and improving the tracking performance. It is shown that the non-coherent MIMO radar provides a significant performance improvement over a monostatic radar with high range and azimuth resolutions. [C5168]

"Finite-sample optimal joint target detection and parameter estimation by MIMO radars"

We consider MIMO radar systems with widely-spaced antennas. We treat the problem of detecting extended targets when one or more target parameters of interest are unknown. We provide a composite hypothesis testing framework for jointly detecting the target along with such parameter estimation while only a finite number of signal samples are available. The test offered is optimal in a Neyman-Pearson-like sense such that it offers a Bayesian-optimal detection test, minimizes the average maximum likelihood parameter estimation error subject to an upper bound constraint on the false-alarm probability, and requires a finite number of samples. While the test can be applied for concurrently detecting the target along with estimating any unknown parameter of interest, we consider the problem of detecting a target which lies in an unknown space range and find the range through estimating the time delays that the emitted waveforms undergo from being illuminated to the target until being observed by the receive antennas. We also analyze the diversity gain which we define as the rate that the probability of mis-detecting a target decays with the increasing SNR for a controlled false-alarm and show that for a MIMO radar with N_t and N_r transmit and receive antennas, respectively, the diversity gain is $N_t N_r$. [C5169]

"A novel non-contact vital sign detection system based on phase-coded pulse radar"

This paper proposes a new sensitive microwave non-contact vital sign detection system based on phase-coded pulse radar. In order to improve the accuracy of the detection, short time autocorrelation and Golay code is introduced in the new system to increase the SNR of physiological signals. Simulation results show that the dc offset and flick noise, which are dominant factors in the conventional continuous-wave radar, are removed through the autocorrelation process while maintaining the dc component of the signal. Moreover, by adopting arctangent demodulation, the null point problem in the conventional radar is solved. With the ability of detecting signal in the noise, a robust sensing can be obtained and the system detection range will dramatically increase. [C5170]

"Performance evaluation of antennas for UWB radar and positioning systems"

This paper presents a study of the performance of three antennas for ultra wideband radio ranging systems. By using different pulse types, the performance of the antennas is measured and quantified by using the Fidelity Factor. [C5171]

"GPRS Based Guard Robot Alarm System Design"

This paper presents a practical approach to design guard robot alarm system using GPRS technology. GPRS offers an interesting communications infrastructure for remotely accessing, controlling and interacting with robots in an integrated and highly portable manner, particularly in recent years the GPRS network provides wireless access of internet for mobile phone which becomes the most important and common terminal equipment. Therefore, in this paper the alarm information is designed to send to the user's mobile phone, and add man-made intervention to the system, thus achieves a more convenient and reliable alarm system. The system mainly

consists of two parts: detection of abnormal and dangerous situation in domestic environment and sending the alarm information as MMS form to the user's phone via GPRS networks. Finally experiments show that the alarm system can accurately send alarm information to the user's mobile phone. The system is low-cost, flexible, reliable, and can be widely used. [C5172]

"Track Association and Fusion Based on Information Demand Analysis"

The paper presents a track association and fusion algorithm based on information demand analysis in the multi-sensor and multi-target environment. Track association first is done to judge whether the tracks from the different sensors derive from the same target by the method of the nearest neighborhood. Then the algorithm discards the tracks with poor quality by analyzing information demand for the fusion and evaluating the quality of each track using the method of statistical variance analysis. Last, Kalman filter and Simple Fusion strategy are used for the state estimation fusion. Experiment results show the algorithm improves the precision of the final track during the process of track fusion. [C5173]

"Inverse scattering solutions for side-band signals"

When a signal is recorded that has been physically generated by some scattering process (the interaction of electromagnetic waves with an inhomogeneous dielectric, for example), the 'standard model' for the signal (i.e. information content convolved with a characteristic Impulse Response Function) is usually based on a single scattering approximation. An additive noise term is introduced into the model to take into account a range of non-deterministic factors including multiple scattering that, along with electronic noise and other background noise sources, is assumed to be relatively weak. Thus, the standard model is based on a 'weak field condition' and the inverse scattering problem is often reduced to the deconvolution of a signal in the presence of additive noise. Attempts at solving the exact inverse scattering problem which take into account multiple scattering effects often prove to be intractable, particularly with regard to the goal of implementing algorithms that are computationally stable and/or compatible with standard signal analysis methods and Digital Signal Processing 'toolkits'. This paper provides an approach to solving the multiple scattering problem for narrow side-band systems (typically, electromagnetic signal processing systems) that is compounded in the introduction of a single extra term to the standard model. [C5174]

"Design and implementation of multi mode Radar Target simulator using Direct Digital Synthesizer"

Idea of Hardware Radar simulator is to electronically generate the Radar illuminated environment without switching on actual Radar transmitter in the field. This paper describes the implementation of Radar Target simulator using advanced technology of arbitrary waveform generator (Direct Digital Synthesizer chip) & FPGA. The Radar Target Simulator has the advantage of measuring of system response, evaluating and optimizing the performance of radars without expensive field trips to harsh regions and can be used to test the radar without interfering with commercial wireless devices. It replicates the feed-through signal between transmit and receive antenna for CW Radar, Conventional Pulsed Radar (with pulse width >70ns) and LFM Pulse Compression Radar. In each mode it accurately generates phase-coherent transmit pulses & simulates target echoes (replication of transmit pulse) with following programmable parameters; (a) Target range by time delay (b) Doppler shift to simulate moving target through phase control of pulses (c) Signal strength to simulate SNR target echoes With the above mentioned salient features this Target Simulator can be used to develop and test Radar Algorithms e.g. Digital Receiver/Pre-processing, Pulse Compression Algorithm, Target detection, Range calculation/range resolution test up to 10m, Doppler Processing and tracking of single or multiple targets. Hence, operating in the 10 to 170MHz range, the target simulator is well-suited to the task of generating multiple phase-coherent signals in the IF range. The output is also compatible with frequency converters, which extends useful operation into the RF realm. The prototype can operate in a stand-alone configuration and can be used for algorithm development, testing and evaluation of the radar in the laboratory. [C5175]

"Optimum beamforming for clutter-cancellation in radar systems"

In this paper we present improved signal processing techniques which can be used to reduce the discrete as well as spatially spread clutter in radar systems through space-time processing. Several techniques are proposed for clutter reduction, most of them model the clutter statistically. The proposed clutter reduction technique models the clutter using parametric modeling. The clutter contained in the measurements is treated as an ARMA model. The advantage of such approach lies therein that once the clutter is satisfactorily known, any target will show up against the known strong clutter background. [C5176]

"A frequency agile fast switching hybrid synthesizer for radar applications"

Design and development of a frequency agile fast switching hybrid synthesizer in the X-band is described. Direct

Digital Synthesizer (DDS) technology offers very fine (sub-hertz) frequency tuning and very fast frequency switching due to its digital structure. On the other hand DDS cannot produce frequencies higher than a few hundred megahertz. Conventional PLL circuits can operate at very high frequencies but they lack in fine frequency tuning and fast switching as compared to DDS. The purpose of this development is to combine the benefits of both the technologies into a single hybrid synthesizer. [C5177]

"K-band PLL based frequency synthesizer"

The design and implementation of a K-band (22GHz) PLL frequency synthesizer is described. The frequency source was intended to be used in a test and measurement setup and the design goal was to achieve spurious free signal with lower phase noise and lesser harmonics. The PLL is locked at half of the output frequency; therefore there is frequency doubler at the output stage. The output signal from the PLL is multiplied, bandpass filtered and amplified to get the desired signal at desired power level. [C5178]

"Automatic change detection of Belum-Temengor forested area using multitemporal SAR images"

Two C-band RADARSAT synthetic aperture radar (SAR) images are used to automatically detect changes that occurred in between year 2004 and 2008 due to extensive deforestation, at Gadong River area of Belum-Temengor, Northern region of West Malaysia. Changes are detected by automatically finding the best threshold value of the standard log-ratio image that is derived from the two multitemporal SAR images. Minimum error thresholding is performed using relative entropy method. The result is validated using the difference of two Normalised Difference Vegetation Index (NDVI) images generated from two SPOT-5 images. [C5179]

"Robust model for retrieval sea surface current from different RADARSAT-1 SAR mode data"

This paper presents the application of robust model to simulate sea surface current pattern. We have developed the horizontal surface velocity model which is estimated from the Doppler frequency theory to model out the sea surface current velocity. The robust model was applied to the RADARSAT-1 SAR satellite at three different modes (Wide-3, High extended-6 and Standard-2). The results of the study were validated using real time in situ current measurements that were acquired by AWAC equipment. It is found that the velocity and direction of the current changed through the period of the study according to the changing of Doppler frequency shift. Onshore sea surface current was modeled from Wide-3 mode varied between 0.22 to 0.25 m/s, while sea surface current velocities extracted from the Extended High-6 and Standard-2 modes were ranged between 0.16 to 0.53 m/s and 0.52 to 0.65 m/s, respectively. The RMS difference between the three RADARSAT-1 SAR images is 0.136, 0.364, and 0.485 in the Standard-2, Wide-3, and Extended High-6 mode, respectively. This shows that RADARSAT-1 Standard-2 mode is the best mode which can be used to simulate sea surface current patterns (velocity and direction). [C5180]

"Session MA5: MIMO radar processing and design"

{no data available} [C5181]

"OFDM MIMO radar for low-grazing angle tracking"

We develop a low-grazing angle (LGA) tracking method considering realistic physical and statistical effects, such as earth's curvature, vertical refractivity gradient of standard lower atmosphere, and non-Gaussian characteristics of sea-clutter. We employ a co-located multiple-input-multiple-output (MIMO) radar configuration using wideband orthogonal frequency division multiplexing (OFDM) signalling scheme. Apart from the frequency diversity provided by OFDM, we also exploit polarization to resolve the multipath signals by using polarization-sensitive transceivers. Thus, we can track the scattering coefficients of the target at different frequencies along with its position and velocity. We apply a sequential Monte Carlo method (particle filter) to track the target. Our numerical examples demonstrate the achieved performance improvements due to realistic physical modeling and OFDM MIMO configuration. [C5182]

"Integrated Aerodynamic/Stealth Design of an Un-round Cross Section Airframe"

Based on the concept of multi-objective optimization, the requirement for the design of un-round cross-sectioned airframe and stealthy performance combines the Pareto methodology and Genetic Algorithm, by using the selected operators which are the reproduction, niche and the Pareto set filter. Niched Pareto Genetic Algorithm gives better distribution and also to improve the optimization efficiency of response surface method (RSM). Based on the N-S equations numerical method to calculate the aerodynamic performance and the application of physical theory of optics and diffraction to calculate the cross-sectional area of the scattering radar, it compromises and optimizes the objective of being non-cylindrical cross-sectioned and stealthy. Hence, optimized

design results are obtained. [C5183]

"Microwave reflectometry: a sensitive diagnostic for electron density property measurement in Tore-Supra fusion plasmas"

Based on radar principle reflectometry measures the electron density in magnetic fusion plasma. On Tore-Supra, six reflectometers measure the density profiles and the properties of density fluctuations with good temporal and spatial resolution. Four swept reflectometers from 33 to 155 GHz provide reliable and accurate measurements of the whole density profile from the edge on the outer side up to the inner side. The sweeping time was recently decreased from 20 to 4 μ s. Fast profile evolution can be followed owing to high repetition rate. Density fluctuations are measured with three different techniques. The classical fixed frequency method looks at large scale density fluctuations. Properties of density fluctuations can also be recovered from consecutive frequency sweeps. Doppler reflectometry is based on wave back scattering on small scale density fluctuations. It measures the poloidal rotation and fluctuations amplitude at different wave numbers. Recent numerical simulation of plasma turbulence have recovered the wave number spectrum obtained from Doppler and fast sweep reflectometry. Reflectometry is also sensitive to the density fluctuations induced by magneto hydrodynamic perturbations. Low frequency modes can be localized by fast sweep profile reflectometry. High frequency modes excited by energetic particles accelerated by the plasma heating system are observed with fixed frequency fluctuation reflectometry. [C5184]

"A radar imaging algorithm based on stepped-frequency signal"

In the case of multi-objective detection, the received signals by radar are the vector superposition of each scattering point. High resolution imaging is a method to distinguish the location of multi-objective. Many algorithms are used for different wideband signal. In this paper, convolution back-projection (CBP) algorithm based on stepped-frequency signal is employed to process the echoes received by antenna and obtain a high resolution two-dimension (2-D) image. After adding a receiving antenna, the height of each scattering point is also gained. The simulation results show the effectiveness of the algorithm. [C5185]

"A one year comparison of radar and pressure tide gauge at Goa, west coast of India"

At many locations absolute pressure gauges are used to obtain sea level data. Therefore, knowledge of the other physical processes which effect the sea level measurements at the coast is very important to insert the required corrections. Data from the radar and an absolute pressure gauge are obtained over a period of one year from the test site at Verem, Goa, India. The variance of difference between the radar and absolute pressure gauge is 15.9 cm², which reduces to 5.7 and 4.0 cm² respectively, when atmospheric pressure and water density variations are introduced for obtaining sea level from an absolute pressure gauge. The regression analysis indicates that atmospheric pressure, water density and rainfall can account for the difference individually up to 71%, 33% and 27% respectively. The aim of the present study is to quantify the effects of atmospheric and oceanographic variables while measuring sea level using pressure gauges and to highlight the advantages of the radar gauge over other type of gauges with regard to easy installation, maintenance and could be given precedence in future applications. [C5186]

"High resolution Doppler estimation using highly Doppler tolerant signals"

We propose a new technique for Doppler estimation and also provide details of experimental verification of the same. The proposed method utilizes pulses of a highly Doppler tolerant signal to estimate the Doppler with very high resolution. This method is both analytically tractable and computationally efficient. We have compared various waveforms as candidate signals for this technique and have derived performance bounds for the estimation and the estimate resolution using simple physical insights into the problem. The details of the experimental verification of the theoretical principles is also mentioned. [C5187]

"A configurable timing and communications engine for radio positioning with implementations for an FPGA or an ASIC"

Executing various combinations of external locating techniques provides many benefits over tracking and locating systems based on radar or GPS. These embedded radio positioning applications are built on a common set of functional capabilities. Development of a specific positioning system involves selection of a subset of these capabilities and implementation into a physical form that meets the size, weight and power requirements of the application while meeting cost, schedule and risk constraints. In this paper we present the design of a timing and communications engine, which is a highly configurable resource for radio positioning applications. We also present an analysis of the design trades in implementing this functionality in a field programmable gate array

(FPGA) or as an application-specific integrated circuit (ASIC). [C5188]

"Analysis and modelling of novel band stop and band pass millimeter wave filters using defected microstrip structure (DMS)"

This paper presents novel millimeter wave filter structures by creation of some slots on the strip. These slots perform a serious LC resonance property in certain frequency and suppress the spurious signals. In high frequencies and high density applications, the board area is seriously limited, so using these filters; the circuit area is minimized. The proposed filters are compact and very suitable for high density MMIC circuits. [C5189]

"The Range-Doppler Chaotic Behavior of the Chaos-Based FM signal"

The article gives a general form of chaos-based FM radar signal, and uses ergodic criterion of chaos sequence-Lyapunov exponent as a criterion, under which the chaos-based FM radar signal having the desired thumbtack ambiguity surface, if the constraint is violated, its ambiguity surface would be away from the expectancy. The conclusion is ensured by several simulation results. [C5190]

"Moving target detection with MUSIC for the bistatic radar using digital broadcasting signals"

In the bistatic radar using broadcasting signals, the delays between signals propagated directly and scattered by the target are measured to estimate the target position with cross-correlation. This results in the delay profile with the width limited by the bandwidth of the signal. To get better resolution, larger bandwidth is required, however, the bandwidth of broadcasting signals can not be increased by the receiver. In this paper, we propose a new method of the moving target detection with MU-SIC (Multiple Signal Classification), processed at only receiver. That offers much narrower width than that of cross-correlation. The proposed method can distinguish the moving targets from the stationary targets, though the conventional MUSIC can not. This is realized by the decorrelation of the time delay-derived phase rotation factors caused by moving targets. The performances using ISDB-T (Integrated Service Digital Broadcasting -Terrestrial), the bandwidth of which is 5.57 MHz, are evaluated by the computer simulations. The results show that two close moving targets, separated by 0.1 ГВіs, with SNR=-10 dB each can be resolved even if the stationary target is located around the one moving target. [C5191]

"Analyzing signal strength versus quality levels in cellular systems: A case study in GSM"

The authors propose a new tool to analyze the performance of a cellular base station. The analysis is based on the joint processing of the received power and quality measurements, both in the uplink (UL) and the downlink (DL). These measurements are originally designed for power control and handover purposes. The main objective of the paper is to fully describe and, therefore, to detect situations involving abnormal interference levels in UL and DL. These situations can be a consequence of a malfunctioning of the power control algorithm, a bad radio optimization and planning or the presence of an outer interference, among others. The novel tool proposed is valid for any cellular system, in this paper we focus on its application to GSM/GPRS system to illustrate its benefits. We include some experiments where real cell data recordings were analyzed. [C5192]

"A Method of Synchronization between High-Speed DAC Chips"

An asynchronism problem between High-Speed DAC Chips in some multi-channel systems is analyzed. And, a method to solve this problem is proposed: Finding out the difference between clocks of each DAC, then compensating through data based on the difference in order to synchronize them. At the end, a diagram is proposed to solve the problem with this method in FPGA. [C5193]

"Design and Implementation of Digital Channelized Receiver in Multi-FPGA"

A method of parallel processing for digital channelized receiver to complex signal is proposed to solve the problem of shortage of resources in real-time signal processing. When complex signals go through poly-phase digital channelized receiver, in order to ensure there are non-blind spots and frequency aliasing, the maximum decimation factor per channel can only be half of the number of the channels. This directly increases the data that will be processed. In order to deal with this data in specific time, the processor needs more resources or higher processing speed. The paper takes full advantage of the decimate factor and analyses the law of the convolution in the non-blind spots digital channelized receiver. The filter bank structure is achieved by using two parallel computing modules. In this way, the digital channelized receiver can be achieved in several processors simultaneously. So, the resource problem is ameliorated by this parallel implementation. Experimental results proved that the proposed method performs well in distributing the processor's resources and improving the characteristic of ultra-wideband channelized receiver, especially complex signals involved. [C5194]

"Anderson-Darling Test based CFAR Detection"

An Anderson-Darling(A-D) test based CFAR detector feasible for multiple interfering targets and clutter edge scenarios is proposed and referred as AD-CFAR, which exploits K-sample A-D hypothesis test technique to censor clutter blocks needed for power estimation. Thereafter, AD test is employed for distribution test of the resultant homogenous blocks to select the proper detection algorithm from strategy library composed by the ready-made cell-average (CA), great-of (GO), Log-t detectors. Theoretical analyses indicate that the proposed AD-CFAR outperforms conventional CFAR detectors in non-homogenous clutter while maintains similar performance in noise-only scenario as CA-CFAR. [C5195]

"Design and Implementation of Radar Video Compression and Network Transmission"

Aiming at the characters of pulse compression radar video echo signal, propose a new radar video compression coding algorithm. Based on the new algorithm, design the network transmission system and validated it. The result shows the new algorithm has better performance, the network transmission system based on it can realize a long time record for radar video, keep the precise structure of target echo, and realize the information sharing. [C5196]

"Improvement of DOA Estimation Using Wavelet Denoising"

The performance of direction of arrival (DOA) estimation such as the conventional beamforming (CBF) degrades progressively with the decreasing of signal to noise ratio (SNR). The performance of DOA estimation may be improved by employing a pre-processing method which enhances the SNR before performing DOA estimation. In this paper, wavelet denoising is applied in the estimation of the direction of arrival. The idea of this method is that prior to the estimation of the DOA, each of the sensor outputs is denoised according to wavelet denoising in order to enhance the input SNR, after that the denoised signals are used for the DOA estimation. Computer simulations illustrate that the proposed method generally gives a better DOA performance over the conventional methods. [C5197]

"Traffic light system design on FPGA"

Traffic light system gives sign of direction and warning to road user to avoid road collision and to optimize the flow rate of vehicle in the junction. This paper presents design of a low cost performance traffic light system. This type of traffic light is suitable for town and small city where sophisticated traffic light system is too costly. A traffic light system nearby the university was chosen as reference. The program is written in verilog on Quartus II software and implemented on DEII FPGA board. [C5198]

"Mobile IP handoff based link layer information"

Network layer indications are not readily available upon a link change; therefore, general dependence on the network layer may introduce unnecessary delays due to network layer signaling for a simple link layer handoff. If information could be gathered at link layer to determine the need for network layer signaling, then both the delay and signaling load could be really improved over current standards. In this paper we introduce the use of link layer information which will be the main function of the Mobile IP handoff decision to reduce packet loss and handoff latency during the handoff. [C5199]

"Ultrasonic chirplet signal decomposition for defect evaluation and pattern recognition"

In this study, a quantitative method using chirplet signal decomposition (CSD) is presented for pattern recognition and defect characterization. The CSD algorithm is utilized to decompose the ultrasonic signal into a linear combination of chirplets, and efficiently estimate the echo parameters. These parameters can be correlated to the structure of defects. For experimental studies, planar and focused transducers with different center frequencies have been used for testing the embedded defects in specimen at normal or oblique refracted angles. It has been shown that the CSD successfully associates the estimated chirplets and their parameters as a quantitative method to characterize defects. [C5200]

"Evaluation of chirp and binary code based excitation pulses for 3D USCT"

3D ultrasound computer tomography (3D USCT) is a new imaging method aimed at early breast cancer detection. For synthetic aperture focusing the data is acquired with (nearly) unfocussed ultrasound emission and reception. Therefore the SNR of the data is low and needs to be optimized. Pulse compression techniques were scored for the USCT approach: Damped sine pulses ('sinusoid' pulses), linear chirps, Barker binary codes with 13 elements, Golay code sequences with 16 elements were evaluated. Applicability to the USCT setup and

designated application was tested with breast tissue mimicking phantom. Robustness and quality of the different pulses was analyzed with an empty measurement. The evaluation was based on the well-established metrics SNR, GSNR, PSF, and ISL. As overall result, the advanced time compressing techniques form radar are suitable to the USCT setup and the designated medical application. The Golay code showed the highest SNR for empty measurement (56 dB) and the object measurement (42 dB), followed by the Barker code and the chirp pulse. The sinusoid pulse has by far the lowest SNR. The evaluated Golay code is a promising option as excitation pulse for USCT, with downside of a doubled DAQ time. Therefore, the Barker code is also an option for increasing the signals' SNR. [C5201]

"Measuring Synthetic Aperture Radar target differences with stochastic distances"

Synthetic Aperture Radar (SAR) imagery plays a central role as a source of unique data for Geographic Information Systems. These data sets provide complementary information to that provided by optical and infra-red sensors as, for instance, Landsat TM, CBERS-2, IKONOS and SPOT, to name a few. SAR sensors capture information about the target roughness and its dielectric properties, and their imaging capabilities are able to penetrate clouds, fog, rain and even some types of land cover as, for instance, forest canopies. A major issue related to the use of SAR images is their statistical behavior. It is well known that classical Gaussian and additive models do not hold for such data. The multiplicative model (MM) has been extensively tested with success, and it is able to explain phenomenological aspects of the image formation. One of the most important distributions related to the MM is the $G\Gamma, B^\circ$ law. The $G\Gamma, B^\circ$ distribution, as all other laws related to the MM, greatly departs from the Gaussian model. This paper assesses the SAR image discrimination capabilities of selected parametric methods based on divergences measures, when compared to the nonparametric Kolmogorov-Smirnov testing methodology. The importance of the Triangular and Arithmetic-Geometric distances is quantified with respect to the Kullback-Leibler parametric and Kolmogorov-Smirnov non-parametric classical distances by means of Monte Carlo simulation. [C5202]

"Generation of three dimensional photo-realistic models from Lidar and image data"

Light detection and ranging (Lidar) instruments collect high density and accurate three dimensional (3D) point clouds of scanned surfaces of objects. 3D building modelling from terrestrial Lidar requires the raw point cloud data to be processed. Through processing, noise and outliers are eliminated from the point cloud, and a 3D photo-realistic model is generated using image data. This effectively reduces redundant data and enhances the visual representation. This paper deals with point cloud processing and proposes methods to automate several of the processing procedures. Specifically, we implemented automatic 3D point cloud registration, automatic target recognition used for geo-referencing, automatic plane detection algorithm used for surface modelling, and texture mapping. The proposed approach leads to the generation of accurately geo-referenced three dimensional (3D) photo-realistic models from point clouds and digital imagery. [C5203]

"A Novel Algorithm for DOA Estimation"

The classic MUSIC algorithm is well known for its high resolution capability. Based on the investigation to it, this paper presents an improvement method of the MUSIC algorithm which can perform better in the presence of correlated or coherent sources and small snapshot as well as low SNR. A new function is also presented for the information of source signal's power estimation. Simulation results have shown that the proposed algorithm is able to provide significant performance improvement over the conventional MUSIC algorithm in the condition of coherent sources and small snapshot as well as low SNR. [C5204]

"Extraction of geo-spatial information from LiDAR-based mobile mapping system for crowd control planning"

The rapid collection of accurate, up-to-date information can be a problem when planning public events. Traditional methods of data collection can be slow and disruptive in areas where the site of the public event is normally used for other public purposes. The advent of mobile terrestrial LiDAR allows for the rapid collection of this type of data without disruption to normal traffic flow patterns. This article presents a case study involving the use of mobile terrestrial LiDAR to scan the route of the 2009 Presidential Inauguration parade. This data is then used to analyze the pedestrian flow patterns for spectators to this event. [C5205]

"Classification of SHOALS 3000 bathymetric LiDAR signals using decision tree and ensemble techniques"

Coastal Management is a complex issue that is facing policy makers and scientists around the world. Monitoring the coast can be difficult given the vast stretch of water which needs to be covered. Ship-based surveys can

take weeks to perform mapping of the coastal zone. LiDAR bathymetry is a tool which shortens the survey time at reduced survey cost. The objective of this paper is to describe the parameterization of the LiDAR waveform from the SHOALS 3000 LiDAR system and show how it can be successfully used for classification of bottom habitat. Decision tree techniques and ensemble methods are used for classification purposes. The Rotation Forest ensemble method provided the greatest overall classification accuracy of 91% averaged over all fractions of the training data. [C5206]

"Expected likelihood-based detection-estimation of multirank signals"

Even for the simple rank-one plane-wave model, the accurate maximum-likelihood (ML) solution of the detection-estimation problem is infeasible, mainly because the multivariate likelihood function is non-convex and multi-extremal. For this reason, a number of "ML-proxy" routines have been developed that, in some important practical cases, approach the efficiency of the ML performance benchmark (Cramer-Rao bound, CRB), for sufficiently large sample volume T and/or signal-to-noise ratio (SNR). [C5207]

"Multi-face radar processing: A new application of MIMO radar"

Radar systems that utilize multiple phased arrays to obtain 360° coverage suffer from reduced sensitivity off-boresite from the phased array faces (aka Γ -Biscan loss Γ , B_i). Multiface radar processing is a MIMO radar technique that takes advantage of the overlapping coverage from adjacent phased array faces to provide up to 5 dB more sensitivity, compensating for the scan loss that would otherwise be incurred. [C5208]

"Session MP2: Multisensor array processing for radar, sonar, and imaging"

{no data available} [C5209]

"Compressed sensing for MIMO radar-algorithms and performance"

Compressed sensing techniques make it possible to exploit the sparseness of radar scenes to potentially improve system performance. In this paper compressed sensing tools are applied to MIMO radar to reconstruct the scene in the azimuth-range-Doppler domain. Conditions are derived for the radar waveforms and the transmit and receive arrays so that the radar sensing matrix has small coherence and sparse recovery becomes possible. Theoretical performance bounds are presented and validated by numerical simulations. [C5210]

"Analysis of circular aperture SAR image formation"

Remote surveillance using a synthetic aperture radar (SAR) flying a circular aperture offers several operational advantages over more traditional linear aperture SAR. Over the years, different SAR image formation algorithms have been proposed and analyzed. Almost exclusively, the analysis is based on straight line trajectory or linear aperture SAR. In this paper, we provide a theoretical analysis of circular aperture SAR image formation using backprojection. In particular, we show the standard backprojection formula results in a distorted image when applied to circular aperture data. We develop a modification to the standard backprojection formula that results in a distortion free SAR image. To highlight one of the main benefits of circular versus linear aperture SAR, we discuss the impact of a scatterer out of the 2-D image plane and the reconstruction of the 3-D scene reflectivity. In contrast to the linear aperture case, an out of plane scatterer is blurred in the SAR image and the amount of blurring is proportional to the height of the scatterer above the image plane. Closed form expression for the blurring are developed. Examples using simulated data are used to illustrate the applicability of the theoretical results. [C5211]

"Target tracking via a sampling stack-based approach"

We propose a novel approach to tracking a target in clutter based on the stack algorithm for tree search. The proposed tracking approach reduces the size of the search tree by employing a coarse discretization of the target state space. To reduce the quantization error that results from coarse discretization, the representative value of each quantized region is sampled from an estimated importance sampling function. A forgetting factor is included in the likelihood metric to control the effect of previous decisions and to reduce algorithm complexity. Simulations reveal that the proposed algorithm provides significantly reduced complexity while suffering no performance degradation relative to stack-based tracking with finer quantization. [C5212]

"Multiband chirp synthesis for frequency-hopped FMCW radar"

This paper presents a method for increasing radar range resolution by stitching together non-contiguous frequency-hopped FMCW radar sweeps across different dwells. The work extends previous bandwidth

extrapolation methods, designed for radar imaging of space-based objects, to applications involving clutter-dominated downward-looking radars. Multiband chirp synthesis (MCS) uses an AR model for the de-chirped radar return in frequency-separated sub-bands across multiple dwells to interpolate missing fast-time data. The method aims to achieve range resolution commensurate with the full frequency-hopped band of the radar rather than the much narrower sub-bands used during each dwell. Both pre- and post-Doppler MCS methods are discussed. Real data results are presented using a 2.4 GHz laboratory radar to synthesize a 600 MHz bandwidth return from multiple fractional sub-band dwells. [C5213]

"Polynomial-phase estimation, phase unwrapping and the nearest lattice point problem"

Polynomial-phase signals have attracted significant interest due to their applicability to radar, sonar, geophysics, and radio communication. In this paper we introduce a new technique for estimating the parameters of polynomial phase signals. The parameters are estimated by performing phase unwrapping in a least squares manner. The least squares problem is formulated as a nearest lattice point problem that can be solved using existing techniques. The statistical performance of the new estimator is excellent when compared with popular existing estimators such as those based on the discrete polynomial phase transform. [C5214]

"Reduced-rank STAP for MIMO radar based on joint iterative optimization of knowledge-aided adaptive filters"

MIMO radar has received significant attention in the past five years. In this paper, we focus on the advantage of MIMO radars in achieving better spatial resolution by employing the colocated antennas and propose a reduced-rank knowledge-aided technique for MIMO radar space-time adaptive processing (STAP) design. The scheme is based on joint iterative optimization of knowledge-aided adaptive filters (JIOKAF) and takes advantage of the prior environmental knowledge by employing linear constraint techniques. A recursive least squares (RLS) implementation is derived to reduce the computational complexity. We evaluate the algorithm in terms of signal-to-interference-plus-noise ratio (SINR) and probability of detection PD performance, in comparison with the state-of-the-art reduced-rank algorithms. Simulations show that the proposed algorithm outperforms existing reduced-rank algorithms. [C5215]

"An Effects Evaluation Method for Angle Deception Jamming"

An effects evaluation method for angle deception jamming was discussed. Based on the analysis of combat capacity of aircraft and weapon system, when the distance between radar and jammer is equal to the minimal shooting distance, the relation between the signal-to-jamming ratio at the radar input and the radar angle tracking error was obtained, and the formula for miss distance of weapon system under jamming condition was presented. In the end, the models of kill probability and its decreasing coefficient were set up, and the application example was given. [C5216]

"Efficient SAR Raw Data Simulation of Extended Scenes Using Chirp Scaling Principle"

To simulate Synthetic Aperture Radar (SAR) raw data of extended scenes efficiently, a novel hybrid domain method based on Chirp Scaling (CS) principle is proposed via the analysis of the SAR raw data model. This method first of all provides a signal by stretching the input surface reflectivity of the target in the azimuth and range directions respectively. Then SAR raw data is derived by inversed-equalizing the signal according to CS principle. A simulation scheme and the steps of processing are proposed. Some simulation results are finally presented in order to verify the accuracy and the effectiveness of the proposed simulation scheme. [C5217]

"Research on Multiplier Theorem of Difference Set Pairs"

We studied on the multiplier theorem of different sets theory, introduced and certificated the multiplier theorem based on the different sets pairs theory, by which to determine the non-existence of some Different Sets Paris. [C5218]

"Adaptive Vector Quantization of SAR Raw Data"

This paper deals with the compression algorithms of synthetic aperture radar (SAR) raw data based on vector quantization (VQ) techniques. The block adaptive tree-structured vector quantization (BATSVQ) algorithm and the block adaptive lattice vector quantization (BALVQ) algorithm are presented. Compared with the block adaptive vector quantization (BAVQ) algorithm, both of the proposed methods using constrained vector quantizer take the full advantage of SAR raw data properties of a Gaussian stationary process after a blockwise normalization. Live SAR data implementations and quantitative analysis of resultant images show that, a better trade-off between performance and complexity can be achieved by using the BATSVQ and BALVQ algorithms.

[C5219]

"Adaptive Heartbeat Mechanism for Meteorology Operation Command System Based on GPRS"

An adaptive heartbeat mechanism has been designed. Hosts on both sides can detect the states of connection established on General Packet Radio Service (GPRS) by exchange heartbeat packets. This mechanism can adapt to the network latency by detect the Round Trip Time (RTT) of transmission, reduce data flow by adjust sending interval and resume the connection automatically when network is at disconnection. This mechanism was integrated into a meteorology operation command system. Testing result performed on many types of mobile-phone indicate that this mechanism is cost-saving and improves the reaction speed for disconnection detection. [C5220]

"A novel autofocusing approach for estimating directions-of-arrival of wideband signals"

We propose a novel approach to the design of focusing matrices which play important role in the coherent methods for wideband direction-of-arrival estimation. We call this 'autofocusing' because unlike the conventional methods, our technique constructs the focusing matrices entirely by processing the received signal and does not require any preliminary DOA estimates. In this way, it overcomes the major drawback of the coherent methods which otherwise possess many desirable properties. Through computer simulations, the proposed method is found to exhibit satisfactory performance in comparison to the existing wideband DOA estimation algorithms. [C5221]

"Adaptive signal processing techniques for clutter removal in radar-based navigation systems"

The problem of background clutter remains as a major challenge in radar-based navigation, particularly due to its time-varying statistical properties. Adaptive solutions for clutter removal are therefore sought which meet the demanding convergence and accuracy requirements of the navigation application. In this paper, a new structure which combines blind source separation (BSS) and adaptive interference cancellation (AIC) is proposed to solve the problem more accurately without prior statistical knowledge of the sea clutter. The new algorithms are confirmed to outperform previously proposed adaptive schemes for such processing through simulation studies. [C5222]

"Image-based querying of urban photos and videos"

We extend recent automated computer vision algorithms to reconstruct the global three-dimensional structures for photos and videos shot at fixed points in outdoor city environments. Mosaics of digital stills and embedded videos are georegistered by matching a few of their 2D features with 3D counterparts in aerial ladar imagery. Once image planes are aligned with world maps, abstract urban knowledge can propagate from the latter into the former. We project geotagged annotations from a 3D map into a 2D video stream and demonstrate their tracking buildings and streets in a clip with significant panning motion. We also present an interactive tool which enables users to select city features of interest in video frames and retrieve their geocoordinates and ranges. Implications of this work for future augmented reality systems based upon mobile smart phones are discussed. [C5223]

"Spectral estimation for clutter processing in digital radars by Dimension-Adaptive Particle Swarm Optimization (DA-PSO)"

Power spectrum estimation from radar data is essential for target detection. For instance, microburst causes detrimental effects on airplane performance, and hence its detection is critical. We compare auto-regression (AR), Periodogram, Kaiser windowed Periodogram, and multiple-signal-classification (MUSIC) methods for microburst clutter spectrum estimation. Given a long train of returned signal, we are able to segment the signal to obtain multiple estimations of the parameters, which leads to a more accurate estimation after coefficient averaging. The estimated power spectrum is then integrated for clutter magnitude calculation to determine whether a target is present at certain cell. The magnitude of clutters in an ensemble from a wide region spatially or through time temporally is used to estimate the clutter map. We choose a K-distribution mixture model over the traditional Rayleigh distribution to better approximate the tail structure of the distribution to minimize the false alarm rate. We show that Dimension-Adaptive Particle Swarm Optimization (DA-PSO) is robust to sample size in estimating the K-distribution mixture model, which is desirable for real-time implementations. [C5224]

"Robustness of a correction method applied to a vertically deformed HFSWR on buoys"

This paper presents two correction methods for vertical deformations of the receiving array belonging to HFSWR on buoys. The method inspired from Schelkunoff's representation is more robust to the deformation's uncertainty

problem. [C5225]

"The effects of SAR data compression on coherent and non-coherent change detection"

The performance of coherent and non-coherent change detection algorithms is evaluated using complex SAR data that have been processed with various data compression algorithms. When BAQ compression is applied to raw (I,Q) SAR phase-history data, our previous studies show that to obtain reasonably good coherent change detection (CCD) performance, BAQ compression requires 4-bit quantization of the I and Q phase-history samples; since the original data were 8-bits, the resulting compression ratio (CR) achieved using BAQ was a factor of 2. This paper demonstrates a wavelet-based compressive sensing approach that gives CR = 3 with comparable CCD performance; we also demonstrate a wavelet-based SPIHT approach that gives CR = 4 with comparable CCD performance. [C5226]

"Detecting 3-D rotational motion and extracting target information from the principal component analysis of scatterer range histories"

ISAR imagery of ships are complicated by the 3-D motion of the target, which causes blurring in the imagery. A technique is proposed which could help detect such motion and prove useful to both analyse the 3-D motion as well as possibly help to estimate the 3-D position of scatterers as a by-product of the analysis. The technique is based on principal component analysis of accurate scatterer range histories and is shown only in simulation. Future research should focus on practical application. [C5227]

"ONERA DRIVE project"

Future UAV employment in the civilian areas of surveillance and communication relays can be conceived now at short term range. Flight tests for such applications have already been done and validated UAV interest. In the domain of remote sensing, and more precisely imagery, many payload configurations may be used in UAV operations, but compared to sensors working in other spectral regions (such as optical or infrared sensors), radar sensor has the main advantage to be able to operate in all-weather condition. [C5228]

"Use of ASTRAD Simulation Tool in radar modes development"

ASTRAD, for Architecture & Simulation Tool for Radar Analysis & Design, is a graphical integrated environment for radar simulation developments. [C5229]

"3 GS/s S-Band 10 Bit ADC and 12 Bit DAC on SiGeC Technology"

In advanced applications such as digital radar, Ultra Wide Bandwidth communications and software defined radio, the need for instantaneous bandwidth often drives system design decisions. Access to high speed data converters enabling up and down conversion directly in the L Band and S Band removes the limit imposed by bandwidth scarcity and allows the design of flexible and simplified system architectures. Broadband ADC's (Analogue to Digital Converters) and DAC's (Digital to Analogue Converters) are key enabling components which open up new design opportunities for digital transceiver systems, including digital down and up-conversion closer to the antenna. In this regard, this paper describes new 10bit 3GS/s ADC and 12 Bit 3GS/s DAC, based on a 200 GHz SiGeC bipolar Technology, which enables direct digitizing or synthesizing of 1GHz arbitrary broadband waveforms directly in the high IF region closer to the Antenna. [C5230]

"Moving target localization using dual-frequency continuous wave radar for urban sensing applications"

The dual-frequency continuous wave radar measures the target range by comparing the signal phases of two single-tone frequencies. Unfortunately, in practical measurements, the range estimation result suffers significantly from direct-path coupling and return signals from other unwanted scatterers. It is also not applicable when multiple targets exist simultaneously. This paper adopts a simple but effective approach that takes the phases of target signals in Doppler domain for comparison. Thus, the range of the moving target can be estimated without the influences of direct-path coupling and other unwanted return signals. Benefiting from the coherent Doppler integration, the range estimation accuracy in noisy environment is improved. Moreover, the adopted technique is also applicable for multiple moving targets if their Doppler frequencies are separable in the Doppler domain. [C5231]

"Issues with consistent generic representations of a radar"

This paper discusses the potential value of generic representations of radars for cooperation between

autonomous sensor platforms, but shows that truly generic representations of radars, or other sensors are probably not possible. The practical difficulties in such a generic approach are illustrated by some examples. A theoretical justification for why such a generic approach may be impossible is produced-the abstractions which have to be made in order to be able to reason about the radars' capabilities will inevitably over-simplify the description for other purposes. An analysis of a number of descriptions of pulse Doppler radars and their environments, taken from different radar simulations has shown major difficulties in trying to reconcile the descriptions. This is further support for the thesis that the aim of generic representations is impossible and this sub-problem could be considered a challenge to be met by any attempt to demonstrate that it is possible.

[C5232]

"Low cost moving target tracking and fire control"

Classical solutions for moving target tracking and fire control are complex and costly as they involve high performance radar, specific weapons and highly accurate seekers. The innovative solution described in this article uses a multiplatform configuration to simultaneously track target and weapon, thanks to a GMTI mode with a wide velocity waveform. The accuracy of the initial designation and the subsequent target+weapon update allow the use of a simpler weapons, drastically reducing the global mission cost. [C5233]

"Radar tracking of a maneuvering ground vehicle using an airborne sensor"

In this paper we compare four different sequential estimation algorithms for tracking a single maneuvering target using data collected by an airborne sensor. The target is ground-based and its motion can be modeled according to Markov chains theory. Maneuvers refer to an inertial reference system and are defined by three different kinematic models: stop, constant speed and maneuver. We analyze a realistic car traffic scenario by considering a sensor whose motion is circular around the designated target. The target motion is defined in Cartesian coordinates, while measurements are expressed in sensor-centered spherical coordinates. Both the target and measurement update equations are characterized by the presence of additive Gaussian noise with known powers. The particular geometry between the target and the sensor can introduce fictitious accelerations. As a consequence, heavy nonlinearities can be generated, especially during the stop and turning phases. This problem is addressed defining both the target and sensor motion directly in continuous-time. In order to extract the kinematic features of the target, Bayesian inference is made on the set of noisy measurements. A special interest is devoted to the use of a particle filter (PF). In particular, we compare two PF-based algorithms, i.e. the multiple model particle filter (MM-PF) and the multiple model auxiliary particle filter (MM-APF), to the well-established extended Kalman filter (EKF) and the interacting multiple model EKF (IMM-EKF). Advantages and disadvantages of the proposed algorithms are illustrated and discussed through computer simulations. [C5234]

"Low cost technology for transmit receive modules"

The growing maturity of ESCAN radar for airborne applications calls for greater emphasis on cost-effective packaging in the active antenna. An attractive solution is to distribute the TRM components across a multi-channel PCB, adopting commercial assembly techniques where possible. Component design, PCB structure and antenna layout are key enablers of low cost manufacture. [C5235]

"A Java-Based Interface for Creating and Mining RDF Database"

The Resource Description Framework (RDF) language can be used to describe data and the relationships between different objects in the data. As larger amounts of data are generated, many applications in the Signal and Image Processing areas such as radar image processing, electromagnetics, etc., present users with the challenge of representing and mining the data. In many cases, this data resides on secure Department of Defense Supercomputing Resource Centers (DSRC). Our earlier work developed a Web interface for querying and searching this RDF data and also allowed users to transfer this data between DSRCs. In this paper, we describe the architecture improvements in the Web interface that make the application easier to deploy, maintain, and modify. The entire application has been refactored in an object-oriented manner, making it easier to customize and re-use parts of the application in other Java based tools. Additionally, we have developed a Java-based tool for creating the metadata associated with existing data. The RDF creation tool makes it easy for users to create RDF databases without the need to learn the intricacies of the RDF language. This new tool can also be integrated into the Web application thus allowing users to generate RDF databases for new data. Pilot studies were also conducted to enable the use of mpscp for high bandwidth data transfers, with promising results. [C5236]

"T/R-module technologies today and possible evolutions"

After many years of development the active electronically scanned array (AESA) radar technology reached a

mature technology level. Many of today's and future radar systems will be equipped with the ASEA technology. T/R-modules are key elements in active phased array antennas for radar and electronic warfare applications. Meanwhile T/R-modules using GaAs MMICs are in mass production with high quantities. Top priority is on continuous improvement of yield figures by optimizing the spread of key performance parameters to come down with cost. To fulfill future demands on power, bandwidth, robustness, weight, multifunctional sensor capability, and overall sensor cost, new emerging semiconductor and packaging technologies have to be implemented for the next generation T/R-modules. Using GaN MMICs as HPAs and also as robust LNAs is a promising approach. Higher integration at the amplitude and phase setting section of the T/R-module is realized with GaAs core chips or even with SiGe multifunction chips. With increasing digital signal processing capability the digital beam forming will get more importance with a high impact on the T/R-modules. For lower production costs but also for sensor integration new packaging concepts are necessary. This includes the transition towards organic packages or the transition from brick style T/R-module to a tile T/R-module. [C5237]

"Compensation of clutter spectrum for airborne forward-looking radar based on the clutter subspace transformation"

Space-Time Adaptive Processing (STAP) is a powerful two-dimensional filtering algorithm for clutter suppression. However, most previous studies of STAP theory have focused on side-looking array radar (SLAR). This paper addresses the issue of forward-looking radar from a STAP. The clutter distribution of airborne forward-looking radar is analyzed and investigated, and a new clutter suppression approach to airborne radar with forward-looking array based on clutter subspace is proposed. This method is referred to as clutter subspace transformation (CST) matrices, use clutter subspace transformation matrices are shown to eliminate ground clutter heterogeneous and generate a sufficient data to construct the new covariance matrix. Finally, the conventional STAP could be applied to the clutter suppression. Simulation results show a good improvement in processor performance. [C5238]

"Modular system design for a new S-band marine radar"

This paper describes a new approach to marine radar design. New IMO regulations allow marine radars to be designed with solid state transmitter power amplifiers using pulse compression waveforms and coherent Doppler processing. This gives a new flexibility and better possibilities to control the transmitter spectrum. The modular system design applies to waveform generation, signal processing and RF hardware. [C5239]

"ASTRAD platform: A future reference in radar simulation"

ASTRAD, which means Architecture and Simulation Tools for Radar Analysis and Design, is a simulation platform, providing services and allowing users to develop, use and exploit complex simulations. The concept of platform is a key point for reducing development time and cost, and focusing on core development. [C5240]

"An extra-trees-based automatic target recognition algorithm"

In this article, we describe a new automatic target recognition algorithm for classifying SAR images. It is based on the PiXiT image classifier, already used in several applications, which uses randomized sub-windows extraction and extremely randomized trees (extra-trees). This approach requires very little pre-processing of the images, thereby limiting the computational load. It was successfully tested on the public standard MSTAR database, achieving a misclassification rate of about one percent. [C5241]

"Nonuniform pulse intervals and nonuniform frequency steps for managing radar ambiguity properties"

The theory of nonuniform or irregular sampling has many new application areas. With pulsed radar, a classic example of nonuniform sampling is staggered PRF which provides aid for MTI or Doppler processing. For example with a conventional surveillance radar, PRF is often too low for decent Doppler analysis due to operational requirement of unambiguous range. This paper discusses a nonuniform sampling scheme that guarantees a desired unambiguous measurement. The approach is applied to two experiments. First, staggering a sequence of PRIs provides desired unambiguous Doppler. Second, range ambiguity is solved correspondingly with a stepped frequency waveform. Of course, one can achieve these by utilizing conventional uniform sampling but with considerably higher number of samples. Results with real pulsed radar recordings prove the applicability of the sampling scheme. [C5242]

"RF MEMS technology for radar sensors"

An overview of applications of radio frequency microelectromechanical system (RF MEMS) technology in radio

detection and ranging (radar) sensors is given. RF MEMS components for radars include attenuators, limiters, (true-time-delay) phase shifters, transmit/receive (T/R) switches and tunable matching networks. Radar subsystems which benefit from RF MEMS technology include active electronically scanned arrays (T/R modules), passive electronically scanned arrays (lenses, reflect arrays, subarrays, and switched beamformers), and radomes. Using a bottom-up approach, the figures of merit for RF MEMS technology are related to the figures of merit for radar subsystems. The paper also discusses ultra wideband RF MEMS reflect array and T/R module design as examples. First, electronically scanned array, radar and RF MEMS fundamentals are briefly introduced. [C5243]

"Handling range-ambiguities in registration-based range-dependence compensation for conformal array STAP"

We consider space-time adaptive processing (STAP) when the radar returns are recorded by a conformal antenna array (CAA). The statistics of the secondary data snapshots used to estimate the optimum weight vector are not identically distributed with respect to range, thus preventing the customary STAP processor from achieving its optimum performance. Realistic compensation of the range dependence of the secondary data requires to account for range ambiguities in the clutter returns. We propose an innovative extension of our registration-based range-dependence compensation algorithm. Our extension allows to obtain an accurate estimate of the interference-plus-noise covariance matrix even when the ground clutter return for a given fast-time sampling instant includes returns from isoranges that are ambiguous in range. The performance in terms of signal-to-interference-plus-noise ratio loss is promising. [C5244]

"A GPU based real-time SAR simulation for complex scenes"

This paper presents a novel simulator which uses programmable graphics processing units (GPU) to generate Synthetic Aperture Radar (SAR) images. The conventional SAR simulations, based on mere mathematical computation, are usually time-consuming and not intuitionistic. In this paper, a new method which can simulate real-time SAR images even for complex scenes is developed. The simulator takes the advantage of computer graphics in three-dimensional display and combines it with SAR principle to yield the SAR images. This is implemented on graphics hardware, which offers 3D hardware acceleration and programmable GPU. [C5245]

"Design of digital beamforming subarrays for a multifunction radar"

Digital beamforming (DBF) in phased array radars is an enabling architecture for advanced signal processing algorithms such as adaptive beamforming and high resolution angle estimation. At the current level of technology, DBF can only be practically implemented at a subarray level for large arrays operating at high frequencies. The choice of subarray layout has a significant impact on the performance of array signal processing algorithms. In this paper, an approach to optimizing the subarray layout with respect to select performance metrics is presented. [C5246]

"SAR Image classification using textural modeling"

It is recognized that texture is an important factor to discriminate forest types and other land cover in Synthetic Aperture Radar (SAR) images. This paper outlines an approach for texture modeling which is suitable for land identification using SAR images. The model is non parametric and is based on a likeness measure between neighborhoods. This study covers the problem of testing the mathematical descriptions of the model by using them to generate synthetic textures analogous with the source textures from which they were derived. This model has multiple applications in many image processing tasks such as texture segmentation, texture compression, inpainting, etc. We focus, here, on the practical application of terrain mapping. [C5247]

"UAV Flight plan optimized for sensor requirements"

To achieve surveillance missions at safety distance, the UAV surveillance radar shall provide SAR (Synthetic Aperture Radar) images and also SIGINT and EO/IR payloads. This article presents the flight plans generated for these UAV by new generation technologies (genetic algorithms) respecting the constraints of uses of the sensors (angles, distances of recording), the UAV performances (load factor in bend, height of cruise, speed of maximal stamina) as well as the environment of the theatre of operation (relief, meteorology, restricted zones). [C5248]

"Development and evaluation of a new real-time detection method of atmospheric turbulent structures by an airborne X-band Doppler radar"

This work is devoted to the detection of turbulent structures such as gravity waves triggered by convective

activity and paves the way to indirect detection of some Clear Air Turbulences by airborne X-band radar. We describe a new analysis of Doppler information, which allows the retrieval of the 3D wind field around the convective structure and provides an early warning of severe turbulence. This method is assessed using synthetic data and applied to real observations. [C5249]

"Harmonic automotive radar for VRU classification"

A harmonic radar and set of passive transponders are used for detection and identification of vulnerable road users (VRU) in automotive applications. The radar system transmits a signal consisting of two distinct frequency components in the 76-81 GHz band. A small transponder is carried by the VRU. The antenna and the electric circuitry of the transponder are printed on flexible film and it can therefore be integrated in clothes. In the transponder the two frequency components are mixed together and a harmonic product, offset from all other reflections, is transmitted back to the radar. By synthesizing this harmonic frequency the radar system can unambiguously identify and localize VRU. [C5250]

"Robust TDOA passive location using interval analysis and contractor programming"

This paper presents a new approach for solving non-linear passive location problems. It is based on a high level interval modeling language named Quimper. Whereas classical passive location resolutions do not provide any guarantee of convergence to a solution, interval analysis, constraint propagation and contractor programming allow us to avoid any approximations and any linearization. Besides, Quimper naturally provides guarantees on location and bounded error. TDOA passive location configurations are discussed to prove Quimper's efficiency. [C5251]

"The effects of reduced bandwidth on HF surface wave radar performance in ship detection"

Bandwidth reduction not only degrades the range resolution of a radar, but may also reduce the maximum detection range. In the clutter-dominated region, the target signal-to-clutter-plus-interference-and-noise power ratio (SCINR) is reduced by the same factor as the bandwidth, but in the external-interference-and-noise-dominated region, the SCINR is unchanged. A dataset from a monostatic pulse HF surface wave radar (HFSWR) operating between 3 and 5 MHz is used to illustrate the effects of a 3-dB bandwidth reduction on the radar performance. The results show that in the detection of large ships, the maximum detection range is essentially unchanged, but in the detection of small ships, the maximum detection range is reduced. [C5252]

"Radar systems for "Sense and Avoid" on UAV"

Up to now, UAV are widely used, but only in special conditions, both in space and time, which leads to the notion of "segregated airspace". Sense and Avoid systems must be installed on board the UAV to allow their insertion in the general air traffic. Such systems will include cooperative and non-cooperative sensors for reliability. The radar is likely the most useful non-cooperative sensors because it is an "all-weather" sensor and it provides, by essence, accurate ranging and closing speed. The paper discusses solutions in three radar bands: S, X and Ka bands. For each of them, one or two solutions are presented and the pros and cons are discussed. It will be seen that X band is an interesting solution to be pursued. [C5253]

"The airborne SAR-system: SETHI airborne microwave remote sensing imaging system"

SETHI, the airborne SAR system developed by the ONERA, the French Aerospace Lab., integrates a new frequency band radar: the UHF-VHF component. Thanks to its new payload, SETHI can operate over a wide range of frequency bands from UHF-VHF, to X including L-Band and has polarimetric and interferometric capabilities. We describe in this paper the pod-based SAR-system SETHI and its associated numeric remote control. Then we describe the UHF-VHF validation campaign and as a conclusion the first polarimetric SAR results. [C5254]

"Analysis of vibrating lightweight radar antennas"

Future military aircraft and UAV's require the installation of lightweight and low-cost Electronically Steerable Antennas (ESA) which are needed by high-performance Airborne Moving Target Indicator and Surface Moving Target Indicator radars. When these antennas are integrated into the skin of air vehicles, they are subject to unsteady aerodynamic loads. Mechanical forces and these aerodynamic loads will cause deformation of the antenna surface. In this paper the effects of vibrations on Direction of Arrival are investigated. [C5255]

"UK airborne AESA radar research"

This paper reviews current UK airborne active electronically scanned array (AESA) designs, discusses current trends towards higher digitisation and multi-function aperture concepts, and details the key future challenges that this technology faces. Specifically the paper discusses applications to fast-jets. Key requirements are for higher levels of digitisation to provide the performance required in ECCM, STAP, GMTI and ESM modes. Building radar systems with the key basic building blocks to as a minimum enable future realisation of these advanced modes will help to future proof the systems. This design philosophy is integral to the concept of through life capability management (TLCM)-i.e. a system designed to support the ability to sustain capability through incremental, spiral upgrade of signal processing, line replaceable items (LRIs), firmware and advanced modes. [C5256]

"Modelling the shape parameter of sea clutter"

The variation of the radar sea clutter K distribution shape parameter with environmental and radar parameters is investigated using recorded data and scattering calculations. The results indicate that improvements to the current empirical model are possible, in particular with regard to its lack of dependence on wind speed and sea state. The extension of the model to littoral environments is also considered. [C5257]

"Detection of vessels in littoral waters in two-channel XWEAR SAR imagery"

X-band Wideband Experimental Airborne Radar stripmap Synthetic Aperture Radar signal data of moving vessels in the St. Lawrence Seaway were acquired in a novel two-channel mode in 2007 and 2008. The data are combined and used in the two-channel interferometric mode for the development of a methodology to separate the images of vessels in littoral areas from the background. The first XWEAR interferometric stripmap images have been obtained and presented in this study. [C5258]

"New polarimetric SAR processors based on signal and interference subspace models"

We develop in this paper new polarimetric SAR processors based on signal and interference subspaces model. These processors aim at using models with physical and polarimetric scattering properties not exploited by the isotropic point model. Our goal is to increase the response of the target and decrease the response of the interferences. These processors are implemented by computing the corresponding target and interference subspaces. Results on FOPEN simulated data with realistic target show the interest and the limits of these new processors. [C5259]

"Broad band RF module of millimeter wave radar network for airport FOD detection system"

Foreign Objects and Debris (FODs) must be removed from runways. With the necessity of automatic continuous survey, we are investigating a new FOD detection system based on a millimeter wave radar network. This paper describes the concept of this FOD detection system and the Radio Frequency (RF) module for this application. In order to minimize cost and size, we installed a broadband FMCW radar using commercial Millimeter wave Monolithic ICs (MMICs) to improve range resolution, with a performance of a 5 GHz bandwidth at the 76 GHz band. We also present the results of practical tests and field tests at Sendai airport using 500 MHz FM deviation. The results indicated that it was sufficient to detect -20 dBsm FODs using low power MMW radar. [C5260]

"The resonant frequency optimization of aperture-coupled microstrip antenna using particle swarm optimization algorithm"

Aperture coupled microstrip antenna is gathering a lot of interest in communication and radar systems. Particle swarm optimization (PSO) has been introduced to the electromagnetic community recently for design optimization of microstrip patch antenna. In this paper PSO has been used for accurate determination of resonant frequency of rectangular aperture-coupled microstrip antenna. The investigation is made at different microwave frequency ranges and it extends up to Ku band. The procedure is repeated for different dielectric constant of antenna and feed substrate. The optimization problem has three variables namely, aperture length, aperture width and stub length respectively. Accuracy of the results encourages the use of PSO. [C5261]

"MSE Bounds for Phase Estimation in Presence of Recursive Nuisance Parameters"

The mean squared error (MSE) is commonly used to measure and compare the performance of various phase estimation techniques in communications and signal processing systems. When the received signal contains recursive nuisance parameters, the MSE is extremely difficult to obtain and even the conventional modified Cramer-Rao bound (MCRB) can not be readily applied. In this paper, a recursive MSE bound and its simplified calculation method are proposed to solve the problem. As an application example, an adaptive hybrid antenna array and its associated angle-of-arrival (AoA) estimation technique are presented. The MSE of the AoA

estimation is simulated and compared with the recursive MSE bound and MCRB. The results show that the proposed recursive MSE bound provides a tighter lower MSE bound than the recursive MCRB. [C5262]

"An MSK Waveform for Radar Applications"

We introduce a minimum shift keying (MSK) waveform developed for use in radar applications. This waveform is characterized in terms of its spectrum, autocorrelation, and ambiguity function, and is compared with the conventionally used bi-phase coded (BPC) radar signal. It is shown that the MSK waveform has several advantages when compared with the BPC waveform, and is a better candidate for deep-space radar imaging systems such as NASA's Goldstone Solar System Radar. [C5263]

"Energy efficient cluster-based target tracking strategy"

This paper proposes a cluster-based target tracking strategy for one moving object using wireless sensor networks. The sensor field is organized in 3 hierarchical levels. 1-bit message is sent when a node detects the target. Otherwise the node stays silent. Since in wireless sensor network nodes have limited computational resources, limited storage resources, and limited battery, the code for predicting the target position should be simple, and fast to execute. The algorithm proposed is simple, fast, and utilizes all available detection data for estimating the location of the target while conserving energy. This has the potential of increasing the network life time. Simulation results show that the strategy saves energy while estimating the location of the target with an acceptable error margin. [C5264]

"On the Use of High-Order Moment Matching to Approximate the Generalized-k Distribution by a Gamma Distribution"

Composite fading takes place in several communication channels due to the random variations of the local average power of the received multipath-faded signal. The generalized-K (gamma-gamma) probability density function (PDF) has been proposed recently to model composite fading in wireless channels. However, further derivations using the generalized-K PDF have shown to be quite involved due to the computational and analytical difficulties associated with the arising special functions. In this paper, the approximation of the generalized-K PDF by a gamma PDF using the moment matching method is explored. As expected, matching positive and negative moments leads to a better approximation in the upper and lower tail regions, respectively. However, due to arising limitations for small values of the multipath fading and shadowing parameters, and the higher level of accuracy sought, the use of an adjustable form for the expressions of the approximating gamma PDF parameters, obtained by matching the first two positive moments, is devised. The optimal values of the adjustment factor for different integer and non-integer values of the fading and shadowing parameters are given. The introduced approximation may simplify performance analysis in distributed antenna systems (DASs), network MIMO, multihop relay networks, radar, and sonar systems. [C5265]

"Centralized and Distributed Optimization of Ad-Hoc Cognitive Radio Network"

In this paper, we study coexistence and optimization of an ad hoc cognitive radio network (CRN) coexisting with multicell primary radio networks (PRNs). We assume the PRN cells operate in multiple frequency subbands, and the ad hoc CRN can utilize several subchannels in each PRN subband using spectrum underlay, which maintains that the pre-specified PRN signal-to-interference-plus-noise ratio (SINR) outage probability is not violated. To jointly optimize the throughput of the ad hoc secondary user (SU) links, we utilize the Lagrange duality optimization tool and design fast-convergent weighted sum rate (WSR) maximization schemes under important system and quality of service constraints, including the power spectral mask (PSM), the available transmit power of SUs, the maximum-subchannel-rate, and the minimum-rate per SU link. Both continuous rate (C-rate) and discrete rate (D-rate) modulations are considered. Additionally, we design a distributed access duality scheme which uses the mini-slot competition approach and involves only CRN local information exchange for the dual update, and achieves fast and stable convergence. Effects of many system operating parameters are presented via simulation results, which show that the optimal duality scheme can perform substantially better than the suboptimal duality scheme, and that the performance loss of the distributed scheme is small compared to the centralized scheduling. [C5266]

"The optimization algorithm of target range profiling for airborne radar"

The range profile is redundant and disordered because the sample interval time is less than transmitted pulse width. The accurate estimation and optimization of the target range profile are essential for realizing the airborne microwave sensor detection system. In this paper, an algorithm for the real-time estimation and optimization of the target range profile due to over-sampling is presented for the airborne stepped frequency pulse sensor system. Under the condition of oversampling this new algorithm employs the FFT and optimization method to

estimate and optimize the target range profile within antenna beam dwell time by using high speed DSP. Through the simulation of sensor data, the target range profile spectrum is measured and analyzed. The result of simulation is that this new algorithm can reduce the effect of over-sampling on the range profile and obtain high resolution range profile of target. [C5267]

"Efficient sparse target tracking algorithm for navigation with UWB-OFDM radar sensors"

There is a great need to develop non-GPS based methods for position and navigation in situations where GPS is not available. This paper presents orthogonal frequency division multiplexed (OFDM) radar signals. Originally designed as a broadband communications device, the OFDM radar will serve an additional function as a navigation system. The paper focuses on the development of a signal processing method for using to the OFDM signal in synthetic aperture radar (SAR) configuration, for potential use as a navigation sensor. [C5268]

"Target identification performance improvement from enhanced HRR radar clutter suppression"

Airborne radar tracking in moving ground vehicle scenarios is impacted by sensor, target, and environmental dynamics. Moving targets can be assessed with 1-D High Range Resolution (HRR) Radar profiles with sufficient signal-to-noise (SNR) present which contain enough feature information to discern one target from another to help maintain track or to identify the vehicle. Typical radar clutter suppression algorithms developed for processing moving ground target data not only remove the surrounding clutter but also a portion of the target signature. Enhanced clutter suppression can be achieved using a multi-channel signal subspace (MSS) algorithm which preserves target features. In this paper, we exploit extra information from enhanced clutter suppression for automatic target recognition (ATR), present a gain comparison using displaced phase center antenna (DPCA) and MSS clutter suppressed HRR data, and generate confusion-matrix identification results. The results show that more channels for MSS increase ID over DPCA, result in a slightly noisier clutter suppressed image, and preserve more target features after clutter cancellation. [C5269]

"Angle of arrival measurement using wideband linear phased array"

A radio frequency (RF) signal detection algorithm is developed based on two-dimensional fast Fourier transform (FFT) on phased array time series data. The sensitivity is calculated based on two-frame signal detection criterion. A collection system consisting of a linear phased array and multiple wideband digital receivers is utilized. Simulation results are presented based on the system parameters of the channelization frequency plan including the frequency range, LO, mixer, and sampling frequency. Experimental angle of arrival data are processed, and the results are shown to be in good agreement with the simulation results. [C5270]

"Bistatic HF ocean radar: Errors and limitations"

Bistatic HF ocean radars are being proposed as a useful option when planning the layout of coastal stations for mapping sea surface currents. Monostatic HF ocean radar stations measure the components of the vector currents which are radially towards or away from the stations. The combination of the radials from one point on the sea surface to each station can be combined to produce the familiar surface current maps, which are the primary product from HF ocean radars. If the monostatic radars were also operating in bistatic mode, then components of the vector current are measured in the direction of the normal to each ellipse which represents a signal path length from the transmitter to the scattering point (on the ellipse) and on to the receiver. Stylised pictures of this geometry show that these surface current components are directed towards the general area of the midpoint between the transmitter and the receiver, and can be useful in reducing errors by providing extra, redundant, information in the calculation of the re-constituted vectors. Errors in determining the location of the scattering point in bistatic radar observations in some circumstances lead to degradation of the accuracy of the currents which can be detected. In this paper we consider two effects: the effect of receiver beamwidth; and the effect of receiver bandwidth. [C5271]

"Navigation system using seafloor geodetic mirror transponders and full-swath mapping system with synthetic aperture and triangle-arrayed interferometry techniques for autonomous underwater vehicle"

We started a new three-year project in 2008 for developing a navigation technology accurate to cm-level and a seafloor bathymetric survey technology at cm-level resolution, when AUV skims several tens meters above the seafloor. The technologies could be expected a practical application of searching for submarine minerals, such as thermal vents a few meters high, to a depth of 3,000 meters. We have developed initial L-array interferometric bathymetry sonar and used it in tens of surveys for searching thermal vents on the seafloor so far. The new full-swath sonar project integrating synthetic aperture, triangle-array interferometry, and multi-beam

techniques was adequately accepted in recognition of past performances of the present interferometric sonar and high accurate seafloor geodetic survey technologies to centimeters, which have been developed by us and practically used during the past ten years. For the synthetic aperture interferometric bathymetry measurement system, we developed the automatic focusing method and verified its effectiveness to realize a relative position correction on the order of millimeters. We also created five rows of new experimental 1.2 m-long receiving arrays with eight embedded hydrophones, and located them in a triangular position. We will use this triangle array and combine the interferometric system and synthetic aperture processing. Next, we designed and developed the long base line (LBL) navigation system using seafloor acoustic reference stations to realize simultaneous measurement of the distance to the four stations. In the initial year, we developed prototype equipment and designed and investigated the measurement systems using it to achieve our final goal. This year, we are designing and producing experimental systems for practical use based on those test results. Next year, we will conduct actual tests to verify the effectiveness of a submarine resource survey using ROV or AUV. These instructions give you basic guidelines for- preparing papers for conference proceedings. [C5272]

"AUV incidents and outcomes"

The remote and autonomous underwater vehicle community has been growing at a tremendous rate. The consequence of which is the increased contact of these vehicle systems with the general population who are using the ocean for legitimate business and recreation. Some of these encounters are humorous, some of them are stressful, and others cause us as operators to sigh with great relief that a potential situation didn't occur. The Monterey Bay Aquarium Research Institute (MBARI) has operated remotely operated vehicles for over 20 years. In that time we've had a number of close calls and some closer than we'd like. To date the situations have never given us cause to engage a lawyer but neither have they always been a science success. Currently the majority of the US science community operates without regard to liability, with the possible exception of insurance against an expensive loss. The potential for liability and coverage for damages is a question usually asked after the fact. The purpose of this paper and panel discussion is to consider, with the ocean science users, if a proactive stance regarding potential liability is a pending topic of concern to science. I believe the discussion in this paper demonstrates without a doubt we are facing liability issues and we already have explicit and/or implied requirements to mitigate the potential for detrimental outcomes by our systems operating in the world's oceans. [C5273]

"The NANOOS Visualization System: Aggregating, displaying and serving data"

The Northwest Association of Networked Ocean Observing Systems (NANOOS) is one of eleven Regional Associations of the US Integrated Ocean Observing System (IOOS). NANOOS serves the Pacific Northwest from the US/Canada border to Cape Mendocino on the northern California coast. Its mission is to coordinate and support the development, implementation, and operations of a regional coastal ocean observing system (RCOOS) for the Pacific Northwest region, as part of IOOS. A key objective for NANOOS is to provide data and user-defined products regarding the coast, estuaries and ocean to a diverse group of end users in a timely fashion, and at spatial and temporal scales appropriate for their needs. To this end, NANOOS is developing a web mapping portal, the NANOOS Visualization System (NVS), that aggregates, displays and serves near real-time coastal, estuarine, oceanographic and meteorological data, derived from buoys, gliders, tide gauges, HF Radar, meteorological stations, satellites and shore based coastal stations, as well as model forecast information in such a way that it presents end users with a rich, informative and meaningful experience. NVS makes use of a variety of services, including the Google Maps service and a data translation and visualization service known as ERDDAP (Environmental Research Division's Data Access Program), compliant Open Geospatial Consortium (OGC) web standards such as the Sensor Observation Service (SOS), Web Map Service (WMS), and Keyhole Markup Language (KML), as well as the Open-source Project for a Network Data Access Protocol (OPeNDAP) as served and cataloged by the NANOOS THREDDS (Thematic Realtime Environmental Distributed Data Services) Data Server (TDS). These heterogeneous data streams are transformed on-the-fly to other formats or representations, which NVS makes available to the end user via a Google Maps interface. We will describe in detail the NVS development process and will demonstrate the ability of NVS to serve as a portal for one-stop access to near real-time regional data and forecast products, including NOAA's first seven core variables? (ocean currents, temperature, salinity, water level, waves, chlorophyll and surface winds), by describing the data flows from NANOOS funded coastal and ocean observing and forecasting assets as well as Federal assets. In addition, we will describe future development plans that include greater functionality, iteratively improving NVS based on feedback received at planned training workshops and from identified stakeholders, and updating NVS to be compliant with future IOOS and OGC standards. [C5274]

"Next generation use of high power and bandwidth in the NE Pacific-A component of the NSF Ocean Observing Initiative"

This paper will present the unique opportunities of integrating the existing Integrated Ocean Observing System (IOOS) technologies with the capabilities of OOI RSN and the resulting significant enhancement to IOOS HF Radar coverage along the Oregon and Washington coastlines. [C5275]

"The COASTALT project: Towards an operational use of satellite altimetry in the coastal zone"

In this paper, we will showcase the main outcomes of the COASTALT project, including improved corrections (with special emphasis on the tropospheric effect) and novel re-tracking techniques built on established research results and the processing chain development with the generation and validation of ENVISAT test data sets over a selection of regional sites. We will also dive in further and explore how coastal altimetry might be exploited to its full potential in the coastal zone. This should be of interest to a broad range of data integrators that have an interest in using these improved altimeter data in their operational products or services. [C5276]

"Multipath cancellation using a maximum likelihood metric space"

Multipath signals occur in many sonar, radar, and communication applications. It is, of course, generally desirable to eliminate these unwanted signals. Traditional array signal processing techniques often have trouble eliminating these signals when only a small number of array elements are available. The maximum likelihood method explicitly models multiple signals in its mathematical construction. This feature effectively opens up a multidimensional space that allows the desired direct path signal to be completely decoupled from the multipath signals. Examples with both narrowband and broadband signals are presented. [C5277]

"National high frequency radar network: Update"

One of the primary efforts for the NOAA Integrated Ocean Observing System (IOOS, B®) Program office is the development of a national high frequency radar (HFR) network for measuring ocean surface currents throughout the coastal United States. After experiencing rapid growth for several years, the number of HF radars deployed in the United States is now approximately 100 with modest annual growth. NOAA IOOS has funded the development and deployment of a trio of redundant data servers located at Scripps Institution of Oceanography, Rutgers University and the NOAA National Data Buoy Center that deliver data files in standard format (netCDF) and are Climate and Forecast (CF) metadata conventions-compliant. In keeping with the IOOS intent to deliver data in standardized ways that allow for interoperability and ease of access, NDBC delivers the HF radar data via Web Coverage Services (WCS). As the NOAA IOOS Program continues to support the development and enhancement of a national HF radar data management and distribution system, new capabilities are developed and implemented by Scripps prior to national deployment, allowing for the system to evolve in a build-test-build environment, yet retain pre-operational status. Numerous success stories over the past several years in the application of HF radar-derived surface currents to real-world problems have spurred the creation of a plan, published September 2009, to build a comprehensive national ocean surface current mapping system based on HF radar. The success stories and the scope of the national plan will be discussed. [C5278]

"Shallow waters SLAM experiments on meredith AUV using forward looking sonar"

This paper describes the sea trial experiments conducted to validate the physical implementation of online EKF-SLAM onboard the Meredith Autonomous Underwater Vehicle (AUV) in shallow coastal waters. This paper provides details of the hardware and software implementations of the EKF-SLAM algorithms running real-time on the AUV to perform feature-based navigation. The computation resources onboard Meredith and the hardware configuration that facilitated the real-time SLAM demonstration are also featured in this paper. The localization estimates from the SLAM algorithm were validated with ground truth provided by GPS and the deployed targets. Dead-reckoning navigation solution based on DVL and FOGs that were used for vehicle autonomy were also made available for results validation. [C5279]

"A novel low actuation voltage RF MEMS shunt capacitive switch"

A low actuation voltage MEMS shunt capacitive switch has been investigated in this paper. The MEMS switch is a freely moving membrane over co planar waveguide, the beam of the switch is serpentine spring and actuation is achieved by electrostatic mechanism. Actuation voltage achieved is of the order of 4 to 5 volt with down state capacitance of 3.77 pF and spring constant of 1.451 N/m. [C5280]

"High frequency ray technique analysis of electromagnetic scattering from triangular plate"

At high frequencies, plane wave incident field backscattered by a perfectly conducting triangular plate is approximated to first order as the sum of the contributions from each individual corner and the opposite edge. An available heuristic corner diffraction coefficient is used to compute the corner diffracted fields. Second order

corner incident edge scattered fields are next computed using uniform geometrical theory of diffraction (UTD). The sum of these contributions is used to obtain the radar cross section (RCS) of the plate. The computed RCS are compared with available measurements and earlier predictions for Sikta's triangle. [C5281]

"A tutorial on design and analysis of waveguide-fed slot array antennas"

This tutorial gives a detailed presentation on the design and analysis of waveguide-fed slot arrays. Examples of application of such arrays in radar, communications and remote sensing systems will also be discussed. [C5282]

"Hybrid diversity strategy using MIMO radar for target tracking"

For the development of radar systems with enhanced performance in target detecting and tracking abilities, various research groups have been investigating multiple input multiple output (MIMO) based radar systems. They have shown that MIMO radars perform better compared to conventional systems like bistatic or even SIMO radars. Especially MIMO capitalizes several diversity parameters inherent to its design to give higher resolution in both range and range rate. Several papers address these diversities. The current work aims at parameterizing these diversities especially spatial, waveform and frequency diversities and hence designing a system which employs a the resultant diversity constraints on the transmitter architecture and on the type and properties of transmit signals. As done in conventional system analysis, here also the formulation of ambiguity function is addressed and in the process a new tool called ambiguity function pair is developed. It has been shown with example evaluations that this ambiguity function pair is more mature in analyzing and tracking targets with systems employing diversity constraints. In the process of evaluation a new strategy with adaptive framework for tracking targets and getting higher range resolution and is addressed. [C5283]

"A novel Jerusalem cross FSS embedded A-sandwich radome for aerospace applications"

The application of Jerusalem cross frequency selective surface (FSS) for the enhancement of electromagnetic performance of A-sandwich radome is presented. The performance parameters of the Jerusalem cross FSS embedded radome panel are computed based on equivalent transmission line method in conjunction with equivalent circuit method (ECM). The EM analysis shows that the Jerusalem cross FSS embedded A-sandwich radome wall configuration has superior EM performance as compared to the A-sandwich wall alone configuration. [C5284]

"Study and comparison of RCS of microstrip patch antennas on LiTi-ferrite substrate"

Radar cross sections (RCS) of rectangular, circular and triangular microstrip patch antennas are presented which are printed on LiTi ferrite substrate in X-band (8-12 GHz) region. In this paper, we precise the preparation of a polycrystalline LiTi ferrite of 2200 Gauss saturation magnetization. The comparison of RCS patterns among RPMA, CPMA and TPMA shows the affective study of radar cross section which differentiates the stealth capacity as well as miniaturization due to the ferrite substrate application. [C5285]

"On the design of CPW-fed square octal shaped fractal UWB antenna"

This paper presents the design of an ultra wide band (UWB) antenna with CPW-fed. The antenna has been designed on FR4 substrate $\epsilon_r = 4.3$ and thickness 1.53 mm. The antenna has been fabricated and tested using VNA. The experimental results of this antenna offer ultra wide bandwidth from 2.86 GHz to 14.38 GHz. This corresponds to the impedance bandwidth 11.42 GHz and 132.48 %. The experimental results also exhibits the first band from 0.62 GHz to 1.657 GHz corresponds to 1.037 GHz bandwidth. The radiation pattern of this antenna is nearly omni directional. This type of antenna can be used for ultra wide band system, positioning system, microwave imaging and Radar application. [C5286]

"Active cancellation of probing in the presence of multiple coherent desired radar sources"

Signals traveling along different paths can be considered coherent with the original source signal if they are delayed and scaled version of the main signal. Coherence is a practical problem faced in beamformers as it leads to signal cancellation. In this paper a weight estimation technique with multiple beam constraints and correlation matrix reconstruction is employed to receive all the coherent/uncorrelated signals from desired radar sources without any loss of information. Simulations are carried out to analyze array efficiency to null all the probing sources and simultaneously receive all the (coherent/ uncorrelated) desired signals. The work reported on multiple signal environments has wide applications in the aerospace engineering. [C5287]

"The role of weight coefficients in adaptive array processing in wideband signal environment"

In an adaptive array, for a single desired signal, steering weights are chosen such that the main beam of the quiescent pattern points in the direction of the desired signal. However when there are multiple simultaneous wideband signals then it is really difficult to have the beam pattern consisting of independent multiple beams towards desired directions. In this paper, the signal environment with the multiple narrowband/wideband desired signals is considered. It is assumed that there are multiple narrowband/wideband radar sources trying to probe a uniform linear antenna array. Simulations are performed to estimate the output SNR as the performance index of the adaptive array. Moreover the factors on which the performance of antenna array depends are investigated. These include weight coefficients, probing directions, bandwidths, input signal strength etc. The objective of the work is to analyze the overall efficiency of the antenna array in such signal environments. [C5288]

"Simulation for Doppler signal Periodogram Spectral estimation methods"

With the rapid development of modern intelligent traffic, the speed-testing radar becomes a kind of essential equipment, which measures speed through the acquisition of the moving target signal frequency deviation according to Doppler principles. Traditional method uses analog filtering, whose measurement accuracy is low and the measured speed is slow. Obviously, it's difficult to meet the need of the modern intelligent transportation management. Speed radar signal processing generally uses the power spectrum estimation method. Periodogram Spectral estimation (using Hamming window periodogram method) considers for different signal to noise ratio of the data spectral estimation, and finally receives the largest frequency error to meet the system requirements for measurement accuracy. [C5289]

"Research on SCADA system for urban pipeline network based on wireless sensor network"

Summary form only given. In order to measure urban pipeline network signal and transmit the data to the data center in real time, the construction method about Supervisory Control and Data Acquisition (SCADA) system for urban pipeline network is presented based on GPRS and wireless sensor network through researching the characteristics of wireless sensor network as well as Zigbee technology. The system consists of wireless sensor network, GPRS network and monitoring center, the core of sensor node is integrated chip CC2430 called RF-SOC, which achieved the single-chip solution to field data collection and wireless transmission. The network coordinator node consisting of AVR microcontroller, RF chips and GPRS communication module plays the role of the gateway in the system. Some approaches for ensuring the reliability of data communication are discussed and system performance is validated through experiments. Experiment results show that the SCADA system based on GPRS and wireless sensor network improves the real-time property, reliability and integrity of pipeline network data with increasing the sensor node density in the monitored region. [C5290]

"Copyright"

The following topics are dealt with: radio networks; vehicle navigation; OFDM systems; radar systems; collaborative processing; cognitive processing; RF adaptive circuits; image processing; biological signals; innovative sensing; reconfigurable components; and photonics. [C5291]

"Next-generation advances in cognitive processing using spiking neural networks for biochemical sensing, radar and rapid HDL"

This invited plenary paper introduces a novel spiking neural network methodology, and applies it to an odorant learning, medical and radar detection applications. Rapid HDL is introduced as a 15 minute rapid prototyping approach, where real-time implementations will be demoed on FPGAs. The spike-time dependent plasticity can support coding schemes that are based on spatio-temporal spike patterns. Spiking (or pulsed) neural networks (SNNs) are models which explicitly take into account the timing of inputs. The network input and output are usually represented as series of spikes (delta function or more complex shapes). Plasticity SNNs have an advantage of being able to recurrently process information. Spike-time dependent plasticity can enhance signal transmission by selectively strengthening synaptic connections that transmit precisely timed spikes at the expense of those synapses that transmit poorly timed spikes. [C5292]

"A solid state high voltage pulser for RADAR transmitter using fractional turn transformer"

This work is concerned with the design and construction of a solid-state high voltage pulsed modulator for RADAR transmitter. The design parameters are chosen such that the pulse can be connected to the solid-state switch, which drives a segment of pulse transformer, no Pulse Forming Network (PFN) is required. The width of the pulse can be adjusted by simply adjusting the trigger duration of the solid-state switch and no PFN ripple occurs on the pulse. A new generation of solid-state high voltage modulators with performance rivaling that of hard tube modulator and thyatron switched line-type modulators is designed and tested for mobile application. The new solid-state switching devices offer the promise of high power efficiency and longer lifetime. Modern

radar is based upon the generation of short pulses of electromagnetic radiation. The function of the pulser is to deliver high power in short pulses to a high frequency generator. [C5293]

"Effect of frequency diversity on SAR ATR"

Synthetic aperture radar (SAR) based automatic target recognition (ATR), has been one of the demanding usages of airborne radar systems. With the developments in the field of hardware, more complicated radar systems can be deployed on aerial platforms. This opens the possibility of using different advanced versions of radar systems, like multi-band radars, multi-polar radars and multi-static radars. In the current paper, we report the preliminary experiments studying the effect of frequency band on SAR ATR performance. In this pilot study we have used the well accepted MSTAR SAR database. The results show that even though bandwidth is kept the same, the ATR performance strongly depends on the central frequency. [C5294]

"Recent advances in SAR remote sensing: "Multimodal POLinSAR imaging with applications to remote sensing of the terrestrial covers and the monitoring of environmental stress changes""

Land cover monitoring is one of the most potential applications of Polarimetric Synthetic Aperture Radar (POLSAR) sensing and so is Repeat-Pass Polarimetric-Interferometric SAR (RP-DIFF-POL-IN-SAR) stress-change assessment by air/high-altitude/space-borne SAR sensor deployment. Provided fully polarimetric SAR information can be made available, a plethora of novel POLSAR matrix decomposition methods can be implemented for recovering rather precise scattering contributions from isolated and distributed scattering scenarios, and so can rather exact environmental changes from consecutive repeat-pass observations at 1 m resolution from air and from space. With the recent launches of the fully polarimetric satellites JAXA-ALOS (PAL-SAR-L-Band), the DLR TerraSAR-X (X-Band) and of RADASAT-2 (C-Band), a new era in space imaging of the terrestrial terrain and ocean surfaces has arrived providing unforeseen advantages. [C5295]

"Development of digital RF memory based target echo simulator for Doppler RADARS"

Radar target echo simulators are needed for calibrating and testing of various Radar systems. A low cost novel implementation of target echo simulator is demonstrated in this paper. Various parameters like target range, range rate, atmospheric attenuation had been simulated using Digital RF Memory technique. The simulated target echo is then sent into the radar signal for test and evaluation. The echo simulator is programmable and can be used for testing of various radar systems. [C5296]

"Investigation of 1D and 2D PCA for SAR ATR"

Principal component analysis (PCA) has been used in many applications ranging from social science to space science, for the purpose of data compression and feature extraction. Usage of PCA for synthetic aperture radar (SAR) image classification, have recently been exploited by the automatic target recognition (ATR) community. PCA can be used in one dimensional as well as two dimensional mode. These different modes have recently been studied for face recognition. Following similar trends, 1D and 2D PCA has been exploited in the present paper for SAR ATR. 2D PCA based algorithm has been fine-tuned for the current usage. Contrary to the conclusions in face-recognition research, here it has been concluded that both 2D and 1D PCA perform equally well for SAR ATR. And both the algorithms outperform the conventional SAR ATR algorithms. [C5297]

"WiMAX signal waveform analysis for passive radar application"

WiMAX is the latest globally accepted wireless broadband access standard, which is also a valuable illuminator for passive radar. This paper analyzes the ambiguity function of WiMAX signal to evaluate its suitability as radar waveform. Simulation and experimental results demonstrate that WiMAX signal has a 'bed of nails' type ambiguity function, whose properties depend on its frame structure, length of cyclic prefix and effective bandwidth. The modulation method has no effect on the ambiguity function. [C5298]

"Measurement and analysis of clutter signal from GSM/DCS and UMTS-based passive radar"

Passive radars have been known to the scientific community since their first application as a system to detect bombers by means of shortwaves radiated by radio broadcasting towers in 1935, though they lately raised a renewed interest among researchers for some specific features that make them more appealing than classic active radar systems. In fact, having the transmitter and receiver located at two different positions, and the adoption of signals carrying other kinds of information such as GSM(either classical or the 1800/1900 MHz DCS version) or UMTS waveforms, makes passive radar virtually undetectable and economically advantageous. In the paper, a measurement system used to characterize the clutter from a GSM/DCS and UMTS-based passive radar is presented. The main objective is to study the statistical properties of the clutter signals, find theoretical models

fitting the measured clutter data, and analyze the differences between the modulated carriers of the two different standards. [C5299]

"Relevance of on-line noise compensated approaches for STAP based on AR-filter"

Space Time Adaptive Processing (STAP) is known as one of the key techniques for radar processing, but its computational cost is high. To reduce it, the so-called STAP filters based on adaptive 2D FIR filters consists in modeling the clutter-plus-noise as a multichannel autoregressive (N-AR) process. In this paper, our contribution is twofold. 1/ the secondary data are assumed to be modeled as a N-AR process disturbed by an additive white noise. This has the advantage of distinguishing the clutter and the thermal noise. 2/ We suggest using on-line methods such as EKF and Sigma Point Kalman Filter (UKF, CDKF) to estimate the model parameters. These methods have the advantage of significantly reducing the number of secondary data to be used. [C5300]

"HFSW radar model and evaluation of a multiscale source extraction approach for target detection"

High Frequency radar, which is based on surface wave propagation, is an important tool to remotely measure sea state. It can also be used to detect targets far beyond the conventional microwave radar coverage. The goal of our project is to investigate this detection capability. In this way, the received power by the system in presence of targets has been modeled leading to a Range-Doppler image. This model can be used for different purpose like, for example, the (theoretical) evaluation of target detection algorithms. In this contribution, a multiscale source extraction method is also proposed as a detection technique and some first results illustrate its capabilities. [C5301]

"Influence of sea surface roughness on electromagnetic waves propagation in presence of evaporation duct"

This paper deals with effects of sea surface roughness and wind direction on electromagnetic waves propagation in presence of evaporation duct. The Parabolic Equation method is used to solve the wave equation above a generated random sea surface which furthermore takes into account a roughness parameter. The wind direction influence on propagation is presented with numerical results of EM wave propagation. [C5302]

"Most threatening trajectories in a radar coverage area"

In this paper, we will address one key issue for radar load regulation related to dwell priority assignment of Search Domains. Threat Level of search beam position is based on density map of most threatening trajectories (penetration corridors). We studied properties of these trajectories so as to find theoretical results (existence or unicity) and also search algorithm which would be able to compute these trajectories. More particularly, we saw that the classical Γ ,B shortest path algorithm Γ ,Bi get useless when dealing with an additional local geometric constraints (local anisotropy of target Radar Cross Section). We built two sorts of algorithm in order to take this local constraint into account. [C5303]

"Waveform optimal design for MISO space-based radar system"

Based on space-borne multiple-input single-output radar systems, a novel orthogonal bi-phase coding waveform optimization design method is presented. However, it is impossible to design a set of codes with ideal impulsive autocorrelation and idea zero cross-correlation performances. Hence, only the shape of its main-lobe and side-lobe near the detected range cell is considered as the optimization criteria. The aperiodic correlation properties are discussed. Simulation results show that the proposed algorithm is effective and feasible. [C5304]

"Modelling surface scattering at grazing incidence"

The radar cross section from a rough surface becomes very small at grazing incidence, since most part of the energy travels in the forward direction. Therefore, building a model that can estimate it accurately is challenging. Here, a rigorous model is suggested, based on a specific integral formalism. Comparisons with approximate methods have been performed to estimate their range of validity at grazing incidence. The case of sea surface is also investigated. [C5305]

"Multi-platform distributed ISAR for surveillance and recognition"

In this paper we exploit the data acquired by multiple radar systems carried by multiple air platforms to increase the cross-range resolution of ISAR images. The distributed ISAR technique is devised for two different cases: (i) multistatic with a single platform carrying an active radar and the remaining platforms equipped with receiving only devices, (ii) MIMO with each platform carrying an active radar. The processing chain needed by the

distributed ISAR is shown with the results obtained against simulated ISAR data for both multistatic and MIMO cases; the performance analysis shows that the proposed technique is able to provide an increase of the cross-range resolution up to the number of radar systems in the multistatic case or even higher in the MIMO case, if the platforms are properly located. The performance degradation arising from errors in the knowledge of both the target rotation motion and the acquisition geometry is also analyzed. Results obtained by processing the experimental data collected by a ground based radar operating together with a rotating platform are shown to validate the proposed approach. [C5306]

"Study of the invariants of the time-reversal operator for a dielectric cylinder using separate transmit and receive arrays: theory and experiments"

In this paper, the DORT method applies to scattering analysis with arrays of transceivers. A large dielectric cylinder is observed by separate transmit and receive arrays with microwaves. First, the decomposition of the scattered field into normal modes and projected harmonics is used to determine the theoretical time-reversal invariants of the Time Reversal Operator. In a second part, we experimentally study the time reversal invariants for various dielectric cylinders. A good agreement is shown between theory and experimental results. The DORT method is finally used in an inverse problem to determine the different parameters of the cylinder, especially permittivity, diameter or location. [C5307]

"The influence of sea surface temperature fronts on radar performance"

A nominal sub-refractive event off the east coast of the United States was modeled with the Coupled Ocean Atmosphere Mesoscale Prediction System. The resulting three dimensional refractivity field was employed as input to the Advanced Refractive Effects Prediction System (AREPS). The sea surface temperature (SST) gradient produced across the western border of the Gulfstream modified the Marine Atmospheric Boundary Layer such that sub-refraction resulted north of the SST front and super-refraction developed south of the SST front. Notional S, C, and X-band radars were modeled by AREPS and detection ranges for a notional target were calculated. Detection ranges were below those for a standard atmosphere north of the SST front but greater than those for a standard atmosphere south of the SST front. [C5308]

"Domain decomposition techniques applied to radar front-end modeling"

Modeling of active electronically scanned phased array antennas is a real challenging problem which needs, due to the complexity of the antenna, the use of a lot of different techniques. One of the key technique is the domain decomposition method which allows to split the global problem into several smaller problems without losing accuracy. The purpose is to present the modeling methodology based on this technique and used by Thales Systèmes Aérospatiaux to simulate active array antenna. [C5309]

"Wideband multifunction airborne antennas"

Increase of functions and improvement of performance required on board aircrafts, associated to the limited amount of available areas to implement the equipments drive an approach leading to grouping of functions operated in various frequency bands and to reduction of thickness of the antennas. Technical and technology research is being conducted on wideband and multi-band radiating structures, making in particular use of metamaterials and FSS structures, and the overall architecture has to deal with the various requirements. [C5310]

"Bandwidth formula for Linear FMCW radar waveforms"

The International Telecommunications Union provides recommendations regarding spectral emission bounds for primary radar systems. These bounds are currently in review and are defined in terms of spectral occupancy, necessary bandwidth, 40dB bandwidth and out-of-band roll-off rates. Here we derive out-of-band domain spectral envelopes, bandwidth formula and roll-off rates, for various Linear FMCW radar waveforms including sawtooth (LFMCW), Quadratic Phase Coded LFMCW, LFM Pulse Train, and Hann amplitude tapered LFMCW. [C5311]

"Electromagnetic wave scattering from sea and bare soil surfaces based on an improved two-scale model"

Remote sensing applications require developing accurate models to predict radar backscattering from rough surfaces. An improved two-scale model to calculate the electromagnetic backscattering coefficients from sea and bare soil surface is investigated. The sea surface calculations are made by assuming the surface height spectrum of Elfouhaily et al. whereas the roughness of soil surface is approximated by Gaussian spectrum. The

simulation results are compared with the published experimental data from ocean surface at Ku-band and for soil surface at L-band. Fairly good agreements are found for the fixed physical surface roughness parameters on these frequency bands specially, for cross polarizations. It is observed that as the roughness of the surface increases the intensity of SHH increases at low grazing angles. [C5312]

"Aircraft Target Recognition: A novel approach for features extraction from ISAR images"

In this paper, we present a system for Automatic Target Recognition (ATR) based on ISAR images. The methodology used is based on knowledge discovery from data (KDD process) process adapted to radar field. The shape extraction is the most important step in recognition system. However, we propose a new approach for Target shape extraction based on combination of Smallest Univalued Segment Assimilating Nucleus (SUSAN) method and Variational Level Set (VLS). The feature vector is then represented by Fourier descriptors of each target shape. Finally, recognition scheme is achieved by both: Support Vectors Machine (SVM) and K Nearest Neighbors (KNN) classifiers. [C5313]

"Broadband echo simulation based on all-attitude RCS database of ballistic missile"

Because of the huge cost, the high demand of sensors and the limitation of observation for ballistic missile in outfield measure, the acquirement of measured data is certainly difficult. Moreover, as the radar echo is modulated by the high-speed and micro-motion of ballistic missile, the ballistic missile's RCS generated by electromagnetic software differs greatly from the measured data. In this paper, the Graphical Electromagnetic Computation (GRECO) method and the high altitude ballistic simulation is studied at first. And the linear frequency modulation (LFM) radar echo model for ballistic missile is analyzed. Then, a broadband echo simulation method designed for all-attitude RCS database of ballistic missile is put forward. The experimental results of the simulation show the efficiency of our method. [C5314]

"Fast technique for along-track motion estimation of moving targets in SAR images"

A novel fast technique for along-track motion parameter estimation of moving targets detected using SAR mode is presented in the paper. The proposed technique is based on the features of Non Iterative Map-Drift (NIMD) technique. Typically NIMD is used as an autofocus technique in classical SAR processing to obtain high resolution SAR images. The main goal of this paper was to extend and test NIMD as a technique for MTI (Moving Target Indication) motion parameter estimation. [C5315]

"Optimized algorithms for detection of sparse targets in heterogeneous Gaussian noise"

In this paper we propose two adaptive detection algorithms for sparse targets embedded in heterogeneous AR Gaussian noise. The first one solves the problem of estimating the subset of cells containing a scatterer via the GLRT principle, while the latter models the number of scatterers as a random parameter and relies on the use of quantized statistics. A preliminary performance assessment, conducted by Monte Carlo simulation, has shown that both solutions allow to reduce the detrimental effects, in terms of collapsing loss, suffered by conventional solutions. In particular the former algorithm is to be preferred in terms of performance while the latter has a lower computational complexity. [C5316]

"Noncircular waveforms exploitation for Radar Signal processing: Survey and study for agile radar waveform"

With new generation of Active Digital Radar Antenna, there is a renewal of waveform generation and processing approaches, and new strategies can be explored to optimize waveform design and waveform analysis and to benefit of all potential waveform diversity. Among these strategies, building and exploitation of the Noncircularity of waveforms is a promising issue. Up to the middle of the nineties, most of the signals encountered in practice are assumed to be second order (SO) circular (or proper), with a zero second correlation function. However, in numerous operational contexts such as in radio communications, the observed signals are either SO noncircular (or improper) or jointly SO noncircular with a particular signal to estimate, to detect or to demodulate, with some information contained in the second correlation function of the signals. Exploitation of this information in the processing of SO noncircular signals may generate dramatic gain in performance with respect to conventional processing and opens new perspective in signal processing. The purpose of this paper is to present a short overview of the interest of taking into account the potential SO noncircularity of the signals in signal processing and to describe the potential interest of SO noncircular waveforms for radar applications. [C5317]

"Nonlinear radar signatures from metal surfaces"

A crucial issue in the exploitation of harmonic and multitone radar is the nature of target signatures at the various

emission frequencies. In this paper we describe some preliminary results on how the nonlinear response of a target depends on its composition for the specific example of a target with a bare metal surface. Our results show that, in contrast to linear radar signatures, those with metal surfaces are the most difficult targets to detect. [C5318]

"Robust improvement of unmasking capabilities of iterative LMMSE filtering"

A general aim in radar processing is to allow for target separation. Several advanced techniques have been developed to fulfill this aim. Nevertheless they pose a heavy constraint on the signal reference known at the receiver, and degrade their performance when this reference is incorrect. This paper addresses the problems that rise when there is a discrepancy between the echoing signal and the signal reference used in the processing. A technique is then developed to counteract the degradation of the performance. [C5319]

"Intelligent M3R Radar Time Resources management: Advanced cognition, agility & autonomy capabilities"

The capabilities of modern multifunction/mission Radar can be only fully realized by using new sensor control strategies and the most obvious sensor management imperative is the development of optimal realtime waveform scheduling algorithms. For this purpose, Thales is studying Intelligent Radar Time Resources management for Multi-mission extended air Defence radar used for both Air and Ballistic Missile Defence, based on innovative Active Electronically Steered Antenna technology. This paper describes the functional architecture of radar resources management used for adaptive time budget optimization and key enablers for advanced cognition, agility and autonomy capabilities. We conclude with simulation in the ASTRAD framework. [C5320]

"Wake vortex X-band radar monitoring: Paris-CDG Airport 2008 campaign results & prospectives"

In order to improve the capacity of airports in view of the expected increasing amount of traffic the knowledge about the safety issues caused by wake vortices has to be improved. The final goal is to build up a wake vortex alert system to ensure the application of appropriate but not oversized safety distances in all weather conditions. Lidar systems are able to deliver very accurate data, but are also sensitive to the weather conditions like rain and fog. We did trials with the X-band radar BOR-A 550 on Paris-CDG Airport in June 2008 to benchmark Lidar & Radar Technologies. Continuous Detection, characterization (strength: circulation), and profiling (age: young/mature /old/decaying) capabilities of wake vortices up to a range of 1500 m have been proved in clear air and rainy weather. The Doppler resolution of around 0.2 m/s used with regularized high Doppler resolution techniques is able to characterize the wake vortex speed distribution in detail. X-band Radar is a full-fledged alternative, which can make a significant contribution to a wake vortex alert system. [C5321]

"Compact polarimetry mode at low frequency for vegetation applications"

Global warming is now known to be the major environmental issue mankind will have to face in the next decade. Monitoring of vegetation and biomass is clearly an essential piece of information required at all levels ranging from the scientific studies to understand and forecast, to the political actors and government leaders responsible for drafting remediation policies and evaluating their impact. Microwave remote sensing with the low-frequency SAR technique can provide a useful characterization of forest (spatial coverage, species, density, height...) at a global scale, relying on the all-weather imaging capabilities of SAR linked with the significant penetration of the low-frequency EM wave in the canopy. The published techniques for forest characterization from low frequency SAR data include radiometry inversion, polarimetric inversion based on the anisotropy parameters and PolInSAR Random Volume Over Ground inversion. In this paper, we will more specifically concentrate on the PolSAR technique and the impact of ionospheric effect. [C5322]

"Experimental validation of the compound Gaussian sea clutter model at sub-meter range resolution"

Compound models are widely used to describe high resolution radar sea backscatter. In this paper, experimental high resolution sea clutter data is used to assess the validity of the compound Gaussian model for range resolution of centimeters. Results show that the central limit theorem is still applicable to local sea backscatter at very high range resolutions. [C5323]

"Management of deformable active antenna"

Radar systems on ground and naval basements require an improvement of flexibility to provide low cost solutions with better tactical deployment and to open new capacities for implementation. We propose to dynamically cope with distortions of radiating panels with an innovative method based on an accurate

mechanical modelling under different load scenarii. In conjunction with either auto-calibration algorithms or instrumented technique, our method allows to recover high quality radiating patterns and to preserve radar system performances. [C5324]

"Low frequency radar targets 3-dimensional imaging using ramp response signatures"

Low frequency imaging in radar domain can have applications for stealthy or buried targets. We consider a technique using transient scattering response from a ramp waveform, which is proportional to the profile function of the target, i.e. its transverse cross-sectional area along the line-of-sight, and consequently, gives information about target size, orientation and geometrical shape. Usual 3-dimensional image generation from ramp responses uses approximate limiting surfaces and is limited to single convex objects. We propose here a new algorithm to reconstruct the global shape of any perfectly conducting target from its ramp response signatures. [C5325]

"Motion information aided envelope alignment of HRR profiles"

Envelope alignment is important for ISAR imaging of moving target. If the target scattering characteristics scintillates during the coherent processing interval (CPI), jumping errors may occur in envelop alignment based on maximum-correlation, which will lead to unexpected envelope migration. With the exploitation of target motion information, a new method is proposed to eliminate jumping errors. In detail, the migration values obtained by conventional maximum correlation are considered as measured data. Meanwhile, the target motion is described by linear model for the prediction and correction of envelope migration. Therefore, the measured data and predicted information are fused by regularization method to provide precise estimate of envelope migration. The results based on real measured data show that the proposed algorithm can effectively eliminate jumping errors and improve the performance of envelope alignment. [C5326]

"A two-step approach to construct minimum redundancy MIMO radars"

A two-step approach is developed for constructing minimum redundancy (MR) multiple-input multiple-output (MIMO) radars. The minimum total number of transmitting and receiving antenna elements is determined for given virtual aperture in the first step. In the second step, the virtual aperture is expanded by adjusting the number between the transmitting and receiving antennas, and by changing the spacings between the elements. Simulation results showing the performance improvement of the MR MIMO radars is presented. [C5327]

"Blind deconvolution via independent component analysis for thin-pavement thickness estimation using GPR"

Blind deconvolution of sparse spikes is a well-known problem in the fields of seismic exploration and ultrasonic nondestructive testing. In measuring thin layer thickness of asphalt pavements using GPR, a similar problem arises; the sparse reflectivity series representing the layered structure of the pavement convolved with the radar wavelet results in masking closely spaced reflections. A successful deconvolution retrieves the reflectivity series and thus improves the time resolution and facilitates quantitative data interpretation. In this paper, we cast the convolutional model as a multidimensional data model which renders blind deconvolution via independent component analysis (ICA) possible. We use a nonlinearity related to the double exponential density whose heavy-tailed nature provides further insight into the sparse nature of the reflectivity series. The method is tested on synthetic and real GPR data from a thin PVC slab. The results attest to the accuracy of the time delay estimates and verify the high resolution of the proposed approach. [C5328]

"Interpolation-based calibration approach for source localization in near field"

We propose an interpolation-based array calibration method for near-field source localization in this paper. A received signal model is developed in presence of imperfect effects in a sensor array. The position-dependent errors are modeled in a diagonal correction matrix. An interpolation-based approach is then proposed to calibrate the array response with a small number of measurements. This approach allows us to improve the efficiency of array calibration for source localization in near-field situation. [C5329]

"Image enhancement and motion compensation of moving targets in ISAR using S-method"

For target recognition applications, a blurred ISAR image has to be refocused quickly so that it can be used for real-time target identification. In this paper, we present the S-method-based approach to real-time motion compensation, image formation and image enhancement of moving targets in ISAR. This approach performs better than the Fourier transform by drastically improving images of fast, maneuvering targets. The method is also computationally simple, requiring only slight modifications to the existing Fourier transform-based algorithm.

[C5330]

"A solution of two dimensional spectrum for general bistatic SAR"

The paper derives the two-dimensional point target spectrum for general bistatic SAR configuration. For the kind of configuration the contributions of transmitter and receiver to the overall instantaneous Doppler frequency are unequal due to the different slant range history. In the paper the instantaneous Doppler contribution ratio is proposed to represent the difference of instantaneous Doppler contributions of transmitter and receiver, and the ratio is derived based on its meaning, which varies with instantaneous Doppler frequency. Then the two-dimensional spectrum is approximately obtained using the principle of stationary phase and Taylor series expansion for general bistatic SAR. The derived spectrum is verified with a point target simulation of general bistatic SAR. [C5331]

"Analysis and comparison of two disambiguity algorithms: The modified CA and CRT"

In high pulse repetition frequency (PRF) radars ambiguities may arise in range measurements. In this paper we describe and compare two algorithms which can be used even when ambiguous returns from several targets are received. The analyzed algorithms are a modified version of the Clustering Algorithm (CA) and a modified version of the Chinese Remainder Theorem (CRT). The performances of both algorithms have been evaluated in terms of probability of false alarm and probability of detection. [C5332]

"Adaptive distributed radar"

In this paper, we develop and evaluate an adaptive distributed radar architecture. We consider the case where the sensor separation leads to uncorrelated target and clutter voltages among the various receivers. The resulting processing architecture is an extension of the single sensor adaptive matched filter applied in a fixed-Earth coordinate system. Using simulated, single transmitter, multiple receiver configurations, we demonstrate the efficacy of the proposed processing approach. [C5333]

"Fragment size detection within homogeneous material using Ground Penetrating Radar"

Ground Penetrating Radar (GPR) offers the ability to observe the internal structure of a pile of rocks. Large fragments within the pile may not be visible on the surface. Determining these large fragment sizes before collection can improve mine productivity. This research has examined the potential to identify objects where the background media and the object exhibit the same dielectric properties. Preliminary results are presented which show identification is possible using standard GPR equipment. [C5334]

"Space-time adaptive processing with a half-cylinder faceted conformal antenna"

Conformal antennas, which assumes the shape of the platform, have several advantages, like reduced weight and space; aerodynamic design and increased field of view. We are interested in detection of moving ground targets with air-borne radar with three antenna geometries: faceted or smooth vertical half-cylinder and plane forward-looking. We study important clutter properties for suppressing the clutter with STAP (Space-Time Adaptive Processing) and find that the subarray division is more important than the antenna element positions, that the faceted and smooth antennas give similar clutter properties and that all three geometries have better clutter properties the smaller the subarrays are. The largest tested subarrays are probably useless for clutter suppression. [C5335]

"Weather hazard interpretation and forecast by an airborne radar"

A method for modeling and tracking convective clouds within radar images is presented. An object modeling approach is used, based on the extraction of grayscale skeletons from 2-dimensionnal cross-section of 3-dimensional radar data. Grayscale skeletons are appropriate shape descriptors for nonrigid and heterogeneous objects, in which gray-level local maxima correspond to regions of interest. Linking meta-data to some chosen points of the skeleton enhances the modeling scheme; this provides a good representation of the weather scene in terms of hazards for an aircraft. Skeletons are stored within a graph structure and tracked among successive pictures by means of relaxation labeling processes. The deduced advection field is used to nowcast the clouds evolution. Preliminary results are satisfying concerning advection forecast. [C5336]

"AMSAR-A European success story in AESA radar"

DGA, BWB and D&ES initiated a radar programme, called AMSAR (Airborne Multi-role Solid-state Active-array Radar) to demonstrate the enormous potential of Active Electronically Scanned Array (AESA) radar. This paper

describes all the stages of the AMSAR project and the results obtained. The AMSAR demonstrator is still the only European, forward-looking multichannel active array radar with the capability of recording the outputs of more than 4 quadrants. [C5337]

"A ternary detection test with applications to the sidelobe blanking problem"

We address adaptive discrimination between the signal of interest and a coherent interferer. To this end, we propose detectors derived resorting to a GLRT implementation of a generalized Neyman-Pearson rule (i.e., for multiple hypotheses). The adaptive detectors rely on secondary data, free of signal components, but sharing the statistical characterization of the noise in the cell under test, in order to guarantee the CFAR property. A preliminary performance assessment, conducted by Monte Carlo simulation, shows that, for the considered case study, the proposed algorithm can outperform the SLC/SLB adaptive detector under certain circumstances. [C5338]

"Comparison of estimation schemes for the K-distribution shape parameter"

Three commonly used estimators together with the maximum likelihood (ML) estimator for the shape parameter of the K-distribution are compared and evaluated. In particular the ML estimation scheme, which provides the most accurate estimate in theory, but which is rarely used in practice, is included and serves as a gage to the other schemes. Distributions of the estimates, as well as other statistical properties, are analysed. Advantages and shortcomings of the different estimators are discussed. [C5339]

"A modified permutation test for robust radar detection under nonhomogeneous and correlated clutter"

A new radar detector is presented, named as Γ, \tilde{B} modified permutation test Γ, \tilde{B} (MPT) for the rest of the article. This detector is a modification of the classical Γ, \tilde{B} permutation test Γ, \tilde{B} (PT), based on the histogram of the PT statistic obtained with a fast permutation test algorithm (i.e. based on linear convolutions of histograms, corresponding to the realization of additions in the PT statistic), and a normalization of the decision statistic. The normalization parameters depend on the mean value and the standard deviation of the referred histogram. The new detector performs adequately under correlated and nonhomogeneous clutter. Furthermore, the MPT is much more robust than the PT, under correlated and/or nonhomogeneous clutter. [C5340]

"New challenges for active reflectarrays"

Active reflect-arrays have proven to be candidates with strong assets as low cost and high performance phased array antennas. THALES Systemes Aeroportes has been developing for some years a concept based on a wave-guide phase shifting cell and applied for various applications in X band. Recent and future applications necessitate improved performances, hence requiring new developments in technique, technology and simulation models. Some of these new challenges are presented here. [C5341]

"MIMO radar detection under non-Gaussian clutter"

In this paper, the GLRT-LQ detector has been extended to the MIMO case where all transmit-receive subarrays are considered jointly as a system such that only one detection threshold is used. The GLRT-LQ detector has been derived based on the Spherically Invariant Random Vector (SIRV) model and is CFAR with respect to the texture PDF. Subsequently, the new MIMO detector is also CFAR. The theoretical performance of this new detector is first analytically derived and then validated using Monte-Carlo simulations. Its detection performance is then compared to that of the well-known OGD, also extended to MIMO case, under Gaussian and non-Gaussian clutter. [C5342]

"AMSAR-A European success story in AESA radar"

DGA, BWB and D&ES initiated a radar programme, called AMSAR (Airborne Multi-role Solid-state Active-array Radar) to demonstrate the enormous potential of Active Electronically Scanned Array (AESA) radar. This paper describes all the stages of the AMSAR project and the results obtained. The AMSAR demonstrator is still the only European, forward-looking multichannel active array radar with the capability of recording the outputs of more than 4 quadrants. [C5343]

"Fine air turbulence characterization by airborne weather radar"

Airborne weather radars have a specific Doppler mode for atmospheric turbulences avoidance. Indeed, turbulent areas may be encountered where classical reflectivity measurements do not indicate special hazards. Usually,

the severity of turbulences is assessed from the measurement of the radial velocity variance of the wind field ahead, assuming that the turbulence has isotropic statistical properties. However, this measurement is not sufficient because the effect, in term of g-load on the aircraft, also depends on the spatial autocorrelation function of the wind field. This paper deals with an accurate method of turbulences assessment, even with low SNR, because the available power for such radars is limited. [C5344]

"Alternate projections technique for radar waveform design"

An alternate projections technique is applied to efficiently generate sparse frequency waveforms with constraints on the frequency band suppression levels as well as on range sidelobes. With a complexity of only $O(N \log N)$, the algorithm could rapidly generate constant power noise-like sparse frequency waveforms that are very suitable for low probability of intercept radars. It has also proven its ability to generate waveforms having ideal periodic autocorrelation function comparable to well known ideal codes. [C5345]

"Online semi-supervised learning: Application to dynamic learning from RADAR data"

Dynamic learning from RADAR data is a new challenge which needs the development of new classification methods using an online semi-supervised learning approach. Except a very recent paper presented at ECML 2008, no algorithm in the literature can deal with this problem. Based on a theoretical analysis of the limitations and advantages of several semi-supervised and online learning methods, we proposed four algorithms as potential solutions to the dynamic learning problem which will be tested in next monthes. [C5346]

"Joint suppression of radio frequency interference and lightning impulsive noise in HFSWR"

The high-frequency surface wave radar (HFSWR) is known to suffer from the co-channel radio frequency interference (RFI) and lightning impulsive noise. Though the suppression techniques for individual interference mechanism have been developed, the simultaneous appearance of two types of interference still presents some challenges as the existence of lightning will affect the application of optimal mitigation scheme for co-channel RFI. In this paper, an adaptive beamforming based processing scheme is proposed which can provide better cancellation for the combination of two interference mechanisms. The performance of the proposed method is verified by using the experimental HFSWR data. [C5347]

"Airborne Radar and shipborne sonar: Recent advances and compared solutions"

The detection of slowly moving target in a strong backscattering background (clutter for radar, reverberation for sonar) is a challenge to both Airborne Radars and Surface Ship or Submarine Sonars communities. In this paper, after outlining the similarities and differences between the above and under-water domains, recent advances in the areas of waveforms design and beam-forming will be described. In a first part, more efficient wide-band Doppler waveforms for sonar will be introduced together with their advantages in terms of detection, and wideband coherent waveforms for radar moving targets detection will be presented. The second part will focus on the implementation of adaptive beam-forming for sonar and coloured transmission space time beam-forming for radar. Results on reverberation reduction obtained on a towed array sonar in CW mode will be discussed, and perspectives for coloured transmission radar systems will be outlined. [C5348]

"Defining configurations for bistatic SAR"

This paper provides important principles for the establishment of transmitter/receiver configurations, suitable for the formation of bistatic SAR images. Resolution aspects are presented for generic 2D and 3D cases, and experimental results are provided. Some specific resolution issues that are linked to the bistatic SAR algorithmic process are also raised in this paper. [C5349]

"A technique for estimating the detection performance of a skywave over-the-horizon radar"

This paper presents a technique for experimentally estimating the single-look detection performance of a skywave over-the-horizon radar system using observations of a live test target. This technique addresses the challenges imposed by time-varying environmental conditions and multiple propagation paths as well as the presence of multiple unknown targets within the data. We show how estimates of the receiver operating characteristic of the radar system can be derived from estimates of the probability of detection and probability of false alarm and present results for a representative system. [C5350]

"An efficient range alignment method for long-range ISAR imaginig"

For the inverse synthetic aperture radar (ISAR) imaging of a target at a long range, range alignment using

existing methods bring about poor results. This paper proposes a three-step range alignment to solve the problems of the existing methods. After coarsely aligning the range profiles using the center of mass of each range profile, range bins irrelevant to the target are removed by thresholds to narrow the search space. Then fine alignment is carried out using the entropy minimization method. An optional particle swarm optimization can be used to further fine-tune the aligned range profiles. This method is computationally more efficient and preserves the image quality. [C5351]

"Detection performance of MIMO radar with realistic target models"

We simulate a multiple-input multiple-output (MIMO) radar system involving a realistic target, which is a life-size land vehicle modeled using a EM simulator FEKO. Numerical results showing the detection performance of a MIMO radar are provided, which is measured based on multiple realizations of the channel matrix generated using the available FEKO data. The results validate in a practical setting the improvements in detection performance available from MIMO radar configurations. [C5352]

"Improving RCS and ISAR image prediction of terrestrial targets using random surface texture"

Tools for electromagnetic simulation, such as SE-RAY-EM/FERMAT, make RCS and ISAR image computations down to millimetre wavelength possible from the CAD of targets. The higher the frequency is, the greater the influence of the precision and the realism of the CAD models on results are. In millimetre wavelength, whatever the precision of the CAD, the roughness of surface and the non flatness of sheets of construction of terrestrial military vehicles cannot be reproduced by the geometry. Nevertheless, a realistic prediction of the RCS can be carried out by using statistical random surface superimposed on the deterministic initial geometry of the CAD. The calculations carried out on the 80 000 and 600 000 faceted CAD of the ZSU 23-4 illustrate the efficiency of this process. [C5353]

"Data fusion for scatterer identification and localization in an indoor spherical 3d RCS near-field facility"

Indoor Radar Cross Section measurement facilities are usually dedicated to the characterization of only one azimuth cut and one elevation cut of the full spherical RCS target pattern. To provide a full function of the roll angle and the azimuth angle, an indoor near field monostatic RCS layout has been developed at CEA, consisting in a spherical experimental layout. From the acquired raw data, signal processing and data fusion techniques provide a 3D map of the main scatterers. [C5354]

"A texture analysis of 3D radar images"

In this paper a texture feature coding method to be applied to high-resolution 3D radar images in order to improve target detection is developed. An automatic method for image segmentation based on texture features is proposed. The method has been able to automatically detect weak targets which failed to be detected with intensity based segmentation. [C5355]

"Tsunami detection using HF radar WERA: A simulation approach"

High-Frequency (HF) radars are operated in the 3-30 MHz frequency band and are known to cover ranges up to several hundred kilometers. Installed along the coastal regions at risk the radars can contribute to Tsunami Early Warning Systems. This paper describes the simulation of tsunami related signatures observed by HF surface wave radar at long ranges in case of a tsunami travelling towards the coast. The possible ocean surface current field changes due to a tsunami event are evaluated using the HF radar backscatter spectra. [C5356]

"Developments in foliage penetration radar"

Radars have been developed to detect buildings and vehicles under dense foliage using Synthetic Aperture Radar modes. More recently, systems and waveforms have been developed to detect moving vehicles and people in the presence of foliage clutter and signal loss. This paper summarizes the system design aspects of FOPEN SAR, and points to future developments for multimode operation. [C5357]

"Radar dynamic range specification and measurement"

A large dynamic range and a matching spurious-free response are now common-place requirements for new high-performance radar systems. In addition resistance to high-level out-of-band electromagnetic interference (EMI) is an important consideration. The key radar subsystem determining these characteristics is the analog radar receiver and the analog-to-digital converters (ADC). A Babel of definitions has been proposed to specify

and describe this type of performance for both radar and communication systems. This paper will highlight the definitions best suited to characterize radar performance for both in-band dynamic range and linearity, and tolerance to out-of-band interfering signals. An example of a measurement procedure, which can be used to quantify such performance, is presented and typical results are included. [C5358]

"Passive Coherent Location system planning tool"

This paper describes a method of modelling the performance of a Passive Coherent Location (PCL) system, utilizing a rigorous propagation model. The model allows for spatial and frequency diversity of the network of receivers and transmitters implementing a proposed Passive Coherent Location system. The modelling includes the important calculation of Signal to Interference ratio, a major limitation of PCL. [C5359]

"Sensor self-calibration methods for a passive conformal airborne antenna"

This paper presents self-calibration methods applied to passive conformal airborne antenna. The sensors of the array are mounted under large wing of an aircraft. During the flight, sensors are subjected to important static distortions and dynamical vibrations so that the array must be self-calibrated in order to keep the optimal performance of localization. This self-calibration is globally a non-observable problem but it may be solved locally using a sufficient number of sources or mechanical distortion models. Two approaches of self-calibration methods are exposed. They allow solving for phase ambiguities and false positions problem due to deformations larger than half the wavelength. [C5360]

"Contribution of the sea surface in monostatic radar echoes"

The contribution of the sea surface in monostatic radar echoes is studied both theoretically and experimentally. The electromagnetic response of a rough surface depends on its shape, its dielectric characteristics, and antennas characteristics and positions. Measurements acquired with a monostatic microwave scatterometer installed above a wave tank, in which controlled swells are generated, are compared with simulation results obtained by two electromagnetic models, based on the Physical Optics approximation and the Method of Moments. [C5361]

"Fast-time STAP for clutter suppression between transmitter and receiver in bistatic radar"

Detection and localization of ground targets in the region between the transmitter and the receiver in bistatic radar is difficult due to strong interference from surface clutter and the direct transmitter signal. We have simulated fast-time (using channels of an array antenna and range bins) and slow-time (antenna channels and radar pulses) STAP (Space Time Adaptive Processing) and find that fast-time gives better interference suppression in this region. We also see that fast-time STAP is useful for all four cases of stationary/moving radar and stationary/moving target and that slow-time STAP with moving radar is useful for both stationary and moving target. [C5362]

"Fitting derivative autofocus for stepped frequency radar"

High range resolution (HRR) profiles can be obtained using stepped frequency waveforms. A burst of linearly frequency modulated pulses on different carrier frequencies are transmitted and a suitable signal processing combines the returned echoes from each pulse to obtain a wide synthetic bandwidth. Target motion during stepped frequency processing causes several degradation effects, which inevitably reduce the desirable range resolution. This paper describes an autofocus technique that can be employed to compensate motion degradation effects on HRR profiles. The algorithm is based on a function of the derivative of the range profile as a measure of range profile focus. As an application the estimation accuracy of target to radar radial speed is tested in case of both one and two reflectors at different SNR (signal to noise ratio) using Monte Carlo simulation. The performances, in terms of standard deviation of radial velocity estimation of the proposed algorithm have been compared with that obtained with the contrast technique. [C5363]

"MIMO based spatial calibration of OTHR transmit arrays"

Spatial calibration of OTHR transmitting and receiving arrays is an important issue when implementing this class of radar. In the paper we demonstrate how MIMO radar techniques can be applied to the calibration of an OTHR transmit array. We provide experimental results to validate our approach. [C5364]

"Algorithmic techniques for discrimination among similar targets"

We investigate how imaging sensors can be exploited to support airborne radar persistent tracking of targets with

similar kinematics. We study two image discrimination algorithms. One algorithm is based upon a chi-square test performed on the histograms of the images and the other is based on a two dimensional cross-correlation of the images. Both techniques may be applied to a variety of imaging sensors, including SAR/ISAR, EO/IR cameras, and HRR radar. A comparison of the two approaches is provided for the case of EO images with varying view angles and signal to noise ratios. [C5365]

"Investigation of target altitude estimation in skywave OTH radar using a high-resolution ionospheric sounder"

This paper presents selected results from a novel ionospheric sounding experiment aimed at exploring the multipath propagation effect that is the basis for target altitude estimation in skywave OTH radar. To date the multipath propagation models that underpin altitude estimation algorithms have not been experimentally validated and it is believed that this accounts for instances of poor algorithm performance. As a first step in remedying this situation, measurements were made of the oblique skywave propagation channel between an OTH radar and an aircraft target at altitude over the sea. This experiment was conducted using an aircraft-borne transmitter and a ground-based HF sounder receiver. Resulting high resolution oblique ionograms are presented which demonstrate E-mode range-resolved altitude multipath. Examples are shown where raw ionogram data is processed to successfully estimate the aircraft altitude by using a simple E-mode multipath propagation model. [C5366]

"Detecting 3-D rotational motion and extracting target information from the principal component analysis of scatterer range histories"

ISAR imagery of ships are complicated by the 3-D motion of the target, which causes blurring in the imagery. A technique is proposed which could help detect such motion and prove useful to both analyse the 3-D motion as well as possibly help to estimate the 3-D position of scatterers as a by-product of the analysis. The technique is based on principal component analysis of accurate scatterer range histories and is shown only in simulation. Future research should focus on practical application. [C5367]

"A sidelobe reduction technique for enhancing images of UWB sparse MIMO array"

This paper addresses the problem of forming high quality images for an ultra-wideband sparse MIMO array in short range applications. The proposed technique uses the prior knowledge of the point spread function of the sparse array to iteratively reduce the side/grating lobes from the initially formed imagery. Numerical simulation results of both isolated and distributed target scenarios show significant reduction of sidelobe level and target break-up, which leads to increase of dynamic range of the imaging system. Experimental results with a sparse linear array further verify the potential of the proposed technique in practical applications. [C5368]

"Analysis of the KK-distribution with X-band medium grazing angle sea-clutter"

Robust maritime surveillance with radar requires an accurate description of the backscatter from the sea. An estimated probability distribution of the backscatter is commonly used to determine the threshold for separating targets from clutter at a given false alarm rate. Data collected at medium to high grazing angles by the Defence Science Technology Organisation (DSTO) Ingara fully polarimetric X-band radar demonstrates that the commonly used K-distribution is not always adequate for modelling the probability distribution. This is especially the case for the horizontal polarisation and in regions of high backscatter where target detection can be a problem. An alternative proposed as a more accurate model in this region is known as the KK-distribution. The analysis presented in this paper describes this model with the addition of multiple looks and a thermal noise component to produce greater accuracy in the mean and underlying shape. The threshold required to achieve a constant false alarm rate is then studied and compared with that derived from the K-distribution model. [C5369]

"Modelling X-band sea clutter with the K-distribution: Shape parameter variation"

Performance modelling techniques for maritime radar target detection problems typically make use of a parametric probability distribution for the background ocean backscatter. In this paper, measured X-band sea clutter is analysed by fitting a K-distribution and the variation of its parameters with radar resolution, polarisation, viewing grazing and azimuth angles and ocean wind and wave conditions is examined. Grazing angles lie in the range 10° to 45° . Earlier work has already characterised the variation in the mean of the distribution. Here, the shape parameter Γ is studied. Surprisingly, it is found that Γ exhibits a sinusoidal like variation with azimuth angle which is aligned with the direction of the wind waves rather than the swell. [C5370]

"DSTO's experimental geosynchronous satellite based PBR"

In this paper, we briefly outline one of DSTO's experimental research projects in passive bistatic radar (PBR). The illuminators of opportunity for the research discussed here are geosynchronous satellites. This paper presents an overview of the system, some theoretical analysis of the expected system performance, and the results of some real world target data captures (a truck, a train and an aircraft) at relatively close range. We conclude this paper with a preliminary empirical analysis of the optimal coherent processing interval for the airborne target and this system. [C5371]

"NDSA measurements between two LEO satellites in Ku and K bands for the tropospheric water vapor estimate: Performance evaluation at global scale"

In this work we present a software simulator for the performance evaluation of the NDSA (Normalized Differential Spectral Absorption) method at global scale assuming a realistic satellite orbital plane with two counter rotating satellite. The software tool processes atmospheric vertical profiles (pressure, temperature, water and liquid contents). The software simulator accounts for the main disturbance effects: scintillation impairments, thermal noise at the receiver and defocusing. The microwave propagation in atmosphere is simulated by means of the MPM93 model. Performance results about NDSA measurements at global scale for a single day at 17.25 and 20.20 GHz are presented and discussed. [C5372]

"Downward-Looking 3-D linear array SAR imaging based on Chirp Scaling algorithm"

Downward-Looking three dimensional (3D) Linear array SAR (LASAR) has the ability to map a directly overflown scene into a high resolution 3D image by looking perpendicularly downwards. The scope of this paper is to present a Chirp Scaling (CS) algorithm of 3D LASAR. Firstly, the principle of the LASAR system is introduced. Secondly, using the echo model the CS algorithm which focused the 3D SAR imaging in the range direction and the along track direction respectively. Then the beamforming technique is used to focus the 3D SAR data in cross-track direction. Finally the numerical experiments validate the feasibility of this algorithm. [C5373]

"A research on the SAR interferogram noise reduction with the application of wavelet transforms"

Interferometric phase noise reduction is a key approach in Synthetic aperture radar (SAR) interferometry. As an effective means in image processing, wavelet transform has been progressively exploited to reduce the phase noise. This paper first introduces a DWT-based noise reduction algorithm. Then, by using the stationary wavelet transform (SWT), we make an amelioration of this algorithm and simulate both algorithms with raw data. Based on the simulation results, we find the connection between reduction effect and the type of wavelet transform. At last, a new scheme, which has good performance both in reducing the phase noise and maintaining the continuity of the interferometric strips especially in high-noise area, is addressed. In the raw-data simulation, the results show that the new algorithm is feasible and effective. [C5374]

"Doppler ambiguity resolving for SAR ground fast moving target indication"

This paper investigates the restrictions of Synthetic Aperture Radar (SAR) ground fast moving target indication based on the conventional clutter suppression method in image domain which ignores the problems of range cell migration (RCM) and azimuth defocus. A technique for fast moving target indication and motion parameter estimation is proposed based on Doppler ambiguity resolving. In range frequency and compressed azimuth time domain of tri-channel SAR/GMTI data, the clutter is suppressed with DPCA technique, and the Doppler ambiguity number can be estimated from the residual signal using Radon transform. This approach exploits the relation between the line slope and the Doppler ambiguity number of fast moving target. Azimuth focusing is carried out with the criterion of entropy-minimization after azimuth cell migration correction (ACMC), and at last the fast moving target is imaged after range compression. The feasibility of the approach is validated by the real airborne data. [C5375]

"A robust approach to ground moving target detection and localization for multi-channel SAR system"

The strong target contamination has a great influence on the performance of the conventional clutter suppression method. In this paper, a robust approach to clutter suppression and ground moving target detection has been proposed for multi-channel SAR system. Firstly, the modulus normalized vector corresponding to the pixel data vector is constructed and its covariance matrix has been formed. Secondly, the ground clutter is suppressed using the new adaptive clutter suppression weight. Lastly, target detection and localization are carried out. The effectiveness and robustness of the proposed approach are confirmed by performance analysis and real measured data processing. [C5376]

"An image co-registration method for wide-swath and high-resolution spaceborne InSAR"

In this paper, we analyse the issue of SAR image co-registration for wide-swath and high-resolution spaceborne InSAR. A solution to this problem is proposed in which three processing procedures are adopted. First, image co-registration pre-processing is performed. There are two methods for this step: one is based on InSAR orbit and radar system parameters, and the other is based on the cross-correlation information of the master and the slave image. Second, coarse co-registration is implemented by block processing. Finally, fine co-registration is executed in order to obtain sub-pixel co-registration accuracy. Data simulation and qualitative analysis of coherence show that this method can provide accurate co-registration for wide-swath and high-resolution spaceborne InSAR, and meet the practical engineering requirement. [C5377]

"A robust estimation method for InSAR interferometric phase"

In this paper, a robust method for synthetic aperture radar interferometry (InSAR) interferometric phase estimation is introduced. In the method, the optimal joint data vector is determined, the generalized correlation steering vector is computed according to the data vector, and then the beamforming technique with the steering vector is used to estimate the InSAR interferometric phase. The method can carry out image coregistration and interferometric phase estimation simultaneously. [C5378]

"Algorithm based on data adaptive processing to compensate clutter range dependence for bistatic radar"

A method based on adaptive data processing to compensate clutter spectrum range dependence is proposed in this paper. The method takes of data interpolation theory to interpolate the range heterogeneous short distance data to the range homogeneous far distance data, in order to provide enough number of samples to carry Space Time Adaptive Processing (STAP) on the far distance data. Through computer simulation of two geometry of bistatic radar shows the data adaptive method can decrease the range dependence and the number of the large eigenvalues of the clutter covariance, and improve performance of (GMTI) ground moving target indication for bistatic radar. [C5379]

"A method for CLSAR 3-D imaging based on backprojection and beamforming"

In this paper, a spotlight model curvilinear synthetic aperture radar system is studied and three-dimensional imaging principle of this system model is analyzed. A three-dimensional imaging processing method based on backprojection and beamforming for curvilinear synthetic aperture radar is proposed, and raw data of curvilinear synthetic aperture radar in X-band is simulated and three-dimensional image is achieved. The imaging result is analyzed, and simulation results confirm the validity of the proposed method. [C5380]

"A new synthesis algorithm for InSAR phase unwrapping"

In this paper, we present a new two-dimensional hybrid algorithm for interferometric synthetic aperture radar phase unwrapping. A new synthesis method for InSAR phase unwrapping is proposed by applying the branch-cut and finite element method. The core theory of this method is to identify reliable and unreliable areas. This algorithm makes full use of the advantage of the branch-cut and finite element method, avoids the phase errors spreading all over the interferogram. Presented experiments on simulated data demonstrate the precision and efficiency of the procedure. [C5381]

"SAR images reconstruction based on Compressive Sensing"

Chirp signals are transmitted by Synthetic Aperture Radar (SAR) and the received signals are sampled into Inphase and Quadrature components which are so-called raw SAR data. The data is so tremendous that it brings extraordinarily high burden to the on-board storage and downlink bandwidth. This paper addresses a new process of the raw SAR data by sampling the data below Nyquist rate in terms of Compressive Sensing, which shows that super-resolved data can be reconstructed from an extremely small set of measurements than what is generally considered necessary. A wavelet-based contourlet transform, a multi-scale random Gaussian sampling, and a stage-wise directional pursuit are cooperating in this new process framework to realize our purpose, and it turns out that with only above 20% of the original transmission data should we reconstruct SAR images promisingly. Two major improvements of this radar transmission system are achieved: (a) potentially low Γ_B information rate Γ_B is preferred rather than high Nyquist rate while the transmission end emit the raw data, and (b) the hardware is significantly alleviated that lots of resources and energy can be saved in the manufacture process. This idea could enable the alleviation of transmission burden, reducing the sampling rates, the transmission time, the measurement time dramatically, shifting the emphasis from expensive transmission hardware to three smart gradients of CS framework. [C5382]

"A novel double-pulse detection method for aircraft target in ISAR"

Double-pulse or multi-pulse detectors have better performance than single pulse detectors in inverse synthetic aperture radar (ISAR) system. The more echoes we use, the better performance we have if the optimum detectors are utilized. The conventional inter-period correlation processing (IPCP) utilizes the received echoes directly. In this paper, a novel triple stage double-pulse detector is derived. We propose the first stage (nonlinear shrinkage map) to realized noise removal, and the second stage to estimate range migration number. Finally, we utilize the modified IPCP receiver to improve accuracy without the increase of the compute load compared with the conventional IPCP system. The proposed receiver is compared with other conventional detectors based on measured aircraft radar data and achieves satisfied performance. [C5383]

"The new criterion to evaluate SAR jamming effect based on the statistical distinction"

In this paper, a new criterion which is based on the statistical distinction to evaluate SAR jamming effect is proposed. The radar signal and jamming signal come from different signal source, and the statistical characteristics are not same, thereby the two signals are considered as independent. Here, the SAR images jammed can be look as the signal source mixed target signal with jamming signal, the jamming removal problem can also be described as blind signal separation problem. Using Independent Component Analysis (ICA) method, which is regarded as the statistical distinction tool of the mixture signal source (SAR images), estimates the orthogonal basis from the images. Moreover, we introduce the kurtosis as the criterion to classify the basis images and select threshold to decide which basis images span into target signal subspace and which basis images span jamming signal subspace. The SAR images jammed by Gaussian noise jamming and similar clutter jamming(SCJ) method are used as the input to the ICA algorithm respectively, the results provide that the effect on the jamming removing is degraded contrasted to the Gaussian noise jamming, because of the clutter jamming signal is similar to the target returned signal on the statistical characteristic. [C5384]

"A contourlet-based interpolation restoration method for super-resolution of SAR image"

As is well known that the quality of a digital image is affected by many factors, such as the distance between the acquisition system and the object, the acquisition environment conditions, and the resolution of the image sensors employed, and so on. So how to obtain high quality images has become a difficult task in practical applications. Image super-resolution reconstruction (SRR) is a signal processing approach which can produces a high-resolution (HR) image from observed multiple low-resolution (LR) images. The purpose of this study is to evaluate the potential application of SR techniques to synthetic aperture radar (SAR). In this paper, a LR image is used to extract high frequency information and reconstruct a high resolution image by an interpolation-restoration method based on contourlet transform to solve the problem of SRR. Experimental results show that the method has the superior performance in subjective visual quality. [C5385]

"Fractional Fourier transform and its application to SAR imaging of moving targets"

In this paper, we introduce the fractional Fourier transform (FrFT), which is a potent tool for linear frequency modulated (LFM) signal processing, and its applications to synthetic aperture radar (SAR) moving target detection and parameter estimation. A new method based on the FrFT for range cell migration correction (RCMC) is also presented. Both the analytic properties and the advantages are shown. Simulations are finally provided to demonstrate the superiority of this new method. [C5386]

"Research on deceptive jamming technologies against SAR"

Synthetic aperture radar (SAR) has its own special features different from conventional radar. It has high processing gain, so jamming to SAR is more difficult than that to conventional radar. Jamming to SAR finds its important usage in some military scene. In this paper, the basic principle of the SAR deceptive jamming and the model of the jamming signal are discussed, and the simulations are made. Finally, two criterions used to evaluate jamming effectiveness are provided. The jamming effectiveness is checked up used these criterions by computer simulation. [C5387]

"A signal processing method for airborne three-channel SAR-GMTI"

Aiming at airborne three-channel SAR-GMTI system, a signal processing method based on Clutter Suppression Interferometry(CSI) is presented including the processing diagram and the principle of clutter suppression. Channel calibration is proposed to correct the magnitude and phase imbalance between inner channels utilizing the test signal, SAR imaging and clutter cancellation are done successively, finally the accurate target parameters (location and velocity) are obtained. The signal processing approach which has been applied in real

data proved its good performance and turned out to be efficient. [C5388]

"Imaging methods for detection of airfield runway disaster"

Ground penetrating radar (GPR) is often used in detecting void and cavities under the airfield runway. Delay and Sum (DAS) imaging method based on time-domain focusing of pulse-echo radar data is commonly applied in imaging technique. Image quality depends on echo amplitude and time delay of backscattered signal that picked up from elementary cell. In this paper, in order to improve the image quality, we decompose the target echoes by calculating the echo amplitude and time delay based on EM inversion theory and then image using DAS focusing method after disposing. The simulation results show that this method improve the image quality greatly. [C5389]

"Jamming suppression in Dual-channel PolSAR"

In the paper, we provide a method to suppress both the blanketing jamming and the deceptive jamming in Dual-channel PolSAR (D-PolSAR) system. The model of the signal and jamming in the D-PolSAR system is analyzed. By comparing the difference between jamming and real signal, a two-channel-cancellation (TCC) method based on phase compensation is proposed to suppress these two types of jamming. The simulation validates the method. [C5390]

"Apply super-SVA to Stepped-frequency chirp signal processing based on dechirp method"

Stepped-frequency chirp signal (SFCS) is an important signal form used for high-resolution radar. It contains several sub-chirp signals with stepped carrier frequency and can be synthesized to a wide-band chirp signal. Dechip method is a quick, effective method to process SFCS, it synthesizes the sub-pulses of SFCS in time-domain. The usual design rule of SFCS is the frequency step (Γ, B_{if}) must be less than the bandwidth of sub-chirp (B_m). If $\Gamma, B_{if} > B_m$, the synthesized signal will have gaps, which leading to grating lobes in radar image. Here we proposed an algorithm by using Super-SVA to extrapolate each sub-pulse so as to fill the gaps and depress grating lobes. Without the restriction of $\Gamma, B_{if} < B_m$, it will be very helpful for using less sub-chirps to obtain higher resolution and reducing the influence of target motion on the quality of synthesized signal. We presented simulations to verify the proposed algorithm. Furthermore the results imply that super-SVA can not only be used for frequency-domain extrapolation, but also time-domain extrapolation of chirp signal. [C5391]

"SAR signal based motion compensation through combining PGA and 2-D map drift"

For synthetic aperture radar (SAR) operating in fine resolution mode, even with advanced motion measurement sensors, residual range cell migration (RCM) together with azimuth phase error considerably deteriorates the image quality. In this paper, a solution to SAR signal based motion compensation (SBMC) is presented, which combines the well-known techniques of phase gradient autofocus (PGA) and map drift (MD). The presented SBMC scheme employs subaperture processing, and compensates the residual RCM in the meantime of combining the subaperture phase error. Experimental results indicate the effectiveness of our approach. [C5392]

"Synthetic bandwidth method for SAR in deramp-on-receive mode"

As current airborne SAR systems aiming to produce SAR imagery at resolution less than 0.1 m, attaining ultrawideband signal become a difficult problem. Synthetic bandwidth based on frequency-stepped chirps is an available method to achieve this type of ultra-wideband signal, the advantage of which is the reduction of the instantaneous bandwidth and sampling rate requirements of the radar system. This paper analyzed the synthetic bandwidth method for deramp-on-receive signal in detail. To evaluate the capability of this method, simulations were carried out. For the lack of real deramped frequency-stepped chirps SAR data, we proposed an approach to transform the common non-deramped total bandwidth SAR data to deramped frequency-stepped chirps data, then process the transformed data with synthetic bandwidth method, and the imaging results show the validity of the proposed method. [C5393]

"Fast compressive sensing radar imaging based on smoothed l0 norm"

Compressive sensing technique has been shown capable of reducing the number of data samples beyond the Nyquist theorem, and achieving perfect reconstruction of the original signal. Because of its compressed sampling ability, compressive sensing has been found many applications in imaging, remote sensing conversion and many other fields. Although several kinds of radar imaging arithmetic were proposed, but the reconstructed speed arithmetic are slow. In this paper, we propose a faster compressive sensing radar imaging arithmetic based on smoothed l0 norm. Simulation experiments conformed that the algorithm has faster reconstruct speed and well reconstruct quality compared with other algorithm. [C5394]

"High azimuth resolution wide swath imaging based on the intrapulse spotlight SAR"

With respect to the contradiction between high azimuth resolution and wide swath, the intrapulse spotlight synthetic aperture radar (SAR) mode is presented to achieve high azimuth resolution wide swath imaging. Firstly, the model of intrapulse spotlight SAR is established, and then the characteristic of echoes in this mode is analyzed in detail. A conclusion that the intrapulse scanning can make point targets in the different azimuth subswaths ambiguous is given. The degrees of freedom along the pitching direction are used to remove the range ambiguities. In the intrapulse spotlight SAR mode, the long synthetic aperture acquired by intrapulse scanning technique is used to realize high azimuth resolution. Meanwhile a low pulse repetition frequency (PRF) is adopted to achieve wide swath. Results of simulation show the effectiveness of this method. [C5395]

"Study on dual-stripmap imaging algorithm for airborne circular-scanning SAR data processing"

The dual stripmap imaging mode for airborne synthetic aperture radar (SAR) is derived from a circular-scanning radar system, which satisfies wide area of imaging scene and high resolution requirements. The working principles, data processing scheme and system parameters design problems resulting from such a novel working mode are analyzed respectively in the text. The point-target simulation and live data implementation results are given to show the validity of the proposed methodology. [C5396]

"Coherent single range Doppler interferometry algorithm for high-speed spinning targets 2D imaging"

This paper focuses on the narrow band radar imaging for high-speed spinning targets. Based on the time-frequency characteristic of the echoed signal, a novel coherent spectrogram redistribution method, coherent single range Doppler interferometry (CSRDI), is proposed, which is of high resolution and robust even in the case of the low signal-to-noise ratio. The spinning rate error is also taken into consideration and an estimating approach based on the focal entropy is proposed. The validity of the approaches is confirmed by numerical simulations. [C5397]

"SAR imaging of multiple ships based on compressed sensing"

Recent theory of Compressed Sensing (CS) gives us a novel version that an unknown sparse signal can be exact recovery with overwhelming probability beyond Nyquist sampling constraints. In this paper, we adapt this idea and present a framework of high-resolution synthetic aperture radar (SAR) imaging with multiple ships. Under the framework, we convert the multiple ships imaging into a problem of sparse signal reconstruction with certain orthogonal basis, hence the sparse reconstruction of CS can be fulfilled and a theoretical upper bound of the cross-range resolution is presented. Real data results verify the effectiveness of the CS imaging framework. [C5398]

"Research on high resolution SAR based on frequency-stepped chirps"

Since the birth of the synthetic aperture radar, how to enhance the resolution is the very important direction of the SAR research, with the resolution of airborne SAR come to 0.1 m, for the design of the SAR system, the realization of the ultra band signal is a difficult problem, in order to alleviate the press of the A/D acquisition and data store, adopting the technique of the bandwidth synthesis to get the range high resolution, in azimuth applying wavenumber domain method, through the azimuth processing in two-dimension, solving the problem of coupling, attaining the high-resolution of the azimuth. The paper introduced the principle of a high resolution SAR system, the arithmetic of high resolution range imaging, give the simulation result, preliminary flight results and expect the future work. [C5399]

"Frequency scaling algorithm for One-Stationary Spotlight Bistatic SAR imaging"

The frequency scaling algorithm (FSA) is proposed to process One-Stationary Spotlight Bistatic SAR (BiSAR) data acquired via the dechirp-on-receive approach. By using series reversion, we can derives the two-dimensional point target spectrum for this BiSAR configuration. This algorithm leads to a very precise and efficient processing since it performs the focusing in the frequency domain and no interpolation is required in the whole processing chain. This algorithm is verified with a point target simulation. [C5400]

"Range Doppler algorithm for bistatic missile-borne forward-looking SAR"

Side-looking SAR cannot image targets in flight direction. Introduced here is the bistatic missile-borne forward-looking SAR system, as an efficient approach to forward-looking SAR imaging. According to the spatial geometry

and the model of echo signal, the signal spectrum derived by the method of series reversion, the phase compensation factors and the realized step of the proposed algorithm are given. Several simulation and processing results are presented to demonstrate the validity of the proposed algorithm. [C5401]

"The chirp scaling algorithm of arbitrary formation bistatic SAR imaging"

The paper derives a chirp scaling(CS) algorithm for arbitrary transmitter and receiver motion (nonparallel tracks, unequal velocities and antenna squint) in a bistatic synthetic aperture radar(BiSAR) constellation. Based on the bistatic geometry and Taylor series, two halves of monostatic phase histories are expanded in two Taylor series around the individual points of stationary phase to derive the point target spectrum. A novel range scaling formulation is proposed based on the spectrum. Finally, the proposed approach is verified with a point target simulation. [C5402]

"A new kind of RMA for translational invariant bistatic SAR configuration"

The range migration algorithm suitable for bistatic SAR is proposed. The phase term of bistatic SAR point target reference spectrum is no longer linear for the range coordinate of the point target because the distance respectively from the transmitter and receiver to the target are not equal and this make it difficult to use the typical RMA to process bistatic SAR signals. According to this, this paper presents a new kind of RMA suitable for bistatic SAR working in translational invariant mode based on a new expression of bistatic SAR point target reference spectrum, and the precision of this approach is only influenced by the precision of interpolation and the division of bistatic SAR azimuth Doppler frequency. Finally a raw data simulation verified the validity of the approach presented here. [C5403]

"ISAR imaging with linear array-antenna"

A linear array-antenna ISAR (LAA ISAR) was concerned in this paper. The imaging geometry and signal model of LAA ISAR were analyzed in detail, and the imaging procedure as well as simulation results were given. Compared with traditional ISAR imaging, the echoes of different antenna element in LAA ISAR should be process before imaging, and a similar digital beam forming method was proposed to solve the problem. After pre-processing, range-Doppler algorithm was adopted to accomplish the imaging process, the minimum entropy criterion (MEC) was used for envelope alignment, and the phase gradient autofocus algorithm (PGA) was adopted to fulfil the phase error correction. Simulations were executed in the end and all results illustrated the effectiveness of the LAA ISAR. [C5404]

"ISAR imaging of ship target based on LMSF signal"

To obtain high resolution ISAR image of ship target in motion with narrow-bandwidth T/R devices and a low-speed A/D sampler, an effective imaging method based on linearly modulated stepped frequency (LMSF) is proposed in this paper. Firstly, the signal model is developed and analyzed. Secondly, a band coherent processing method is proposed to eliminated the error induced by the translational motion and the high range profile is obtained. Finally, the high resolution of cross range is achieved by using the DechirpClean technique. The theory analysis and the result of real data processing demonstrate the performance of the proposed method. [C5405]

"Micro-Doppler analysis and imaging of air-planes with rotating parts"

In ISAR imaging of air-planes with rotating parts, the micro-Doppler phenomenon induced by the rotors will generate side-bands about the rigid body image. This paper derives the imaging model and analyzes the micro-Doppler of rotors. Then, a method for micro-Doppler separation based on low chirp rate matching is proposed. Meanwhile, an algorithm for scaling the 2D imaging of rigid body is presented, based on the complex-valued back-projection algorithm. Similarly, ISAR imaging of the rotating rotors can be obtained through the same algorithm. Finally, images from the rigid body and the rotating rotors are merged together to obtain a full image of the air-plane. The validity of the proposed algorithms has been proved by simulations. [C5406]

"Application of compressed sensing in sparse aperture imaging of radar"

A new optimal reconstruction method based on compressed sensing (CS) for sparse synthetic aperture radar (SAR)/ inverse SAR (ISAR), which can be used in widely sparse aperture, is proposed in this letter. Unlike other parametric estimation method as all-pole algorithm, CS can obtain near-optimal estimation and global-minimal error of gapped signal representation with structured dictionaries and random projections. To resolve the issue of minimization of non-zeros elements, traditional approaches such as orthogonal matching pursuit (OMP) and basis pursuit (BP) may be used. This non-adaptive means performs better than FFT imaging, especially in

azimuth focusing of SAR/ISAR. The results with simulation data and real sparse SAR/ISAR data validate the feasibility and superiority of the approach. [C5407]

"Range-time backprojection for 3D shape estimation of small space debris"

A coherent backprojection based approach is presented for 3D shape estimation of small debris in space. The approach utilizes the fact that space debris is in high-speed spinning motion. Making use of the modulated range envelope and Doppler spreading, a backprojection maps the data into a three-dimensional parameter domain, and the spatial coordinates of scatterers can be extracted to reconstruct 3D shape. In most of recent papers on the imaging of space debris or rotating targets, the rotation from the translational motion is assumed to be neglectable, while in our approach the backprojection is combined with a Fourier transform to deal with the rotation of translational motion and full coherent accumulation can be achieved. The approach is robust in the occurrence of serious profile overlapping and strong noise. Simulations confirm its validity and good performance. [C5408]

"Research on parallel processing of SAR imaging algorithm"

A parallel SAR imaging algorithm based on RDA is presented in this paper on the basis of the existing sequential algorithms after deeply studying parallel processing of SAR imaging. The algorithm which is on task level adapts well to the parallel processing system with high communication performance. The results of experiments on IBM blade server verify that the algorithm has highly real time property and parallel efficiency. [C5409]

"The development and performance of the prototype coded ARC"

The development and performance of a prototype coded Active Radar Calibration (ARC) in S-band, which is used as a ground calibration reference standard for Synthetic Aperture Radar(SAR), are described. The coded ARC uses phase shifting and delay techniques which affect the SAR signal in azimuth and range. The ratio of the ARC signal to the background signal is improved. An internal gain stabilization subsystem, which ensures the stability of the complete signal path and Effective Isotropic Radiated Power(ERIP), is included in the prototype coded ARC. An experiment was made in microwave chamber to prove the precision of the coded ARC's Radar Cross Section(RCS). The precision concluded from the result of the experiment is $< 1, \pm 0.2$ dB. And the whole performances fulfill the needs of the ARC's specifications. [C5410]

"A class of sharpness measures"

In signal processing, it is often necessary to measure the sharpness of a distribution. A class of sharpness measures is studied in this paper. First the class is defined. Then the relation between sharpness and the class is clarified, and this justifies the class as sharpness measures. In addition, in general, we investigate the effect of the kernel on the sharpness measure and present a guide to select the kernel. [C5411]

"Method of resolving ambiguity for sparse array via modified sparse even array based on MUSIC algorithm"

A novel method of resolving ambiguity via modified sparse even array based on MUSIC algorithm is proposed in this paper. Firstly, uses the data from original array to do DOA, then modified the array slightly. Finally, uses the two received data to do DOA in the same reference frame, which can separate the ambiguity angle from the two spectrum functions to get the real DOA. At the same time, the least adjust value of resolving ambiguity is given. In additional, both the measure function of resolving ambiguity and the relationship between resolving ambiguity ability and glip space are given. Simulation results and performance analysis verify that the algorithm is effective and feasible. [C5412]

"Forward scattering micro radars for situation awareness"

In the paper a progress in the netted forward scattering radar research is presented. A special attention is paid to the optimal and sub-optimal signal processing algorithms. These algorithms are assumed to be efficient when the signal is received at a background of Doppler clutters and AWGN. [C5413]

"An iterative segmentation algorithm of SAR image based on support vector machine"

In this paper, an iterative algorithm, which is based on support vector machine (SVM), is proposed for synthetic aperture radar (SAR) image segmentation. The proposed method considers the SAR image segmentation as the pixel classification. The pixels of the previous segmented image are regarded as the training samples for SVM,

which is used to re-segment the image. These iterations are repeated until the convergence, which is determined by checking the relative change of the entropy between two consecutive segmented images. Experimental results show that compared with, the proposed algorithm can achieve much better segmented results than the Markov random field (MRF) algorithm, and the proposed method dramatically reduces the influence of initial segmentation on the final result. [C5414]

"A SVR-based SAR target azimuth fusion estimation"

In SAR ATR, target azimuth estimation is one of the important pre-processing steps. Accurate estimation will bring a higher recognition rate. This paper presents a novel target azimuth estimation algorithm based on SVR with feature fusion. First target imaging pose is estimated roughly by long-edge fitting (LF) and ridgelet transform (RT) respectively, then SVR estimators are trained by the above estimated results which are combined together as the sample features. With the SVR, SAR target azimuth can be estimated more accurately. Experimental results with Moving and Stationary Target Acquisition and Recognition (MSTAR) database show the proposed method is effective, and can give better estimation performance than that either by LF or RT. [C5415]

"Optimal projection space method for SAR target recognition"

Automatic target recognition technique, based on the projections in the samples range space, can be available used in SAR target recognition. It requires that the relativity between the range spaces of different targets should be minimal. However, the relativity between the corresponding range spaces is very big if the different targets have similar appearance and structure, which will considerably reduce the recognition performance. So, it is essential to construct new projection spaces from the range spaces of similar targets, so as to enlarge projection difference. In this paper, an efficient method for constructing the optimal projection space is proposed. The proposed method can effectively enlarge the difference between similar targets by the projections in the optimal projection space. Experimental results show that the optimal projection space can greatly increase the separability between different similar targets, and is superior to other classical methods in both recognition performance and efficiency. [C5416]

"Turbo-like Iterative Thresholding for SAR image recovery from compressed measurements"

Compressive sensing (CS) has attracted many researchers since it offers a novel paradigm that one can acquire sparse signals at a sub-Nyquist rate without information losses. In J. Ma, April 2009, S. Bhattacharya et al, Aug 2007, and G. Rilling et al, 2009, the authors have presented some schemes for CS application on remote sensing imaging, some of which are related to SAR. CS remote sensing imaging includes two steps: on-board encoding imaging and off-line decoding recovery. Based on the on-board encoding imaging scheme proposed in J. Ma, April 2009, this paper focuses on the off-line decoding recovery algorithm. We proposed a turbo-like iterative residual thresholding algorithm (RTIT) to decode the compressed SAR data with approximately sparse property. The experimental results show that it outperforms the state-of-the-art iterative thresholding algorithm (IT). [C5417]

"Two-stage sequence classification of PolInSAR imagery"

In this paper, we present a two-stage scheme for supervised classification of polarimetric interferometric synthetic aperture radar (PolInSAR) imagery. In the first stage, a regularized logistic regression classifier is employed to generate probability vectors of object labels with polarimetric and interferometric features, respectively. The soft outputs (probability map) of previous logistic classifier with different features are concatenated as the input features of the second stage classifier-SVM classifier, which provides the final classification. We compare the two-stage methods against the baseline method and show its effectiveness. [C5418]

"A new reduced-rank STAP method based on cross spectral defined by range cell echo"

In the cross spectral method (CSM), the cross spectral is defined by space-time steering vector. One character of the method is that the cross spectral should be calculated and arranged in every angle-Doppler cell, so it has a great burden of calculation. A new reduced-rank (RR) STAP method is developed in this paper, the cross spectral is defined by the echo data of a range cell, instead of the steering vector. In the new method the cross spectral is calculated and arranged only one time for each range cell, so it greatly decreases the burden of calculation. It is proved in theory that the new method has a good clutter suppression performance as well. The result of simulation shows the good efficiency of the method. [C5419]

"Velocity compensation based Ultra-Wide bandwidth wireless moving target localization"

The extremely high resolution of Ultra-Wideband (UWB) signal in time domain and range measurement precision makes it advantageous in precise positioning. The algorithm based on averaging TOA is effective in reducing error in the precision positioning of stationary targets. But for moving targets, severe error will be introduced which makes the method unusable. This paper presents two means to improve the performance of the original algorithm in dealing with moving targets, using radial velocity compensation and triangulation velocity compensation. The precision has been improved by 40% via triangulation velocity compensation method in the bistatic 2-dimension (2D) simulation. [C5420]

"An improved passive location algorithm based on UKF"

With the merits as far responding distance, hiding receiving and easy-deploying, the single observation passive location has a broad application in military domain and plays an important part in passive radar, navigation and aerospace, etc. With the information of phase-difference, phase-difference rate of change and Doppler frequency rate of change, a new algorithm called PFRC, based on EKF, is proposed. Compared with two popular passive location methods which are bearing-only (BO) and phase-difference rate of change (PRC), the PFRC has good performance in that it has higher precision and higher speed. However, the linearization processing of the EKF introduces truncation error, which degrades the estimation precision. In order to reduce the error, based on the PFRC and the unscented transform, an improved passive location algorithm is proposed. Simulation results show that the proposed algorithm has better estimation precision. [C5421]

"Performance analysis of parameter estimation algorithm for LFM signals using quadratic phase function"

The aim of this work is the performance evaluation for a method used to analyze of a mono-component linear frequency modulation (LFM) signal, based on the quadratic phase function of the signal. A closed form is found for the output signal to noise ratio. The parameter selection problems of the algorithm are also discussed. Thresholds of the input SNR are presented to guarantee a reasonably accurate estimation of the frequency rate at the given signal length. The Monte-Carlo simulations verify the theoretical results. [C5422]

"Protocol analysis and simulation of inter-satellite communication for formation flying systems"

IEEE 802.11 protocol is widely used in Wireless Local Area Networks (WLAN) for its high data transmission rates. The formation flying satellite system has a short inter-satellite distance, which is similar to WLAN. It may be a good choice to apply IEEE 802.11 protocol in inter-satellite communication to increase throughput. However inter-satellite distance is longer than what desired by WLAN, so IEEE 802.11 protocols should be modified to be used in formation flying satellite systems. In this paper, two methods of medium access control for IEEE 802.11b protocol are analyzed firstly, which are Distributed Coordination Function (DCF) and Point Coordination Function (PCF), and then the protocol is modified to be used in the formation flying satellite systems. Finally, we analyze the performance of the modified protocol through simulations. [C5423]

"Diversified MIMO SAR waveform analysis and generation"

Inspired by recent advances in multiple-input and multiple-output (MIMO) radar, which has the potential to dramatically improve the performance of radar systems over single antenna systems. This paper proposes a waveform diversity-based MIMO synthetic aperture radar (SAR) concept. The fundamental difference between MIMO SAR and conventional SAR is that the latter seeks to maximize coherent processing gain, while MIMO SAR capitalizes on the diversity of target scattering to improve imaging performance. The system concept and signal models are developed. An example diversified waveform using for MIMO SAR is designed, along with several computer simulations that investigate the correlation performance of the designed waveform. Furthermore, a direct digital synthesizer (DDS)-based approach of diversified waveform generation, in which parallel DDSs are applied, is proposed for MIMO SAR systems. [C5424]

"Analysis of phase noise effect on noncooperative wideband bistatic receiver"

Noncooperative narrow-band coherent processing techniques have been developed, however, this capability for wideband signals processing require to investigate further. Of all the obstacles preventing coherent reception techniques from making transition into the optical domain, phase noise caused by system imperfections is one of them. This kind of phase error will defocus discrete scattering centres in the range-Doppler image, which will preclude target identification and analysis. The amount of phase noise in signal is directly related to its so-called bandwidth, the 3 dB line width of its power spectrum. Numerous investigators have studied the effects of laser phase noise. We will examine the effects it has on the performance of this receiver. Both theory and application of this original work is extended in this paper. The research defined a system configuration and assessed its potential performance via modelling. It was developed to support pulse compression of wideband waveforms for

applications. The associated implementation issues introduced by electro-optical component characteristics were discussed. Coherent detection was used to implement difference mixing for subsequent digital processing.

[C5425]

"A systematic frequency planning method in Direct Digital Synthesizer (DDS) design"

Direct Digital Synthesizer (DDS) based frequency synthesizer is important to the performance of radar. Effective DDS frequency planning is a problem still untouched in DDS design. Traditional software based method in DDS design can only get one frequency point spur performance at each run. A new DDS frequency planning method is proposed in the paper, this method can indicate DDS's output Γ_{Biclean} , Γ_{Bi} frequency band with a graphic method. This simple and useful method can tell the designer the usable DDS's output frequency band in the early stage of the overall frequency synthesizer design. As a result, it is of great significance in realizing a high performance synthesizer. Finally, a real S band frequency synthesizer was developed for a stepped frequency radar, the frequency synthesizer works well and its test results prove the effectiveness of the frequency planning method. [C5426]

"Touch-less heartbeat detection and cardiopulmonary modeling"

This paper presents a contact-less heartbeat detection system and a cardiopulmonary modeling. Using a vector network analyzer, our proposed microwave system shows the ability of detecting the heartbeat signal at different frequencies, as well as at different output power levels. Based on parameters extracted from real measurements, a model representing the heartbeat and the respiration signals is presented. Different processing techniques are used in order to separate the heartbeat and the respiration signals. For different signal to noise ratios, wavelet filters show higher accuracy over classic filters in determining both the heartbeat rate and the heart rate variability. [C5427]

"Code sequence synchronisation for SAR radiometric calibration"

Code sequence synchronisation in active coded transponder (ACT) is very important in the process of SAR radiometric calibration. According to the principle of coded SAR radiometric calibration, a signal processing model of active coded reflected signals is proposed in this paper. By means of three cyclic steps, correlation property of pseudorandom code sequence is used for code sequence synchronisation which is divided into two steps: coarse timing synchronization and fine timing synchronization. Simulation experiments with the compression of SAR azimuth signals are carried out. Finally, based on the experimental results, this paper proposes a new method of code sequence synchronisation for SAR radiometric calibration. [C5428]

"Realization and comparison of QRD algorithms for STAP"

For space time adaptive processing of airborne multichannel array radar, the computation load of calculating weighting vector is the heaviest. With sample matrix inversion (SMI) algorithm, QR decomposition usually is used to calculate weighting vectors. Four types of QR decomposition algorithm, Gram-Schmidt, modified Gram-Schmidt, Householder transform and Givens rotation, were studied in this paper. Through realization with ADSP-TS201, the computation efficiency and numerical stability of these four algorithms were compared. The realization results were validated with simulated multi-channel echo data. [C5429]

"Research on FMCW SAR signal characteristic and improved azimuth matched filtering algorithm"

Theory and application study of Frequency Modulated Continuous Wave (FMCW) Synthetic Aperture Radar (SAR) imaging has gained more attention nowadays. Based on Range Doppler Algorithm (RDA), signal characteristic of FMCW SAR was analyzed in details, and aiming at the azimuth matched filtering problem a method named Scene Range Cell Covering Algorithm (SRCCA) was proposed. Simulation results indicate that accurate imaging can be achieved with no effect on calculation load for the scene of large swath. The proposed SRCCA is effective for azimuth compression. [C5430]

"Research on tactical indexes of anti-SAR equipment in position protection"

In order to give rational indexes of anti-SAR equipment in position protection, this paper brings forward the concepts of max admissible response time and max admissible sensitivity which are detailed analyzed and modeled. Meanwhile, the power of coherent jamming is computed. Test results show the rationality and feasibility of the models. [C5431]

"A reformative method of SAR range bandwidth synthesizing and error compensation"

A reformative SAR bandwidth synthesizing method to produce high range resolution through stepped frequency chirp signal is introduced in this paper firstly. Then according to the requirement of engineering application, the effect of system error which is inherent in radar system on synthetic results is analyzed. And a compensation algorithm based on range PGA in frequency domain is presented. At last simulation results validate the algorithm. [C5432]

"Comparison of several methods for high speed detection target with narrow bandwidth"

A new method dealing with high speed target (HST) detection in pulse-Doppler (PD) radar is proposed. By utilizing Keystone Transform (KT) and linear range walk rectification, the range walk can be removed completely. The method is also compared with the Hough Transform (HT) and Complex Radon Transform (CRT). The simulated data validates the method and the analysis. [C5433]

"An eigenspace-like algorithm for multibaseline InSAR phase unwrapping"

In this work we present an eigenspace-like technique for the estimation of the unwrapped phase which is based on the model of the multi-baseline joint data group. The method is shown to work well even in the presence of the image coregistration misalignment and the steering vector mismatch, and has the ability to overcome the conflict associated with the computational complexity and the lack of the independent and identically distributed (i.i.d.) samples. The performance analysis of the technique is carried out based on Monte Carlo simulations and Cramer-Rao lower bounds (CRLBs) calculation. Numerical results on simulated data demonstrate the efficiency and precision of the proposed method. [C5434]

"Research on application of Keystone transform in radar"

Keystone transform for wideband LFM signal after dechirping is presented in this paper, which can correct range migration and improve the speed of signal processing. The affection of Keystone transform on echoes of ballistic targets with micro-motion and extracting micro-motion information is studied. Simulation experiments are carried out, whose results prove that the algorithm proposed above is valid. Simultaneously, we can draw the conclusion that in order to extract micro-motion or micro-Doppler information Keystone transform should not be applied. [C5435]

"Research on the azimuth ambiguity of phased array sliding spotlight mode SAR"

The azimuth ambiguity is a key character to scale the image quality, but the traditional expression in strip-map SAR does not match the situation in sliding spotlight. This paper firstly introduces the azimuth ambiguity expression of strip-map SAR. Then focusing on the phased array sliding spotlight condition, analyses its working principle, aims at the characteristic that antenna patterns are changed continuously in the process of beams sliding, constructs the azimuth ambiguity calculation function of phased array sliding spotlight SAR, makes corresponding system design and simulation farther, provides effectual reference for SAR system design. [C5436]

"Comparison of ALOS PALSAR RVI and Landsat TM NDVI for forest area mapping"

The objective of this research is to investigate the effectiveness of the radar vegetation index (RVI) derived from ALOS PALSAR full polarimetric data for forest area mapping. Comparison was made between RVI and NDVI of Landsat TM data. After examining of the index maps and the corresponding histograms, forest/non-forest segmentation was performed by unsupervised classification and by threshold method. The results show that RVI is much better in this kind of application. Considering the data acquisition capability, full polarimetric SAR data are quite promising for forest monitoring. [C5437]

"Urban area extraction in airborne SAR imagery based on the parameter of GO A distribution"

An algorithm of extracting urban areas in airborne synthetic aperture radar (SAR) imagery is presented based on the local statistical characteristics. The GOA distribution is introduced to model the ground scene in SAR imagery firstly. Then we demonstrate that the parameter Γ, B_i of GOA distribution in urban regions is much smaller than those containing non-artificial regions. Finally, experimental results using PiSAR data show that the proposed algorithm can distinguish urban areas from other areas better than the Weibull distribution based algorithm. [C5438]

"The Super-Resolution Range Imaging Based on multiband wideband signal fusion"

This paper researches on the method of fusion imaging based on echoes from multiple frequency band radars.

When using wideband LFM signal, an applied algorithm is presented. Echoes data from multiple radars are used to the fitted model, and high resolution is achieved by using modern spectral estimation techniques. This approach is validated by theoretical analysis and the result of static range experiments. At last, a fusion range profile of a plane by two different frequency wideband radars is given. [C5439]

"Flooded area detection using multi-temporal TerraSAR-X data"

Flood is one of the most common and expensive natural disaster. Rapid and efficient procedure to accurately detect the flood-inundated area irrespective of weather conditions will help the monitoring and rescuing during the seasonal flooding period. In this paper, a procedure is proposed to obtain the flood mapping using multi-temporal TerraSAR-X data. And a comparative experiment is design to test the effect of the proposed procedure. The result shows that it can extract the flooding area effectively. [C5440]

"Application of spaceborne SAR imagery in monitoring green algae"

Synthetic Aperture Radar (SAR) satellite image is first used to monitor dramatically growing green algae near Qingdao coastal in 2008. The system played important role in ensuring Qingdao 2008 Olympic Sailing Competition. Based on imagery statistic analysis, the influences of radar parameter on detection performance are evaluated. A processing method which used in practice is presented. Processing results consist with field observation data well, which validate the feasibility of the method. [C5441]

"Design of modified spectrum filter based on Mismatched Window for NLFM signal"

In the radar field, Non-Linear Frequency Modulation (NLFM) signals are widely used. The conventional design method of side-lobe suppression filter for NLFM signal is based on the principle of stationary phase with the window functions and the modified spectrum algorithm. A new filtering technique of Modified Spectrum Filter based on Mismatched Window (MSFMW) algorithm is proposed in this paper. This method respectively designs the NLFM signal and the pulse compression filter based on different window functions. So the spectrum magnitude of the filtered waveform is proportional to the window function which is different from the one used for waveform design. The performance of the pulse compression can be modified by the different window functions. The simulation results demonstrate that the Ratio of Main-lobe peak to Side-lobe peak (RMS) can be increased by 0.8 ~ 7.7dB, without changing the main-lobe width. [C5442]

"A novel coherent compensation method for multiple radar signal fusion imaging"

It is an effective method to improve the resolution of target range profile by fusing signals of multiple radars with different carrier frequencies. Aiming at the coherent compensation problem of multi-band radar signal fusion imaging, we propose a new data-based coherent compensation method, compensating for lack of mutual coherence among different radars. Compared with the existing model-based coherent compensation method, modelling of individual bands is not needed in the proposed method. Therefore the algorithm is simplified and the precision of phase parameters estimation is improved because of eliminating the modeling error. Both theoretical analysis and simulation results show that the proposed scheme is superior to the original one under fusion imaging. Moreover, it has nicer anti-noise capability. [C5443]

"Raw SAR data compression by structurally random matrix based compressive sampling"

Synthetic aperture radar (SAR) is an imaging system which can provide high resolution images of earth surface. It transmits chirp signals and the received echoes are sampled into I and Q components, thus producing a huge amount of raw SAR data which may exceed the on-board storage and downlink bandwidth. In this paper, we compress the raw SAR data by sampling the signal below the well-known Nyquist rate using a novel framework of compressive sampling (CS), i.e, a fast and efficient sampling with structurally random matrices(SRM) which is developed on the provable mathematical model. In this framework, a 2DFFT and a structurally random matrix whose columns are permuted randomly are employed in the encoder. At the decoder the basis pursuit reconstruction then proceeds to find the sparsest signal. Simulation results are also presented to prove the feasibility of our proposed scheme. [C5444]

"Analysis of the polarimetric parameters of representative targets and its application to land use classification"

Polarimetric SAR (POLSAR) data contains both phase and amplitude information from radar returns transmitted in four different polarizations. Thus it is necessary that we place strong emphasis upon extracting physical information from the observed scattering of microwaves. In this paper, we studied the Freeman decomposition method as well as some feature parameters that can represent targets' characteristics. Further more, we made

an in-depth investigation on applying these parameters to discriminate several representative terrain cover types. [C5445]

"New development of ECS algorithm for SAR imaging processing"

Traditional extended chirp scaling (ECS) algorithm, after RCMC in the range signal/Doppler domain, can not equalize the FM rates of targets in the same range gate. In this paper, a novel approach for high squint missile-borne SAR data processing using a modified extended chirp scaling algorithm is proposed. A non-linear chirp perturbation function (CPF) is presented and can be applied to each range gate to equalize the targets FM rates before azimuth compression, which can accommodate azimuth compression and improve precision of algorithm. Comparison between this development named modified ECS with traditional ECS algorithm is implemented and several simulations of point targets demonstrate the validity. [C5446]

"Diricast: Flooding-reduced routing in MANETs without destination coordinates"

The majority of the routing protocols designed and implemented to date for mobile ad hoc networks (MANET) rely on flooding of route requests for the establishment of routes on demand, flooding of topology information, or the hop-by-hop dissemination of distances or paths for each destination. The signaling overhead incurred with these strategies consumes excessive amounts of the scarce bandwidth available in a MANET as the number of nodes and the number of information flows increase. We introduce Diricast as an alternative for routing in MANETs. Diricast assumes that each node knows its own geographical coordinates and the geometry of the terrain in which the network is deployed. To find the route to a destination, a node selects a limited number of relays to forward a route request message based on their coordinates and the boundary vertices of the terrain if the prior location of the destination is unknown, or based on the prior location of the destination if it is known. If the destination is reached, a route reply is sent back to the source containing its coordinates. We compare Diricast with OLSR and AODV, which are representatives of traditional proactive and on-demand routing approaches in MANETs, and show that Diricast attains much lower routing overhead, which also leads to better delivery rates and shorter end-to-end delays. [C5447]

"Optimal point target detection with unknown parameters by MIMO radars"

We consider multiple-input multiple-output (MIMO) radar systems with widely spaced transmit and receive antennas. We treat the problem of detecting point targets when one or more target parameters of interest are unknown. We provide a composite hypothesis testing framework for jointly estimating such parameters along with detecting the target while only a finite number of signal samples are available. The test offered is optimal in a Neyman-Pearson-like sense such that it provides a Bayesian-optimal detection test, minimizes the average mean-square parameter estimation error subject to an upper bound constraint on the false-alarm probability, and requires a finite number of samples. While the test can be applied for concurrently detecting the target along with estimating any unknown parameter of interest, we consider the problem of detecting a target which lies in an unknown space range and find the range through estimating the vector of time delays that the emitted waveforms undergo from being illuminated to the target until being observed by the receive antennas. We also analyze the diversity gain which we define as the rate that the probability of mis-detecting a target decays with the increasing SNR and show that for a MIMO radar system with N_{t} and N_{r} transmit and receive antennas, respectively, the diversity gain is 1 for point targets. [C5448]

"Intelligent scheduling and flexible interconnection of multi-function radars"

This paper presents a novel approach towards cooperation between conglomerates of sensors for compiling an enhanced operational picture. It uses the benefits of distributed processing via multi-agent systems for intelligent scheduling of multi-functional radars and their flexible interconnection via mobile ad-hoc networking technology. These dynamically reconfigurable networks facilitate the cooperation of roaming sensors that move into communications reach. Overall, a multi-faceted architecture is presented to optimize the usage of scarce time and energy from sensors for target searching and tracking and to bring contributions of coalition partners together with the goal to improve the operational picture. [C5449]

"Ultra high speed ADCs and DSP brings direct digital RF beam forming to MILSATCOM phased array apertures"

In spite of its proven advantage, realization of affordable multi-functional phased-arrays, combining multiple communication apertures, is hindered by size, weight, and power consumption (SWaP) and cost issues. Incremental improvements in both transmit and receive analog RF chains are being pursued. However, it is difficult to expect revolutionary advances in phased array SWaP using architectures based on state-of-the-art analog component efficiencies and performances. These difficulties are very pronounced for the multi-band,

multi-beam applications often found in modern MILSATCOM mobile and shipboard systems such as the Army's HC-3, Navy's NMT and Integrated Topside and Air Force's FAB-T programs. Dramatic improvements in single or multi-purpose large phased array apertures require a breakthrough technology. HYPRES has been developing superconductor wideband Digital-RF technology-a disruptive technological innovation capable of enabling dramatic change in communication architectures. Impressive results through recent live demonstrations have been achieved in proving that Digital-RF technology can be practically applied to next generation communication systems. Recent advances in direct conversion Digital-RF technology show that affordable, reliable, large multi-purpose phased arrays for communications, radar, and electronic warfare can be a reality. [C5450]

"Source localization in near-field using a moving array"

This work proposes a method for localizing a single near-field source using a moving array. Using a phase correction factor calculated from two sequences of selected data snapshots, we extend the array aperture and compute the initial estimates of the source's bearing and range from the extended data sets. With the initial estimates of bearing and range we construct a phase difference factor to modify the data sets into the ones as if they were collected by a stationary extended array. Finally the localization of the single near-field source is carried out by using a modified 2-D MUSIC with parameter refinement iterations on the modified data sets. Simulation results are presented to demonstrate the feasibility of the proposed method. [C5451]

"Security in Mobile Governmental Transactions"

In recent years mobile transactions have attracted a large number of clients. Being a more convenient and secured approach to perform remote governmental transactions than Internet, mobile transaction has turned into a more appealing method than previous methods. However, implementing wireless communication technologies may result in more complicated information security issues. This paper discusses the security of mobile network protocol along with information security for governmental transactions. [C5452]

"A Risk Management System of Real-Time Gas Pipelines Network Based on Wireless Data Transmission"

Based on advanced ZigBee and GPRS technology, which collects and transmits data, risk evaluation system of gas pipelines network realize the real time risk analysis and management. This paper introduces the methods of wireless data transmission, gives the architecture of software platform, discusses a processing method for real-time data, and analyzes risk assessment and evaluation model. This has extremely application prospect. [C5453]

"High-performance floating-point implementation using FPGAS"

Traditionally, digital signal processing (DSP) is performed using fixed-point or integer arithmetic. The algorithm is carefully mapped into a limited dynamic range, and scaled through each function in the datapath. This requires numerous rounding and saturation steps, and can adversely affect the algorithm performance. Use of floating-point arithmetic provides a large dynamic range and greatly simplifies the task of system performance verification, usually against a floating-point simulation. The drawback is an order of magnitude larger computational requirement, whether using a digital signal processor or FPGA-based simplification. Recently available FPGA design tools and IP provide a substantial reduction in computational resources, as well as greatly easing the implementation effort in a floating-point datapath. Moreover, unlike digital signal processors, an FPGA can support a DSP datapath with mixed floating- and fixed-point operations, and achieve performance in excess of 100 GFLOPS. This is an important advantage, for many high-performance radar, electronic warfare, and sensor fusion applications only require the dynamic-range floating-point arithmetic in a subset of the total signal processing. The choice of FPGA implementation coupled with floating-point tools and IP allows the designer flexibility in a mix of fixed-point data width, floating-point data precision, and performance levels unattainable by a processor-based architecture. [C5454]

"The Practice of an Automatic Registration System Based on Contour Features and Wavelet Transform for Remote Sensing Images"

Image registration is an inevitable problem arising in many image-processing applications whenever two or more images of the same scene have to be compared pixel by pixel. The increased volume of satellite images has reinforced the need for automatic image registration methods. In this paper, two new feature-based approaches to automated image-to-image registration are presented. The characteristic of the first approach is that it combines an invariant moment shape descriptor with improved chain-code matching to establish correspondences between the potentially matched regions detected from the two images. This method works well for image pairs in which the contour information is well preserved. For the registration of the optical images

with synthetic aperture radar (SAR) images, we propose another method based on the wavelet transform, this second method uses spectral information of the images and their local wavelet transform modulus maxima to extract a set of control points. The experimental result demonstrates the robustness, efficiency and accuracy of the two algorithms. [C5455]

"Emerging methodologies in encoding airborne sensor video and metadata"

The Defense Information Systems Agency (DISA) has been supporting dissemination of airborne sensor Full Motion Video (FMV) since the inception of the Global Broadcast Service (GBS). DISA actively investigates emerging video technologies and participates in DoD and industry conferences related to FMV. In 2006, DISA increased its involvement in FMV dissemination through support to several US Central Command (USCENTCOM) Joint Urgent Operation Needs Statements (JUONS). These JUONS established a two-way, IP based satellite architecture for backhaul and dissemination of tactical aerial sensor content from the USCENTCOM Area of Operations based on the Digital Video Broadcast -Return Channel Satellite (DVB-RCS) standard. A key component of FMV service in the DVB-RCS network is the video encoding technology. The video encoder compresses and encodes source video and accompanying metadata for further dissemination. Video encoders fielded during the initial deployment of the USCENTCOM DVB-RCS network several years ago provided advanced video services at that time. However this installation base no longer provides the most efficient compression capabilities and also lacks support for emerging metadata formats. Newer Commercial-off-the-Shelf (COTS) encoder models are currently being assessed to satisfy the challenge of an increasing number of end users as well as expanding FMV capabilities requirements. This paper will discuss the emerging techniques, challenges, and lessons learned in encoding full motion video and metadata generated by airborne sensors. [C5456]

"Using a Genetic Algorithm to determine an optimal position for an antenna mounted on a platform"

Determining an optimal position of an antenna on a platform is not always intuitive. This paper examines the implementation of a genetic algorithm (GA) within XFDTD, a finite difference time domain (FDTD) solver, for its effectiveness in determining an optimal antenna position when compared to a brute force method. XFDTD uses the FDTD method to solve general electromagnetic problems. Built into XFDTD is the concept of feature based modeling (FBM), which uses relative coordinate systems to position antennas in a geometry in relation to other parts. The GA, written in C++, is available to XFDTD's Scripting API. Through scripting a user specifies the antenna to move and provides bounded regions where the antenna can be located for maximum efficiency. [C5457]

"Power Delay Profile Matching for Vehicle Target Recognition"

Radar echo contains unwanted echoes called as clutter, which make it difficult to detect vehicle or obstacle. Especially short-range/wide-angle vehicle radar at 24 GHz suffers from heavy clutter unlike long-range radar at 77 GHz. It is therefore expect to improve the detection performance by suppressing the clutter using a pulse integration and CFAR (Constant False Alarm Rate). However the radar echo should include multiple vehicle targets as well as the clutter, thereby it is not easy to improve the performance. In this paper the target discrimination technique, let say, power delay profile matching scheme is proposed and the usefulness is investigated by conducting the measurement at 24 GHz where the clutter suppression scheme is also considered. As a result, a vehicle target is found to be recognized from multiple vehicles. We have also investigated the effect of bandwidth on the target discrimination capability. [C5458]

"A Physical Analysis of an Accident Scenario between Cars and Pedestrians"

Every year still thousands of people are injured or killed in accidents with cars, trucks and busses. Many of these people are pedestrians or cyclists. Several research groups work on solutions to avoid accidents between cars and pedestrians with the help of different technologies. In this paper we present an innovative approach for a collision avoidance system which should be able to tackle these accidents. To understand the potential of this approach, we will present a physical analysis of the system time available between detection, warning and reaction. We also discuss different architectures of our approach utilizing ad-hoc and/or cellular technologies. Additionally, we present experimental results of connection establishment and ping response times of these wireless technologies. [C5459]

"Angle-of-arrival-assisted Relative Interferometric localization using Software Defined Radios"

In this work, we present SDR-ARI-a software defined radio (SDR) approach to an angle-of-arrival-assisted relative interferometric (ARI) RADAR transceiver. It has a number of desirable attributes including the ability to reduce the synchronization, network, and hardware requirements when operating as the sole RADAR modality

and its ability to augment existing pulsed and CW RADAR algorithms. While, ARI encoding was initially proposed in prior work, no implementation had been completed and only a pure hardware approach to the receiver was reported. We have developed and implemented a software-defined model in Matlab, and have designed, simulated, and implemented an SDR-ARI transceiver utilizing USRP hardware and gnuRadio software. The use of software-defined radio has allowed us to implement ARI in a timely manner. The proposed approach is described and analyzed. [C5460]

"Modeling of a radar signal for scan pattern"

As electronic warfare (EW) environment has rapidly changed to be more complex, ambiguity in detecting and identifying enemies' radars also has increased in electronic warfare support (ES) systems. To overcome this critical problem by the limitation of the conventional detection and identification method based on the inter-pulse modulation characteristic such as pulse repetition interval (PRI) and frequency modulation type, a new approach introducing scan patterns of radars has been presented. The conventional researches, however, have mostly dealt with a simple scan pattern type like a circular scan. This is due to the difficulty in gathering various radar signals, even though they are essentially needed to identify lots of radar systems. Therefore it is required a solution which secures the various radar signals to trigger and advance related researches. To satisfy this need, we propose a novel radar-signal model which can generate radar signals including various scan patterns. By analyzing and considering the relationship between a shift of radar boresight by the scan pattern and parameters determining power variation, we establish the proposed model. To make the model more practical, some distortions such as noise, missing pulses, and spurious pulses are added. The validity of radar signals generated from the model is verified by analyzing their results where various radar signals of a typical radar scan pattern type are produced varying with operational parameters. [C5461]

"Denoising method for weak-power radar signals using the modified sinc wavelet"

Electronic warfare (EW) is commonly divided into three subfields: electronic warfare support (ES), electronic attack (EA), and electronic protection (EP). Among them, ES systems take charge of collecting and analyzing the received signal from enemy's emitters and then provide the processed information to friendly EA and EP systems. The information is of critical importance because it is the first prerequisite for the proper discharge of duties of EA and EP systems and is directly linked to the issue of a battle. However, ES systems have difficulty in carrying out their jobs because there are some cases of having no information about enemy's operating frequency and the received signal power is sometimes seriously weak. In this paper, we propose a novel method to solve these problems at once based on the modified wavelet transform by using the unique scaling property of continuous time wavelet transform and the frequency shifting property. Computer simulation results show that the proposed method can be useful and practical to cope with low SNR environment. [C5462]

"Situation assessment via multi-target identification and classification in radar sensor networks"

DoD has defined three levels of data fusion for network centric warfare (NCW). Level 1 data fusion combines data from single or multiple sensors and sources to provide the best estimate of objects and events in the battlespace. Level 2 data fusion focuses on situation assessment. Level 3 data fusion is threat assessment. To facilitate situation assessment, we investigate the problem of jointly classifying and identifying multiple targets in radar sensor networks where the maximum number of categories and the maximum number of targets in each category are obtained a priori based on statistical data. However, the actual number of targets in each category and the actual number of target categories being present at any given time are assumed unknown. It is assumed that a given target belongs to one category and one identification number. The target signals are modeled as zero-mean complex Gaussian processes. We propose a joint multi-target identification and classification (JMIC) algorithm for radar surveillance using cognitive radars. The existing target categories are first classified and then the targets in each category are accordingly identified. Simulation results are presented to evaluate the feasibility and effectiveness of the proposed JMIC algorithm in a query surveillance region. [C5463]

"A set of triphase coded waveforms: Design, analysis and application to radar system"

Based on the zero correlation zone (ZCZ) concept, we present the definition and properties of a set of new triphase coded waveforms -ZCZ sequence-pair set (ZCZPS) in this paper and propose a method to use the optimized punctured sequence-pair along with Hadamard matrix construct the optimized punctured ZCZ sequence-pair set (optimized punctured ZCZPS). According to property analysis under the Doppler shift condition, the optimized punctured ZCZPS has good autocorrelation and cross correlation properties when Doppler shift is not large. We apply it to radar target detection. The simulation results show that optimized punctured ZCZ sequence-pairs (optimized punctured ZCZPs) outperform other conventional pulse compression codes, such as the well known polyphase code-P4 code. [C5464]

"Mono-static MIMO radar array design for interferences suppressing"

The multiple-input multiple-output (MIMO) radar has drawn considerable interest recently. Many notable research results have been obtained, such as virtual receive array (VRA) concept for orthogonal waveform transmitting MIMO radar. The mono-static MIMO radar proposed in this paper shares the same transmit and receive antenna array, so it is very similar to conventional transmit/receive (T/R) digital beamforming (DBF) radar. The VRA concept can be easily extended to T/R DBF radar system by re-designing the antenna array structure. In this paper, an optimal antenna array design for mono-static MIMO radar is proposed in order to improve the interferences rejection capabilities. The minimum redundancy array (MRA) concept is also used to maximize the antenna virtual aperture for an array of given numbers of elements. Simulation results show that compared with the T/R DBF radar, the proposed monostatic MIMO radar can effectively improve the interferences rejection capabilities, especially the mainlobe interferences rejection capabilities. Moreover, mono-static MIMO radar with MR VRA has better interferences rejection performance than mono-static MIMO radar with uniform VRA.

[C5465]

"Adaptive reflected power canceller for single antenna FMCW radar"

FMCW radar with single antenna causes leakage of transmitted signal into the receiver which can reduce the dynamic range and degrade the receiver sensitivity. One of the greatest challenges in designing continuous-wave monostatic radar lies in achieving sufficient isolation between the transmitter and the receiver. A novel adaptive reflected power cancellation technique in real-time digital signal-processing is proposed to nullify the transmitter leakage at the receiver front-end to achieve high isolation. With the digital implementation, the proposed scheme requires limited hardware and reduced logical elements than the previously reported adaptive digital implementations.

[C5466]

"Background noise estimation using outer product expansion for ELF electromagnetic wave signal"

This paper shows the denoising performance of the outer product expansion with non-linear filters for the background noise included in the extremely low frequency (ELF) electromagnetic (EM) waves. We have proposed novel source separation techniques based on an outer product expansion with non-linear filters. Some kinds of the algorithm for the outer product expansion and its effectiveness have been reported. However, the denoising accuracy for real data has not been shown in the conventional researches. In this paper, two algorithms for an outer product expansion are applied to conduct the suitable method for the background noise reduction problem of EM wave data. Two topics are discussed in this paper. The performance of background noise reductions for ELF EM data analysis is represented using an outer product expansion. Moreover, optimal parameters, which yields the accurate denoising for EM wave data, are introduced.

[C5467]

"A new wavelet based algorithm for estimating respiratory motion rate using UWB radar"

UWB signals have become attractive for their particular advantage of having narrow pulse width which makes them suitable for remote sensing of vital signals. In this paper a novel approach to estimate periodic motion rates, using ultra wide band (UWB) signals is proposed. The proposed algorithm which is based on wavelet transform is used as a non-contact tool for measurement of respiration motion rate. Compared with traditional contact measurement devices, experimental results utilizing a 3.2 GHz bandwidth transceiver, demonstrate 99% similar results. The standard deviation of the proposed algorithm for 30 independent experiments has obtained 19% for respiration motion.

[C5468]

"An improved correlation method of phase difference detection between two signals in polarimetric radar signal processing system"

In this paper, an improved correlation method is proposed to detect the phase difference between two signals in high frequency in a polarimetric radar system. The mean value of the correlation of two sampled signals is calculated based on field programmable gate array (FPGA) to give a more accurate result of the detection. The method is simulated in Simulink®, and the blocks are then converted into a Quartus II project and compiled to show the occupied resources. The basic principle of the method is described in detail and the results of the simulation provide some evidences that the method can be applied in the radar system for real time processing. Some notes are also given to improve the performance in practical applications.

[C5469]

"X-band PN radar experimental platform with high accuracy"

A high accuracy experimental platform for X-band PN radar performance evaluation has been created in our research lab. This PN radar platform could be used for the applications such as unmanned-aerial-vehicle anti-collision, and short-range distance measurement etc. It includes compact size X-band radar transceiver,

baseband signal processing in FPGA, high speed analog to digital converter (ADC), arbitrary waveform generator (AWG), and Matlab Simulink tools. Our measurement result shows this PN radar has high accuracy within detection range. The detected range error is 0.082 m. The radar carrier frequency is 9.5 GHz. [C5470]

"A prototype for stepped-frequency SAR dechirp imaging system and experimental verification"

In SAR imaging, range resolution is inversely proportional to the transmitted signal bandwidth. Generally, for technological or cost reasons relative to radar hardware, the ability to produce or receive wide bandwidth signal is limited. However, if the frequency band of the transmitted signal is skipped within a train of sub-pulses and the received signals are properly combined, then the signal bandwidth could be effectively increased, as well as the range resolution could be improved. The proposed system indeed breaks through the limitation in range resolution which is set by the radar hardware units in traditional method. Synthesized processing of stepped-frequency chirp subpulses makes SAR range resolution much higher. The experiment has been conducted successfully and the improvement on range resolution is verified. [C5471]

"Investigations into breast cancer detection using Ultra Wide Band Microwave Radar technique"

An experimental investigation into capabilities of an ultra wideband (UWB) microwave radar to detect breast cancer is presented. A phantom, consisting of a cylindrical plastic container with a low dielectric constant material imitating fatty tissues and a high dielectric constant object emulating tumour, is scanned over a circular cylindrical surface with an UWB probe antenna. Following the collection of an experimental data, spatial images of the breast phantom are formed using two different approaches. One neglects and the other one compensates for the signal drop with distance. The approach compensating for the received signal drop enables a successful detection of tumour targets with a diameter as small as 5 mm at different distances from the skin layer just by visual inspection of the produced image. [C5472]

"Design of a 24-GHz PSK transmitter for SRR applications based on differential switches in 0.13- μ m CMOS process"

This paper proposed an architecture of an SRR transceiver for the applications in multi-target automotive environment. The millimeter-wave radar signal is phase-modulated by a specified gold code sequence to make the reflection signal be capable of identification via auto-correlation. A 24-GHz PSK transmitter for the SRR application is also implemented. The original VCO frequency is designed at 12 GHz to release the constrictions of the CMOS process. Differential switches are employed in the transmitter for the purposes of the frequency doubling and the phase modulation. The PSK transmitter of the SRR transceiver is demonstrated in TSMC 0.13- μ m CMOS process. The chip size is 1.03 Γ fB— 0.93 mm². The measurement results show that the free-running frequency of the VCO in the chip is around 10 GHz and the doubled frequency is around 20 GHz. The phase modulator is also tested under a baseband frequency of 1 GHz and the result shows that it is functional work. [C5473]

"Direction of arrival estimation using nonlinear function of sum and difference beam"

In this paper, a high resolution direction of arrival (DOA) estimation algorithm is proposed that based on the usage of nonlinear function of sum and difference beam. The generalized expression of this technique for different scenarios was derived in details. Unlike the conventional high resolution algorithm such as the MVDR, the MUSIC, and the ESPRIT, the proposed algorithm keeps the high resolution ability under low Signal-to-Noise Ratio (SNR) conditions. In addition, the proposed algorithm is suitable for real-time applications in that it has low computation complexity. Simulation results verified the validity of the proposed algorithm. [C5474]

"Characteristic study of ionospheric clutter in high-frequency over the horizon surface wave radar"

The presence of ionospheric clutter in high-frequency over the horizon surface wave radar may extremely affect the performance of radar system and degrade the capability of detecting target. The characteristic analysis of ionospheric clutter is the foundation of studying method to suppress ionospheric clutter. By using the MUSIC algorithm to analyze plentiful radar echoes data, directivity characteristic of several major kinds of ionospheric clutter has been summarized and the superposition situation that two kinds of ionospheric clutter exist at the same altitude has been discussed, moreover, the pertinence between directivity characteristic of ionospheric clutter and the working frequency has been studied. All these works provide convenience for advancing and realizing ionospheric clutter suppression methods based on directivity characteristic of ionospheric clutter. [C5475]

"Linear Method for WLAN Positioning System"

In this paper, a linear method is proposed to determine the distance according to RSSI, which avoids the traditional disadvantages of low effectiveness, high cost greatly. And two measures, first and second filtering, are taken to discard all the incorrect information and improve the accuracy for location. [C5476]

"On the MUSIC-derived Approaches of Angle Estimation for Bistatic MIMO Radar"

We investigate the topic for the direction of departure (DOD) and direction of arrival (DOA) estimation in bistatic multiple-input-multiple-output (MIMO) radar systems with the exploitation of array invariance. Several MUSIC-derived algorithms for angle estimation in MIMO radar have been presented and compared for their complexity costs against that of ESPRIT. The proposed scheme of multi-invariance multiple signal classification (MI-MUSIC) has the best performance and also can be considered as a generalization of MUSIC. Simulations verify the collaborative usefulness of our algorithm. [C5477]

"The optimization of orthogonal coded signal group based on multiple population evolving strategies"

An improved genetic algorithm based on multiple population evolving is presented and applied to the optimization of orthogonal coded signal group for MIMO radar systems. According to the fitness of individuals, the population is divided into three groups and different evolving strategies are applied to every sub-population. The inoculation to all sub-population is actualized. This algorithm can strengthen and preserve the diversity of population. Meanwhile it can enhance the constringency speed and overcome the precocity of GA. Simulation results show that the improved genetic algorithm is effective and the optimized signal can used in MIMO radar. [C5478]

"A digital ultra-fast acquisition linear frequency modulated PLL for mm-wave FMCW radars"

We propose a new digitally-intensive frequency synthesizer for a 60 GHz wireless sensing FMCW radar system and verify it through detailed circuit-level and system-level simulations. It consists of a 20 GHz digital PLL and a frequency tripler. The 20 GHz digital PLL features ultra-fast acquisition (less than 5 μ s) and low phase noise (-80 dBc/Hz at 100 kHz offset) by adopting dynamic and hitless loop bandwidth control. Linear frequency modulation (LFM) produces a triangle-shaped chirp signal with 3.2 GHz bandwidth in a 2 ms sweep. The maximum frequency deviation is only 0.014% of the chirp bandwidth. A multiplier following the 20 GHz PLL extends the LFM bandwidth to 9.6 GHz centered at 60 GHz, resulting in a range resolution better than 5 cm. [C5479]

"Signal detection technology on earth diastrophism using electromagnetic wave observation"

It is well known that electromagnetic (EM) waves are radiated from the Earth surface as precursor phenomena due to Earth-crustal movements such as earthquakes. Issues on anomalous signal detection and observation systems are widely investigated by researchers. Recent several researches in our study are reviewed in this paper. [C5480]

"A novel indoor positioning method based on key reference RFID tags"

Radio Frequency Identification (RFID) technology are gaining much attention for indoor location sensing. LANDMARC was the first attempt utilizing RFID reference tags which make the system adaptable to the environment changes. However, the system suffers from some problems. For example, to further improve the localization accuracy, more reference tags are needed. This means longer latency in tracking a target because the system has to visit all reference tags when calculating the coordinates of the target. In this paper, we present a novel method to overcome the above drawbacks. We use the concept of key reference tags to eliminate redundant reference tags of the system in real time location phase. Key reference tags will help to obtain the signal strength values of all reference tags by searching a database established in off-line data collection phase. Our approach uses less RFID reference tags and will not affect the overall performance. [C5481]

"Integrated millimeter-wave on-chip antenna design employing artificial magnetic conductor"

The design of millimeter-wave on-chip antenna has been plagued by the ground image current induced by the lossy substrate and the presence of ground plane below the chip. With the existence of this image current, it results in poor radiation property and impedance bandwidth. In this paper, a novel method that integrates the artificial magnetic conductor and a wideband slot antenna design is introduced. Two designs are implemented in mainstream CMOS technology. A gain of 2 dBi at 60 GHz and an impedance bandwidth of more than 126% have been obtained for the first time in standard CMOS. [C5482]

"Undue influence: Mitigating range-intensity coupling in AMCW 'flash' lidar using scene texture"

We present a new algorithm for mitigating range-intensity coupling caused by scattered light in full-field amplitude modulated continuous wave lidar systems using scene texture. Full-field Lidar works using the time-of-flight principle to measure the range to thousands of points in a scene simultaneously. Mixed pixel are erroneous range measurements caused by pixels integrating light from more than one object at a time. Conventional optics suffer from internal reflections and light scattering which can result in every pixel being mixed with scattered light. This causes erroneous range measurements and range-intensity coupling. By measuring how range changes with intensity over local regions it is possible to determine the phase and intensity of the scattered light without the complex calibration inherent in deconvolution based restoration. The new method is shown to produce a substantial improvement in range image quality. An additional range from texture method is demonstrated which is resistant to scattered light. Variations of the algorithms are tested with and without segmentation-the variant without segmentation is faster, but causes erroneous ranges around the edges of objects which are not present in the segmented algorithm. [C5483]

"Research and implement of key technology of Wideband Digital Receiver"

Wideband Digital Receiver (WBDR) with great dynamic range, high sensitivity and software radio property is discussed in this paper. A 3.2GHz/8Bit WBDR having instantaneous bandwidths of 1.6GHz is presented, which has stable, reliable and flexible merits. [C5484]

"Mismatch network in active radar transponder"

This paper is devoted to design a new type of mismatch network to modulate the retransmitted signal of an active radar transponder (ART). It can effectively distinguish the reflected ART signal from background signals. The effects of separation depend on the characteristics of the mismatch network. In order to achieve the best separation between the reflected ART signal and background signals, we need to make optimal design of mismatch network. This paper gives a general network design which is based on Paired-Echo Theory. The optimal coefficients can be solved by simulation experiments with compression of line frequency modulate (LFM) signals. The results prove that the mismatch network could separate the reflected ART signal from background signals effectively. The optimal weighting coefficients were solved with certain SNR conditions. [C5485]

"Design and optimization of combined modulation waveform using genetic and simulated annealing algorithm"

Frequency and phase combined modulation waveform has been considered as an important technology that provides significantly improved LPI performance and compression ratio in Radar system. In this paper, genetic simulated annealing algorithm(GASA) has been applied to the design and optimization of the combined modulation waveform. On the basis of genetic algorithm(GA), GASA introduces annealing process in energetic, thus enhancing the searching capability and efficiency in the whole searching scope. The feasibility and high efficiency of the algorithm is validated by the simulation result and implementation in engineering. [C5486]

"Method of chirp-subpulse stepped frequency signal range profile based wavelet transform at low altitude"

Feasibility of chirp-subpulse stepped frequency signal to implement high range resolution at low altitude is deduced through analysis of its amplitude and frequency spectrum in this paper. Method of chirp-subpulse stepped frequency signal range profile based wavelet transform with nicer locality and approximation on time-frequency domain is brought forward. Compared with traditional IDFT, range resolution capability is improved further on multi-path problem by using this method, and thus makes locating and tracking for targets at low altitude penetration more feasible. [C5487]

"Pattern synthesis with desired magnitude response for arbitrary arrays"

A pattern synthesis with desired magnitude response based on the combination of genetic algorithm and convex optimization is proposed. The phase in mainlobe is used as the optimization variables for genetic algorithm, and the fitness function is constructed with the desired magnitude of mainlobe. The optimal fitness degree for the corresponding individual can be obtained through solving the fitness function with the convex optimization, which improves the algorithm search performance with great efficiency. The optimization design in phase makes the synthesis result has no relation to the array reference point and the proposed algorithm is suit for the array synthesis with arbitrary element positions. The validity of method is confirmed by the result of the simulate data. [C5488]

"Envelope simulation by MATLAB-compatible models of a SAR system"

Fast and accurate system behavior simulation is an important technique for developing advanced radar system, Envelope simulation has been proved to be an efficient tool for analyzing and simulating narrow bandwidth system, such as communication system and radar system. In this work a common model for the envelope simulation of the transmitter and receiver of a SAR system is presented. Experimental results validate the reliability and efficiency of the proposed simulation method. [C5489]

"A novel method of SAR simulation based on non-equidistant interpolation algorithm"

In this paper, a modified SAR simulation method based on three-dimensional electromagnetic model is presented. SAR's squint working mode and three-dimensional electromagnetic model will cause facing slope reduction and backing slope increases phenomenon. The effect will lead to SAR image distortion and targets position migration. A non-equidistant interpolation algorithm is proposed in the SAR simulation processing, which is applicable to SAR simulation to eliminate the impact of facing slope reduction and backing slope increases. Simulation results have proved that SAR image processed with this SAR simulation method is more close to real scenes. [C5490]

"Broadband digital beamforming based on fractional delay in SAR systems"

Synthetic Aperture Radar (SAR) system can achieve both high azimuth resolution and wide swath by applying digital beamforming (DBF) technique in its receiving terminal. This DBF-SAR system requires broadband digital beamforming on the receiving array. In broadband beamforming, phase-shift method causes beam pointing deviation and mainlobe widening. In this paper, digital true time delay filters were used to compensate the phase deviation at the pointing bearing. Under interference, a structure composes of digital time-delay filters and tapped delay line (TDL) was built to implement adaptive broadband beamforming. It is showed by simulation that this method is effective in both broadband beamforming and broadband interference suppression, which improves the SINR of received signals. [C5491]

"A new processing flow of digital beam-forming for IF signal"

The traditional processing flow of the digital beam-forming (DBF) for IF real signal is improved in this paper. The improved flow puts the low-pass filter and extraction in the digital down-converter (DDC) behind the weighting in DBF, which can reduce the computation load when the number of the sensors is much more than the number of the beams to be formed. The advantage of the new method is proved by the simulation. [C5492]

"A novel algorithm for repeated trajectory bistatic spotlight SAR imaging"

This paper makes a detailed analysis on the echo signal of the repeated trajectory bistatic SAR. According to the characteristic of spotlight SAR signal, an algorithm based on Spectrum Analysis (SPECAN) method is proposed. The algorithm removes the azimuth ambiguity, and it also ensures good imaging quality over wildfield scene without defocus caused by spatial variance of target position. [C5493]

"A new fast 2-D superresolution imaging algorithm"

A novel method is proposed for reconstructing the 2-D scattering centres of radar target, research the frequency scatter model of electromagnetic scattering, we resolve the problem by extracting two 1-D scattering centres parameter instead of extracting directly 2-D scattering centres parameter, separately estimate the 1-D scattering centres in range dimension and cross dimension using conjugate unitary Root-MUSIC algorithm, group them and attain all possible spatial frequency pairs, then the unveracious frequency pairs are eliminated by spatial filtering, achieve the 2-D scattering centres parameter. [C5494]

"A new deramping algorithm for airborne squint-mode spotlight SAR data processing"

This paper presents a new airborne squint-mode spotlight SAR data focusing algorithm based on a two-step processing strategy that combines the advantages of the efficiency of spectral analysis (SPECAN) algorithm and the precision of wavenumber domain (WD) algorithm. The first step of the proposed algorithm implements a modified SPECAN processing to the range compressed echo signal. This operation can eliminate azimuth spectrum folding effect and migrate and scale the azimuth data support. Then the residual and precision focusing of the SAR data is achieved by applying the WD algorithm requiring some modifications and implemented in the frequency domain. Finally, experiments carried out on simulated data confirm the validity of the presented approach. [C5495]

"Compressive Sensing in ISAR spectrogram data transmission"

In the process of transmitting the returned signal information to the processors on the ground, a method of compressing and reconstructing ISAR data based on Compressive Sensing (CS) is proposed in this paper. The method is revealed as follows. Firstly, the returned signal is transformed to spectrogram field (fast time-cross range plane). Secondly, the CS technology is utilized to compress spectrogram, and then the compressed spectrogram can be transmitted so that the transmitting data is reduced obviously. Thirdly, the reconstructing method based on the orthogonal matching algorithm is employed to recover the spectrogram information. Simulation results show the reconstructed spectrogram is quite similar to the spectrogram uncompressed, and the fine ISAR image can be reconstructed by using the recovered spectrogram. [C5496]

"A multi-mode UAV SAR real-time signal processor system"

SAR real-time signal processing system already becomes an important part of SAR devices and an indispensable means to military application. This paper introduces a SAR real-time signal processor system which is provided with multi-mode processing, such as continuous high-resolution large-scale strip imaging, accurate pointing spotlight imaging and other interrelated processing. The selected system architecture and algorithm are introduced. Excellence experimental results are obtained based on UAV platform. And this shows that the system is reliable and feasible. [C5497]

"Maximum likelihood method for time-delay estimation of multiple echoes"

When the ground-penetrating radar (GPR) is used as a non-destructive testing method in the field of civil engineering, the thickness of the mediums can be deduced from radar profiles by echo detection, which provides the time-delay estimation (TDE) associated with each interface. In order to improve the performance of TDE, this paper proposes a new technique based on maximum likelihood principle for estimating the time delays. The proposed method takes into account the multiple echoes phenomena of the propagation of underground wave. [C5498]

"A digital down conversion of WB radar based on intersection of spectrum"

A new wideband digital down conversion (WB-DDC) method based on intersection of frequency spectrum is proposed. In this method, the input wideband signal is split into several subbands by analysis filter bank and each of these subbands with explicit meanings can be processed independently. The outputs of useful subbands are combined by synthesis filter bank to get the complex baseband signal. That means subband operation becomes possible and great flexible comparing with the traditional structure. Moreover, the new method is computationally more efficient than the traditional method. The methods of designing filter bank and the perfect reconstruction condition are analyzed. The influence of the prototype filter to reconstruction is indicated by simulation. The simulation results show that the presented method is of good performance. [C5499]

"A miniature implementation of air-born SAR real-time processing"

A miniature air-born real-time imaging system has been developed. Based on TS201 chip, the imaging system achieved powerful compute performance; balanced I/O bandwidth and high stability. Optimized signal-processing library has been developed. Written specifically to take advantage of the TigerSHARC superscalar architecture's ability, the library deliver optimal speed, performance, and flexibility. To support multi tasks, the data-driven technology has been applied. [C5500]

"Improved FPGA implementation of particle filter for radar tracking applications"

Particle filter has been considered as great advancement for radar tracking in nonlinear and non-Gaussian scenarios. But the huge computation and complexity limited its application in real-time systems. In this paper, we improve the architectures of sampling importance resampling particle filter (SIRF) in FPGA on the Xilinx VIRTEX-5 platform and then apply it to the bearings-only tracking system. Not only the whole design is simulated by the Modelsim, but also is realized in hardware, where the data are transferred using UART. The improved architectures could provide a fine real-time characteristic in radar tracking system. [C5501]

"Sea State Monitoring HF Radar Controller Using Reconfigurable LabVIEW FPGA"

High Frequency (HF) Radars are used extensively for ocean observation and to provide synoptic current maps covering thousands of kilometres. HF Radar for Ocean observation is under development at SAMEER, IIT Bombay Campus. The project is funded by the Government of India, Ministry of Earth Sciences. The controller for this Radar is designed using NI LabVIEW 8.5 Professional System Development platform, National

Instruments high precision R series NI PXI 7833 intelligent DAQ with reconfigurable FPGA and onboard memory, NI LabVIEW FPGA compiler and NI PXI 1033 chassis for PC interface. This design is implemented as two modules. 1. FPGA Module:-generates Carrier modulating chirp, switching pulses, synchronising and control signals for operating the radar, and receives Receiver signal samples in FPGA buffers. This design is compiled and synthesised on Xilinx Virtex-II reconfigurable FPGA with 3M gates. 2. Host Module:-This module runs on the Host PC. It is used for reconstruction of time domain Signal (TDS), Power Spectrum (PS) and FFT computation of intra and inter sweep radar echo's, signal processing and wave spectral analysis and display, waveform storage as .jpeg and .bmp files for offline analysis, velocity and significant wave height limit detection and storm/disaster prediction. The FPGA and LabVIEW based design has resulted in a very deterministic system performance, reduced development time and cost and is reconfigurable to adapt new features. [C5502]

"Passive Acoustic Sensor Network Time-Delay Probabilistic Localization Algorithm"

Target signal is measured by acoustic sensor with the character of time-delay and bearing-only. The problem of target locating and time-delay registration can be solved by composing sensor network. A passive acoustic sensor network time-delay probabilistic localization algorithm is presented in this paper. Firstly, two sensor measures can be chosen that intersection angle is closed to 90° to get initial position of the target. Depend on the initial position, time-delay registration is processed, and then the measure data is refreshed which intersection angle is closed to 90° to get new initial position estimation of the target. Finally, the new initial position is utilized to get more accurate estimation by probabilistic localization algorithm. The simulation results show that the algorithm has the performance of low calculation, real-time and high precision. [C5503]

"SAR Image Segmentation Based on Immune Genetic Algorithm and Gaussian Mixture Models"

In this paper, an effective synthetic aperture radar image segmentation method is proposed. Gaussian mixture models optimized by greedy expectation maximization algorithm are applied. The immune genetic algorithm is employed to initialize greedy expectation maximization algorithm and search the optimal values in the whole range, instead of general k-means algorithm, which is different from the traditional algorithm. Experimental results show our method can get better results for target segmentation. It can effectively segment the object from SAR images and inhibit speckle noise. [C5504]

"The Chaotic Neural Network is Used to Predict the Sea Clutter Signal"

The study includes the correlation dimension and the largest Lyapunov exponent of sea clutter based on real radar data obtained with IPIX X-band polarimetric coherent radar, which proved that sea clutter has chaotic characteristics. A method of prediction about sea clutter signal based on chaotic neural network and theory of phase-space reconstruction is established, which has a in-depth analysis of the chaotic neural network and modulates the network parameters to improve the convergence rate of the network. The numerical results of prediction model demonstrate that chaotic neural network is better than traditional methods. [C5505]

"Investigation of the doping profile effect on operation of internally Q-switched laser diodes aiming at high-power picosecond light source"

Lately demonstrated high-power (50W from 20 μ m stripe) picosecond (30ps) lasing from a laser diode has addressed us to internal Q-switching phenomenon, discovered four decades ago and not understood so far. We found that the realization of nanosecond or picosecond mode from a diode depends on doping profile across the structure. [C5506]

"Surface projection for mixed pixel restoration"

Amplitude modulated full-field range-imagers are measurement devices that determine the range to an object simultaneously for each pixel in the scene, but due to the nature of this operation, they commonly suffer from the significant problem of mixed pixels. Once mixed pixels are identified a common procedure is to remove them from the scene; this solution is not ideal as the captured point cloud may become damaged. This paper introduces an alternative approach, in which mixed pixels are projected onto the surface that they should belong. This is achieved by breaking the area around an identified mixed pixel into two classes. A parametric surface is then fitted to the class closest to the mixed pixel, with this mixed pixel then being project onto this surface. The restoration procedure was tested using twelve simulated scenes designed to determine its accuracy and robustness. For these simulated scenes, 93% of the mixed pixels were restored to the surface to which they belong. This mixed pixel restoration process is shown to be accurate and robust for both simulated and real world scenes, thus provides a reliable alternative to removing mixed pixels that can be easily adapted to any mixed pixel detection algorithm. [C5507]

"Detecting motion from noisy scenes using Genetic Programming"

A machine learning approach is presented in this study to automatically construct motion detection programs. These programs are generated by genetic programming (GP), an evolutionary algorithm. They detect motion of interest from noisy data when there is no prior knowledge of the noise. Programs can also be trained with noisy data to handle noise of higher levels. Furthermore, these auto-generated programs can handle unseen variations in the scene such as different weather conditions and even camera movements. [C5508]

"Chirped fiber Bragg gratings beamformer for SHF phased-array antenna transmissions"

A multi-channel optical signal is used to provide of the required phase shift of the optically controlled phased antenna. Chirped fiber grating can provide optical time delay, and thus the steering angle of the antenna array can be controlled with specified directions. [C5509]

"Liquid lens: Advances in adaptive optics"

Liquid lens' technologies promise significant advancements in machine vision and optical communications systems. Adaptations for machine vision, human vision correction, and optical communications are used to exemplify the versatile nature of this technology. Utilization of liquid lens elements allows the cost effective implementation of optical velocity measurement. [C5510]

"Study on synthetic aperture imaging lidar based on a laboratory-scale sliding guide system"

Synthetic Aperture Imaging Lidar (SAIL) is an extension of conventional microwave Synthetic Aperture Radar (SAR) to much shorter wavelengths (by a factor of about 100,000). This kind of active imaging radar can offer finer resolution and better image feature which is closer to optical image. In this paper, we introduce our laboratory-scale SAIL system in detail, elaborate difficulties that we have solved and will solve, and report our infrared optical synthetic aperture image of a fixed, diffusely scattering target with an aperture moving along with a sliding guide. [C5511]

"Angle and doppler ambiguity mitigation for spaceborne sparse array GMTI radar"

Ground moving target indication (GMTI) using spaceborne sparse array radar is attractive. To mitigate angle and Doppler ambiguities of the moving target detection for sparse array, the paper presented the model of a multi-carrier-frequency radar system and analyzed the basic principle of space time adaptive processing (STAP). Finally, the paper presented preliminary simulations to show that the angle and Doppler ambiguities can be effectively reduced by using multi-carrier-frequency technique. [C5512]

"A two-level simulator for spaceborne SAR"

A novel two-level simulator for spaceborne Synthetic Aperture Radar (SAR) is presented in this paper, and this simulator consists of two different simulation levels: the raw signal level and the image level and the implementations are discussed in detail. For the raw signal level, a new model with higher computation efficiency based on Graphic Processor Unit (GPU) to generate the radar echoes is proposed. For the image level, an efficient approach to create single-look image is processed. Finally some experimental results by the novel simulator are presented. These results demonstrate not only the validity of the proposed simulator but also the conformability of the two simulation levels. [C5513]

"A flexible baseband SAR ground moving targets simulator design and experimental results"

A digital Synthetic Aperture Radar (SAR) simulator of ground moving targets is presented. Real scene data is used as the clutter background for fidelity and moving targets are real-time computed and embedded into scene data in time domain according to pulse repetition frequency (PRF). The experimental results prove the effectiveness of the system. [C5514]

"Downward-looking 3D-SAR with dual-transmit and multiple-receive linear array antennas based on time and waveform diversity"

The dual-transmit and multiple-receive (DTMR) configuration of linear array antennas (LAA) is firstly introduced in downward-looking 3D-SAR imaging in this paper. The geometrical model and the signal model based on the principle of time diversity and waveform diversity are analyzed. The three-dimensional imaging processing algorithm for downward-looking 3D-SAR with DTMR-LAA is given via a stepwise mathematical derivation and the analytic expression of 3D PSF after 3D imaging processing is presented. The simulation results confirm the

feasibility of the downward-looking 3D-SAR with DTMR-LAA imaging concept. [C5515]

"Intelligent Load Balancing Strategies for Complex Distributed Simulation Applications"

With the rapid development of computer simulation technology, the Radar simulation applications scale up increasingly. More and more Radar simulation applications adopt distributed structure to improve system performance and availability. Hence, how to enhance the robustness and efficiency of these complex distributed simulation systems is a hot point. We should balance the load for the applications to enhance the resource's utility and increase the throughput. To overcome the problem, one effective way is to make use of load balancing. At the same time, load balancing middleware provides better scalability, response time and throughput. However, we must pay attention to the fact that the computing of the load should be adaptive and predicative to avoid the affection of the peak load. To the complex simulation applications, the peak means the system may suffer extremely high load for a short period while keeping stable load for a long time and some hosts of the system may be overloaded and the response time may be decreased for this kind of fluctuate. Therefore, to utilize the services effectively especially when the workloads fluctuate frequently, we should make the system react to the load fluctuate gradually and predictably. So we have proposed and implemented machine learning based load prediction and fuzzy logic based replica management for adaptive and flexible load balancing mechanism within the framework of distributed middleware. [C5516]

"The Necessary Condition of Families of Odd-Periodic Perfect Complementary Sequence Pairs"

The theory of families of odd-periodic perfect complementary sequence pairs(OPCSPF) is given. OPCSPF can be derived from the odd-perfect almost binary sequence and sequence pairs. Some characteristics of OPCSPF are discussed. The Fourier spectrum characteristics of OPCSPF are studied, and the necessary conditions for existence of OPCSPF are given. The method for constructing an OPCSPF is given and proved. [C5517]

"Enhancement of QoS of VOIP over Heterogeneous Networks by Improving Handoff Speed and Throughput"

The increasing demand for broadband services is causing the cellular network providers to consider for the integration of Wireless LAN with GPRS. WLAN is having higher data rate but low coverage area but GPRS is having lower data rate but with high coverage area. So integrating these two heterogeneous networks will lead to utilization of advantages of both and can increase the system throughput. The handoff latency is reduced by considering the threshold values of both the networks and anticipating the handoff well before. Especially the packet loss is completely eradicated by multicasting the packets during the handoff period and switch back to normal mode after the handoff. Hence the system throughput obviously increase by certain amount by our procedure of multicasting. [C5518]

"DOA Estimation Based on RBFNN for Minimum Redundancy Linear Array (MRLA)"

The mutual coupling matrix (MCM) of uniform linear array (ULA) can be modeled as a banded symmetric Toeplitz matrix. However, the MCM of MRLA is a symmetric but not a Toeplitz matrix. Many conventional calibration algorithms based on the banded symmetric Toeplitz matrix for ULA can't be applied to MRLA. Based on RBF neural network, a DOA estimation algorithm in the presence of mutual coupling for MRLA is proposed in this paper. Since the array correlation matrix is symmetry and there is no DOA information on its diagonal, the upper triangular half of the matrix is extracted as the input vectors. This method not only reduces the dimension of the input vectors but also present a modified preprocessing scheme to handle the problem at the endfire angles of the array. Simulation results demonstrate the proposed algorithm is efficient and valid. [C5519]

"A novel high-resolution stepped-frequency SAR signal processing method"

A new high-resolution airborne synthetic aperture radar (SAR) system utilizing stepped frequency technique is investigated, and a novel high-resolution stepped frequency SAR signal processing method is proposed. The new algorithm combines the time-domain back-projection (BP) algorithm with the traditional stepped frequency signal processing method, and it solves the wide-beam and stepped frequency signal processing problems very well. [C5520]

"A smart repeater for radar test based on signal processing"

The smart radar repeater is a hardware system controlled by computers whose function is to perform an accurate and end-to-end test for the radar system in its normal operational mode. It provides a thorough performance check of the radar by using a vertical antenna to simulate the ballistic trajectory of a shell in flight. The signal processing component is also used to acquire sampled transmit pulses data and represent the

Doppler, range and amplitude charges during the flight. Electrically connected to a subject radar, the repeater is automatically triggered by the radar beam and simulates the radio frequency energy returned from accurately modelled projectiles following ballistic trajectories. To provide an exact radio frequency energy returned, blind deconvolution technique is employed by the signal processing component to recover the raw signal which is convolved with an unknown radar external world. All the design philosophy and composition of the repeater are explained and the feasibility of signal processing techniques is discussed too. [C5521]

"Radar automatic target recognition for alterable noise environment"

Noise level of radar target returned echoes is an essential issue for HRRP automatic target recognition, which will deteriorate recognition performance if test sample have different noise level compared with the training samples. Assuming that HRRP contains additive Gaussian white noise and HRRP signals of range cells are jointly Gaussian-distributed, this paper selects PPCA-subspace model to describe HRRP. The main contribution is a promising adaptive method to deal with alterable noise environment between training phase and test phase for HRRP statistical recognition. To make the algorithm more practical, an approximate algorithm is presented to accelerate the original one while keeping the sacrifice of recognition precision very small. Simulated recognition experiments based on measured data illustrate our proposed method's effectiveness. [C5522]

"Application of real-time signal processing in chirp scaling SAR imaging"

In order to meet the challenges of space-borne SAR real-time imaging, a two-processor chirp scaling SAR processing cluster is currently under research and development. First, this paper focuses on the optimizing of real-time imaging processing method based on deep analysis of CSA and Doppler parameter estimation algorithm. And then, different levels of parallel processing technique on hardware are discussed. The experiment is performed on real space-borne SAR echo data block (16384*16384) and the whole progress is completed within 41s. The design and implementation concept of this highly flexible SAR processing cluster can be extended to other platform. [C5523]

"IF band width optimization of envelope detection system in presence of phase noise"

In many radar and EW applications, after some processing, the envelope of the received pulse is calculated and is used for target detection. Most of the time only the effect of thermal noise is considered in such detectors, but in most of the practical applications, before envelope detection, the signal should be down converted from radio frequency (RF) to an intermediate frequency (IF). In this case, the phase noise of the local oscillator will affect the signal, too. Surprisingly, in contrast to thermal noise, the effect of phase noise on the envelope of signal becomes more considerable whenever the IF bandwidth is decreased. So there exists an optimum IF bandwidth for the receiver. In signals with higher bandwidths, thermal noise degrades the signal and in signals with lower bandwidths, the phase noise affects it. In this paper the optimum bandwidth is calculated under some realistic approximations. [C5524]

"Applications of kernel methods to polarization radar target recognition using polarizationscattering matrix"

In this paper, we propose novel methods of polarization radar target recognition based on kernel methods using polarization scattering matrix (PSM), in which feature extraction from PSM is avoided. Firstly two kinds of kernel function based on PSM are defined, then, they are employed to the kernel principal component analysis (KPCA) respectively. Finally the nearest neighbor (1NN) classifier and the support vector machine (SVM) classifier are used for classifying targets. Experimental results based on simulated data show that the proposed methods achieve good recognition performance. Several forms of kernel function are used to prove the generalization of the proposed kernel methods. In order to validate its effectiveness, radar target recognitions of high resolution radar profiles (HRRP) are done, and the results show that the proposed methods are feasible. [C5525]

"Low sidelobe beamforming for Millimeter wave radar seeker with conformal phased array"

A novel method based on optimal nonuniform subarray configuration and optimal subarray's excitation is proposed to study low sidelobe beamforming with Millimeter wave conical phased array. This method employs multi-objective evolutionary algorithms following two procedures. Firstly, sampling is made in scanning space and then conformal array patterns are formed. Secondly, two multi-objective functions which realize low sidelobe patterns inside scanning space anywhere are introduced for constraining these patterns at sampling points. By optimizing subarrays' configuration and their excitations with the multi-objective evolutionary algorithms, the sidelobe level can be suppressed effectively. Simulation results verify the effectiveness of the proposed method. [C5526]

"Angle measurement performance analysis and simulation of sum and difference phase-comparison monopulse radar"

Monopulse radar is widely used for its high-precision angle measurement and powerful anti-jamming performance. Because the components of radar system are not ideal, the radar measurement accuracy is reduced. According to the structure of sum and difference patterns phase-comparison two-dimension monopulse radar system, the system is divided into three parts, which include the circuit from antenna to sum-difference comparators, the sum-difference comparators and the channel signal processing module. The impacts of their non-ideal to the performance of angle measurement are analyzed and simulated. Some meaningful conclusions are acquired which may bring great convenience to engineering and system design. [C5527]

"Modeling of wideband radar micro-Doppler signatures for a coning object"

Micro-motions such as vibration or rotation of an object or the moving parts on it induce frequency modulations on the returned radar signal, called micro-Doppler signature. In this work, a software platform for modeling of the wideband radar micro-Doppler signatures for ballistic objects is developed. This includes kinematic modeling, electromagnetic scattering calculation, and wideband radar return signal modeling and processing. Typical results for a coning object show that simulated signatures are coincident with theoretical results. [C5528]

"WEAK target detection using dynamic programming TBD in CDMA based passive radar"

Long time integration is of great importance in weak target detection in passive radar systems. When an integration time of seconds level is used, a migration of Doppler and range may take place during the process of matched filtering. This paper presents a novel approach named DPA-TBD to obtain target parameters by taking full advantage of the target migration information. DBT and TBD methods are briefly compared in principle. Then a detailed mathematic description of DPA-TBD is introduced. A model of CDMA based passive radar is established with a slow maneuvering moving target. Two methods, CA-CFAR and DPA-TBD, are applied to target detection, revealing that the latter totally overwhelms the former. Finally, simulation results demonstrate the validity of the theoretical analysis. [C5529]

"Poly-phase encoded waveform optimal design for space-borne MISO radar systems"

The application of multiple input techniques to sparse space-borne radar offers a number of advantages, including mitigating the effect of the target scintillation and being more freedom of signal processing. A novel orthogonal poly-phase encoded waveform optimization design method is presented. It is combined the Genetic Algorithm (GA) with the frequency functions designed by window functions to reduce the computation complexity. For the radar system, multiple transmissions of orthogonal coding signal and single reception, the high ISL of the optimized waveforms may cause degradation of the detection performance of the ground moving target. So, there is a trade-off optimization between the orthogonality and side-lobes of the signals. Simulation results show the effect of the transmission waveforms characteristic on the system's detection performance. [C5530]

"A research on compensation for UWB ISAR system"

A compensation method for ISAR receiver system using STRETCH processing is presented. The effect of system distortion on radar echo signal is analyzed by using the Phase Stationary Principle and the Paired Echo Principle, and system compensation method is obtained by comparing the difference between ideal echo signal and distorted signal. A series of simulation results demonstrate the efficiency of the method. [C5531]

"Compressive sensing in radar imaging"

In a conventional radar system, the sampling rate of images is constrained by Nyquist rate. High sampling rate, fast processing speed, and large capacity of memories could be challenges to this radar system. Radar imaging based on the concept of compressive sensing (CS) is a potential solution. According to CS, sparse or compressible signals can be reconstructed from a small set of their linear measurement. In this paper, we briefly introduce the principle of CS at first. Then we analyse its theoretical scheme in radar imaging and present the numerical simulation results of 1D target detection and 2D radar imaging. This paper concludes with a short discussion and conclusion. [C5532]

"Study on signal processing of azimuth multi-channel spaceborne sar with yaw steering"

The signal processing of azimuth multi-channel spaceborne SAR is studied. A compensating method for different path signal error in azimuth is given. A novel method to process nonuniform sampling in azimuth with yaw steering and reconstruction of digital spectrum is proposed. The yaw steering error boundaries are analyzed. All

the computer simulation results are presented in detail. [C5533]

"A pre-processing and storage unit of an on-board space-borne SAR Quick-look system"

This paper contains the spaceborne synthetic aperture radar signal processing with large amounts of data, large memory capacity and other characteristics, it analysis the function of the signal processing system, a method of using FPGA to reduce the range sampling filter, solves controlling 2 GB SDRAM memory of FPGA, and implements a isomorous system of a high-performance floating-point DSP and a large scale FPGA. [C5534]

"A efficient DOA estimation algorithm of coherent sources for MIMO radar"

To estimate the DOA of coherent sources of MIMO radar, a new spatial smoothing (SS) technique based on MIMO radar is presented using the diversity of the transmitted waveform and the independence of the transmitting-receiving channel. In the technique, the array is not necessary to be divided into sub-arrays, the received signal of the virtual sub-arrays are extracted from the output of the matched filter banks of MIMO radar, and then the auto-correlation matrix of the sub-array is derived. The technique in this paper can avoid the reduction of the array effective aperture, and adapt to arbitrary array structures, and increase the maximum number of coherent signals that can be estimated. Some numerical examples are simulated to verify the effectiveness of the technique. [C5535]

"Spatial correlation analysis on radar echoes of MIMO radar"

Spatial correlation between the amplitudes of radar echoes has a great impact on the signal processing methods and the performance of MIMO radar. There is an urge need to analyze the spatial correlation in order to optimize the performance of radar system. In this paper, we model the target consisting of a finite number of scatterers distributed in three dimensions, and derive the formula to evaluate the spatial correlation between the echoes from different aspects. Furthermore, we precisely analyze the relationships between the spatial correlation and some important factors, such as the effective baselength and the scattering pattern. We also do experiments with the real models of two certain aircrafts. More importantly, reasonable physical interpretation for the simulation results is presented and the conclusions can be used in practical work. [C5536]

"New approach of fast matrix access for real-time SAR system"

Based on the analyzing read-and-write features for synthetic aperture radar real-time processing and synchronous dynamic random access memory, an optimized fast matrix access algorithm is presented. The new method has been implemented on TS201 processing platform, which is used to process radar signal. Based on the analysis of experiment, it can be known that this new algorithm can achieve a constant speed and high efficiency for matrix access without altering bus data rate. The efficiency of real-time SAR system can be increased because of using the new approach of matrix access. [C5537]

"Compensation of clutter spectrum for forward-looking radar based on the spatial steering vector fitting"

The clutter spectrum depends highly on range for forwardlooking radars, which results in heterogeneous ground clutter in space-time adaptive processing (STAP). A new method for the range-dependence of clutter spectrum is proposed. The method firstly obtains a transform matrix by fitting the spatial steering vector of the range gate under test with that of secondary range gate. The transform matrix is then applied to spatial data at a given Doppler gate to compensate clutter spectrum, thus achieving an identical clutter spectrum. The conventional STAP could exploit the compensated data for the clutter suppression. Simulation results show a good improvement in processor performance. [C5538]

"An efficient algorithm for array optimization of MIMO radar"

Array optimization of MIMO radar is important to obtain better system performance. Numbers of efficient virtual array elements that can be obtained by MIMO radar are analyzed and compared among different linear array arrangement. An efficient algorithm for array optimization of MIMO radar is presented, by the algorithm, the virtual array of MIMO radar is a MR array, and the most efficient virtual sensors can be obtained. Last, the performance of MIMO radar optimized by the algorithm in this paper are compared with the conventional ULA MIMO radar, the simulation results indicates that the resolution capability of the optimized MIMO radar is better than that of ULA MIMO radar when they have the same physical sensors. [C5539]

"A research on synthesis processing of Orthogonal Array Radar based on Non-linear Frequency

Modulated signals"

Orthogonal Array Radar OAR is a new radar system. This paper introduces the principles of the OAR. Since the array elements of the OAR transmit orthogonal signals in the omni-direction at the same time, after the signals in different channels are received, the signal synthesis can form the transmitting beam and obtain a narrow pulse. If each transmitting signals are single frequency signals and the multiplied product of the time width T of the transmitted signals and the frequency interval Δf between each signal is larger than 1, the distance grating lobe will occur after the signal synthesis. To reduce sidelobe level, increase the Ratio of Mainlobe and Sidelobe (RMS) and eliminate the distance grating lobe effectively, the method using the Non-linear Frequency Modulated(NLFM) signal as the transmitting signal is presented in this paper. The analysis result shows that this method is effective to solve these problems. [C5540]

"Ground moving targets detection and unambiguous motion parameter estimation based on multi-channel SAR system"

This paper introduces an approach for ground moving targets detection and motion parameter estimation based on multi-channel SAR system which requires three consecutive operations as follows: array calibration, clutter rejection and motion parameter estimation. The analytical expressions of cross-track velocity, along-track velocity, cross-track acceleration and along-track acceleration are derived for multi-channel synthetic aperture radar (SAR) system. On this basis, these motion parameters can be well estimated. Before clutter rejection, array calibration is performed to provide precise parameter estimation latter. Radon transform is used to detect the range walk and correct it. Doppler ambiguity is mitigated by compensating the cross-track velocity estimation. Simulated and real measured data verify the effectiveness of proposed approach. [C5541]

"Convex optimization applied to transmit beampattern synthesis and signal waveform design for MIMO radar"

This paper deals with designing the signal waveforms transmitted via multiple-input multiple-output (MIMO) radar antennas to approximate a given transmit beampattern, and also to minimize the cross-correlation of different echoes. In this paper, we consider a non-uniform but fixed elemental power constraint instead of the uniform elemental power one while still maintaining the same total transmit power. With the relaxed constraint and for a given power gain, we first construct a set of transmit beams or signal waveform vectors with globally optimal peak sidelobe levels. Next, we combine these beams or the corresponding vectors according to some ratios to synthesize a desired transmit beampattern or its corresponding probing signal matrix. Convex optimization is applied to get these vectors and their ratios. Numerical comparison shows that our synthesized transmit beampattern has lower peak sidelobe levels and also has lower crosscorrelation peak sidelobe levels due to relaxing the uniform elemental power constraint. Additionally, the probing signal transmitted by each antenna element has a constant modulus because of the fixed elemental power constraint. [C5542]

"Instantaneous polarimetric radar PSM measurement for moving target"

This paper proposes the instantaneous polarization radar measurement method of the PSM (polarimetric scattering matrix) using the up and down chirps for the motive target with a uniform acceleration; it defines a new ambiguity function matrix considering Doppler frequency shift and acceleration in order to get the PSM of target. This paper also gives the signal processing and the expression of the PSM for a target moving at a uniform acceleration. The simulation results of missile-defence radar prove the feasibility of the presented method, which enhances the precision in measurement of the PSM compared to the traditional method. [C5543]

"Wide swath, high range resolution imaging with MIMO-SAR"

The paper describes a novel approach combining space filtering with bandwidth synthesis to achieve wide swath and high range resolution, Firstly, Low PRF is adopted to achieve unambiguous wide swath; then space filters is used to remove azimuth ambiguity; finally sub-band signals are combined into a wider band signal to achieve high range resolution. Simulation results are provided to show the validity of the proposed method. [C5544]

"Fuzzy fractal algorithm for low-observable target detection within sea clutter"

In this paper fuzzy fractal algorithm for discrete signal processing is introduced. The two major concepts of the algorithm are fuzzy fractal dimension and grade of fractality, which merge fuzzy theory and fractal theory. The fuzzy concept of fractality in discrete time series can be reconstructed as a kind of fuzzy set and the objective short time series can be used by a new membership function. In order to process long time series, sliding measurement is adopted. In the end, the local grade of fractality is applied to X-band real sea clutter and the performance of the detection algorithm is analyzed. [C5545]

"Robust estimation of the number of sources using an MMSE-based MDL method"

In this paper, using the mutual information, we bridge the probability density function and the minimum mean-square error (MMSE) between the observed data and the desired signal, and then employ the MMSE to construct an MMSE-based MDL criterion for accurate source enumeration. The presented numerical results demonstrate that the proposed method is superior to the existing MDL methods in detection performance.

[C5546]

"Keeping sharpening ratio constant for DBS of airborne mechanic scanning radar"

Doppler Beam Sharpening (DBS) is a technique which can improve the resolution of radar azimuth. The FFT processing with a constant PRF is more suitable for the mechanic scanning radar having unchanged scanning speed and PRF. The pre-filtering and the frequency-domain interpolation available can be used to keep the sharpening ratio constant. Based on analyzing and comparing the two methods, the frequency-domain interpolation with the drawback of too much energy losing in interpolating is improved with the thought of rounding to the nearest integer. Finally, the validity of the improved method is proved by the evident results from processing the raw DBS data. [C5547]

"A robust beamforming method via exploitation of centro-symmetry property"

This paper exploits a so-called centro-symmetry property of the array response manifold to improve the beamforming performances, such as better robustness to signal-to-noise (SNR) change, smaller number of snapshots, signal mismatches, or calibration errors, etc. For a uniform linear array (ULA), the structure of correlation matrix of array output is Hermitian and Toeplitz. Based on this property, the presented method exploits the space-time averaging techniques to modify the array covariance matrix. The simulation results show that the beamforming performance of the proposed method can be improved, especially on the condition that SNR is low and the number of snapshot is not enough. [C5548]

"Estimation of direction of arrival for wideband coherent signals with known waveforms"

A Direction of Arrival (DOA) estimator for wideband coherent signals with known waveforms and unknown amplitude is presented in this paper, which is extended from the estimation algorithm for time delay, referred to as WRELAX. The method can be called coherent space-time RELAX (CST-RELAX), which is a relaxation-based minimizer of a complicated nonlinear least squares cost function and is implemented in both space and time domain. Numerical examples in the presence of white and colored noise respectively are provided to demonstrate its performance and compare with other well-known algorithms including CSM (Coherent Subspace Method) and wideband RELAX. The proposed method improves the estimation accuracy and has an excellent resolution. [C5549]

"A robust algorithm for source number detection based on space-time averaging techniques"

A new source number detection method is proposed, in this paper. The presented method makes using of space-time averaging techniques to increase robustness for source number detection. Via the rotational invariance techniques, the number of incidence signal sources can be estimated, for multiple narrowband far-field signals impinging on a uniform linear array (ULA). Simulation results are presented verifying the efficiency of the proposed method. [C5550]

"Adaptive statistical model for radar HRRP recognition"

Radar automatic target recognition (RATR) should have a robust recognition performance in different noisy conditions. Most of the algorithms in RATR are based on high signal-to-noise (SNR) condition, not consider the recognition performance in low SNR. In this paper, based on the probabilistic principal component analysis (PPCA) model, we develop an adaptive statistical model for radar target recognition. This algorithm makes the parameters of PPCA model altered by different noisy conditions. Experimental results for measured data show that the average recognition performance of the proposed adaptive statistical model has an obvious improvement in low SNR. [C5551]

"The signal to noise ratio analysis of ground forward scattering radar"

In this paper, based on the complex signal model of ground forward scattering radar (FSR), the analytical signal energy formula is derived step by step, and moreover the close form of signal to noise ratio (SNR) is obtained, therefore the improvement factor of optimal processing can be also directly obtained. Finally according to the signal model and SNR formula, the simulate results show the correctness of the SNR analysis of ground FSR, it

also indicates the huge potential application of ground FSR. [C5552]

"Sigma-delta modulator for low power with SC techniques"

ADC is very important for the receiver and transmitter in radar system. The performance affects the signal process precision in the front. And for the low power requirement, here a sigma-delta modulator of second-order with SC techniques is shown in this paper in 0.5um CMOS process. SC techniques present a discrete low power system without continues current transmission. And a low power op amplifier with continuous common-mode feedback and a dynamic comparator is also designed. This new amp works under the supply of 3.3v and with the direct current of 400uA. This system is simulated by Matlab, while the circuit is designed by Cadence in 0.5 um CMOS (3.3v model) process. The modulator achieves over 82dB dynamic range in 24-kHz signal bandwidth with OSR=128. And it consumes 3mW under 3.3v supply voltage. [C5553]

"The application of power density spectrum estimation on synthetic aperture radiometer"

Aperture synthetic is a technique for overcoming the limitation that a large antenna aperture places on passive microwave remote sensing from space. This is an interferometric technique in which pairs of small antennas are used together with signal processing to achieve the solution of a single large aperture antenna. In this technique, the product of the signal from each pair of antennas is measured using a correlation radiometer. The complex product is recorded for pairs of antennas at many different spacings. The spacing is called a baseline and both the magnitude and orientation of the distance between the antennas is important. Once the place and the number of antennas are determined, the complex products are determined. In this paper, we get more complex products by the method of power density spectrum estimation to improve the temperature sensitive. [C5554]

"Design of universal radar signal processing system architecture"

Based on the analysis of the demand and technical characteristic of radar signal processing system, one new kind of radar signal processing system architecture was presented. And the design methods of general structure, processing node, IO node, interconnections were presented in detail. This architecture was based on cPCI platform, has four kinds of interconnection methods which are cPCI bus, Serial RapidIO net, programmable high-speed real-time link net, and synchronization timing bus. So it meets the demand of multiple parallel structure, multilevel data stream, multiple flow drive modes of radar signal processing system, and has the characteristics of standardization, modularization, scalability, restructure, and universality. [C5555]

"Dynamic reconfigurable storage and pretreatment system of SAR signal processing using Nios II architecture"

Because of synthetic aperture radar (SAR) is a powerful remote sensing technique, there has been growing interest in using SAR to obtain high resolution image. Modern high- performance SAR requires advanced and sophisticated signal processing technique to get high-quality image products. Meanwhile, the semiconductor technologies are updated day after day, programmability and flexibility are the trend of current electronic system, and it leads to the advent of system-on-chip (SOC). The Nios II, a soft-core processor integrated in Altera FPGA chip, is characterized by its flexibility and programmability. In this paper, a dynamic reconfigurable storage and pretreatment system of SAR signal processing is designed and realized based on the Nios II soft- core processor. The proposed architecture takes advantage of the embeded CPU to control all the peripherals, highly incereased the efficiency of the design. [C5556]

"CIOR analysis approach for SAR real-time signal processing cluster based on shared bus"

In the paper, SAR processing model is analyzed firstly. After the analysis of real-time processing cluster based on shared bus, the CIOR(Compute-IO Rate) conception is introduced, and the CIOR of some SAR algorithms and processors are assessed. Finally, several suggestions on how to improve the processing cluster performances are given. [C5557]

"Design and implementation of multifrequency front end using bandpass over sampling"

Direct digitization front end using direct radio frequency (RF) sampling is useful in multifrequency application for its flexibility and minimization of problems resulting from analog components. In such front end, the sampling frequency is the most important factor. This paper proposes the constraints and steps to design the sampling frequency using bandpass over sampling which means over sampling is based on the signal bandwidth. A new direct digitization front end for GPS L1 and L2 is then designed, implemented and tested. The digital down converter in this front end mixes the two signals to the same intermediate frequency (IF) which will facilitate the post signal processing and benefit the coherence consideration between frequencies [C5558]

"Simulation of noise suppression jamming signal on ISAR"

The paper provides the simulation method of various jamming signals on the output of the wideband receiver, which is based on the signal processing model of the receiver. Noise-amplitude-modulated jamming and noise-frequency-modulated jamming signals are simulated. The effect of these two noise suppression jamming signals on ISAR is evaluated by different quantitative indices of one-dimensional range profiles and two-dimensional ISAR images. [C5559]

"Motion compensation for modulated frequency stepped pulse"

The modulated frequency stepped pulse radar signal uses chirp as subpulse of a frequency stepped pulse train. One of the key problems of the signal is target motion compensation. This paper analyses the influence of target motion, then discusses the compensation method based on the analysis. A compensation method introduced to correct the envelop shift. The doppler processing between frequency stepped bursts is a method used in velocity measure, but the unambiguous doppler range is small. A new method is presented to improve it and resolve the problem. [C5560]

"Synthesis of unequally spaced array by genetic algorithm and convex optimization"

Unequally spaced array is usually characterized by higher side lobes. In order to decrease the side lobes of the array, a hybrid algorithm is presented in which genetic algorithm and convex optimization are combined to optimize the elements' positions and weight coefficients. Under the constraint of certain main lobe width, the resulted side lobes for a 25-element array over an aperture of 50λ are limited to -13.86 dB, which is lower than those reported in literatures. [C5561]

"Adaptive genetic algorithm for optimal selection of non-uniform code based on Euclidean distance"

A novel adaptive genetic algorithm based on Euclidean distance (EAGA) is presented. This algorithm can strengthen and preserve the diversity of population. Meanwhile some improvements are implemented to prevent degeneration during the optimization process by introducing new individuals generated by certain rules into the group. Compared with the other three algorithms, EAGA shows an effective global search capacity. [C5562]

"Efficient detection approach in DBF system"

This paper focuses on the critical issues of data caching strategy, parallel algorithm design and its optimized implementation in constructing large-scale real time digital beam forming (DBF) radar signal processing systems. They are the bottleneck of the system scalability and efficiency. At the end of the paper, we provide a solution for a practical DBF radar system with a Commercial-Off-The-Shelf (COTS) based implementation proving its effectiveness. [C5563]

"FPGA implementation of SNR estimation for DSSS signal of space borne secondary radar"

According to the problem of SNR estimation for DSSS signal in space borne secondary radar, an efficient approach has been presented. For the implementation of real-time processing of SNR estimation, the efficiency is improved by the redesign of the algorithm flow. Moreover, the SNR estimation is accomplished on a large-scale programmable gate array with the capability of processing high resolution. Simulation results indicate that the principle of the method is correct. Taking into account the space condition, the method performs well. [C5564]

"Real time signal processing system of Digital Array Radar"

This paper focuses on the cascaded two-level DBF structures of Digital Array Radar processing system. A real time processing platform is designed and implemented, including hardware system establishing and algorithm mapping, based on general purpose COTS modules. The signal processing system is scalable, restructurable, could satisfy the processing requirement of Digital Array Radar. [C5565]

"Optimal sidelobe suppression filters design with a constraint of maximum loss in process gain"

For the problem of loss in process gain due to the mismatched filters, a method for the design of sidelobe suppression filters under a constraint of maximum loss in process gain is proposed. The design of sidelobe suppression filters, considering an available loss in process gain, is converted to a second-order cone programming (SOCP), which can be solved with great efficiency by interior-point methods. The proposed method provides an optimal tradeoff among the sidelobe level, the loss in process gain and the filter length, which has

many advantages such as flexible design, high accuracy and quick convergence. The validity of method is demonstrated by the results of the simulate data. [C5566]

"Real-time DBS imaging based on diving model"

A real-time DBS imaging technique based on diving model is proposed in order to solve the problem of imaging at the stage of missile's diving attack. The signal model under the diving mode is established, and the imaging algorithm for diving mode and the flow chart of hardware processing are given. The validity of DBS imaging under the diving mode is illustrated through simulation. [C5567]

"Diagonal Clustering-based discriminant analysis for synthetic aperture radar Automatic Target Recognition"

A novel subspace analysis method called diagonal clustering-based discriminant analysis (DiaCDA) is proposed. Unlike principal component analysis (PCA), fisher linear discriminant (FLD) and clustering-based discriminant analysis (CDA), DiaCDA directly seeks the optimal projection vectors from 2-dimensional diagonal image matrices not from 1-dimensional original image vectors. Moreover, the advantage of DiaCDA over 2-dimensional PCA (2DPCA), 2-dimensional FLD (2DFLD) and 2-dimensional CDA (2DCDA) is that DiaCDA seeks the projection vectors by interlacing both row and column information of the original images, while 2DPCA, 2DFLD and 2DCDA seek the projection vectors by using only row information of the original images. Experimental results conducted on the moving and stationary target acquisition and recognition (MSTAR) public database show that DiaCDA has obtained higher recognition rates or at least the same ones as 2DPCA, 2DFLD, and 2DCDA. In addition, the recognition performances can be further improved and feature dimensions can be reduced sharply by combining DiaCDA with 2DCDA. [C5568]

"Micro-Doppler analysis of high speed moving targets"

Micro-Doppler induced by mechanical vibrating or rotating of structures in a radar target is potentially useful for target detection, classification and recognition. While the Doppler frequencies induced by the target body scatterers are constants after motion compensation, the micro-Doppler due to vibrating or rotating structures of the target is a function of dwell time. Now the characteristic of micro-Doppler has been used in low speed moving targets' recognition widely, but high speed moving targets have different properties from the low speed moving targets. Due to the influence of high speed, the returned signal after stretch processing will appear range profile broadening and range migration. This paper analyzes the micro-Doppler signature of high speed moving targets, and computer simulations are given to prove the validity of the analysis. [C5569]

"Target detection based on correlation and power features in sea clutter"

In this paper, an adaptive filter is presented for sea clutter suppression that is based upon the real-time median estimation of the power spectrum of sea clutter from the echoes of the detected cells and adjacent secondary resolution cells. The ACSF can suppress most sea clutter in a received time series while retaining possible echoes from a target with small distortion. Two features relevant to the correlation and average power of the filtered time series are proposed for target detection. With the real sea clutter data and simulated target echoes, the experiment results show that the proposed ACSF is effective, and the detector provides better detection performance than some existing methods do. [C5570]

"Design and implementation of a wideband Digital reconnaissance receiver"

The design of reconnaissance receiver is one of the essential research of electronic countermeasures. Based on the analysis of the characteristics of the conventional receiver structure design, it puts forward a novel receiver structure, which adopts the technology of sweeping frequency in large step, 200MHz instantaneous band width and digital processing at IF (intermediate frequency). Furthermore, the key technology for implementing this receiver are discussed in this paper. This receiver owns the advantages of the channelized receiver, super-heterodyne receiver and digital receiver. It ensures the coverage of the wide bands, rapid signal interception and real-time processing of the wideband signals. [C5571]

"An on-board real-time UWB SAR processor"

This paper mainly introduces a high-performance system of real-time Ultra Wide-Band (UWB) SAR processing. Firstly, the sub-aperture Nonlinear Chirp Scaling (NCS) algorithm is optimized and selected to form the UWB SAR image, and then it is mapped to the Multiple Digital Signal Processor (Multi-DSP) board. Secondly, the timing sequence of the real-time processing is analyzed, and the processing time of each task is measured. Finally, the simulation result of the real-time UWB SAR processing is given. [C5572]

"A novel method for ISAR imaging of ship target"

High resolution ISAR (inverse synthetic aperture radar) imaging and recognition of ship target is very important for many applications. Although the principle of ISAR imaging of ship target on the sea is the same as that of flying target in the sky, the former usually has more complex motion (fluctuation with the oceanic waves) than the latter, which makes the motion compensation very difficult. However, the change of phase chirp rate caused by the complex motion of ships will deteriorate the azimuth focusing quality. In this paper, we first model the complex motion of ship target with cubic phase terms (parameterized on chirp rate and its change rate), then a new ISAR imaging method, referred to as TCD-echirpClean, is proposed, which estimates the chirp rate and the change rate of chirp rate of all scatters in the time-chirp distribution plane. Both numerical and experimental results are provided to demonstrate the performance of the proposed method. [C5573]

"High range resolution based on Multi-Carrier-Frequency MIMO Radar"

Multi-Carrier-Frequency MIMO (MCF MIMO) Radar is a radar system with multiple transmit antennas and multiple receive antennas capitalizing on frequency diversity and spatial diversity to obtain orthogonality of transmitted signals and it can combine a number of narrow bandwidth signals to form a large bandwidth signal to obtain high range resolution(HRR). Two processing methods based on dechirp processing and channel separation technique to obtain the HRR, which are respectively IDFT Coherent Synthesis method (short for ICS method) and Spatial Domain Synthetic Bandwidth method (short for SDSB method), are proposed in the paper. Also both methods are characterized by the reduction of the instantaneous bandwidth and slightly influence on the moving target. Finally the simulation results on the computer validate these conclusions. [C5574]

"Micro-motion targets resolution in a high noise environment"

Multi-target resolution is a major challenge when there are numbers of targets in the same range cell. Micro-motion, such as vibration/rotation of an object or structures on the object, offers a new method to resolute targets. The paper proposes a novel method to implement the multiple targets resolution based on the micro-Doppler(mD) induced by micro-motions on targets in a high noise environment. In this paper, the concept of multi-target micro-Doppler(MMD) in general conditions is introduced. An effective time-frequency B-Distribution(BD) is applied to extract the mD features and the Viterbi algorithm for instantaneous frequency estimation is used to enhance the mD features in a high noise environment. Simulation results based on synthetic data confirm the method. [C5575]

"Detection and tracking method of echo signal for miss-distance measurement"

A new method of echo signal detection and tracking is proposed for greatly reducing the computations of miss-distance measurement. The main idea is that miss-distance measurement in its nature only needs data containing echo signals, so that raw data are divided into frames and only frames that pass proposed detection and tracking algorithm will be further processed. Firstly, an initial scope of frequency-point is defined. And an adaptive threshold detection scheme is implemented in the frequency-point scope to confirm if the data in the frame contains the echo signals. Then, according to the detection result, the tracking of frequency-point is performed to renew the scope of frequency-point for the detection of next frame. The detection and tracking are carried out by turns until the terminate condition is met. The algorithm has a very lite computation and the simulation results show the effectiveness of the proposed method. [C5576]

"Performance analysis on MIMO radar waveform based on mutual information and minimum mean-square error estimation"

Multiple-Input Multiple-Output (MIMO) technology can improve the performance of radar by spatial diversity. Two methods for designing MIMO radar waveform are introduced in this paper. The first one is to design waveforms that maximize the conditional mutual information (MI) between the reflected waveform and the channel impulse response. The second one is to minimize the minimum mean-square error (MMSE) in channels estimation. A particular analysis of detection performance is made here to illuminate the improvement. Finally the simulation results are presented and the performances of the two approaches are compared. [C5577]

"Detection and recognition of anti-radiation missile based on external illuminator"

Anti-radiation missile (ARM) detection technique in radar system which based on opportunity illuminators is investigated in this paper according to velocity and acceleration characteristics of ARM radar echo. Firstly, Range-Doppler processing and time-frequency algorithm are used to obtain the acceleration of ARM in passive radar system. Then, the approach of linear frequency modulation (LFM) compensation is applied to accumulate

ARM echoes which results in an effective detection of ARM. The simulation results show the availability of the proposed algorithm. [C5578]

"Fast method for estimation of the number of spatial signals"

Estimation of the number of spatial spreaded signals is one of the key problems in array signal processing community. In this paper, we present a Fast Detection Method via Modified Hung-Turner Projection (FDM-MHTP) for solving the problem. A threshold is derived exploiting the asymptotic distribution properties of the estimation errors of the sample covariance matrix. The threshold is used to detect the number of signal sources in conjunction with performing Gram-Schmidt orthogonalization onto the columns of the sample covariance matrix. Without eigenvalue decomposition, the proposed method has good detection performance and low computational complexity. Computer simulation shows the correctness and efficiency of the method. [C5579]

"A method of waveform design based on multi- eigenvector selection"

Cognitive radar is a newly proposed radar system, which may adaptively and intelligently interrogate a propagation channel using all available knowledge including previous measurements. Thanks to a great important role of the adaptive waveform design technique in cognitive radar, it receives much more attention in the near future. However, due to the existence of aspect uncertainty and sensitivity characteristic of the target's impulse response, it is difficult to adaptively design waveform for target recognition task, which also often leads to the available approaches ineffective. In order to solve the problem, a new method termed Multi- Eigenvector Selection is proposed in the presence of additive Gaussian coloured noise (AGCN) in this paper, which optimizes via selecting multi-eigenvector and tries to improve the separability effectively. Experimental results prove the efficiency of the proposed method compared to the existing methods. [C5580]

"A numeric range migration algorithm of space- surface bistatic SAR"

Focusing on the continuous wave spaceborne-airborne bistatic synthetic aperture radar (SAR) system where satellites of global navigation satellite system (GNSS) as transmitters and the airborne radar as the receiver, we propose a fast numeric range migration algorithm (RMA). Firstly, based on the concept of instantaneous Doppler wavenumber, analytic formula of the point spread response in the spectral domain is developed for bistatic SAR(BiSAR) with unequal velocity and parallel trajectory constellation. Then, relying on a first-order Taylor expansion of the above formula with respect to the parameter called the sum of closest distances on the swath center, a bistatic RMA algorithm is proposed for BiSAR imaging. Simulation results have confirmed the effectiveness of the proposed novel approach. [C5581]

"Design and realization of the step frequency echo simulator based on DDS"

In the development of the step frequency radar, time and costs would be greatly curtailed by applying the echo simulator of step frequency waveform to verify the signal processing system. This paper analyzes the characteristics of step frequency echoes in detail and describes the implementation of the point-target echo simulator based on DDS. The experimental results of the scheme show that the equipment closely simulates the echo of step frequency signal and the feasibility of this method is also soundly proved. [C5582]

"The SoPC based design for real-time RADAR seeker signal processing"

A SoPC system fabric suitable for the radar seeker signal processing application is introduced. The SW/HW function partition method based on the idea of SoPC regarding to the arithmetic characteristics is specified, and all the function modules for the overall processing can be implemented into one FPGA chip. The detailed engineering implementation architecture in one chip of Virtex4 FX60 is given and the design idea has been guaranteed by the successful utility in the radar seeker processing system's miniaturization and intelligitization. [C5583]

"The performance of power transform in high resolution radar target identification"

Power transform is a nonlinear pretreatment method, which can improve the recognition rate of high resolution range profiles obviously[2]. This paper mainly analyses how we should decide the power transform coefficient in order to get good recognition results. We process the range profiles in different noise condition using different power transform coefficients, and then we classify them with radial basis function classifiers. According to the real data processing results, we know that we should decide power transform coefficients in accordance with the signal-to-noise ratio. [C5584]

"DSP implementation of SPECAN algorithm"

In order to implement the SCANSAR algorithm based on high-speed digital signal processing system, the Spaceborne SAR SPECAN imaging algorithm and the geometrical mosaic algorithm are discussed in detail, and a real-time SAR processor, which is based on DSP boards, is introduced. Both the principle of SPECAN and the mosaic algorithm are carefully analyzed in detail and realized. Furthermore, in order to achieve a high processing efficiency, the parallel structure (SIMD software mode) is adopted in this system, the token rule is brought to improve the local DSP bus accessing speed on a board, and the real-time performance of the DSP system is deeply studied. Finally, the image of SPECAN algorithm is given. [C5585]

"Super-resolution of stepped frequency radar based on RELAX algorithm"

The range resolution of radar is in inverse proportion to the bandwidth of transmitted signal [4]. But the synthesized bandwidth of stepped frequency signal is limited in practice considering engineering realization. It is a problem to improve the range resolution of the stepped frequency radar under limited synthesized bandwidth. In this paper, we applied the RELAX algorithm to super-resolution processing of stepped frequency radar echo. Simulation results approve that using RELAX algorithm obtains higher range resolution than using traditional IFFT algorithm with same bandwidth, and RELAX algorithm can solve the problem that the bandwidth of transmitted signal is limited. Finally, we conclude the advantage and disadvantage of the RELAX algorithm using in super-resolution of stepped frequency radar. [C5586]

"Design and implementation of multi-rate data exchange system for radar signal processing"

On the basis of the characteristic analysis of data transmission and interconnection interface in complicated radar real-time signal processing system, a multi-rate data exchange system based on large-scale FPGA is designed. Then the structure and composition of this system are described in detail. The system has the characteristics of standardization, modularization and scalability. And through the implementation and application in an airborne SAR signal processing system, the universality and flexibility of this system were proved. [C5587]

"Study on extracting target information from the high-low resolution two-dimensional images on stepped frequency signal"

In the process of stepped frequency radar signal, we usually obtain the range information of the target through the target extraction algorithm. For the moving target, in order to avoid the issues such as amplitude loss, target lost and fake peak, we need to do the speed compensation before extracting target directly. Based on the target range high-low-resolution two-dimensional image analysis and processing, this paper gives a method to extract the target range and speed information at the same time from the two-dimensional images, and the constraints of the method for stepped frequency signal parameters design. [C5588]

"Sum and difference pattern synthesis for conformal arrays"

To synthesize low sidelobe sum and difference pattern for conformal arrays, an improved pattern synthesis algorithm is presented based on adaptive array theory. In the algorithm, the sidelobe level deviation of the computed pattern and the desired pattern is normalized by the desired sidelobe level. Then the product of normalized deviation and the current interference power is made as the variable in the iteration. Compared with the similar algorithms, its iteration coefficient is robust to synthesis conditions, and its convergence is steady and effective. Then the technique is developed to search the lowest uniform sidelobe given the width of mainlobe region, and synthesize difference pattern with shaped sidelobe. The synthesized pattern that is nearly the same as the desired pattern can be obtained. Simulation results are provided to demonstrate the effectiveness and behavior of the proposed algorithm. [C5589]

"Aperture coherent processing in distributed SAR"

In synthetic aperture radar(SAR), the azimuth resolution is limited by synthetic aperture length and it is difficult to be improved. A novel solution is to construct a bigger aperture by using several apertures in distributed SAR. But the precondition is to obtain the coherent information, that is, the time delay between these apertures. In this paper, the problem of abstracting coherent information between apertures is researched, and the algorithm of aperture coherent processing is provided. Firstly the signal models are built by modern spectral estimation techniques, and then by the model the original signals received by distributed SAR are extrapolated. Finally, the time delay between apertures is estimated by cross correlation. The algorithm is proved to be valid by simulation. [C5590]

"Design and implementation of an ultra high speed dual-channel DAC module based on CPCI"

According to high performance application needs, based on the structure of a high speed parallel signal processor, this paper presents a method to design and realize a dual-channel DAC module with the convert rate high as 1.2 Gsps. In this module, the key technical problems about generation of high speed clock, the synchronization between channels and the design of high speed data channel are perfectly solved. This module has already been used in several systems which indicate its applicability in high performance signal processing systems. Meanwhile, the universality of this module has been soundly proved. [C5591]

"Time-frequency analysis based image processing for maneuvering target detection in HF OTH radar"

In this paper an algorithm for maneuvering target detection in HF over-the-horizon radar is presented, which is based on the interpretation of the time-frequency map as an image. In the algorithm, radar signal is processed in joint time-frequency domain with short-time Fourier transform. Low-threshold CFAR combined with local thresholding processing transform the time-frequency map into multi-level image. Then neighboring search based region growing technique is developed to extract target ridge among false alarms due to transient events. Real data results show that the presented multi-stage scheme can achieve accurate instantaneous Doppler estimation and good detection performance. [C5592]

"A novel wind profiler radar real-time signal processing system"

A novel wind profiler radar (WPR) signal processor constructed by commercial digital down-converter (DDC) board and computer is proposed in this paper. The implementation scheme of the proposed signal processor, signal processing procedure, main design points and signal processing algorithm are also presented. The proposed signal processor brings the advantages of high reliability, high real-time, high extensibility and low cost. Experiments and practical operation demonstrate that the proposed signal processor could satisfy the requirements of wind profiler radar real-time signal processing. [C5593]

"Research on Wireless Storage System Key Technologies"

In the environment of wireless and pervasive computing, wireless storage can provide flexible data access function, data transfer, data collection, and information services, etc. The paper proposes the architecture of wireless storage system, discusses wireless storage system key technologies, and gives performance analysis of it. Later, the paper illustrates related question and some algorithms, and makes a conclusion at last. It is expected that the wireless storage system will be developed and applied more popularly with the cloud computing and cloud storage technology. [C5594]

"A New Waveform Design Method for Cognitive Radar"

In cognitive radar system, how the transmitted waveform adapts in response to information regarding the radar environment is an important problem. In this paper, the waveform design for cognitive radar is viewed as an optimization problem. Then a new waveform design method for cognitive radar is proposed, which uses IPM (interior-point method) to carry out the optimization task. The simulation results demonstrate the validity of our algorithm. [C5595]

"On Line Measurements and Visualization of Distances in WSN with RSSI Parameter"

In some wireless sensor networks (WSN) applications (e.g. fire lighting scattering wireless nodes from the plane) nodes positions needs to be resolved. In WSN we are trying to keep the price of a node as low as possible and for that reason we are trying to avoid implementing additional hardware (e.g. GPS module) to the node. One of possible localization methods using standard WSN 802.15.4 radio chip is use of Received Signal Strength Indicator (RSSI) parameter and radio propagation model. In the article we are describing the implementation and experiments of localization using RSSI and Log-distance path model. Measurements and visualization of the distances was successfully realized online and in "real time". [C5596]

"Robust Method for Analyzing the Various Speeds of Multitudinous Vehicles in Nighttime Traffic Based on Thermal Images"

This paper presents a robust method for analyzing the various speeds of multitudinous vehicles by utilizing thermal images as the source of operation. The objective of research is to analyze the speeds of vehicles when encountering the light constraints of a nighttime traffic. For the operational steps, three spontaneous thermal features of a vehicle consist of the windscreen, radiated heat from the engine, and elsewhere will be initially detected; the mentioned features that imply a vehicle type, then, will be classified and tracked. The final process

is to analyze the speeds of multitudinous vehicles. Firstly, the locus of each tracked vehicle will be continually searched from frame to frame in order to utilize for computing a displacement. Hereafter, the displacement was known, the averaged speed of vehicle can be found by dividing the displacement with an interval time between the consecutive frames. With this rational behind, for all detected vehicles, the various speeds of multitudinous vehicles are able to be identified by repeating the same operational pattern to all vehicles that appeared in a frame. It is found that, when implementing the analysis method to sample thermal image frames recorded from a nighttime traffic of Rangsit-Nakornayok road, various vehicle types and speeds could be continually indentified when changing from a frame to a frame. Meanwhile, the correction of a speed analysis of multitudinous vehicles is over 59 percents, considering on the situations that has one vehicle, two and three consecutive vehicles. However, the percentage is relatively low for the situations that over three consecutive vehicles are appeared, and it is a challenge for undertaking further research. [C5597]

"Time Allocation in Cognitive Radar for Multiple Target Detection"

For cognitive radar, it should have the basic function which is learning. The radar needs to manage its resources dynamically and interactively between the setting of radar parameters to optimize the tasks the setting of radar parameters to optimize the tasks to be carried out and perceive environment highlights the role in which knowledge and intelligence will be central in cognitive radar performance. The problem discussed here is the time allocation of cognitive radars in a multitarget environment. Radars are used to detect, to locate and to identify target. In this paper, we develop the optimization criterion based on the detection probabilities. [C5598]

"Research on Wireless Positioning System Based on the Principle of Phase Interferometer and its Implementation"

This paper expounded the basic principle of phase interferometer system, established positioning model of one-dimensional double-base line, improved the bearing accuracy and solved the fuzzy problem. The whole circuit of the positioning system was designed, radio signal communication was implemented by RF transceiver chip, low frequency signal was used as signal frequency to modulate it to carrier, the antenna radiated electromagnetic wave to the outside, main station were used to identify whether the corresponding signal were useful signal or not, useful signal received by two slave stations went through filter, amplification and mixing to obtain two ways of IF signal which then were input into phase demodulator respectively, distinguished potential difference of two phase to get a more precise phase according to the proportion of baseline, again using the relationship between phase and azimuth to get the information of target location. According to the plan, control system was designed and a lot of related experiments were made, the experimental results showed that the system was applicable to the direction of elevation which did not exist and had certain applications and development value. [C5599]

"Nonlinear Modeling and Optimal Controller Design for Radar Servo System"

Radar servo system is a complex system with nonlinearity and coupling. In this paper, the nonlinear mathematical model of radar servo system is established according to the model of executive motor and the load characteristics of radar antenna. Based on the model, an optimal controller for radar servo system is designed by the theory of feedback linearization and linear quadratic regulator (LQR). The feedback linearization approach is employed to realize the linearization and decoupling of the nonlinear model, and LQR is used to design the optimal controller to ensure that the speed tracking error is optimal. The experimental results show that, compared with the traditional feedforward control and feedback control, the designed optimal controller enhances the speed tracking accuracy of radar servo system, while suppressing the load disturbance more effectively. [C5600]

"A Vertical Soft Handoff Scheme Based on SIP in the Ubiquitous Wireless Network"

Ubiquitous Wireless Network will be the important infrastructure for ubiquitous information service in the future. Ubiquitous Wireless Network is objectively heterogeneous network, so vertical handoff is one of crucial topics. A vertical soft handoff scheme is proposed based on SIP using Wireless Access Gateway (RGW). RGW triggers and controls the handoff session to ensure same two-way delay of handoff and rate of zero-loss packet for real-time streaming media. Using M/M/1 queue model, delay of the scheme meets requirement of real-time streaming media. [C5601]

"Topology and Design of Power System for RTU of Remote Monitoring Pharos"

The article introduces hardware structure of RTU for monitoring remote pharos and its details of power topology, the power system consists of DC-DC modulators and LDOs, it solves the questions to improve power reliability and compatibility, and the control with good flexibility, it not only ensures RTU running well but also meets the demand of low-power-consumption. [C5602]

"The implement of millimeter wave active homing guidance based on embedded system"

In this paper, we discuss the millimetre wave active homing guidance signal processor's workflow. Then we present an embedded system design method based on FPGA and solve the problem of multi-processors interlink and communication. The SFP and LFM signal process are also discussed. The module we present can be developed to any guidance signal processor. [C5603]

"Distributed space-based GMTI with synthetic aperture radar"

In this paper, a new target detection and location approach which is performed in three stages is proposed, i.e. array manifold calibration, clutter rejection and target radial velocity estimation. Once the array manifold has been calibrated based on clutter echoes in range-Doppler domain, the objective of clutter cancellation can be achieved by the linear combination of the joint pixels data with the corresponding adaptive weighting vector. This step does not require target steering vector searching. The last stage is carried out at determinate cell under test (CUT) to locate moving target by velocity searching for that one fitting best to the moving target signal, thus the location performance would not be sacrificed in order to suppress clutter and/or interference and the high resolution radial velocity estimation can be achieved. Simulation results demonstrate the effectiveness and robustness of the proposed method. [C5604]

"Image formation algorithm for missile borne MMW SAR with phase coded waveform"

The feasibility of the application with phase coded waveform to missile borne Millimetre Wave (MMW) Synthetic Aperture Radar (SAR) system was investigated. Based on theory analysis, the geometry model was simplified, the expression of the equivalent range and the Range-Doppler image formation algorithm were deduced simultaneously. The phase coded waveform is pulse compression signal, and it can depress the peak value power and provide large bandwidth, so the phase coded waveform is usually employed in SAR systems in order to acquire the low probability of intercept. The image results concentrated on the point array target and the area scene. Simulated results demonstrate that the SAR system with phase coded waveform has the ability to get the image of the target, and hence, the results validate the effectiveness of the image processing method. [C5605]

"Parallel realization of high resolution radar on multi-DSP system"

In this paper, a pulsed doppler (PD) radar signal processing algorithm designed to track targets with high velocity is implemented in hardware based on 8 ADSP-TS201 TigerSHARC processors. And both the radar signal processing algorithm and hardware architecture are proposed. To map the algorithm effectively, pipeline optimization on system and instruction levels are adopted, and various factors are taken into consideration, such as system complexity, balance of the task in each processor, communication between processors. Practical experiment proves that both the design of this hardware platform and the realization of algorithm are effective, real-time and reliable. [C5606]

"Clutter modeling and simulation for missile-borne high resolution radar"

This paper researches a clutter modeling and simulation method based on the generalized correlated K-distribution for missile-borne high resolution radar. Firstly, it analyze clutter echo characteristics of the missile-borne high resolution radar based on the LFM signal, point out that under the condition of missile high-speed movement, the generalized correlated K-distribution can better reflect the actual scene of clutter distribution. Then give the process of clutter simulation based on generalized correlated K-distribution for high resolution radar. Finally, the simulation on the computer validates the feasibility of the proposed methods. [C5607]

"Soil Moisture Estimation with TerraSAR-X: With Dubois Empirical Model"

This paper presents a possibility of supervision against leaks in artificially made river canals, which can be done by estimating soil moisture content with TerraSAR-X synthetic radar aperture images. For soil moisture estimation problem an empirical model was used, which estimates dielectric constant and later on this can be transformed into soil water moisture content. [C5608]

"Regularization of Complex SAR Images Using Markov Random Fields"

This paper presents despeckling and information extraction using non-quadratic regularization. The novelty of this paper is that instead of the Gaussian prior model a Gauss-Markov random field model is chosen, because it can efficiently model textures in the images. The iterative procedure consists of noise-free image and texture parameter. The experimental results show that the proposed method satisfactorily removes noise form synthetic

and real SAR images and is comparable with the state of the art methods using objective measurements on synthetic SAR images. [C5609]

"Cramer-Rao Bound-Based Evaluation of Texture Extraction from SAR Images"

SAR images are affected by speckle which is a coherent process modelled as a multiplicative noise. It makes the automatic image classification difficult. Thus, many methods have been developed to remove speckle from SAR images while preserving the useful information of the image such as texture. This paper presents an evaluation of texture extraction parameter estimation methods using Cramer-Rao lower bound (CRLB). The first evaluated method is model-based despeckling (MBD) algorithm, which uses Gauss-Markov random fields as prior. The second one is the maximum a posteriori auto-binomial method (MAP-ABM), which rather uses auto-binomial model as prior. The evaluation has been carried out using simulated SAR data. In here, data with increasing number of looks have been used in order to study 1) how the estimated parameters approach the real one, and 2) how their variances get closer to CRLB. The experimental results show the superiority of MBD parameter estimation. Both MBD and MAP-ABM provide the most robust texture parameters when the number of look is between 3 and 4. [C5610]

"Damage Assessment Based on SAR Image Analysis: Flood Scenario for Romanian Eastern Carpathian Region"

When natural disasters occur, it is necessary for the authorities to make fast and effective decisions in order to prevent the occurrence of more damage, as well as to find solutions for the affected population that needs to be relocated. Satellite imagery can prove to be a useful instrument in decision support during emergency situations of such nature (floods), and especially SAR data, due to its all weather capabilities. This paper makes an assessment of the utility of satellite radar products (TerraSAR-X and Radarsat) in the frame of emergency situations management. A real case study is presented, where radar data were processed by human specialists on one hand, and automatically on the other hand, using an intelligent information extraction system. [C5611]

"A signal separation method for phased array radars"

Interferences, clutter and thermal noises greatly influence the target detection by using phased array radars at low signal-to-noise ratio. A blind signal separation based brief and effective signal detection model for phased array radars is brought forward in order to extract the target information. Based on the advanced mixing signal model, a method combining the wavelet transform (WT) and independent component analysis (ICA) is proposed. The signal separability of the phased array radars' signals in the clutter and jamming environment is discussed. Simulation results demonstrate that the proposed method is quite effective to extract the target signals and the jamming signals, which is quite practical in the modern war. [C5612]

"An enhanced acquisition method for spread spectrum communication with high bit rate"

Spread spectrum communication system with high bit rate, has bad performance of acquisition sensitivity, since the coherent integration time is short. The bad performance can be improved by the method of non-coherent integration processing after coherent integration. But in low SNR environment, the performance is not satisfying because of the large SNR loss of noncoherent integration. This paper describes a new acquisition method. The method is to pre-process the coherent integration results before non-coherent integration. This measure can effectively improve the sensitivity performance because it has the merit of increasing the time of coherent integration. The efficiency of this method is proved through simulations. [C5613]

"Detection of ships for OTHR based on AR-MUSIC algorithm"

In order to ensure the data rate, ship detection within short coherent integration time (CIT) is an operational requirement for over-the-horizon radar (OTHR). However, the resulting low Doppler resolution of short CIT brings difficulties in discrimination of the ship target peak and the powerful ocean clutter. To solve this problem, high resolution spectrum estimation techniques have been used to replace the conventional Fast Fourier Transform (FFT) for Doppler spectrum analysis. In this paper, a new spectrum estimation algorithm is proposed for ship detection by OTHR, which has higher Doppler resolution compared with the conventional method. In addition, in case that the signal-to-noise ratio (SNR) is low or the Doppler frequency of the target is close to that of the first-order ocean clutter Bragg peak, the presented algorithm can still effectively be used for ship detection for OTHR. The superiority of the proposed algorithm is illustrated by simulated OTHR data. [C5614]

"Adaptive detectors for MIMO radar with sidelobe signal rejection capabilities"

Antenna beam patterns in MIMO radar systems (as in any radar system) exhibit sidelobes. Naturally it is

possible for clutter and other undesirable signals to be detected accidentally through these sidelobes. In a MIMO radar system this has the effect of misaligning the mainbeam steering vector and consequently reducing detection performance. In this paper we develop and examine two adaptive processing schemes aimed at reducing unwanted signals entering the system through sidelobes and hence restoring the steering vector to its true position. In this way signal to noise and detection performance are also largely restored. The MIMO version of an adaptive beamformer orthogonal rejection test (MIMO-ABORT) method together an adaptive detector with conic rejection (MIMO-ACR) are developed, that exploit the generalized likelihood ratio principle. Subsequently the constant false alarm rate (CFAR) properties of the two proposed detectors are demonstrated. The performance of the MIMO-ABORT and the MIMO-ACR detectors are numerically evaluated. The results show that the two detectors can reject sidelobe signals with good performance at the cost of a slight reduction in mainlobe signal detection performance, as compared with MIMO version of Kelly's GLRT (MIMO-GLRT). [C5615]

"A general design of orthogonal sequences with alternate periodic correlation values equal to zero"

Based on the interleaving technique, a general design of orthogonal sequences with alternate periodic correlation values equal to zero is proposed. The proposed sequence set can be divided into two groups. In addition to traditional orthogonal properties, the periodic auto-correlation functions (ACFs) and intra-group cross-correlation functions (CCFs) of the designed sequences take zero at any odd shift while the inter-group CCFs take zero at any even shift. As a special case of the sequences with zero correlation zone (ZCZ), the designed sequences have the fixed ZCZ widths of 1 and 2, and can achieve the theoretical bound of set size for sequence length and ZCZ width. [C5616]

"Doppler velocity simulation and application with SVVP retrieval method"

For the VVP (velocity volume processing) wind retrieval method, the problem of an ill-conditioned matrix arising from the coefficients of equations not being resolved, so the method has not been applied adequately and effectively in operation. In this paper, multiple simulated wind field signals with the SVVP (the step-VVP) method are tested. The results prove that the method has the higher precision. An experiment of typhoon Ғ, BiSaomaiҒ, Bi is used to verify the retrieval result, the whole structure of vortex is correct. The simulation and application show that SVVP method is the useful means for retrieval wind of severe weather. [C5617]

"A method for angle estimation using pulse width of target echo"

The time domain characteristic of short range target body echo of UWB array was analyzed based on the Gaussian pulse. The mathematical relation between the pulse width and the most radiation direction of UWB array, angle of target position was put forward, a method for angle estimation using pulse width of target echo was put forward first time. Through simulation and calculating, the feasibility of the new method was validated. [C5618]

"Clutter processing for digital radars based on FPGA and DSP"

Clutter processing is a key link for vessel traffic services. According to the shortcomings of traditional analog video system, this paper proposes a design solution for digital radar signal processing system based on FPGA and DSP and studies both related preprocessing method and constant false alarm rate algorithm based on wavelet transform. This method can suppress the interference of sea clutter without impairing the target resolution. Experimental results demonstrate this design can decrease the false alarm rate, increase the detection accuracy and improve the tracking performance. Thus, signal processing system based on FPGA and DSP plays an important role in the vessel traffic services. [C5619]

"The proof of AODV loop freedom"

Loop freedom is an important property for distance vector routing protocols, especially for the protocols of ad hoc network because the topologies are dynamic. This paper gives a formal description of the AODV protocol and presents a strictly formal proof of its loop freedom property in Isabelle/HOL. The proved theorem states that no loop will exist in any number of nodes. The result demonstrates the feasibility of completely formal verification of some properties of routing protocols with reasonable effort. [C5620]

"Bridge Management with GPR"

Ground penetrating radar (GPR) is regularly applied to examine bridge deck, roads, railways and runways. Many applications have been pioneering proof-of-concept tests to define the benefits and limitations of GPR. For the quality of bridge major include three parts: the thickness of the liner; the Defects of the liner such as the voids, non-compacting area and crack; the number diameter of the rebar concrete deterioration (delamination and

debouncing) and rebar corrosion. There are many situations where GPR signals do contain quantitative information useful for developing data needed for engineering decision making. [C5621]

"Geophysical Characters for Archaeology in the Ancient City of JinYang, China"

The ancient city relics in Jinyang have a long history, and Jinyang is a very important burial region of ancient culture. It has abundant relics with unique burial forms under the ground. Due to the wide measured range of the target layers and target articles which is from centimeters to meters, and the different requests of the resolution, we take the method combining with the high density resistivity technique (HDRT) and geophysical prospecting radar (GPR) to carry through geophysical testing exploration on several ancient culture layers and target areas of relics in Jinyang. In this paper, we have collected a rich knowledge of the geophysical characters, which has laid a solid foundation of geophysical exploration for archaeological study on the ancient city relics in Jinyang. [C5622]

"The Visualization Simulation of Chaff Based on Aerodynamics and Statistics"

Chaff is one of a popular passive jamming. In modern military counterwork becomes a hotspot to visualize simulation. Having analyzed the whole chaff jamming process, the paper researches aerodynamics model, statistics characteristic and builds the appropriate mathematics model. Finally, it realizes visualization simulation of fidelity based on entity modeling technology and particle system technology. [C5623]

"Remote Uninterruptable Power Supply Monitoring over GPRS"

The running status of Uninterruptable Power Supply (UPS) is very important factor for the safe running of devices in computer room or other application fields. In order to supervise the running status or performance of the UPS, a UPS online remote monitoring system based on general packet radio service (GPRS) network is proposed in this paper. The system could monitor the voltage, current and temperature of the UPS through the long-distance supervised terminal. The system sends the running parameter to the supervision center or mobile termination and receives the remote command from remote hand terminal or control centre by GPRS or Internet. The system could also set the alarm boundary of the voltage, current and temperature of the UPS, if the UPS appears abnormal status, the system would sent the alarm information to the mobile termination or the supervision center, as a result, the UPS could be maintained easily. The system shows the superiority in remote monitoring UPS in practice. [C5624]

"Design and Implementation of Web Services Oriented GPRS Remote Meter Reading Model"

Based on the research on a power company remote meter reading system and for the purpose of enhancing the management level of the meter reading of power companies, the Web services oriented GPRS remote meter reading model is suggested. By means of the Web services technology, the model is integrated with various related heterogeneous systems and application seamlessly; simultaneity through the JNLP (Java network launch protocol) specifications, the deployment and maintenance of the system can be simplified much; The real-time and reliable front-end based on the GSM/GPRS (global system for mobile communications/general packet radio service) network is implemented by Java multi-threading and and socket technology. As an example of reading "the present three-phase voltage and current" of one remote transformer meter, this paper will give the model design and key codes based on the latest Java Web services specifications JAX-WS (Java API for XML-based Web services) and the JNLP specification. The model designed meets the actual requirements well, and accords with the standards of State Grid Corporation. The model has a favorable application in the actual remote meter reading system of the power companies. [C5625]

"Research on Admission Control Mechanism in Heterogeneous Network Platform"

In the future, different types of networks will be integrated. The heterogeneous networks should support a broad range of multimedia services with guaranteed quality of service. In order to support the requirements, a new call admission control is needed to support the integrated architecture. In this paper, we focus on admission control in heterogeneous network platform. Because rejecting a handoff session would lead to the result much worse than rejecting a new session, service class differentiation is adopted to define the service priority according to service type and handoff type. A new admission algorithm is proposed on consideration of service utility functions to maximize the utility function and balance load of heterogeneous networks. Analysis results show that the admission control mechanism is effective to the extent. [C5626]

"Study on frequency-shifting jamming to linear frequency modulation pulse compression radars"

Aiming at the frequency-shifting deceptive jamming to linear frequency modulation pulse compression radars,

this paper analyses the jammings caused by the three kinds of jamming signals, which are the single false target jamming, multiple-false targets jamming and multiple-cover jamming. It gives the mathematical expression of the jamming signals after matched filtering and shows the relationship between the frequency-shifting amount and the relative distance of the true and false targets. Besides it analyses the loss of the jamming energy caused by frequency mismatching and offers the theory support to the jammer when setting the jammer power. Finally the simulation is given and the results demonstrate the correctness of the theories. [C5627]

"SAR Internal Calibration Technology Study"

The SAR Internal Calibration (SIC) technique is indispensable for a spaceborne SAR system. In general, the SIC technique includes Internal Calibration (IC) theory, IC strategy and highly stable IC instrument. The IC task of phased array antenna SAR system is more complicated than that of TWT (Traveling Wave Tube) transmitter SAR system in many aspects, e.g., T/R modules test, IC three loops construction and the process of IC data. However, there are lots of similarities between the two systems. In this paper, we only discuss the basic theory of the SIC based on the TWT transmitter SAR system and the process of the internal calibration data. Further, the precision analysis of the SIC will be given. Finally, we demonstrate the effectiveness of the proposed method based on the experimental SAR image. [C5628]

"Research of the Signal De-noising in Life Detection Based on Wavelet Transform"

In life detection radar echo signal is very weak and hard to extract. For solve this problem, weak life signal de-noising based on wavelet transform is studied. Through the studies of wavelet threshold de-noising method, the use of it in weak life signal de-noising in strong noise background, and the verification of simulation by Matlab, the results shows that wavelet threshold de-noising method can remove the noise signal from weak life signal effectively and be an effective de-noising and extraction method for weak life signal. [C5629]

"Efficient subspace-based recognition method for SAR targets with similar structure"

To identify target for the images obtained by synthetic aperture radar (SAR), those subspace-based methods for automatic target recognition (ATR) usually operate on the range subspace of the training samples. When some targets with similar structures need to be distinguished, the corresponding templates are poorly separable because their range subspaces of each other have a big intersection. A method is proposed for SAR target ATR in this paper, which chooses the orthogonal subspace of the sample range subspace as the projection subspace. Consequently, the difference, between the projections of the different type targets on the projection subspace, is enlarged, which significantly improves the identification effect. Experimental results show that the proposed method is superior to the other similar methods. [C5630]

"Key technology analysis of sub-millimetre wave seeker"

The paper introduces the characteristics and the main applications of sub-millimetre wave. The technology development status of SMMW in home and abroad are also introduced. The characteristics of sub-millimetre wave seeker and the problems which are needed to be solved are specified. Both key technology and investigative difficulties of sub-millimetre wave seeker are analyzed. The influence of target movement towards SMMW chirp is analyzed. The analysis result proves that velocity compensation must be carried out before signal processing of SMMW-chirp is implemented. [C5631]

"A new method for velocity estimation in multicarrier-frequency MIMO radar"

The multi-carrier-frequency MIMO radar transmits orthogonal signals of multiple carrier frequencies and capitalizes on the spatial and wave diversity to significantly improve the performance and the flexibility of the radar. A new velocity estimation which can overcome the velocity ambiguity is presented in this paper, using which the LS(least-squared) estimation of true velocity can be obtained from the Doppler shifts corresponding to the different transmit frequencies without transmitting multiple PRF(pulse repetition frequency) signals. Some numerical results are presented to verify the validity of this method. [C5632]

"A study of SAR signal analysis and processing in sliding spotlight mode"

This paper introduces prominently the principle of sliding spotlight mode SAR and analyses its particularities including synthetic aperture time and azimuth resolution based on the difference between the mode and other modes such as strip mode and spotlight mode. The wavenumber algorithm is represented combining with the linear item of Doppler centroid frequency is defined and removed, furthermore, the simulation have been carried through and the results validate the algorithm. [C5633]

"Target detection based on wideband PD radar with linear frequency modulation"

The target detection issue of the PD guidance radar is firstly analyzed in clutter regions under the trail-attack and low-altitude condition, and then a novel method is proposed, which utilizes new wideband linear frequency modulation system to enhance the target detection performance in clutter region. The signal processing and detection performance are discussed theoretically and calculated for this wideband linear frequency modulation PD seeker radar. The result indicates that the technology of wideband linear frequency modulation can be applied in the PD radar for its improving detection performance in the clutter regions significantly. [C5634]

"The research and implementation of digital signal processing algorithms on pulse LIDAR"

In order to increase SNR of the echo signal and improve the target detect ability of a pulse ranging LIDAR, researches on digital signal processing technology about the echo signal have been done. Based on digital filtering, pulse accumulation and correlation detection techniques, a signal processing circuit of the laser ranging radar has been designed, using DSP chip. Experimental results showed that digital signal processing technology of the LIDAR, significantly increase the echo SNR, and increase accordingly the maximum ranging distance. [C5635]

"An interference suppression subsystem for HF radar"

The external interference often reduces the performance of high-frequency surface-wave radar. In this paper, a novel interference suppression subsystem for HF radar is proposed, in which virtual auxiliary channels are constructed by a group of mismatched filtered signal data so that radio interference in the main beam can be effectively suppressed by a subsequent a coherent side-lobe canceller. The processing results of experimental data show that this subsystem is quite effective and practical. [C5636]

"Multitarget detection and localization method for bistatic MIMO radar"

In this paper, we present a scheme of detection and localization of multiple targets in the same range cell using two transmitters bistatic MIMO radar. The signal model is constructed by means of the rotational factor produced by transmitter. Based on the signal model, canonical correlation test (CCT) method is extended directly to determine the number of targets. Furthermore, a close form solution for localization the multiple targets is presented via ESPRIT. The direction of arrivals (DOAs) and direction of departures (DODs) of the targets can be solved and paired automatically. Simulation results demonstrate the effectiveness of the methods. [C5637]

"An efficient imaging algorithm for missile-borne side-looking SAR"

This paper presents an efficient imaging algorithm for missile-borne SAR. In the course of missile's diving flight, it is difficult to use the traditional imaging principle because of the strong coupling between range and azimuth signal. Through the fourth order range model, the echo model is established and the two-dimensional point target spectrum is derived by the method of series reversion. Then, the corresponding range and azimuth match filtering functions are given. Finally, simulation results demonstrate the accuracy and validity of the proposed algorithms. [C5638]

"Coheret integration detection of multiple high speed targets with range migration and Doppler spread"

Range migration and Doppler spread are the two basic and troublesome problems in moving target detection during long integration period. In this paper, a narrowband detection method for multiple high speed targets which effectively solve the two problems above is proposed. The proposed method utilizes keystone transform (KT) to correct range migration, and Doppler spread is compensated according to the target radial acceleration which is accurately estimated by the combination of cyclic auto-correlation detection algorithm and "Dechirping" method, then, coherent integration is implemented for target detection. The new algorithm has many advantages including improved detection performance, an effective solution to range migration and Doppler spread, extended observable coherent integration time (CIT), precise estimation of the target moving parameters and less computation costs. Its performance and computer simulations are analyzed at end of this paper. The simulation results demonstrate the superiority and validity of the proposed algorithm. [C5639]

"An approach to compensate clutter range dependence for bistatic airborne radar"

In a bistatic airborne geometry, snapshot statistics are range dependent. Straight averaging degrades the accuracy of clutter plus noise covariance matrix estimation. To mitigate the range dependence, a new method is presented in this paper. The method interpolates short range space-time steering vectors to the referenced

range by using subspace fitting technique. And moving target steering vector restrictions are added to avoid ground moving target elimination. Compared to conventional sample matrix inverse (SMI) method, this approach can significantly improve the performance of ground moving target indication (GMTI). At last, simulated results are presented to verify the effectiveness of the proposed approach. [C5640]

"A target velocity measurement method in submillimeter step frequency radar"

A target velocity measurement method based on positive and negative step frequency waveforms is presented in this article. Using the characteristic of positive and negative step frequency waveforms, three signal process methods are introduced. With these methods we can get different velocity resolution and unambiguous velocity range. Combining these methods we can get the precise target velocity without ambiguity. A signal process flow and matlab simulation are given in the end. [C5641]

"Impulse and aperture synthesis in multi-carrier-frequency MIMO radar"

The multi-carrier-frequency MIMO radar uses a sparse-array to transmit the FMCW signals of multiple carrier frequencies, and an array to receive the echoes. The signal model of multi-carrier-frequency MIMO radar is analyzed in this paper. A new method for impulse and aperture synthesis is presented. Every range cell after coherent integration is divided equally into N parts, which is weighted by the coherent integration results. As a result, the range grating lobes are suppressed greatly and the aperture of transmitting and receiving array is utilized adequately. The simulation results indicate the validity of the method presented in this paper. [C5642]

"Array calibration with sensor position errors using particle swarm optimization algorithm"

The performance of high-resolution algorithm will degrade badly in the presence of sensor position errors. To deal with this problem, a new method for array calibration using Particle Swarm Optimization (PSO) algorithm is proposed. This new method has no requirement for calibration sources while the sensor position errors as well as the direction-of-arrivals (DOAs) of the incident signals can be estimated simultaneously. Computer simulations are conducted to show the validity and feasibility of the proposed method. [C5643]

"A new method for parameter estimation based on temporal-spatial extrapolation"

An iterative nonparametric algorithm for estimating the frequencies and direction-of-arrivals (DOAs) of signals impinging on the passive array is proposed in this paper. The procedure includes two parts, frequency estimation by extrapolating the series in time domain and angle estimation by extrapolating the series in space domain. The extrapolation is carried out by using its sparse discrete Fourier transform (DFT), to get which, the deductions of minimization problem based on l_2 -norm constraint and linear constraint using the iteration algorithm are presented. It is shown that the algorithm offers increased resolution, significantly reduced sidelobes and much lower computational complexity. Some numerical simulation and real data processing results are presented to verify the effectiveness of the method. [C5644]

"Implementation of a signal processing system for ground surveillance radar"

This paper is on the design and implementation of a signal processing system for ground surveillance radar. Hardware structure of the signal processing system based on TI's chip TMS320C6416 as well as interfaces among hardware modules are designed. Global frame of system software is analyzed, and some key techniques are presented. This radar has great capabilities of anti-jamming and Low Probability Intercept (LPI), due to multiple Pulse Repetition Frequency (PRF) and biphasic codes. Experimental results present that it is able to detect the interested target under complicated environments and track it steadily. [C5645]

"Approach for airborne radar ISAR imaging of ship target"

Ship target ISAR imaging has significant meaning in maritime surveillance and traffic management in vast sea areas. This paper propose a novel approach for long observation time of ship target from airborne radar. First, a second-order generalised keystone formatting method is used to compensate for the range curvature induced by long integration time. Secondly, estimate the target motion parameter by virtue of Time Frequency technique (WVD) and remove the quadratic term of slow time, then use the second-order keystone formatting again to eliminate the residual range walk. So the coupling of the range and azimuth term are completely removed. At last, the clear ISAR image can be obtained. Both numerical and experimental results are provided to demonstrate the performance of the proposed method. [C5646]

"Experiment data processing on "one-active" laser"

"One-active" LASAR is a kind of new synthetic aperture radar, which can obtain the 3-D radar cross section distribution of the observation scene. Comparing to the full-element LASAR, it fires only one element in one footprint, and can reduce the cost of data acquisition and imaging processing greatly. In this paper, the signal characteristic of "one-active" LASAR is analyzed to explain the reason that "one-active" LASAR can product cross-track resolution. Finally, the 3-D imaging result of "one-active" LASAR is presented and analyzed in detail. [C5647]

"A waveform diversity technique for countering RGPO"

In modern battlefield the jammer performing deception jamming of range gate pull off (RGPO) generates a false target and causes the radar to break its track on the target. The use of waveform diversity to remove the false target from the real one is considered. Received signal model under deception jamming is built on the base of the principle of RGPO. A new kind of design method for waveforms orthogonal in frequency domain is proposed and the correspondence signal processing method for removing the false target under RGPO is deduced. Its validity is proved by the simulated experimental results. [C5648]

"Processing method base on synthetic spectrum using stepped-frequency chirps"

To decrease the influence of echo envelop migration in one-dimension high range resolution profile and depress the sidelobe of the profile, an improved signal processing schemes for stepped-frequency chirps is proposed. It assumed the stepped-frequency chirps as a chirp signal with large bandwidth, but was transmitted and received separately by several times. After synthesizing spectrum of each sub-pulse in frequency domain, high range resolution profile could be achieved through the matched filter. Compared to the classical method, it has advantages such as without range unambiguous, lower sidelobes level in the range profile and convenient motion compensation. [C5649]

"A miniaturized universal architecture for radar signal processing systems"

This paper proposes and examines a type of miniaturized universal system architecture for radar signal processing platforms. This architecture can satisfy the urgent demands both on high-performance computing, parallelizable processing, scalability, ability to reconfigure in today's universal radar signal processing systems, and on strict limitations for volume, weight, power consumption, and physical shapes in airborne or missile-borne Synthetic Aperture Radar (SAR) real time imaging processing systems. Based on the new architecture, numerous characteristics of the system hardware architecture were anatomized. The performance and structure of the key processing elements, such as hybrid parallel processing nodes, high-speed serial switching networks and distributed storing was discussed in detail. A detailed analysis of how to implement system parallelization and extension with different topologies was performed. Finally, a successful application case in an airborne SAR processing system was presented. [C5650]

"Experimental results for shadow inverse synthetic aperture radar"

Bistatic Shadow Inverse Synthetic Aperture (SISAR) offer a number of promising features such as: simple hardware; enhanced target radar cross-section (RCS); a long coherent interval of the diffracted signal; robustness to stealth technology; In spite of a number of theoretical research efforts in the application of SISAR for target imaging, there are few experimental results available that are able to confirm the theory and specify problems of SISAR's practical design. This paper is dedicated to the experimental study of the feasibility of SISAR micro-sensors for the imaging of ground vehicles. A motion compensation method based on waveform entropy is presented in the paper. Finally experimental results, conclusions and recommendations are presented. [C5651]

"Efficient implementation of fixed-point fft on ADSP-TS201"

Due to the DRAM used in the internal memory of ADSP-TS201 produced by ADI, it is not optimized for random access in the conventional FFT algorithm using standard structure. SingLeton structure is used to ensure that the reads in each stage are sequential. Program flow of this algorithm is introduced, and efficient implementation is provided by using appropriate assembly instructions and well designed software pipeline. Test results shows that the performance of FFT on TS201 is greatly improved, and it can be widely used in radar signal processing. [C5652]

"Implementation of two dimensional pulse compression based on embedded processor in FPGA"

This paper first analyses the technology characteristic of FPGA. An efficient two dimensional pulse compression processing system in which FPGA is the platform of signal processing and its embedded processor MicroBlaze is

control kernel is designed and implemented using Xilinx's XC2V6000FPGA. In the limit of resource in FPGA, two different implementation architectures of pulse compression are presented in terms of speed and area restrictions. A DDR SDRAM controller which is realized in FPGA carries out efficient matrix transposition processing under the way of matrix partition linear mapping. Further more, a simple SAR imaging processing is simulated in this FPGA system for validation. [C5653]

"Performance analysis and data processing of space-borne multi-channel ScanSAR Mode for high-resolution wide-swath"

Multi-channel radar systems alleviate the contradiction between the wide swath and high azimuth resolution. In order to implement even wider swath with high azimuth resolution, the paper investigates the parameter design and performance analysis of multi-channel ScanSAR mode. Furthermore, the restrictions of the multi-channel system are also illuminated. As a next step, the effects caused by the difference of the amplitude and phase among receiving channels and non uniformly sampled signal in azimuth are analysed. Finally, the paper studies the imaging algorithm and gives a design example that enables the imaging of a 800 km wide swath with azimuth spatial resolution of 10 m. [C5654]

"Maneuvering target signal processing algorithm based on improved S-Method for HF OTH radar"

Core steps of S-Method based maneuvering target signal processing for HF(High Frequency) OTH(Over-the-Horizon) radar include the calculation of S-Method Distribution from signal's STFT (Short Time Fourier Transform) and S-Method Distribution based signal decomposition. However, as one of the main parameters of the whole signal processing algorithm, the window function of STFT has a great influence on the results of the signal processing, and this lead to the reducing performance of the algorithm. In this paper, we analyse theoretically the window function's influence on the algorithm for the first time, on the basis of which we propose improved S-Method that meets the principle of optimal signal processing, and consequently obtain a maneuvering multi-target signal processing algorithm based on improved S-Method. Eventually, simulation and performance analysis are shown in order to verify the validity and advantage of improved algorithm. [C5655]

"Passive location and precision analysis based on multiple CDMA base stations"

The use of multiple non-co-operative CDMA base stations as external illuminators for passive radar target detection and location is investigated. A signal-processing scheme is developed to locate moving targets. Clutters resulted from direct-path and multi-path signals are filtered adaptively using a well-designed cost function. The target's range and speed information are acquired via pulse compression. Finally by fusing couples of location parameters, the target could be located and the multiple base stations could bring about an improvement in location precision. The real data and simulation results verify the feasibility of this passive location system. [C5656]

"Study on the signal processing of high-speed and wide-beam LFMICW radar altimeter"

A signal processing method is presented in order to solve the problem of measurement error caused by wide terrain fluctuation within antenna's wide beam and the range-velocity coupling problem caused by platform's high velocity. A signal processing method and height detecting algorithm is proposed in this paper to implement height measurement. The beat spectrum is processed by intercepting and weighing to solve the measurement error problem mentioned above, and the coupling problem is solved by pairing between positive and negative sweeping frequency. Certain measurement accuracy is achieved by the method. The effectiveness of the method is validated through simulation results. [C5657]

"A joint multichannel balance and interferometric phase unwrapping algorithm"

In this paper, a joint method to estimate unwrapped interferometric phase and alleviate the channel mismatch based on the multibaseline SAR interferometry system is presented. The calibration method proposed herein estimates the second order moments of phase vector from a set of received echo data. These theoretical analysis, supplemented with experimental results show that the method can effectively relieve the channel imbalance and accurately provide the unwrapped interferometric phases in the presence of the large image coregistration errors. [C5658]

"Use of large curvilinear synthetic aperture for 3-D target imaging"

Parametric imaging methods for the curvilinear synthetic aperture radar (SAR) are always used the extracted three-dimensional (3-D) target feature (amplitude and 3-D position) to reconstruct the 3-D target image. Their efficient implementations, however, are only suitable for small synthetic aperture case. In this paper, a model is

presented for describing the scatterer's echo received by large synthetic aperture, and based on this model, an efficient parametric method is proposed for imaging the 3-D target. The proposed method removes the coupling between the range and cross-range, which is introduced by range migration. With the decoupled data, the proposed method can replace the high dimensional search with a series of lower dimensional searches, which results in the feature estimates being extracted efficiently. The simulation results show that the method proposed in this paper can achieve the objective of the complex 3-D imaging, and the feature estimates can be reach the corresponding CRBs at low signal-to-noise ratio. [C5659]

"Doppler processing for PRC-CW radar in strong-clutter background using Duffing oscillator"

Based on the theory of Duffing oscillator, a new method of Doppler processing for pseudo random-code continuous wave (PRC-CW) radar signal in strong-clutter background is presented in this paper. By identifying the state of the chaotic oscillator system, Doppler frequency-shift is detected in order to calculate the speed of the target and solve the problem of Doppler sensitivity of pulse compression. At the same time, a fast method is introduced to accelerate identifying the states of the chaotic system. In order to estimate the phase of the Doppler component and prove the validity under stochastic phase, the influence of phase separation is also discussed. Simulation results demonstrate the effectiveness of this new method. [C5660]

"Space-time resampling method for the range-dependence of clutter spectrum in non-sidelooking STAP radars"

The clutter Doppler frequency depends on range in non-sidelooking arrays for Ground Moving Target Indication, which would lead to an inaccurate estimate of the covariance matrix of the clutter at the range bin of interest in space-time adaptive processing(STAP). According to clutter model, we propose a space-time resampling method which can mitigate the range dependence of clutter spectrums by adjusting the space-time sampling rate. Different from other compensation methods, the method uses an interpolation filter to obtain identical clutter spectrum in both the mainlobe and the sidelobes. STAP is then applied to the output of the filter. The method has low computational complexity. Simulation results show the validity of the proposed method. [C5661]

"Method for detecting ground moving target with range migration"

For airborne radar detecting ground moving target, the range migration of the moving target was often ignored. However, for the cases of high relative speed between the radar and the target, the range migration should be considered, especially for high range resolution (HRR) airborne radar. Since the range migration can dramatically reduce the performance of detecting the moving target for airborne radar, the effect of range migration must be removed. In this paper, the data model of moving target with range migration is discussed, and a STAP method is proposed for detecting the moving target with range migration. Simulation results show that the proposed method can remove the range migration of all moving targets simultaneously, and improve the detection capability for the ground moving target with range migration. [C5662]

"Marker-controlled SAR image segmentation algorithm"

This paper presents an algorithm for automatic segmentation of SAR imagery into target, shadow, and background clutter regions, which is a key pre-processing step for SAR image based automatic target recognition. Power transformation is employed in this algorithm to transform SAR image data to nearly Gaussian distributed data, followed by which is a de-noising processing by using partial differentiation equation. A marker-controlled based SAR image segmentation algorithm is used to segment the de-noised images. We introduce a new sliding window method to find extreme value in SAR image, which is used as marker for controlling segmentation region. Experiment results show that this algorithm can overcome the influence of impulse noise and the correlation and dependency of adjacent pixel in SAR imagery, and get trim borderline and good segmentation performance. [C5663]

"Direction finding using minimum redundancy MIMO radar"

An augmented covariance matrix, which has the characteristics of Hermitian and Toeplitz, is constructed for minimum redundancy (MR) multiple-input multiple-output (MIMO) radar to implement direction finding using Capon algorithm. A diagonal loading technique is employed to avoid non-positive definite of the covariance matrix. The diagonal loading level is adjusted adaptively according to the eigenvalues of the covariance matrix. The proposed method not only expands the system degrees-of-freedom (DOFs), but also has robust spatial spectrum estimation performance. In addition, the method requires no priori knowledge of the number of targets. Simulation results showing the performance improvement of the proposed method is presented. [C5664]

"Analysis and solution of rabbit ear effect in channelized receiver"

Rabbit ear effect is a special problem in the channelized receiver. In this paper, response mode of rabbit ear effect is examined. From the response mode, a new eliminating method based on the response estimation is proposed. The method detects the transient energy in channelized output and determines the occurrence of rabbit ear effect. Then response of the effect in each channel is estimated to form detection threshold. Correction for the weak signals that are split by rabbit ear effect of strong signals is used according to the threshold compare marks. The method is adaptive to different rabbit ear effect caused by different radar pulse edges and simple enough to be implemented in real-time signal processing systems. [C5665]

"Parameter estimation in detection of BPSK radar signals"

In process of detecting low probability of intercept radar signals, cyclostationary spectral can be adopted in the method to analyze and detect BPSK radar signals, the carrier frequency and code-width etc parameters as a result can be detected and estimated in comparative low signal-to-noise ratio environment. In the environment that signal-to-noise ratio turns further lower, cyclostationary spectral can be combined with cepstrum as methods to be taken in identifying BPSK radar signals and estimating key parameters like carrier frequency and code-width. [C5666]

"Integrated radar systems for precision monitoring of heartbeat and respiratory status"

This work presents simulation and measurement results of the vital sign parameters based on low-power microwave and millimeter-wave monitoring systems through Doppler radar techniques. The cardiac beating and the breathing of patients are examined. Three systems operating at 5.8 GHz, 24 GHz and 35 GHz, respectively, are designed, simulated, and fabricated. Using such three systems and applying signal processing techniques, measured signals obtained at distance up to 1 m from the patient of reference are presented. These results show that the heartbeat and the frequency of breath are well detected which validates our radar analysis and design approach. Performances (sensitivity, complexity, etc.) of the different systems are compared and studied, showing that the highest sensitivity detection can be achieved with the system at the highest frequency (35 GHz) in this case. [C5667]

"Ship detection and recognition in high-resolution satellite images"

Nowadays, the availability of high-resolution images taken from satellites, like Quickbird, Orbview, and others, offers the remote sensing community the possibility of monitoring and surveying vast areas of the Earth for different purposes, e.g. monitoring forest regions for ecological reasons. A particular application is the use of satellite images to survey the bottom of the seas around the Iberian peninsula which is flooded with innumerable treasures that are being plundered by specialized ships. In this paper we present a GIS-based application aimed to catalog areas of the sea with archeological interest and to monitor the risk of plundering of ships that stay within such areas during a suspicious period of time. [C5668]

"Detection and radiation area estimation of anomalous environmental electromagnetic wave related to earthquake precursor"

Anomalous radiation of environmental electromagnetic (EM) wave is reported as a portent of earthquake. We are observing environmental electromagnetic waves in ELF band all over Japan. Our goal is to predict earthquakes by detecting anomalous EM radiation. We have proposed various detection methods of anomalous radiation. However, the earthquake prediction requires the estimate of EM radiation area in addition to the detection of anomalous radiation. If the EM radiation area can be estimated, we can obtain information about the occurrence area of possible future earthquake. In this paper, we propose the method of detection and area estimation in the anomalous EM radiation by using cross-correlation in magnetic field azimuth. We apply the proposed method to the observed signals before the large earthquake that occurred in the past, and we detect an anomalous radiation and estimated the EM radiation area. [C5669]

"Oil slick spot detection using K-distribution model of the sea background"

A new method is proposed to get the segmentation threshold and detect the dark spot in oil-spill images. The method is inspired from the Γ ,Bi-distribution model of sea background, which is widely accepted to describe the ocean clutter. By comparing the histograms of oil-spill region and the sea background, it is found that the oil slicks break the Γ ,Bi-distribution model, but there is still some information unchanged-the relative probability ratios among the pixel values in 95%~99% CDF extent, which is used to deduce the original Γ ,Bi-distribution model. Finally, the intersection of the original histogram of the oil spill image and the deduced sea background PDF is selected to be the threshold. Experiment in RADARSAT-2 image shows the effectiveness of the method.

[C5670]

"Morphological operators applied to X-band SAR for urban land use classification"

This study provides an assessment of the potential for using contextual information with TerraSAR-X backscattering images in classifying urban land-use. Due to the lack of multi-frequency data, a contextual analysis was carried out to extract geometrical information of objects/classes within the images. Anisotropic morphological filters were applied to the backscattering image using a multi-scale approach. A range of different spatial domains were investigated by neural network pruning. The final map of land-use composed of seven different classes of interest was obtained using a Multi-Layer Perceptron neural network with an accuracy of 0.91 in terms of K-coefficient. [C5671]

"A combination of particle filter, matrix pencil and region growing techniques for phase unwrapping in SAR interferometry"

This work presents an improved InSAR phase unwrapping (PU) method based on a combination of a particle filter, a region growing technique and a matrix pencil based local slope estimator. The better performance of this new solution when compared against some representative traditional methods and the previous particle filter PU approaches is justified and illustrated with results obtained from synthetic and real data. [C5672]

"Interferometric SAR calibration with area calibration site of same height"

Aimed at the interferometric calibration problem for the Dual-antenna Airborne InSAR, Considering Ground Control Points(GCPs) are limited, calibration site of area with same height such as flat terrain is advanced. A scheme of establishing parameters bias and building Digital Elevation Model (DEM) is designed. Some airborne InSAR data, derived by Institute Of Electronics, Chinese Academy Of Sciences(IECAS), were used to do calibration experiments with the proposed processor. Their results demonstrated it is efficient. [C5673]

"Large scale land subsidence monitoring with a reduced set of SAR images"

In this work we presented the first experimental results of land subsidence mapping for large areas by using Coherent Point Target SAR interferometry with a reduced set of images in the North China Plain (NCP). Since the limitations of the classical Permanent Scatterer InSAR (PSI) for short temporal span surface deformation monitoring due to the dependency on large volumes data availability, we combine the classical PS InSAR and Small Baseline Subset (SBAS) technique in the data processing chain for large coverage InSAR data processing with a reduced set images. The starting point of our study is the generation of small baseline interferograms of the continuous frames in the same track. Following that, each stack of interferograms are processed with CPT InSAR so as to minimize the effect of phase ramp caused by inaccuracy baseline estimation. For large scale land subsidence mapping, all the mean velocity map are merged into a long strip and the subsidence rate of each coherent point are retrieved. The algorithm are tested with 15 ENVISAT ASAR images collected during the period from Jun, 2007 to Nov, 2008 with an extent of 100 ГfB— 400 km²in the NCP for land subsidence mapping. The presented results indicates the large scale land subsidence in central NCP and demonstrates the effectiveness the approach. [C5674]

"Enhancing complex interferograms by anisotropic diffusion"

In this paper a new algorithm for interferometric phase restoration is presented. Firstly, a continuous framework for anisotropic phase diffusion is stated. A tensorial based metric allows directional control. The periodic continuous structure of the phase representation is accounted for. Secondly, this framework is adapted for interferometric phase filtering. Progressive re-estimation of directionality avoids directional bias. Isotropy and anisotropy are adaptively combined with a constant overall diffusion rhythm, so that the degree of regularization is the same regardless of the underlying topography. Robust estimation minimizes the spread of outliers. Results on both synthetic and TerraSAR-X data are provided. [C5675]

"Simulation of dual-channel SAR-GMTI for velocity estimation and compensation"

The velocity and acceleration of the ground moving target can cause the target position to be displaced and defocused in the SAR image. In this paper, the displacement compensation scheme is presented to correct the displaced position and defocused moving target image in the DPCA based SAR-GMTI system. The influence of the ground moving target due to the velocity and acceleration is analyzed in range and azimuth directions, and its compensation method is presented with the simulation results. The performance of the proposed method is compared with respect to the estimated velocity and defocused quantity in both range and azimuth directions. [C5676]

"A pattern recognition system for extracting buried object characteristics in GPR images"

In this work, we present a pattern recognition system for the automatic analysis of ground penetrating radar (GPR) images. This system comprises pre-processing, segmentation, object detection, object material recognition, and object dimension estimation stages. Object detection is done using an unsupervised strategy based on genetic algorithms (GA) which allows to localize linear/hyperbolic patterns in GPR images. Object material recognition is approached as a classification issue, which is solved by means of a support vector machine (SVM) classifier. Dimension estimation is formulated within a Gaussian process (GP) regression approach. Results on synthetic images, representing random exploration scenarios, are reported and discussed. [C5677]

"Supervised classification by neural networks using polarimetric time-frequency signatures"

In radar imaging, the assumption is made that scatterers are white in the emitted frequency band and isotropic for all direction of observation. Nevertheless, new capacities in radar imaging, using a wideband and a large angular excursion, make these hypotheses not valid. Time-frequency analysis highlight this point of view and show some scatterers are anisotropic and/or dispersive. This information source can be completed by radar polarimetry. This paper suggests a supervised classification of scatterers using neural networks based on polarimetric time-frequency signatures. This method is applied here on anechoic chamber data, however can be generalized to SAR or circular SAR imaging. [C5678]

"Bayesian building extraction from high resolution polarimetric SAR data"

Building extraction from high resolution Synthetic Aperture Radar (SAR) images can benefit from modelling the interaction of several elements in urban scene. This paper proposes a Bayesian approach to exploit the interplay. The appearances of buildings in SAR images are dependent on their orientation angles. We estimate the orientation angles of buildings by supervised learning. The knowledge of other object classes could contribute to the building detection. We extract surface evidence of major object classes. The integration of angle estimation, building detection and surface classes provides promising results. [C5679]

"Hyperimage concept: Multidimensional Time-Frequency Analysis applied to SAR imaging"

This paper deals with the analysis of non-stationary scatterers in SAR images. Indeed, SAR imaging makes the assumptions that the scatterers are isotropic and white in the emitted frequency band. However, new SAR applications use a large bandwidth and a strong angular excursion. These assumptions become obsolete and the behavior of scatterers becomes non-stationary. The basic tool to study non-stationary signals is the time-frequency analysis. Recent studies based on multidimensional Time-Frequency Analysis describing the angular and frequency behavior of scatterers has highlighted anisotropic and dispersive behavior of bright points. This paper generalizes the hyperimage concept to study scatterers. Multidimensional Time-Frequency distributions are tested on simulations, then they are applied to very high resolution SAR images and show some scatterers are anisotropic and dispersive. [C5680]

"Resolution enhancement of SAR image using a multiframe super resolution technique"

This paper proposes a SAR image resolution enhancement method employing a multiframe super resolution technique. The super resolution process providing high robustness by local iterative operations is adopted in consideration with orbit deviations of a satellite and temporal changes. At first, offset functions between SAR images are estimated by co-registration with sub-pixel order. An initial high resolution image is simply produced by enlarging a master SAR image. The high resolution image is iteratively modified while the total error between simulated and original SAR images is larger than tolerance. Processing results of the resolution enhancement using ALOS PALSAR images are shown. [C5681]

"Speckle reduction of SAR images using sure-based adaptive Sigmoid thresholding in the wavelet domain"

Synthetic aperture radar (SAR) images are corrupted by speckle noise due to random interference of electromagnetic waves. The speckle degrades the quality of the images and makes interpretation, analysis and classification of SAR images harder. Therefore, some speckle reduction is necessary prior to the processing of SAR images. The speckle noise can be modeled as multiplicative i.i.d. Rayleigh noise. Sveinsson and Benediktsson [1996], proposed an adaptive sigmoid thresholding method for SAR images in the wavelet domain. The coefficients thresholding for this method is based on the choice of parameters in the sigmoid thresholding function. They were chosen according to a visual appreciation, i.e., by an ad hoc method. We propose to select

these parameters by minimizing an estimate of square error between the clean image and the denoised one. The key point is that we have in our proposal computable, statistically unbiased, MSE estimate-Stein's Unbiased Risk Estimate (SURE)-that depends on the noisy image alone, not on the clean image. We apply the proposed method on an SAR images, both simulated and real data. [C5682]

"A preliminary study of target contour extraction based on scattering mechanism using polarimetric SAR images"

Finding the target contour information from a remote sensing image is one of the fundamental steps for image analysis. Conventional target contour extraction methods are usually based on the statistics information of the image. In this paper, using the maximum return value of the normalized scattering matrix derived from full-polarized Synthetic Aperture Radar (PolSAR), the relationship between the contour of targets and their corresponding dominate scattering type is preliminary researched. Then a novel target contour information extraction method based on the physical scattering mechanism of terrain targets is proposed, which is more effective and adaptable due to the scattering mechanism of terrain targets do not depend on the radar backscattering intensity, but its proportion among different polarizations. After applying to E-SAR airborne data, the results show that this method has a good capability to extract the target contour information. [C5683]

"An accuracy assessment of ML texture tracking algorithm over multitemporal SAR images"

In this paper, the accuracy assessment of the recently proposed Maximum Likelihood (ML) texture tracking algorithm is discussed. Its comparison with the well known texture tracking technique, i.e., Normalized Incoherent Cross Correlation (NICC), has also been investigated in the case of the presence of multiplicative noise structure. [C5684]

"Speckle reduction of TerraSAR-X imagery using TV segmentation"

The nonsubsampling contourlet transform (NSCT) is a new image representation approach that has sparser representation at both spatial and directional resolution and thus captures smooth contours in images. On the other hand, wavelet transform has sparser representation of homogeneous areas. In this paper, we are going to use the three combinations of undecimated wavelet and nonsubsampling contourlet transforms that was used in for denoising of TerraSAR-X images. Two of the methods use the undecimated wavelet transform to de-noise homogeneous areas and the nonsubsampling contourlet transform to denoise areas with edges. The segmentation between homogeneous areas and areas with edges is done by using total variation segmentation. The third method is a linear averaging of the two denoising methods. A thresholding in the wavelet and contourlet domain is done by non-linear functions which are adapted for each selected subband. The non-linear functions are based on sigmoid functions. Simulation results suggested that these denoising schemes achieve good and clean images. [C5685]

"Anti-jamming techniques for synthetic aperture radar"

Excellent performance of SAR has aroused deep study of jamming techniques. This paper first discusses present jamming techniques and their shortcomings, then gives methodology of classifying ECCM of SAR, and at the same time, gives principle and results of signal design method, which combines orthogonal codes and random initial phase at each pulse, the method leads to disability of jamming to finish match filtering of both range and azimuth. Finally this paper points out that beamforming technique is a potential method for the future of ECCM of SAR. [C5686]

"The effects of multi-path scattering on the SAR image of cylinder cavity"

In this paper, the effects of multi-path scattering mechanisms on SAR image is deduced through range Doppler algorithms (RDA). The conclusion that the cloud phenomenon appeared due to the multi-path scattering mechanisms is detained. Through the analysis, the cloud caused by the multi-path in the down range is corresponding to focus mechanisms and the cloud appeared azimuth is non-focus. At last, the shooting and bouncing ray (SBR) technique is employed to calculate the scattering of the cylinder cavity and by combining with range Doppler algorithms (RDA), the SAR image of a cylinder cavity with underside closed is precisely given, considering the effects of the multi-path scattering mechanisms in different azimuth. [C5687]

"PSLR estimation considering clutter background from SAR image data"

Synthetic aperture radar (SAR) image performance can be quantified by the impulse response function (IRF) resulting from a ground reference-point scatterer. Since the level of clutter background surrounding the point scatterer affects not only the shape of the IRF but also the relative magnitude of the peak-to-sidelobe ratio

(PSLR) of the IRF, the PSLR can be an important measure for SAR image quality evaluation. In this letter, a new PSLR estimation scheme for SAR image quantification is presented by taking into account the various groups of clutter backgrounds. In order to give a realistic clutter effect in the simulation, a group of clutter data extracted from a real SAR image is individually superimposed into an ideal IRF. Then, a clutter-containing IRF is analyzed with respect to the level of PSLR affected from a various group of clutter background. As expected, simulation result shows that the average PSLR varies from 0.4 dB to 2.0 dB over the various clutter backgrounds surrounding a reference point scatterer, which is well represented by the realistic clutter background compared to the ideal PSLR. [C5688]

"Combined metal detector and ground-penetrating radar sensor experiments in a variety of soil conditions"

Landmine detection is a hazardous operation. To reduce the human casualties during landmine detection, unmanned ground vehicles (UGV) can be used. There are many landmine detection modalities that can be used with a UGV. However, the ground-penetrating radar (GPR) and the metal detector (MD; electromagnetic induction sensor) are fast and may be the most reliable means of landmine detection. In addition, GPR and MD sensors can easily be packaged in one sensor head. It is also easy to configure the sensor heads in an array. To combine GPR and MD sensor data, a series of experiments has been performed. The GPR and MD combined sensor is scanned over a 2 m ГrB— 2 m ГrB— 1 m soil box at a constant height. The soil box contains stony sand and a landmine, which is buried at 200 mm depth when measured from the surface of the ground to the top of the landmine. The control parameters for the experiments are sensor height and soil moisture. The sensor height is varied from 40 mm to 100 mm with 20 mm increment from the soil. The soil moisture conditions considered in the experiments are dry and wet. The stony sand used in the experiments contains rocks with approximately 100 mm diameter scattered in a random manner and a brick placed 200 mm apart horizontally from the landmine. The GPR and MD responses are recorded for all control parameter combinations and later analyzed. The GPR images are generated using time-domain back projection (TDBP) algorithm. The GPR images and MD responses are compared for the soil conditions and sensor heights. A combination algorithm, which enhances GPR images using MD responses, is also presented. [C5689]

"SAR raw signal simulation accounting for antenna attitude variations"

An efficient SAR raw signal simulator accounting for antenna attitude variations is presented here, based on the 2-dimensional Fourier domain formulation of SAR raw signal in presence of antenna beam pointing errors. It can meet the requirements of InSAR system simulation to deal with the extended scenes. The validity limit is analyzed to show that this algorithm is suit for the simulation of practical systems. [C5690]

"An imaging method and the correction of distortion for Spaceborne-airborne bistatic SAR"

Because of the great speed difference between the transmitter and the receiver of the spaceborne/airborne bistatic SAR (SA-BiSAR), the bistatic angle changes with time, which makes the geometric structure of the SAR system no longer invariant, and the imaging result distort seriously and dissimilarly. In order to solve this problem the geometric model of the SA-BiSAR is established in this paper at first. Then based on the analysis to cause the image distortion, a correction method for bistatic SAR distortion named Inverse-Projection is brought up. The simulation results demonstrate that this method can work well for spaceborne/airborne configuration. [C5691]

"Spotlight SAR processor by using extended frequency scaling"

Frequency scaling algorithm (FSA) is generally used as a spotlight synthetic aperture radar (SAR) processor. FSA can directly process dechirped raw data. However, the plain algorithm itself is purposed for a single target because the formula of the algorithm is for a target. This paper presents a method to process a sliding spotlighted scene with FSA. Extended frequency scaling algorithm (EFSA) is used for focusing a point target in this paper. In order to get a focused scene of high quality image, effective velocity and Doppler centroid need to be very accurate for each target. Test has been done with a step steering sliding spotlight simulated raw data. [C5692]

"SAR raw signal simulation based on GPU parallel computation"

In this paper we present a raw signal simulator based on GPU parallel computation for synthetic aperture radar. We describe a mathematical model of SAR simulation based on FFT in detail and implement it through GPU parallel computation. GPU has a better performance in complex calculation than CPU. It supports parallel computation and raises the speed of algorithms. At the last part of this paper, a simulation comparison is given. The result shows that the simulator base on GPU parallel computation improves the efficiency of algorithm. It is very useful when the algorithm consumes large amount of CPU time. [C5693]

"SAR target recognition based on sub-block statistical features extracted from the Gabor filtered image"

A method for SAR target recognition using low-frequency sub-band and Gabor filter sub-block statistical feature is proposed. The sub-band image extracted from the pre-processed SAR image is filtered by Gabor filter on different directions and scales. The each filtered sub-band image is divided into different sub-blocks and the statistical features derived from every sub-block of all filtered sub-band images are regarded as the target recognition feature, which can be used to recognize the targets with SVM. The proposed method is validated on MSTAR dataset for 3-type SAR target recognition. [C5694]

"Effect of linear array elements spacing on angle imaging performance of downward-looking 3D-SAR"

This paper presented the 3D-SAR with linear array antennas (LAA) which could, in contrast to conventional single-channel 2D-SAR, create the real 3D resolution cells to avoid geometric distortions. Except for conventional side-looking mode, 3D-SAR with LAA can be operated in downward-looking mode which can avoid shadowing effects. The relation between the LAA elements spacing and the elevation angular ambiguity is derived, and the maximal distance between individual antenna elements allowed to avoid elevation angular ambiguity is deduced in this paper. The demonstration of the feasibility of the 3D-SAR with LAA and the relation between elements spacing and elevation angular ambiguity are analyzed by simulation in the last part of this paper. [C5695]

"Research on the relationship between satellite attitude stability and interferometric performance"

Attitude stability is a very important design parameter to synthetic aperture radar (SAR) satellite platform. The mathematical expression of distributed satellite SAR system impulse response function with attitude jitter is studied using paired echo theory. The effect of attitude stability on interferometric performance is confirmed according to the change of peak sidelobe ratio (PSLR) and integrated sidelobe ratio (ISLR). The constraint relationship is given between three-axis attitude jitter and interferometric performance. Through computer simulation, the relationship curve is obtained to verify the conclusion. The study in this paper provides an important theoretical basis for the integrated design of distributed satellite SAR system. [C5696]

"Motion measurement errors analysis for the "one-active" LASAR"

The influences of the motion measurement errors (MMEs) to the 3D SAR imaging are analyzed based on the "one-active" LASAR system in this paper. Firstly, the principle and the spatial ambiguity function (AF) of the "one-active" LASAR are introduced. Then the 3D MMEs are introduced according to three forms: the 3D velocity errors and the 3D acceleration errors, the sine vibration errors and the array vibration errors. The 3D SAR system's maximum allowable MMEs are obtained and the influences of the 3D MMEs to the 3D AF are analyzed by the numerical simulation. Finally, the ground experiments and its results are presented, which validate the feasibility of the "one-active" LASAR. [C5697]

"A revised radiometric normalisation standard for SAR"

Improved geometric accuracy in SAR sensors implies that more complex models of the Earth may be used not only to geometrically rectify imagery, but also to more robustly calibrate their radiometry. Current beta, sigma, and gamma nought SAR radiometry conventions all assume a simple flat as Kansas flat Earth ellipsoid model. We complement these simple models with improved radiometric calibration that accounts for local terrain variations. In the era of ERS-1 and RADARSAT-1, image geolocation accuracy was in the order of multiple samples, and tiepoint-free establishment of the relationship between radar and map geometries was not possible. Newer sensors such as ASAR, PALSAR, and TerraSAR-X all support accurate geolocation based on product annotations alone. We show that high geolocation accuracy, combined with availability of high-resolution accurate elevation models, enables a more robust radiometric calibration standard for modern SAR sensors that is based on gamma nought normalised using an Earth terrain-model. [C5698]

"An internal calibration scheme for polarimetric Synthetic Aperture Radar system"

Two important aspects of internal calibration of polarimetric Synthetic Aperture Radar (SAR) are discussed, that is, system gain calibration and individual Transmit/Receive Module (TRM) calibration. System gain variation is measured utilizing the internal calibration loop. Dualchannel TRM gain and phase calibration is carried out using Orthogonal Phase Coding (OPC), in which signal of individual TRM is phase-encoded according to a set of orthogonal codes in order to be separated from the composite calibration signal of all TRMs. Calibration results

are developed both theoretically and through simulation in the case of TRM failure. A crosstalk model is used to investigate the effect of imperfect isolation between the two polarization channels of each TRM on the calibration error. [C5699]

"Accuracy assessment of the first high-resolution IFSAR campaign over the coorong region of South Australia"

This paper discusses the vertical accuracy assessment of a high resolution digital elevation model and associated orthorectified radar imagery Apogee and Intermap Technologies are collecting in the Murray-Darling Basin region of Australia. This dataset will form the geospatial foundation upon which further remote sensing and field survey information resides forming a single uniform dataset which is consistent over large areas. A new highly accurate geoid will also be generated to ensure the accuracy and consistency of the data. [C5700]

"Kernel regression-based background predicting method for target detection in SAR image"

Target detection with SAR image is one of important research topics in remote sensing. In this paper, a kernel regression-based predicting method is proposed for target detection in SAR image. Badly speckle noise and background clutter are two main factors which make the target detection with SAR image difficult. In the proposed method, the kernel regression on local image is used to exactly predict the background interferences and make Gaussian assumption in conventional detector better followed after kernel regression-based prediction and suppression of background clutter. Thus, final CFAR detection is performed on the background clutter-removed SAR image. Experiments conducted on real SAR image show that the proposed algorithm can effectively predict and suppress background clutters, and greatly improve the performance of the conventional CFAR detector. [C5701]

"Calibration of the high performance airborne SAR system (Pi-SAR2)"

NICT (National Institute of Information and Communications Technology, Japan) have developed a high performance airborne SAR system (Pi-SAR2) since 2006, as a successor to the Pi-SAR (X-band). Pi-SAR2 has polarimetric and interferometric functions with high spatial resolution of 0.3-0.6 m in along track (azimuth) direction and 0.3-0.5 m in cross track (slant-range) direction at X-band. In this paper we report the ground based calibration experiment using active radar calibrators (ARC) and corner reflectors (CR) in conjunction with the Pi-SAR2 test flight. [C5702]

"Transpolarizing trihedral measurement using UPC X-band GB-SAR"

The use of a transpolarizing surface placed on one side of a trihedral corner reflector (TCR) as polarimetric calibrator is presented in this paper. The transpolarizing-TCR presents a high back-scattered cross-polar response. This structure has been tested at 9.65 GHz (X-band) with the help of the UPC GB-SAR system. [C5703]

"Urban areas characterization from polarimetric SAR images using Hidden Markov Model"

Scatterers in synthetic aperture radar (SAR) images exhibit high dependence on scatterer-sensor orientations. This phenomenon is prevalent in urban areas. This paper applies hidden Markov model (HMM) to characterize the dependence and model the variations with respect to orientation. Buildings in high resolution SAR images of urban areas are studied. Buildings regions are divided into several discrete classes according to their orientation angles. We model the variations of scatterers characteristics throughout the subapertures using HMM. Subapertures are generated using wavelet packet decomposition. The experimental results show that HMM is efficient in building detection and orientation angle identification. HMMs trained using different feature sets are investigated. The evolution of scatterer states in subapertures are obtained from the HMM inference. [C5704]

"An a-contrario approach for unsupervised change detection in radar images"

This paper presents a new approach for unsupervised change detection in pairs of Synthetic Aperture Radar (SAR) images. As changes to detect can have various sizes and intensities which are a priori unknown in most applications, we propose a multiscale approach without considering any a priori information. Using multiscale series of a cumulant-based Kullback-Leibler divergence (CKLD) measure computed between two dates, changes are characterized as areas where the CKLD values vary a lot when the scale varies. In a probabilistic a-contrario framework, a measure of meaningfulness of such an evolution through scale is derived, leading to a criterion free of parameter. Results are presented using a pair of SAR images acquired before and after the volcanic eruption of the Nyiragongo in January 2002 (Congo), showing the robustness of the method with respect to the number of false alarms. [C5705]

"An approach to SAR tomography with limited number of tracks"

In SAR tomography, the available information in the height direction is limited by the number of different tracks that can be acquired in practice. To counterbalance this limitation, electromagnetic scattering models, properly exploiting the available a priori information, should be used, the $\Gamma, B_{\text{few}}, B_i$ possible acquisitions should be accurately selected, and processing algorithms, guaranteeing the reliability of the results, should be employed. We present an approach for the reconstruction of the vertical reflectivity distribution of vegetated areas facing the above three points. In particular, an eigenvalue optimization procedure is exploited to design an $\Gamma, B_{\text{ioptimal}}, B_i$ constellation to be flown, the peculiar features of ground and canopy are accounted for and an effective global optimization algorithm is used to enhance the reliability. The approach is tested with both simulated and real data acquired by the E-SAR system of DLR over the Dornstetten forest test-site. [C5706]

"A study on GPP inversion of different ecosystems by remote sensing and impact factors comparison"

Light use efficiency model is one of the method to retrieval regional scale Gross Prime Productivity (GPP). Absorbed Photosynthetic Active Radiation (APAR) and Light use efficiency are the main parameters of this kind of model. At the same time, light use efficiency is affected by air temperature and precipitation. In this article, one of the Light use efficiency model is used to retrieval daily GPP of the Chinese five typical ecosystem experimental station in 2003. The inversion results are compared with MOIDS NPP product and station measurement data. Based on the different air temperature and precipitation condition of the different station, it also analyses the sensitivity of parameters. [C5707]

"Integrating remote sensing and ancillary data for regional ecosystem assessment: Eucalyptus grandis agro-system in KwaZulu-Natal, South Africa"

The ability of various ecosystems to perform vital functions such as biodiversity production, and water, energy and nutrient cycling depends on the ecosystem state, i.e. health. Ecosystem state assessment has been a topic of intense research, but has reached a point at which accurate large scale (e.g. regional to global scale) modelling and monitoring are hindered by limitations in conventional assessment methods such as direct field sampling, modelling from environmental drivers such as temperature, precipitation and available nutrients, and modelling from remote sensing data. The Ecosystem-Earth Observation (Eco-EO) research group at the Council for Scientific and Industrial Research (CSIR), South Africa has highlighted the need in remote sensing research for an integrated sensing approach at the systems level. This perspective is based on the assumption that a modelling approach that exploits the strength of the various techniques (in situ environmental variables, direct field observation and remote sensing data) could potentially improve the assessment of ecosystem state at various geographic scales. In this light, the Eco-EO research group has embarked on an agro-system state assessment project since 2007 as a first step towards the implementation of the integrated modelling approach for various ecosystems. The agro-system consists of a monoculture forest plantation of Eucalyptus grandis situated in KwaZulu-Natal, South Africa. This paper presents preliminary results from the KwaZulu-Natal E. grandis experimental study. [C5708]

"Hardware-accelerated edge detection for polarimetric synthetic aperture radar data"

From the literature review, there are two constant false alarm rate detectors for detecting edges in multi-look fully polarimetric synthetic aperture radar (POLSAR) imagery, namely the likelihood ratio edge detector and the Roy's largest eigenvalue-based edge detector. In the latter approach, one major restriction is the computation complexity, i.e. in the context of the chosen C language-based implementation. Thus, in this paper, a novel hardware-based architecture is presented to improve the processing time for the Roy's largest eigenvalue-based edge detection. The algorithm was implemented in a field-programmable gate array (FPGA) with an accelerated solution targeting data rates of up to 1 Gb/s. Its performance was examined using nine-look NASA/JPL C-band data and evaluated in terms of processing speed and accuracy as compared to the C language-based implementation on a personal computer (PC) with a Core Γ, B_i 2 Duo processor clocked at 2.2 GHz. [C5709]

"Neural network algorithm and backscattering model for biomass estimation of wetland vegetation in Poyang Lake area using Envisat ASAR data"

Poyang Lake is the largest freshwater lake in China with an area of about 3000 km². Its wetland ecosystem has a significant impact on China's environment change. In this paper, we discuss the neural network algorithms (NNA) to retrieve wetland vegetation biomass using the alternating polarization Envisat ASAR data. Two field measurements were carried out coincident with the satellite overpasses at this area through the hydrological

cycle from April and November. Training data of the neural network are generated by the Michigan Microwave Canopy Scattering (MIMICS) model which is often used for the tree canopy. We modified the model to make it applicable to herbaceous wetland ecosystems. The model input parameters are defined according to the wetland circumstance. NNA retrieval results are validated with ground measured data. The inversion results show the NNA combined with MIMICS model is capable of performing the retrieval with good accuracy. Finally, the trained neural network is used to estimate the overall biomass of Poyang Lake wetland vegetation. [C5710]

"Comparison of L- and P-band biomass retrievals based on backscatter from the BioSAR campaign"

With the continued threat of global warming, the need to obtain consistent and accurate measurements of the carbon stored in forests is strong. L- and P-band SAR backscatter data have shown to be sensitive to forest biomass, which in turn is coupled to the stored carbon. In this paper a biomass retrieval method is developed for L- and P-band using data from the BioSAR campaign conducted in Sweden during the spring 2007 over hemi-boreal forest. The results show that the use of L-band data gives an underestimation of biomass for stands with high biomass; while for P-band no such underestimation is seen. RMSEs are found to be 30-40% of the mean biomass for L-band and about 25% for P-band for stands with biomass ranging from 10 to 290 tons/ha. [C5711]

"Real time monitoring of flooded areas by a multi-temporal analysis of optical satellite data"

Optical sensors aboard meteorological satellites are an excellent tool to monitor floods and support the flood risk management cycle, mainly thanks to their high temporal resolution, which allow us to obtain real time and frequently updated information on environmental changes. The RST (Robust Satellite Techniques) approach, an automatic change detection scheme, has been already applied using AVHRR (Advanced very High Resolution Radiometer) and MODIS (Moderate Resolution Imaging Spectroradiometer) data to detect and monitor flooded areas. Results achieved have shown its capability in automatically identify flooded areas with a low rate of false alarms, also discriminating permanent water from actual inundated areas. In this paper, in order to further assess the reliability and the sensitivity of the proposed approach in different conditions of observation, the RST methodology has been used to analyze the July 2007 and October 2008 floods occurred in the South Africa and Algeria regions. [C5712]

"SETHI, the ONERA airborne SAR sensor, and his low frequency capability"

SETHI is the airborne SAR system developed by the ONERA, the French Aerospace Lab dedicated to civilian application. This new SAR system was designed to explore the science applications of radar remote sensing; it can operate over a wide range of frequency bands (X, L and UHF/VHF) and it has polarimetric and interferometric capabilities. In this paper, we will more specifically illustrate the low frequency capability of this new airborne SAR system and provide some results obtained with the system. [C5713]

"Focusing Synthetic Aperture Sonar (SAS) data with the Omega-K technique"

Synthetic Aperture Radar (SAR) and Sonar (SAS) systems provide high resolution reflectivity maps of the imaged scene by coherently combining the echoes collected along a virtual array of receivers. A peculiarity of SAS systems is that the echoes are often collected by moving a short real array of hydrophones to avoid range ambiguity. In this paper we present a modification of the standard wavenumber focusing algorithm widely used in SAR data processing to make it suitable for focusing bi-static SAS data. An autofocusing technique is then exploited to estimate and compensate for the deviation of the platform trajectory from the rectilinear one. [C5714]

"Coherent multi-frequency-band resolution enhancement for synthetic aperture radar"

This paper presents a method whereby the range resolution of multi-frequency-band SAR systems can be enhanced. If multiple signals are coherent and cover disjoint frequency bands, they can be combined into a single signal which can be processed using slightly modified SAR processing algorithms, resulting in an image with a range resolution enhanced by the sum of the constituent bandwidths. [C5715]

"UAE mapped attenuation at RF frequencies (UAE-MARF)"

This paper develops both theoretical and experimental models for the prediction of attenuation and reflectivity of satellite signals at Ku-band in the UAE. The theoretical model gives a detailed study on the effect of the attenuation and the reflectivity due to the increase of the frequency or the density of different hydrometers. The experimental model, which is based on actual measurements obtained from NASA, was used to extract the required precipitation radar (PR) products. By applying the image analysis techniques on the PR data for one whole year (2000), a graphical representation of attenuation at Ku-band in the UAE was obtained. Results of this

paper are vital for the successful design of satellite TV broadcast systems in the UAE operating at Ku-band. [C5716]

"Adaptive scan-on-receive based on spatial spectral estimation for high-resolution, wide-swath Synthetic Aperture Radar"

Intensive research is currently ongoing in the field of Smart Multi-Aperture Radar Techniques (SMART) for high-resolution wide-swath Synthetic Aperture Radar (SAR) imaging. This work investigates the possibility of applying direction of arrival estimation methods to spaceborne SMART SAR systems, that employ receive beam steering. In particular, a new algorithm based on the actual spatial distribution of the received signal power is proposed. The performance of the algorithm is evaluated by Monte Carlo simulations and compared with that of the conventional scan-on-receive approach, in different operational scenarios. The Cramer Rao Lower Bound is also reported as a benchmark on the performance. [C5717]

"3D SAR focusing for subsurface point targets"

In this work we develop a methodology for imaging subsurface point targets using a single-pass strip-map synthetic aperture radar (SAR). The point targets are embedded in an arbitrary homogeneous half space, and are located at arbitrary depths. It is assumed that the radar frequency is low enough and system sensitivity high enough to allow the required two-way penetration depth to target. The succession of steps required to form the image of the subsurface point targets are described, including the estimation of the subsurface wave velocity, estimation of the depth of the point target, and the modified range and azimuth filters to achieve optimum resolution. The theoretical approach is described and results are presented for a range of point target depths, subsurface velocities, and radar system parameters. It is found that with the assumptions made it is possible to image the point targets in 3D with good range, azimuth, and depth accuracy. [C5718]

"Modeling and validation of GPR wave scattering with the Semi-Analytic Mode Matching algorithm: Choosing optimal coordinate scattering centers"

Choosing the coordinate scattering centers (CSCs) for the Semi-Analytic Mode Matching (SAMM) algorithm is a critical and heretofore unexplored aspect of this method, necessary for the ultimate goal of simulating full 3D scattering. Establishing the locations at which modes originate is essential for accurate modeling of electromagnetic fields with SAMM. Six test scattering objects are investigated, and the CSCs are found for each by considering the radii of curvature at each Γ_i fitting Γ_i point on the objects' perimeters. Additional CSCs are needed for scattering objects which have long Γ_i flat Γ_i regions. Excellent results are found comparing SAMM and Finite Difference Frequency Domain (FDFD) for 2D scattering objects several wavelengths in size. [C5719]

"Remote sensing based season calendar for Indian districts using MODIS data"

Seasonal characteristics and crop growth information is of great utility for crop management. The primary occupation in India being agriculture, it is important to devise quick and reliable methods that will help in making decisions affecting agricultural practices at a macro level more efficiently. In this paper, the authors have devised an algorithm to derive a seasonal calendar from the time series data of a moderate resolution satellite, MODIS which is one step short of producing a crop calendar. The method proposed involves filtering time series data using Local Maximum Fitting, finding maximum and minimum points on the time series profile, calculating phenological parameters namely start of season, mid of season, end of season and seasonal amplitude and finally clustering these phenological parameters to obtain a cluster center which is representative of a particular season/cropping practice. The initial results are promising as they are similar to the information available in the form of handouts of the regions under study. A full scale validation involving field visits and comparison with statistical data from government sources will prove the utility of this product. Nevertheless, this work demonstrates the utility of time series MODIS data for obtaining phenological parameters. [C5720]

"Innovative and efficient strategy of calibrating Sentinel-1"

In the frame of the GMES program, the main objective of the Sentinel-1 mission is to ensure the continuity of SAR data acquisitions for SAR applications in C-band for global earth monitoring. But in contrast to SAR systems already existing in C-band like ASAR/ENVISAT or RADARSAT-2, high demands on the radiometric accuracy are made. Thus, product quality is of paramount importance and the success or failure of the mission depends essentially on the method of calibrating the entire Sentinel-1 system in an efficient way. This paper describes the strategy and the method of calibrating Sentinel-1. [C5721]

"A neural network electromagnetic approach for GPR pavement diagnostic: A preliminary study"

In this paper, a preliminary study, based on GPR data analysis by means of artificial neural networks, for automatic pavement diagnostic is addressed. The proposed solving solution models the pavement as a multi-layered medium composed of N parallel homogenous layers, which are separately analyzed through a recursive procedure able to reconstruct their permittivity and thickness. The basic processing module of the whole procedure, is here presented. [C5722]

"Developing new spectral indices for karst rocky desertification monitoring in Southwest China"

Karst rocky desertification is a special kind of land desertification developed under violent human impacts on the vulnerable eco-geo-environment of karst ecosystem. The fractional cover of photosynthetic vegetation (PV), non-photosynthetic vegetation (NPV), bare soil and exposed bedrock are key indicators of the extent and degree of land degradation in karst region. The vegetation fractional cover can be estimated approximately from remote sensing with vegetation indices. However, the vegetation indices cannot be easily applicable to all land cover types. In this study, we developed new spectral indices, karst rocky desertification synthesis indices (KRDSI), were then designed based on tied-spectrum permutation and unique spectral characteristics of main land cover types. Comparing with the use of traditional vegetation indices and LSU, the KRDSI was more consistent with the field measurement of main land cover fractions. Our study indicates that KRDSI is a useful tool for karst rocky desertification monitoring with remotely sensed data. [C5723]

"Woody cover and heterogeneity in the Savannas of the Kruger National Park, South Africa"

The woody vegetation of the Kruger National Park varies greatly in species composition, biomass and cover at regional scales. This study focuses on woody (tree and shrub) cover as a defining characteristic of savannas. We combine field measurements, optical and radar remote sensing to map woody cover across the whole of the Kruger Park at medium resolution (90 m). We also explore relationships between the mapped woody cover, climate, soil, topography, fire and herbivory. The spatial and temporal variability of woody cover is significant for Park managers in support of priorities relating to maintenance of structural and biotic heterogeneity. We derive a product that quantifies the spatial heterogeneity in woody cover within 1-km cells. [C5724]

"Preliminary results of the Passive Advanced Unit Synthetic Aperture (PAU-SA)"

This paper presents the current state and preliminary results of the Passive Advanced Unit Synthetic Aperture's instrument (PAU-SA) validation tests. The performed test has been focused on the implementation of the PAU-SA's interface in order to test extended source simulations. Moreover, the currently status of the hardware instrument is presented. [C5725]

"Independent component analysis of polarimetric SAR data for separating ground and vegetation components"

In this study, the use of independent component analysis (ICA) to separate the ground and vegetation scattering components from polarimetric, synthetic aperture radar (SAR) data is presented. In vegetation covered terrain, the backscattered signal is a composite of both a ground scattering component and a vegetation scattering component. The FastICA algorithm is customized and applied to both simulated and field data. The improved customized algorithm is found to work better than the standard FastICA algorithm. It is also shown that noise and depolarization limit the ability of ICA to separate the different scattering components. The technique is applied to field data from the Glen Afric region in Scotland and produces results consistent with other radar metrics obtained from that region. [C5726]

"Modeling surface-flow characteristics in glaciated landscapes"

Geographic Information Systems (GIS) hydrologic modeling techniques are used to better understand the surface-flow characteristics in the Prairie Pothole Region (PPR) of North America. This research uses an airborne Interferometric Synthetic Aperture Radar (IFSAR)-derived digital terrain model (DTM) as a base for developing a hydrologically-correct DEM and derivative products. The IFSAR DTM is assessed for accuracy and ability to resolve wetland features. A wetland mask is developed to selectively fill the DTM and from it products such as wetland catchments and drainage linkages are derived and interpreted. Study sites in the PPR are two surveyed and closely monitored wetland complexes, Crystal Springs and Orchid Meadows in Deuel County, South Dakota, USA. [C5727]

"Study on the influence of drought to crop growth based on SAR remote sensing"

This paper aims to get the relationship between drought and crop growth. By investigating synthetic aperture radar (SAR) backscattering coefficients, HH- and VV- polarization were found different due to influence from

canopy, because of strong attenuation of the VV- polarization by the vertically oriented wheat stems. In small incidence angle, HH is sensitive to soil moisture, while VV is more sensitive to canopy. Two classes of crop with low and high soil moisture are investigated by Γ , Bi water-cloud Γ , Bi model with vegetation descriptor vegetation water mass (VWM). Parameters of the model show that in drought the crop growth will be worse. This research presents that it is possible to study the influence of drought to wheat growth with small incidence angle of C-band SAR. [C5728]

"Analysis of the effect of crown structure changes on backscattering coefficient using modeling and SAR data"

Stand level forest canopy structure such as the size, density, and distribution of the branches and leaves may have a strong effect on radar backscatter. In this study, several broad-leaf (birch) stands and needle stands (larch) with different growing stages and different canopy structures are established using parametric and stochastic L-system. Stands with 10, 30, 50 years and with 10, 40, 100 years, which correspond to young, mid-age and mature birch and larch stands respectively, are simulated according to field measurements. To stands with the same age, the above ground biomass is almost the same. Then different 3D birch and larch crown architectures faithful to the real stand are generated using L-system, which provide realistic and detailed canopy biometric data for radar model. The radar model used here is an improved 3D forest radar backscatter model based on Radiative Transfer Theory, which considers tree crown distribution and multiple scattering from canopy during backscattering calculation. In this paper, total 60 stands with 30 Γ B—30m area, namely three stand ages, ten canopy structures and two species, are simulated and analyzed at C-, L-band with different polarizations. Simulation results show that the backscatter coefficient is sensitive to the canopy structure, particularly at C-band and L-band HV polarization. The discrepancy between birch and larch stands with the same tree age is distinct. The crown structure effect to the C-band is more obvious than L-band because of its short wavelength. Then the simulation results of L-HH, C-HH and C-HV polarizations are compared with JERS-1, ASAR data of Changqing forest farm located at DaXinAnLing, northeast of China, which shows good correspondence. [C5729]

"Parametrization of integrated hydrological model of Nam Co lake catchment on Tibetan Plateau using synergy of SAR and optical data"

Understanding of exchange processes over Tibetan Plateau including hydrological cycle is becoming increasingly important since their influence on the formation of the Asian monsoon system is known. Tibetan Plateau is source area for main Asian rivers that are of crucial importance for downstream communities of China, India, Bangladesh, Pakistan and SE Asia. Accurate and up-to date information of the characteristics and the current trend of these changes, provided by modern satellite systems like TerraSAR-X, are thus needed. The study area is delimited by the watershed of Nam Co basin on Tibetan Plateau in Tibet Autonomous Region of China approximately 100 km NNW from Lhasa. The no-outlet basin of the lake offers an excellent example of landscape unit characteristic for Tibetan Plateau where all exchange processes between land and atmosphere can be studied. Hydrologic modeling of Nam Co basin will be supported by complex interpretation of TerraSAR-X data that will provide whole set of hydrologic parameters. The TerraSAR data will be processed in synergy with other available microwave and optical remote sensing data sets. Basic extracted variables will be thus transformed into meaningful hydrological parameters. Data evaluation will take into account various aspects of landscape qualities with respect to water cycle. Variability of lake level, seasonal changes of soil moisture, influence of wetlands, lake icing and snow melt will be estimated. The synergetic approach to interpretation of TerraSAR-X data will benefit from major advantages of the high spatial resolution, the fast repetition cycle and the full-polarimetric capabilities in combination with high resolution optical data (RapidEye, QuickBird, Kompsat-2, ASTER, Landsat etc.) and digital elevation models. [C5730]

"Measurement and analysis of paddy field by polarimetric GB-SAR"

Polarimetric ground-based synthetic aperture radar (GB-SAR) measurements in a paddy field and its analysis results are presented. The measurements were carried out three times before and after an ear emergence of rice, and SAR images of full polarimetric components are reconstructed from the acquired dataset. By using those images, a sensitivity of a polarimetric component and a frequency range due to the ear emergence is discussed. Then, we could confirm that HH component of C-band is the most sensitive parameter although HV and VV components do not give significant changes. Especially, HH component of 5-6 GHz and 6-7 GHz show 10 dB increases after the ear emergence. Moreover, Freeman decomposition is applied to the SAR images. And, increases of a surface scattering component and a double bounce component in a same frequency range with the increase of HH component can be observed. [C5731]

"DEM production utilizing stereo technology of TerraSAR-X data"

This paper describes the generation of digital elevation models (DEMs) with stereo technologies. We developed this method, and applied it to high-resolution TerraSAR-X data. The generated DEM was evaluated quantitatively using airborne DEM. It showed that the vertical accuracy was dependant on the land cover, and almost satisfied the objective specification in flat area. [C5732]

"A polarimetric vegetation model to retrieve particle and orientation distribution characteristics"

A simple vegetation model for polarimetric covariance and coherency matrix elements is presented. The model aims to represent vegetation characteristics which are observable by radar polarimetry, including the average particle scattering anisotropy, the main orientation of the volume, the degree of orientation randomness in the volume, and the terrain slopes. The goal of this approach is to quantify these parameters and to enable their estimation in a remote sensing parameter inversion framework. The retrieval of parameters related to effective particle shapes in the polarization plane and the orientation distribution characteristics is evaluated on real SAR data acquired by DLR's E-SAR system at L-band. [C5733]

"Tropical forest biomass recovery using GeoSAR observations"

Tropical forests host some 40% of the world's above-ground vegetation biomass. Tropical forest biomass estimation from remote sensing is a key issue for REDD and carbon market credit allocation and monitoring. At present there is no consensus on the appropriate remote sensing technologies for tropical forest areas. Cloud cover in the tropics and biomass saturation suggest that a combination of low-frequency SAR and interferometry (either PolInSAR or dual-band interferometric SAR DBInSAR) can provide a solution. The airborne GeoSAR collects X-band and P-band InSAR data simultaneously, at a rate of 288 sq km / minute, and is used for wide-area mapping. Tropical forest biomass recovery using X-P DBInSAR and P-band backscattering cross section has been demonstrated from an airborne platform. The technique is applied to GeoSAR data of tropical forests. We show that GeoSAR X-P interferometric data alone may be used to recover tropical forest biomass, removing ambiguity associated with variation in ground conditions. The effects of terrain slope on biomass recovery are discussed. Airborne observation would yield only a "snapshot" of biomass and carbon stocks. We suggest that a combination of GeoSAR observation with PALSAR data for forest/non-forest classification, plus natural sequestration modelling, should provide an accurate measure of tropical forest biomass temporal variation at high-spatial resolution. [C5734]

"Estimation and correction of ionospheric induced phase errors in SAR images using Coherent Scatterers"

Coherent Scatterers (CSs) are usually detected in SAR data using spectral correlation techniques, by evaluating multilook images in the range direction. The first part of the paper demonstrates an alternative way to detect CSs by exploiting their inherent strong phase stability along frequency. The main advantage of the technique is the absence of a spatial average (necessary in the original procedure), which avoids loss of resolution. The second part of this work illustrates the use of CSs for the estimation and correction of phase errors along the synthetic aperture. Such source of errors may be originated by different effects as platform motion and atmospheric or ionospheric disturbances. For the correction of one and two-dimensional phase errors addressed here, a CSs based autofocus procedure was implemented and applied to simulated and real data. [C5735]

"C-band D-InSAR and field data for calibrating a groundwater flow and land subsidence model"

Differential Synthetic Aperture Radar Interferometry (D-InSAR) is a powerful technique used for detecting and measuring surface deformation with sub-centimetre accuracy. Using C-band data from three different satellites, the D-InSAR technique is used to calibrate a coupled groundwater flow and land subsidence numerical model. Additionally, D-InSAR results from different sensors are compared and contrasted. When comparing D-InSAR results with extensometers and water levels, a direct correlation is noticed. For all D-InSAR image pairs, large baselines, atmospheric effects, temporal decorrelation, and vegetative cover were limiting factors in obtaining a maximum number of usable interferograms. The total maximum subsidence for a point location in the valley between November 2003 and May 2008 is approximately 40 cm reaching a maximum total subsidence of over 2.0 metres since 1962. When contrasting the ENVISAT ASAR and RADARSAT-1 data, subsidence rates were similar yet the distribution had significant differences. Additionally, ENVISAT's shorter baselines led to more accurate results. [C5736]

"Forest parameters inversion using Polarimetric and Interferometric SAR data"

In this paper we discuss some aspects of the forest height estimation using Polarimetric and Interferometric (POLINSAR) SAR data. Three main issues limit the inversion of the POLINSAR coherence from repeat-pass POLINSAR systems: temporal decorrelation, terrain slope distortions and effects of wave penetration. We show

that, if temporal decorrelation is not severe, the distortions due to terrain slope can be removed and the wave penetration can be compensated using the predictions of the scattering simulator PolSARProSIM. A detailed procedure that applies to any POLINSAR data is presented and illustrated using ALOS/PALSAR data and the SRTM digital elevation model (DEM). [C5737]

"Quantitative study of the Eco-water indices based on remote sensing"

Eco-water is defined as a transformation of precipitation, which is deposited by vegetation layer, humiliated vegetation layer and soil layer. It plays an important role in the water-cycle system. As potential factors on Eco-water and Eco-water layer are different from one season to another, multi-temporal and multi-type remote sensing data, measured spectrum and the routine observation were applied to construct the indices for Eco-water and its inversion model. The four Eco-water indices, including Vegetation Canopy Interception Content, Vegetation Water Content Index, Soil Moisture Index and Eco-water Storage Index, were calculated. The results show that the RS information model can reflect the real soil moisture. The dissertation brings forward the Eco-water Remote Sensing quantitative study based on vegetation layer. The vegetation-based calculation model for Eco-water with quantitative remote sensing technology, which has been identified in the dissertation, possesses significant science affect and practical value; and it can not only advance the methods of Eco-environment study, but also promote the research on water-resources transformation and water-cycle, also enlarge the domains of remote sensing applications. [C5738]

"Forest parameter retrieval using a general repeat-pass polarimetric interferometric vegetation model"

This paper concerns forest parameter retrieval from multi-temporal polarimetric interferometric SAR data. A two-component polarimetric interferometric model, designed for geophysical parameter retrieval, is presented for volumetric media over the ground. It is founded on a scattering model based polarimetric decomposition and the random volume over ground (RVoG) PolInSAR inversion technique. For forest vegetation observed at L-band, this model accounts for the ground topography, canopy layer and total tree heights, mean wave attenuation in the canopy, tree morphology in the form of orientation distribution and effective shapes of the branches, surface scattering contribution, and double-bounce ground-trunk interactions. A parameter retrieval framework is developed for repeat-pass acquisitions which aims to estimate and to compensate temporal decorrelation. The parameter estimation performance is evaluated on real airborne L-band SAR data in the repeat pass mode. [C5739]

"Variable wind influence on InSAR imagery of forests"

The horizontal and vertical (3D) structure of Earth's forested ecosystems are of great significance to their ecological functioning and societal uses. An InSAR approach is one methodology whereby a forest's structure and height in particular can be successfully estimated. Critical to the successful estimation is a high correlation between multiple SAR images. Regardless of a forest's location on the Earth, wind can significantly alter a forest's appearance to an L-band SAR system and so decrease this necessary correlation. In order to investigate the wind-induced decorrelation, we have developed a model for the repeat-pass interferometric SAR response of a forested area taking into account wind effects. The simulation consists of multiple interconnected parts including static tree geometry's generation, a wind simulator to apply to a static tree, and an electromagnetic model to allow us to calculate the interferometric SAR response. The static tree geometry generation process generates a pseudo-random tree based on a given DNA file which specifies a species specific structure. This geometry is then modified by the wind simulator producing snapshots of tree-geometry as a function of time. Each snapshot is then used in the interferometric SAR simulator to synthesize the wind-blown geometry's InSAR response. Results present coherence as a function of wind speed and forest structure. An important feature of this research is the usage of a physically based realistic wind model that is based on measurements of wind effects on trees as well as realistic models of fluid flow and simple harmonic branch resonators. Allowing branches to bend and move out of the plane of the incident wind field enables our model to capture numerous features of a physical tree blowing in the wind. This realistic model is necessary for a realistic simulation of the effects that wind has on a given InSAR imaging system. [C5740]

"Data processing frame for airborne SAR prototype development"

Since 1993 The National Institute of Aerospace Technology (INTA) has been working on the Synthetic Aperture Radar (SAR) program based on airborne SAR prototypes with increasing complexity development. In this frame, flexible data processing tools are needed as ground support, to allow the complete prototypes operation. This paper outlines the data processing framework of Radar laboratory. High level SAR processing environment is described. Different tasks and developments built in SAR data processing are introduced in several tools (data

take campaigns design, performance assessment estimation, system configuration, product generation and data analysis). This group of tools performs the data processing core for the INTA SAR prototypes. New processing tools to cover specific needs for the new SAR prototypes developments in this laboratory are also introduced.

[C5741]

"Experiences in optical and SAR imagery analysis for damage assessment in the Wuhan, may 2008 earthquake"

The Sichuan Earthquake on the 12th of May 2008, and the extensive rescue operations following this tragic event, proved the value of high-resolution optical and radar remote sensing during the emergency response. Optical data provide a fast and simple way to value $\Gamma_{\text{B}i\text{at glance}}\Gamma_{\text{B}i}$ damages while radar sensors can deliver images independent of weather conditions, day and night, and thus in principle can represent a mean to obtain a damage map in the immediate aftermath of an event, providing precious information for intervention planning. On the other hand, SAR data is far more difficult to interpret than optical data both to the expert and non-expert. In this paper we present a case study of damage assessment on the Sichuan earthquake experimenting the use of very high resolution data from both worlds, discussing preliminary results and perspectives. [C5742]

"Evaluating VHF-band SAR autofocus algorithms using a forest backscatter model"

The objective of this paper is to assess the accuracy of an autofocus method developed for the Fast Factorized Back-Projection (FFBP) algorithm in simulated scenarios. We specifically address the question whether correlation measurements between subimages will suffice in the focusing process in one arbitrary merging step. A forest clutter model is used together with a model of the impulse responses to simulate two SAR sub-images of a forest. Correlation is used for sub-image matching and residual displacement errors are compiled using simulation. We conclude that the matching error increases with increased number of trees per resolution cell but can be restored with a larger image size in the correlation measurements. We also conclude that the autofocus method will be successful. [C5743]

"SBAS-InSAR analysis of surface deformation at Mauna Loa and Kilauea volcanoes in Hawaii"

We investigate the deformation of Mauna Loa and Kilauea volcanoes, Hawai'i, by exploiting the advanced differential Synthetic Aperture Radar Interferometry (InSAR) technique referred to as the Small Baseline Subset (SBAS) algorithm. In particular, we present time series of line-of-sight (LOS) displacements derived from SAR data acquired by the ASAR instrument, on board the ENVISAT satellite, from the ascending (track 93) and descending (track 429) orbits between 2003 and 2008. For each coherent pixel of the radar images we compute time-dependent surface displacements as well as the average LOS deformation rate. Our results quantify, in space and time, the complex deformation of Mauna Loa and Kilauea volcanoes. The derived InSAR measurements are compared to continuous GPS data to assess the quality of the SBAS-InSAR products. [C5744]

"Monitoring land subsidence within the Venice Lagoon with SAR interferometry on Trihedral Corner Reflectors"

Before the summer of 2007 58 square Trihedral Corner Reflectors (TCR) were installed in salt marshes within the Venice Lagoon where anthropogenic structures completely lack or few constructions are scattered at a distance from one another too large to reliably resolve the radar phase ambiguity on ERS and ENVISAT interferometric point target analysis. An optimal TCR network has been established taking into account the location of $\Gamma_{\text{B}i\text{natural}}\Gamma_{\text{B}i}$ point targets in ERS and ENVISAT SAR interferometric analyses and keeping to a value of about 1 km the maximum distance between the TCR or between an $\Gamma_{\text{B}i\text{artificial}}\Gamma_{\text{B}i}$ and the adjacent $\Gamma_{\text{B}i\text{natural}}\Gamma_{\text{B}i}$ reflectors. In this contribution we discuss the set-up of the TCR, their backscattering intensity response on ENVISAT ASAR and TerraSAR-X images, and the approach followed to measure the ground displacement in areas of particular interest within the Venice Lagoon. [C5745]

"Polarimetric SAR interferometry for forest application at P-band: Potentials and challenges"

This paper presents the impact of simulation parameters according to the potential future space-borne mission BIOMASS (P-band) in polarimetric and interferometric SAR (Pol-InSAR) inversion performance. Forest height inversion is obtained from the simulated data sets (bandwidth, NESZ and ambiguities) generated from DLR E-SAR (Experimental Synthetic Aperture Radar) airborne SAR data. For this study two campaign data sets (BioSAR 2007 / INDREX-II) have been selected and investigated. The several comparative results of Pol-InSAR between airborne data and the simulated data (incl. bandwidth, NESZ and range/azimuth ambiguities) will be shown and discussed. [C5746]

"Global atmospheric aerosol optical depth retrievals over land and ocean from AATSR"

Aerosol radiative forcing is a major unknown in climate modelling. Owing to the large spatial and temporal variability exhibited by atmospheric aerosol concentrations remote sensing is the only feasible way to obtain global measurements. The ATSR-2 (1995-2002) and AATSR (2002-) radiometer instruments together provide one of the longest available, well calibrated datasets of satellite radiance measurements. The algorithm presented here enables the retrieval of aerosol optical depths (AODs) from these data over a wide variety of surface types including ocean, vegetated land surfaces, and desert. This paper demonstrates the potential for retrievals based on ATSR-2 and AATSR data to reveal spatial and temporal signals in AOD from 1995 onwards. AODs based on AATSR data are validated against surface-based measurements and 6-year time series of regional monthly composites are presented. [C5747]

"Methods of analysis of atmospheric aerosols from future spaceborne high spectral resolution lidar data"

The limitations of single wavelength elastic scatter lidar with regard to retrieving various optical or microphysical properties of the observed aerosols are well known. Typical retrieval methodologies rely on elastic scatter information at at least two wavelengths, together with either temporally or geographically inferred estimates of the extinction-to-back-scatter ratio S_a , or aerosol model parameters which constrain the solution in such a way as to be consistent with the optical properties of commonly observed aerosol types. High spectral resolution lidars (HSRL) now facilitate unambiguous, direct measurement of aerosol extinction and backscatter profiles, greatly augmenting the level of information available for determining aerosol type or other relevant parameters. In this paper, we explore a methodology for using HSRL data at one wavelength to facilitate retrievals from traditional elastic scatter data at other wavelengths. Further, we extend the scope of the technique to improving aerosol models used to constrain retrievals from multi-wavelength elastic scatter lidars. We explore this methodology in the context of currently available HSRL technology as well as anticipated future spaceborne HSRL systems. [C5748]

"Mapping aurora activity with SAR-a case study"

Auroral physics is an exceedingly rich and complex subject. However, due to a lack of high resolution data of ionospheric activity during auroral events, not all phenomena in the high latitude ionosphere are fully understood. Recent research has proven that L-band SAR data is significantly affected by the ionosphere and can be used for mapping its activity. With this paper we will prove and unambiguously verify the potential of L-band SAR to capture auroral activity. We will present examples of aurora signatures mapped from ALOS PALSAR data and will verify the results from SAR with observations provided from ground based measurements. [C5749]

"Dependence of P-band interferometric height on forest parameters from simulation and observation"

GeoSAR is a unique dual-band, interferometric SAR (DBInSAR) sensor capable of collecting single-pass, X-band (VV) and P-band (HH) interferometric data simultaneously. In this paper we examine the dependence of the P-band HH interferometric phase centre height upon forest and terrain parameters. We develop a simple model for P-band GeoSAR observations, and use the model to show how the elevation in P-band HH phase centre height above true ground height is related to the volume-to-ground scattering ratio. GeoSAR is not fully-polarimetric, but records cross-polar (HV) returns at P-band (although not interferometrically). We conjecture that these returns are dominated by direct-volume scattering and related to the direct-volume HH backscatter. We use this relationship to model the dependence of the P-band HH DTM height upon the HV/HH ratio, and the difference in X-band DEM with P-band DTM heights. The relationships are examined using simulated forest InSAR data, and a model is proposed for ground-height and tree-height estimation using DBInSAR that does not require full polarimetry. [C5750]

"Improvement of bare surface soil moisture estimation with L-band dual-polarization radar"

This study demonstrates a new algorithm development for estimating bare surface soil moisture using dual-polarization L-band backscattering measurements. Through our analyses on the numerically simulated surface backscattering database by Advanced Integral Equation Model (AIEM) with a wide range of soil moisture and surface roughness conditions, we found that the relative difference of the overall surface roughness parameters at the different co-polarizations can be well estimated through a roughness index. This new finding leads to an algorithm on estimation of bare surface soil moisture. We will demonstrate the theory and techniques of this algorithm through the AIEM simulated database and validate it with two field ground scatterometer experimental data. The results indicate that bare surface soil moisture can be estimated quite well with only co-polarized backscattering signals. It provides a solid support for Soil Moisture Active and Passive mission (SMAP). [C5751]

"Operational approach for ship detection and classification"

The necessity to control all the activities within the marine environment is nowadays vital for most official authorities. Besides protecting the ecosystem and providing safety and surveillance along the transportation corridors, illegal immigration and sustainable economic activities are also issues to cover. Since early nineties, a lot of efforts have been devoted to develop monitoring systems based on transponders (VMS or AIS). Such systems use active on-board devices to track ship positions via satellite communications. Despite of their great performance, the experience has shown, however, that this approach does not have the required independency and other alternatives are necessary. Among them, the one gathering more benefits is the integration of remote sensing, specially Synthetic Aperture Radar (SAR), with operational transponders. Certainly, this solution provides redundancy, 7/24 and all-weather monitoring capability, independently from the targets to track. [C5752]

"An operational algorithm for snow cover mapping in hydrological applications"

An operational algorithm to produce snow cover maps from remote sensing data in the Italian Alps has been implemented in the framework of the Italian national project PROSA to contribute timely information to civil protection from floods and landslides. The algorithm can generate maps in presence of cloud cover by combining optical data from MODIS and SAR data from ENVISAT/ASAR. It has been validated on a wide area in North Italy by comparing the algorithm output with ground measurements. [C5753]

"Multifrequency theoretical simulations of backscattering from flooded areas"

This paper investigates the sensitivity of backscattering coefficient to variations of soil moisture and flooding for two kinds of crops, such as wheat and maize, and for deciduous forests. Investigations are based on model simulations at L and C band, VV and HH polarization. At L band, a significant sensitivity to flooding effects is observed for all vegetation covers. At C band, the sensitivity is still acceptable for wheat, while for maize it is present only in case of non uniform cover. For forests, the performance of C band is poor. [C5754]

"Advances in unsupervised ship detection with multiscale techniques"

This paper constitutes an example of analysis proving that new satellite borne full polSAR data is favorable for automatic ship detection purposes. In particular, this paper is based on a multiscale method for automatic ship enhancement based on the wavelet transform on single channel data and it proposes its extension to full polSAR images. Then, the enhancement of contrast of the ships with respect to the background sea reached with the method proposed is compared to that obtained by the classical polarization entropy. [C5755]

"INTA's developments for UAS and small platforms: QUASAR"

This paper will outline the objectives and mission, general features and roadmap and will give a brief description of the two main prototypes of QUASAR (Quicklook Unmanned Aerial SAR), the main project in Synthetic Aperture RADAR for small platforms carried out by the Spanish National Institute for Aerospace Technology. QUASAR is planned be released as a functional demonstrator in 2011 and as complete, operative and deliverable high resolution Ku-band SAR with ground segment station for mission planning, image formation and data exploitation system in 2013. [C5756]

"GPU-based framework for distributed interactive 3D visualization of multimodal remote sensing data"

Interactive visualization of remote sensing data allows the user to explore the full scope of the data sets. Combining and comparing different modalities can give additional insight. In this paper, we present a 3D visualization framework for interactive exploration of remote sensing data. Data from different modalities can be combined into a single view. The visualization can be distributed across multiple graphics processing units and/or hosts, allowing interactive exploration of remote sensing data in virtual reality systems. [C5757]

"Ship detection in the Brazilian coast using TerraSAR-X SAR images"

Extensive Brazilian coast and a growing up maritime vessel traffic lead to research better ancillary methods to control ship's flow. Orbital SAR imagery is an important tool, especially due to its ability to work day and night and clouds coverage doesn't interfere often. At present study, some well-known ship detection concepts are investigated, applying them to TerraSAR-X (TSX) ScanSAR images (16 m resolution), in VV and HH polarization. Statistical parameters are estimated and trough Kolmogorov-Smirnov test K-distribution fit to TSX images is checked. Algorithm detection based on Constant False Alarm Rate (CFAR) concept is applied and its

performance is verified. Incidence angle, CFAR's windows size and Probability of False Alarm (PFA) influence are further analysed. Finally, we discuss some operational issues about near-real-time image delivery and the delay impact on a surveillance system or on an urgency request. [C5758]

"Ship detection from polarimetric sar images"

SAR image from sea can constantly contain ships and their ambiguities in azimuth and range directions. For maritime applications, the ambiguities are visible due to their strong intensities in a low backscattering background of sea environment. Thus, the ambiguities can be often mistaken as ships and cause false alarms. Many approaches have been proposed for reducing the azimuth ambiguities in single channel SAR image. This paper analyzed scattering mechanisms of the azimuth ambiguities for PolSAR images and proposed a method for detecting ships from PolSAR images. By using eigenvector-eigenvalue decomposition, three eigenvalues can be used to differentiate ship targets, azimuth ambiguities and sea clutter. One C-band JPL AIRSAR polarimetric data have been chosen to evaluate the method. The experimental results show that the proposed method can effectively reduce false alarms caused by the azimuth ambiguities. [C5759]

"GRLT detection of moving target by along track SAR interferometric systems"

In this paper we consider the problem of the detection of a ground moving target using Synthetic Aperture Radar Along Track Interferometric (AT- InSAR) systems. We propose a method exploiting a Generalized Likelihood Ratio Test (GRLT) and based on a Gaussian model for the target response. We also derive the log-likelihood ratio probability density function in closed form, both in the hypothesis of presence of target and absence of target. Numerical results based on simulated data are presented. [C5760]

"SWIM: A state of the art multi-incidence beams Ku-band waves scatterometer to go beyond current radar systems"

The instrument SWIM (Surface Waves Investigation and Monitoring) on the CFOSAT program (Chinese French Oceanographic Satellite) is a state of the art radar for several reasons. At first, SWIM is the first ever space radar concept that is mainly dedicated to the measurement of ocean waves directional spectra and surface wind velocities through multi-azimuth multi-incidence observations. Orbiting on a 500 km sun-synchronous orbit, its multiple Ku-band (13, 575 GHz) beams illuminating from nadir to 10° incidence and scanning the whole azimuth angles ($0-360^\circ$) provide with a 180 km wide swath and a quasi global coverage of the world between -80 and 80° . Secondly, such a wide range of observations requiring high range resolution (about 20 m on the ground) have led to design an instrument whose architecture and technology goes beyond what has been done on altimeter and scatterometer systems. The global coverage and the reduction of telemetry budgets have required to perform onboard range compression. The variety of signals at different incidences, the impact of the complex moving geometry of observation and the required real-time signal processing have led to propose onboard complete digital range compression on backscattered 320 MHz bandwidth signals. Finally, multi-azimuth multi-incidence observations requirements have led to design a complex antenna subsystem that rotates at 6 rounds per minute while transmitting high power RF signals towards tunable directions. [C5761]

"A novel STAP algorithm using sparse recovery technique"

A novel STAP algorithm based on sparse recovery technique, called CS-STAP, were presented. Instead of using conventional maximum likelihood estimation of covariance matrix, our method utilizes the echo statistics on spatial-temporal plane, which is extracted from sample data of only ONE training range cell with Compressed Sensing techniques, to construct a new estimator of covariance matrix, and build the optimal detector based on it. Full description of CS-STAP is given. Numerical result on real data has provided the evidence for great potential of CS-STAP as a effective approach when clutter is non-stationary because it need much less training data compared with common STAP methods. [C5762]

"A linear Kalman filter approach for estimation of a vehicle's motion parameters using range-Doppler tracking and road information"

For the processing of ISAR images of curving vehicles, the accurate knowledge of the target position as well as the aspect angle rate is essential. Especially when the targets are non-cooperative, there are no measurements like GPS positions available. This paper presents a Kalman filter based algorithm which fuses radar measurements of distance and velocity in line of sight with road information. The result is a set of parameters containing target position, velocity and acceleration, each in Cartesian coordinates. The aspect angle can then be obtained by calculating the angle between target velocity vector and the slant range vector. [C5763]

"Atmospheric water vapor effects on spaceborne interferometric SAR imaging: Comparison with ground-based measurements and meteorological model simulations at different scales"

Spaceborne Interferometric Synthetic Aperture Radar (InSAR) is a well established technique useful in many land applications, such as monitoring tectonic movements and landslides or extracting digital elevation models. One of its major limitations is the atmospheric variability, and in particular the high water vapor spatial and temporal variability, which introduces an unknown delay in the signal propagation. On the other hand, these effects might be exploited, so as InSAR could become a tool for high-resolution water vapor mapping. This paper describes the approach and some preliminary results achieved in the framework of an ESA funded project devoted to the mitigation of the water vapor effects in InSAR applications. Although very preliminary, the acquired experimental data and their comparison give a first idea of what can be done to gather valuable information on water vapor, which play a fundamental role in weather prediction and radio propagation studies.

[C5764]

"Forest biomass retrieval from lidar and radar"

The use of lidar and radar instruments to measure forest structure attributes such as height and biomass are being considered for future Earth Observation satellite missions. Combined use of lidar sampling data and complete global coverage of L-band SAR data for vegetation 3D structure mapping requires some new data processing and fusion technologies. In this study, the potential information on biomass from a lidar waveform and the required lidar samples for reliable biomass estimation were investigated using both model and real data. First, the Laser Vegetation Imaging Sensor (LVIS) data was used to generate an above-ground biomass map of the study site. The map was considered to represent the true biomass of the area. Then random samples were taken from the biomass image and the correlation between biomass and co-located SAR signature was studied. The proper model was used to extend the biomass from lidar samples into all forested areas in the study area. The new biomass map was compared with the original biomass map derived from LVIS data. The results showed the potential of the combined use of lidar samples and radar imagery for forest biomass mapping.

[C5765]

"Forest parameter mapping based on lidar and SAR data"

Vegetation spatial structure including plant height, biomass, vertical and horizontal heterogeneity, is an important factor influencing the exchanges of matter and energy between the landscape and atmosphere, and the biodiversity of ecosystems. Estimation of boreal forest canopy height is an extremely urgent research because it is essential for understanding ecosystems changing by human activities and climate change. Data from lidar and radar contain information relevant to different aspects of the biophysical properties of the vegetation canopy. GLAS (Geoscience Laser Altimeter System) and ALOS PALSAR data were used to test the combined use of lidar samplings and radar images for canopy height and stand biomass mapping in our test area. The result showed that maximum tree height and biomass in gLAS footprints can be predicted by GLAS waveform data. By using these sampling data parameters retrieval models using SAR data only can be developed. These models were applied to the entire SAR image, and the results were assessed using large-scale forest inventory data.

[C5766]

"Boreal forest height estimation with SAR interferometry and laser measurements"

In this paper we summarize the results of FINSAR campaign, which was arranged to evaluate X- and L-band SAR interferometric and polarimetric SAR techniques for Boreal forest. The main emphasis of the work was on L-band polarimetric interferometry and forest height estimation. Also X-band interferometry and coherence tomography for X- and L-band, phase center height, extinction coefficient of forest and several other aspects of polarimetric interferometry were studied with help of ancillary measurements. Our results show that L-band polarimetric SAR interferometry can estimate well Boreal forest height. Also X-band interferometry shows good potential in height estimation. When accurate ground model is available, tree height can be estimated even by using one polarization interferometry. SAR appears to be more accurate in forest height measurement than forest inventory database, but not as accurate as laser measurement. [C5767]

"Directional wave spectrum estimation by SWIM instrument on CFOSAT"

SWIM is a Ku-band radar designed for wave directional spectrum estimation. This radar operates at six incidence angles (from 0° to 10°) with a complete azimuth scanning. SWIM is currently in Phase B (concept and design phase). In the preliminary design and associated performance analysis have been published taking into account the end of Phase A design. This paper is focused on the performance assessment of the SWIM instrument based on the new developments which occur during Phase B. In addition, major reviews have been carried out on the performance analysis. [C5768]

"SRAL, a radar altimeter designed to measure a wide range of surface types"

The SRAL (Sar Radar ALtimeter) instrument is the core instrument of the topography mission carried on-board the Sentinel-3 satellite which is to be launched in 2013. A detailed overview of this instrument (on-going C/D phase) is given in terms of mission requirements, architecture and modes, budgets/performances and equipments. [C5769]

"The relationship between radar backscatter cross section and ocean wave parameters at low incidence angles"

Using collocated data set of Tropical Rainfall Mapping Mission (TRMM) precipitation radar (PR) and buoy wind and wave measurements, we study the relationship between the Ku-band radar backscatter cross section ($\Gamma_{Bi}\Gamma_{B^\circ}$), radar incidence angle (Γ_{Bi}), the buoy measured near surface wind speed in 10m (U_{10}), significant wave height (SWH), wave steepness (Γ_{Bi}), and wave age ($\Gamma_{Bi}B_u$). Sensitivity analysis of those parameters shows there is a nodal point at incidence angle about $11\Gamma_{Bi}B^\circ$ for radar backscattering, which exhibits not only low sensitivity to wave parameters but also an overall low variability. Tabular empirical functions relating PR $\Gamma_{Bi}\Gamma_{B^\circ}$ to each single wave parameters for incidence angles from nadir to $18\Gamma_{Bi}B^\circ$ are developed. The dependence of $\Gamma_{Bi}\Gamma_{B^\circ}$ on a single wave parameter in a fixed incidence angle is not unique, so multi-parameter functions of PR $\Gamma_{Bi}\Gamma_{B^\circ}$ are also investigated. Those multi-parameter functions can be used to retrieve wave parameter from radar backscatter with other wave parameters measurements. An example of empirical tabular model function relating wave steepness to PR $\Gamma_{Bi}\Gamma_{B^\circ}$ in terms of Γ_{Bi} and U_{10} is firstly developed from collocated buoys and PR measurements. [C5770]

"SAR altimeter retracker performance bound over water surfaces"

This paper provides the theoretical limit for the performance of a Maximum Likelihood Estimation (MLE) DDA re-tracker for different Significant Wave Height (SWH) conditions based on Cramer-Rao Lower Bound (CRLB) analysis. [C5771]

"A radar suite for ice sheet accumulation measurements and near-surface internal layer mapping"

Many satellite, airborne, and in situ observations have been made to better understand the mass balance of the ice sheets. Satellite missions such as GRACE, ICESat, and Cryosat provide broad coverage, but are only capable of collecting data at relatively coarse temporal and spatial resolutions. Satellite observations alone are not sufficient to fully understand all mechanisms responsible for changes in the overall ice sheet mass balance. While these are sufficient over much of the interior of the ice sheet, to understand and model the dynamics of fast flowing glaciers and the margins of the ice sheet, finer resolution data are required. Airborne platforms, especially autonomous platforms, allow for key regions of the ice sheets to be measured with fine-resolution remote sensing instruments. These platforms provide more accurate ice thickness estimates, internal layer mapping, and ice-bedrock interface imaging. To address this gap in the observations, we are designing and developing an instrumentation suite to be deployed on crewed and uncrewed aircrafts. Here we will focus on two radars in the instrumentation suite: an accumulation radar and a radar altimeter. The altimeter will be capable of measuring surface elevation and near-surface internal layers to a depth of about 10 m. The accumulation radar will be capable of measuring internal layers to a depth of about 100 m. A previously developed 150 MHz radar depth sounder/imager will be used to map layers below 100 m, as well as the ice-bedrock interface. This radar is beyond the scope of this paper. Field data collection using these systems will be performed simultaneously, providing a fine-resolution characterization of the ice sheet from surface to bedrock. The altimeter provides annual and short-term information on the accumulation, while the accumulation radar provides information on the decadal scale variability. The depth sounder provides information on the century scale variability. Initial data collection occurred during the early spring 2009 Greenland field season; additional data collection will continue during future campaigns both in Greenland and Antarctica. System refinements will allow for this suite to be deployed on uncrewed aerial vehicles (UAVs), also being developed at the Center for Remote Sensing (CRSIS) at the University of Kansas. [C5772]

"Measurements of ocean wave spectra with vertical polarization X-band radar image sequences"

Ocean wave parameters, such as significant wave height, can be computed from wave spectrum. Ordinarily X-band nautical radar can produce the three dimensional wave number frequency image spectra from a time series of radar images with a 3-D FFT algorithm. The fundamental image spectrum is related to the surface wave spectrum by the modulation transfer function (MTF). To determine the modulation transfer function, the field experiment for vertically polarized X-band nautical radar is carried out at Zhangzi Island. This paper presents the results of an experimental study by in-situ data analysis with existing inversing modeling method aimed at

estimating the vertically polarized modulation transfer function, which can minimize the difference between the image spectra from radar images and spectra from buoy, and measuring the sea parameters using ocean wave spectra for two polarizations. [C5773]

"Chirp scaling based detection of moving targets in SAR images"

A moving target detection and high-resolution focusing scheme is presented for single-channel SAR systems. The moving target focusing is made of a bank of Chirp Scaling Algorithms (CSA), each one matched to a different along-track target velocity component, thus allowing to produce a high-resolution image of the target itself. The effectiveness of the proposed technique is shown with reference to a sample dataset obtained from a SAREX-92 image. [C5774]

"SAR interferometry and Speckle tracking approach for glacier velocity estimation using ERS-1/2 and TerraSAR-X spotlight high resolution data"

Glacier retreat and advance is general phenomenon in Himalayan region due to change in climatic conditions. For quantifying the global warming effects on local scale glacier system monitoring and estimating its dynamic geophysical parameters viz. movement and volume change are important. In this study glacier movement estimation is attempted in north western Himalayan region using spaceborne InSAR technique, which is based on preserving the coherence between two acquisitions of the same scene. It is observed that ERS-1/2 tandem data give high correlation over Gangotri glacier and Siachen glacier and movement in LOS direction is deciphered. However, with the use of SAR Speckle tracking method two dimensional (Azimuth and range directions) velocities of glaciers can be obtained. In this study attempt has been made to measure 2-D velocity components of Gangotri glacier. New generation TerraSAR-X (TS-X) high resolution spotlight mode (HS), single look slant range complex (SSCs) data of 28th August, 2008, 08th September, 2008, 19th September, 2008 and 30th September, 2008 are exploited for this study. Interferogram, coherence image and intensity image are generated. It is observed that Interferometric SSC data of 28th August, 2008 and 08th September, 2008 give some fringes outside glacier area and complete decorrelation is shown on the Gangotri glacier due to high movement of glacier. [C5775]

"Estimation of target motion and 3D target geometry using multistatic ISAR movies"

Inverse synthetic aperture radar (ISAR) is one of the radar techniques used to observe two-dimensional images of a remotely based target using radio waves. If we keep observing the target and consecutively generate multiple ISAR images, which we call ISAR movie, the target image varies considerably due to the motion of the target. The authors have proposed an algorithm for reconstructing three dimensional target shape from an ISAR movie; however, the algorithm requires a priori knowledge of the relative motion of the target. In this paper, we propose a novel method that estimates the relative motion and the three dimensional shape of the target using multistatic ISAR movie. [C5776]

"Time series of polarimetric and interferometric observations of TerraSAR-X data over rice fields in Spain"

The objective of this work is to investigate the coherent co-polarized behavior of rice plants during the growing stages and to explore their information content for rice monitoring at high frequencies recently available through new SAR satellite missions. Time series of dual-pol TerraSAR-X images have been acquired during the whole cultivation period over a rice site in Spain. Among different observations, the backscattering coefficients at HH and VV channels and the HH/VV ratio have confirmed to show a temporal variation that has a significant correlation with the development of the plants during the vegetative and reproductive phenological phases. In addition, the information content of the HHVV complex coherence and a dual polarimetric target decomposition is investigated and discussed. All the information layers investigated are contributing to the discrimination of rice fields from other crop types. Finally, interferograms computed with pairs of successive images (11 days separation) have been preliminary tested. [C5777]

"High resolution mapping of soil moisture by SAR: Data integration and exploitation of prior information"

Two different approaches to deal with the problem of estimating soil moisture content from SAR data in the presence of vegetation are presented. They exploit also the information about the biomass provided by ancillary optical data. The first method is suitable for sparse vegetation and is founded on the application of the well-known water cloud model. As for dense vegetation canopy, we have designed a model that expresses the variation of the component of the backscattering coefficient due to the soil characteristics as a function of the

variations of the measured backscattering coefficient and of the biomass, assuming the availability of a time series of radar and optical data. To carry out the soil moisture retrieval, a multi-temporal inversion algorithm, based on the Bayesian MAP criterion, has been developed. It integrates all the samples of the time series of SAR data corrected for the vegetation effects. The approaches were evaluated on two case studies; the first one concerning an ENVISAT/ASAR observation of an agricultural site located in Northern Italy. The second test was performed on the AirSAR data collected during the SMEX02 experiment. The comparison between the estimated soil moisture contents and the in situ measurements has given encouraging results. [C5778]

"Sea-clutter analysis at multiple wavelengths (L, C, X) for target-clutter contrast assessment in littoral waters"

This study is aimed at quantifying the statistics and nature of sea-clutter as seen from spaceborne platforms and assessing the target-clutter contrast in the Adelaide harbor area of South Australia. To this end a series of images in mixture of polarizations were collected over this area in typical wide area surveillance mode-ScanSAR single polarization images from TerraSAR-X, Dual-Polarization Wide Beam images from RadarSAT-2 and Full and Dual Polarization images from ALOS-PALSAR. Synchronized with the acquisitions (dawn/dusk orbit of SAR satellites) video over flights with a low light camera were performed to record the sea-state. AIS data was collected for the information on the larges vessels and meteorological buoy readings for surface wind, wave height and swell were noted. [C5779]

"A study of forest vertical structure estimation using coherence tomography coupled to a macro-ecological scattering model"

In this paper we combine a macro-ecology forest model with a numerical scattering code to estimate the vertical scattering profile of L-band penetration into forests. We use these simulations to show that structure has an important impact on interferometric coherence and hence on height retrievals based on single baseline polarimetric interferometry. We conclude with some suggestions for dual baseline extensions to allow for better height and structure estimation in future sensors. [C5780]

"A first validation experiment for a Multi-Chromatic Analysis (MCA) of SAR data starting from SLC images"

The Multi-Chromatic Analysis uses interferometric pairs of SAR images processed at range sub-bands and explores the phase trend of each pixel as a function of the different central carrier frequencies to perform absolute topographic measurements. The previous work on the subject has started demonstrating the practical feasibility of the technique by using a set of SAR data collected by the airborne AES-1 radar-interferometer and by focusing the sensor raw data. The present work verifies the reliability of MCA procedures starting from SLC images, tests the robustness of MCA methods with respect to the total processed bandwidth and, provides first indications on the use of TerraSAR-X satellite data. [C5781]

"Near real time oil spill detection and monitoring using satellite optical data"

Timely detection and continuously updated information are fundamental in reducing the ecological impact of the different sources of sea pollution. Satellite remote sensing, especially from meteorological platforms having a high temporal resolution and an easy data delivery, can be profitably used for a near real time sea monitoring. Recently, a new methodology for oil spill detection and monitoring, based on the general Robust Satellite Technique (RST) approach, has been proposed. This technique has shown, by using AVHRR Thermal Infrared (TIR) data, a good capability in automatically detect, with high level of reliability, oil spill presence. In this paper, such an approach has been exported for the first time to MODIS TIR data. Preliminary results obtained for an oil spill event occurred during Lebanon war in 2006, are shown and discussed. [C5782]

"Estimation of forest vertical sructure parameter by means of multi-baseline Pol-InSAR"

In this paper the impact of vertical forest structure on model based Pol-InSAR forest height inversion is discussed. For different scenarios appropriate extensions of the RVoG model are proposed and possible inversion schemata are suggested and validated against experimental data and ground measurements. [C5783]

"Building detection by fusion of optical and SAR features in metric resolution data"

In this paper, we propose to jointly use optical and SAR features issued from satellite images with metric resolution, to deal with the problem of building detection and height retrieval. In a first part, a process described in previous works for building boundary extraction, is briefly exposed and illustrated on a Quickbird urban scene. In a second part, the framework of fusion with SAR data is developed. After the steps of feature projection and

registration, a new method for building height estimation is proposed. This one is based on a Likelihood criterion optimization and is built on the scheme "height hypothesis characteristic areas generation energy minimization". Such an approach refers to the adequation between a potential building signature and the real signature, effectively present on the SAR image and defined by characteristic building areas such as layover, shadow, roof and ground/wall echo. This height retrieval process is tested on simulated and real (TerraSAR-X) data. [C5784]

"General framework on change detection in a sparse domain"

The paper presents a general framework for change detection in radar images, for an operational purpose and in the context of environmental monitoring. This framework is based on a processing which provides highly sparsifiable representations of data. This processing is called turbo-median and is a combination of the sample median robustness and the turbo principle for iteratively correcting errors. The turbo-median processing of a scene is an homogenized representation based on an iterative median and which consists in spreading the statistically more robust measurements of the scene under consideration over the size of the image representing this scene. It allows for reducing the change detection problem into the problem of detecting a signal, with unknown distribution, in additive noise. [C5785]

"The Orfeo Toolbox remote sensing image processing software"

Orfeo Toolbox, OTB, is a remote sensing image processing library developed by CNES, the French Space Agency. OTB is distributed as open source software and is therefore available for any remote sensing scientist or processing chain developer. This paper describes the main features of OTB, how it can be used and the expected evolutions in the coming months. [C5786]

"Edge-preserving classification of high-resolution remote-sensing images by Markovian data fusion"

Very high spatial resolution (HR) data provide plenty of detailed information about the ground on a regular basis for applications such as urban planning, precision farming, or damage assessment after environmental disasters. The complex nature of HR observations, especially when acquired over urban/artificial environments, makes the accurate discrimination of distinct thematic classes a difficult task. In the present paper, a novel technique is proposed for supervised classification of multispectral HR images, based on the key-idea to fuse through a Markov random field (MRF) the information conveyed by user-defined thematic classes, subclasses related to the spectral responses of different ground materials, and spatial edges. The method is validated by experiments on IKONOS images. [C5787]

"A web application with visual SAR processor for education"

In this paper, a web application with a visual SAR processor is proposed in consideration of educational use and computer system environment. A system structure of the web application employs Ajax technology and object oriented software components. The main window of a client computer consists of view area, scene selection tab, tool panel, vertical and horizontal scroll bars. The processor can generate intermediate complex and map-projected images from raw SAR data using the range-Doppler method. An example of the educational use is demonstrated by compositing orthorectified images generated from a pair of ALOS PALSAR data observed by ascending and descending orbits. [C5788]

"GSOC's Scatterometry GNSS receiver for ocean remote sensing: Design and initial results"

The department of Space Flight Technology at the DLR's German Space Operations Center (GSOC) is currently developing a new Reflectometry/Scatterometry GNSS receiver for ocean remote sensing. This new instrument is being designed to be used in several conditions ranging from terrestrial applications to spaceborne GNSS experiments. One of its key features is the ability to compute at different scales a Delay Doppler Map (through time multiplexing the Doppler space) on one reflection event at a time using a 3ГfB—3 fully digitally steerable antenna array. Another feature is to perform digital beamforming of the incoming downconverted digitized GPS signal after IF carrier and C/A demodulation. This significantly reduces the technical requirements and costs of the analog RF front-end chain and the computation bandwidth at the FPGA respectively. A prototype version of this Scatterometry GNSS receiver is being developed as a proof of concept, using the Namuru II board as development platform. [C5789]

"Antenna pointing measurement for spaceborne SAR based on sign-MLCC algorithm"

Dual-antenna single-pass synthetic aperture radar interferometry needs alignment of both antenna beams to achieve the best interferometric performance. Meanwhile, geosynchronous synthetic aperture radar, potentially

used for global earthquake prediction and many other attractive applications, also requires antenna pointing control system to steer the radar antenna to illuminate desired territory, otherwise, even slight deviation from ideally boresight direction can cause a great variation of footprint position, because of the large slant range from the radar to mapped area. In principle, it is possible to measure antenna pointing information directly; however, measurement uncertainties will limit the accuracy. Thus it is feasible to resort to received radar data to measure the antenna pointing. This paper concentrates on the antenna pointing measurement using onboard Doppler centroid estimator, and furthermore, to drive pitch and yaw angles to steer the antenna pointing. In order to realize real-time onboard processing, a novel Doppler centroid estimation algorithm, called sign-MLCC, is presented here, utilizing the phase information of the received signal and the arcsine law by analyzing the sign alone, then evaluation of the algorithm is discussed. Finally, simulations are shown to prove the validity and reliability of the proposed method. [C5790]

"Flood disaster monitoring with ALOS/PALSAR observation"

We investigate an effective algorithm to identify flood-inundated area with ALOS/PALSAR observations. Radar cross section from water surface is generally smaller than that from ground surface without water, which derives larger differences of radar cross section in flood-inundated area because there is no water in this area before disaster. Variances of differences in $3\sigma_B$ —3 pixels are also enough to identify flood-inundated area, and more effective algorithm to identify flood-inundated area will be obtained by taking radar cross section differences and variances of differences into account. [C5791]

"ALOS-PALSAR polarimetric SAR data to observe sea oil slicks"

In this study an electromagnetic approach is proposed for exploiting polarimetric information for sea oil slick observation in L-band ALOS PALSAR full polarimetric SAR data. The problem is tackled from an electromagnetic viewpoint by describing the sea surface scattering mechanism with and without oil slicks. Following this rationale, a filtering technique, based on the Mueller scattering matrix, is applied to detect oil slicks in full polarimetric SAR data. Successively, the filtering results are verified by the analysis of the slick-free and slick-covered pedestal height and polarimetric entropy (H). Experiments, accomplished on a meaningful set of Level 1.1 L-Band ALOS PALSAR full polarimetric data, demonstrate the effectiveness of the proposed approach. [C5792]

"Speckle reduction and edge detection for TerraSAR-X single-look dual-polarization imagery"

Preliminary work on speckle reduction and edge detection of TerraSAR-X single-look dual-polarization (HH and VV polarizations) spotlight data is reported. A speckle reduction approach is introduced based on a beta-distributed sample squared radius. The performance of the speckle reduction approach was benchmarked against the boxcar filter and assessed with respect to the degree of speckle reduction, radiometric preservation as well as image feature retention. For detecting edges in TerraSAR-X single-look dual-polarization speckled imagery, a constant false alarm rate (CFAR) detector is presented in this paper based on the Wilks' lambda. The applicability of the edge detector for TerraSAR-X single-look single-polarization intensity data is also discussed. [C5793]

"Automatic target recognition of aircraft models based on ISAR images"

In this paper, we present a system for aircraft automatic target recognition (ATR) using inverse synthetic aperture radar (ISAR) and based on knowledge discovery from data process adapted to radar domain. We propose a method for target shape extraction from ISAR images based on the combination of two methods, SUSAN modified and active deformable contours via level set. In the second part of this work, we propose to fuse two commonly used shape descriptors algorithms based on moments invariant and Fourier descriptors. We have investigated the impact of the information fusion on the recognition rate. The classification scheme is ensured using support vector machine (SVM) classifier. Several combination strategies are compared at score/decision/feature level. Experimental results of the proposed method are provided and discussed. [C5794]

"Comparison with L-, C-, and X-band real SAR images and simulation SAR images of spilled oil on sea surface"

In recent years, the oil spill detection over sea surface and similar oil material filtration are attracting much attention from the ecological point of view, and synthetic aperture radar (SAR) is considered as an effective way of monitoring such phenomenon due to the day-and-night and all weather observation capability. In this paper, results of the oil slick detection experiment by multi-frequency space borne SARs are reported. On December 7, 2007, an oil tanker was wrecked in the Yellow Sea off the Korean west coast, spilling over 12, 000 tons of crude oil, and causing considerable damage on the coastal environment. In order to analyze the impact of the oil spill, we acquired 4 sets of multi-frequency spaceborne SAR images, including TerraSAR-X X-band data, ENVISAT

ASAR and RADARSAT-1 C-band data, and ALOS-PALSAR L-band data. We also computed, as a preliminary study, the backscatter radar cross section (RCS) based on the physical optics model at three microwave frequencies for different wave damping ratios by oil slick. In this paper, we describe the present status of the study on oil slick detection, and suggest the possible future direction to be taken. [C5795]

"Automated information extraction from high resolution SAR images: TerraSAR-X interpretation applications"

High resolution remote sensing SAR images-such as the image data acquired by the German TerraSAR-X mission-contain a variety of details that have to be extracted by automated processing in order to fully exploit and understand the image content. In particular, the interpretation of man-made structures that are typical of built-up or agricultural areas poses a number of challenges including parameterized image focusing during routine processing, careful despeckling, descriptor and feature extraction, and final classification including specific scattering and 3D effects. Therefore, we propose a set of general sequential as well as dedicated application-dependent processing steps that allow user-oriented classification of high resolution SAR images. We will also report on actual classification results and experiences. [C5796]

"Comparison of precipitation effects in space-borne X- and Ka-band SAR imaging"

As the operating frequencies of SAR-systems are increasing, the visible distortions due to precipitation in SAR-images are becoming more frequent. This holds especially for the case of convective rain events. The German space-borne satellite TerraSAR-X has delivered a series of measurement examples, which were used to study precipitation effects in SAR-images. Based on these valuable data takes and simultaneous weather radar measurements, a quantitative estimation of precipitation effects in SAR-images is presented. In a further step, an attempt is made to extrapolate the observed effects to systems operating at higher nominal frequency-bands, i.e. Ka-band, being taken under consideration for future SAR-systems. [C5797]

"Modelling and analysis of rain effect on Ka-band single pass InSAR Performance"

The adoption of Ka-band for performing SAR interferometry is considered very promising since it could provide the possibility to embark the full instrument within a single satellite. However, one of the major concerns of the effectiveness of spaceborne Ka-band radars is the impact of the atmosphere, and, in particular of precipitation on the instrument performance and availability. This paper analyzes the impact of precipitation on the performance of Ka-band across-track InSAR. In order to assess the rain impact on the InSAR random height error, the paper proposes an extended form of the interferogram coherence. The paper shows that, for the reference instrument configuration investigated, a random height error compatible with HRTI-3 specification can be met under moderate rain condition. [C5798]

"Space-borne high resolution tomographic interferometry"

SAR tomography (TomoSAR) is a way of overcoming the limitations of standard 2-D imaging by achieving focused 3D images. Its capability of 3-D reflectivity reconstruction and multiple scatterers separation has been demonstrated in the urban environment in absence of significant deformation. In this paper, an example which reveals the distortion of 3-D reconstruction result by coupled deformation information is presented. Differential SAR Tomography (or 4-D SAR focusing), a new interferometric mode crossing differential SAR interferometry and the 3-D multi-baseline tomography concepts, are implemented. In this paper, space-borne high resolution differential SAR tomography is demonstrated using TerraSAR-X high resolution spotlight data. High resolution SAR is proven to be very attractive for city mapping. [C5799]

"RADARSAT-1 deformation time-series analysis based on the SBAS-DInSAR algorithm"

We extend the Small Baseline Subset (SBAS) algorithm to generate deformation time-series from SAR data acquired by the Canadian Space Agency (CSA) RADARSAT-1 sensor. The proposed approach is mostly oriented to the investigation of large scale deformation events with relatively low spatial resolutions (of about 100 ГрВ— 100 m), and is based on the use of conventional multi-look interferograms with small temporal and spatial baseline separations. With respect to the original SBAS approach, several improvements are required to take into account the inaccuracies on the knowledge of the RADARSAT-1 orbital parameters, and of the significant fluctuations of the dop-pler centroid values over each single SAR scene. This work is aimed to present the first results achieved by applying the implemented RADARSAT-1 SBAS processing chain to an archive of SAR scenes, acquired in the time interval from 2000 to 2003 over, and relevant to the Hawaii Island area. The presented results markedly confirm the effectiveness of the implemented RADARSAT-1 SBAS processing chain. [C5800]

"Use of radar images for the development of a propagation oriented space-time rain model"

The propagation of electromagnetic waves through the atmosphere at frequencies above 10 GHz is strongly influenced by oxygen, water vapor, clouds and, even more heavily, by rain. The scarcity of worldwide reliable rainfall data has pushed towards the development of models that could adequately reproduce real rain fields. This contribution presents the analysis of some spatial and temporal characteristics of rain cells for rainfall modeling purposes, based on an extensive database of weather radar images. The results obtained in this study are of key importance in the development of advanced cellular space-time rainfall models. [C5801]

"Fusion of multisource data sets from agricultural areas for improved land cover classification"

An approach for spectral-spatial classification of multisource remote sensing data from agricultural areas is addressed. Mathematical morphology is used to derive the spatial information from the data sets. The different data sources (i.e., SAR and multispectral) are classified by support vector machines (SVM). Afterwards, the SVM outputs are transferred to probability measurements. These probability values are combined by different fusion strategies, to derive the final classification result. Comparing the results based on mathematical morphology the total accuracy increased by 6% compared to the pure-pixel classification results. Moreover the transfer of the SVM outputs into probability values and the subsequent fusion further increases the classification accuracy, resulting in an accuracy of 78.5%. [C5802]

"Fusion of high resolution optical and SAR images with vector data bases for change detection"

This paper addresses the issue of cartographic database creation or update using high resolution SAR and optical images. In cartographic applications, objects of interest are mainly buildings and roads. This paper proposes a processing chain to update building databases. The approach is composed of two steps. First, the presence of each database object is checked in the images. Then, we verify if objects coming from an image segmentation should be added in the database. To do those two steps, features are extracted from images in the neighborhood of the considered object. The object removal/inclusion in the database is based on a score obtained by the fusion of features in the framework of Dempster Shafer evidence theory. [C5803]

"Toward a GUI remote sensing environment built over OTB"

The need for fast and reliable remote sensing algorithms is continuously growing. Remote sensing libraries are scarce and sometimes are difficult to use. The Orfeo Toolbox (OTB) is one such library that stands apart with its robust development scheme and programming concepts. Not all remote sensing researchers have a strong programming background. Programmers need to find ways of giving easier access to desired algorithms without the need of cumbersome programming overhead. This paper compares the actual parameter management class of OTB with a proposed dynamic graphical interface to replace it. The programming concepts used will first be presented. This work will lead to creating a visual programming environment for OTB. [C5804]

"Overview of the PolSARpro V4.0 software. the open source toolbox for polarimetric and interferometric polarimetric SAR data processing"

The objective of this paper is to make a review of the current status of the PolSARpro v4.0 Software (Polarimetric SAR Data Processing and Educational Toolbox), developed under contract to ESA by a consortium comprising I.E.T.R at the University of Rennes 1, AELc, DLR-HR and Dr mark Williams from Adelaide. The objective of this current project is to provide Educational Software that offers a tool for self-education in the field of Polarimetric SAR data analysis at University level and a comprehensive suite of functions for the scientific exploitation of fully and partially polarimetric multi-data sets and the development of applications for such data. The PolSARpro v4.0 Software establishes a foundation for the exploitation of Polarimetric techniques for scientific developments and stimulates research and applications developments using PolSAR and PolInSAR data. [C5805]

"FullAnalyze: A Research tool for handling, processing and analyzing full-waveform lidar data"

Full-waveform (FW) lidar systems provide range profiles of the Earth topography. They are acquired from airborne platforms or from satellites. Many applications derive from the use of such data, from the extraction of 3D point clouds to the inversion of vegetation profiles. Nevertheless, handling range profiles is much more difficult than handling 3D point cloud. The aim of this paper is to present a research tool based on opensource libraries that can process and visualize such data. We focused our work on the implementation on the 2D/3D interface that gives the possibility to visualize the interaction between the lidar electromagnetic waves and the Earth topography. Moreover, this tool integrates several processing steps of FW Lidar data. [C5806]

"An evaluation of PolSAR speckle filters"

Speckle suppression in PolSAR images is an important step for the extraction of meaningful information from PolSAR images, especially for homogeneous extended targets. It has been shown that insufficient noise filtering resulting in low equivalent number of look (ENL) values will increase bias on incoherent polarimetric parameters such as the Cloude-Pottier parameters. In addition, meaningful high-frequency information, such as edges and point targets must be preserved. Adaptive filters have been the most successful in reaching a good compromise between noise suppression and detail preservation. A large set of artificial PolSAR images, which ground truth are realizations of Markov random fields, has been generated. Performance metrics are focusing on speckle suppression (ENL), edge preservation, relative errors on polarimetric parameters and point target preservation. [C5807]

"Integration of RADARSAT-2 ScanSAR and AWiFS for operational agricultural land use monitoring over the Canadian prairies"

Agriculture plays an important role in the global economy, and sustainability of this sector is critical for world food security. Annual information on agricultural land use (crop inventory) would permit efficient and effective delivery of agricultural programs that support sustainability of this resource. Previous research has revealed encouraging results on using space borne satellite data (Landsat, SPOT) for crop mapping at the regional scale. Given Canada's large land mass, for operational crop monitoring satellite data with a wide swath and moderate spatial resolution are needed. This study presents the results on integrating RADARSAT-2 ScanSAR data with AWiFS data to improve crop identification. This study demonstrates that multi-temporal AWiFS data can produce an adequate crop classification, with an overall accuracy of 83%. The addition of ScanSAR data increases the overall classification accuracies. The radar contribution is most pronounced during the earlier season. [C5808]

"CSIR-NLC mobile LIDAR-first scientific result"

In this paper, we present the obtained first scientific results from CSIR-NLC mobile LIDAR (Light Detection And Ranging) and its validation/comparison with other ground and space-borne measurements. The LIDAR results are compared using aerosol measurements from the Stratosphere Aerosol Gas Experiment (SAGE) and Optical depth derived from sun-photometer employed under AEROSOL ROBOTIC NETWORK (AERONET). [C5809]

"The effect of orientation angle compensation on polarimetric target decompositions"

The orientation angle of scattering media affects the polarimetric radar signatures. This paper investigates the effect of orientation compensation on polarimetric target decompositions including Pauli decomposition, Freeman and Durden decomposition and Yamaguchi decomposition. The Cloude and Pottier decomposition is excluded, because entropy, anisotropy and alpha angle are rotational invariant. We will show that after the orientation compensation, the volume scattering power is consistently decreased, while the double bounce power has increased. The surface scattering power is relatively unchanged, and the helicity power is rotational invariant. All these characteristics can be explained by the compensation effect on the nine elements of the coherency matrix. This analysis reveals that, contrary to the general perception, the 4-component component decomposition by Yamaguchi et al. does not use complete information of the coherency matrix. Only six quantities are included-one more than the Freeman/Durden decomposition under the assumption of refraction symmetry. [C5810]

"Airborne D-InSAR at X-band: Results with the complete repeat-pass processing methodology"

This paper presents the interferometric airborne repeat-pass mode results at X-band after applying a complete residual motion compensation (MoCo) strategy. The data were acquired, over the Perugia area, Italy, by the OrbiSAR sensor from OrbiSat, Brazil, and the first X-Band D-InSAR results were published, where a space-invariant topography-dependent MoCo was applied after focusing with smoothed elevation model. Now, in this paper, we apply to the same X-band data the precise topography- and aperture-dependent (PTA) MoCo and the weighted phase curvature autofocus (WPCA) to account for high-order residual motion errors. We compare the differential interferograms and coherence map obtained after PTA-WPCA to the formerly results. The results show improvement in the interferometric accuracy after PTA-WPCA processing. The need of such complete processing chain for narrowband systems is discussed. [C5811]

"SAR tomography from sparse samples"

Three dimensional (3-D) Synthetic Aperture Radar (SAR) image formation provides the scene reflectivity estimation along azimuth, range and elevation co-ordinates. For 3-D image focusing multiple signals, acquired along different orbits, are required. The practical application of the focusing methods requires that non-uniformly spaced acquisition orbits have to be considered. In this paper we propose a technique exploiting the

Compressive Sampling theory, and assuming that the image to be focused has a sparse representation along the elevation directions, which amounts to suppose that only few point-like scatterers with different elevation are present in the same range-azimuth resolution cell. Numerical results on simulated data show the good performance of the method. [C5812]

"Analysis and observation of polarimetric scattering behavior in wetland area"

This paper proposes a simple monitoring technique for water area change in wetland environment based on POLSAR image analysis. From the results of the image analysis by utilizing fully or quad. polarimetric SAR data set, it is found that strong double-bounce scattering can be observed at the vicinity of the boundary region between water area and the surrounding emerged-plants area. This peculiar scattering feature is utilized as a useful marker for estimating the water area change. To verify the generating mechanism of the double-bounce scattering, the Finite-Difference Time-Domain (FDTD) polarimetric scattering analysis is also carried out for a simplified water-emergent boundary model. The dependency of the polarimetric scattering feature on the variation of the radar incident angle, the change of the biomass and material parameters of the surrounding emerged-plants is investigated. Resultantly, it is confirmed from the detailed FDTD analysis that by using the proposed technique, one can estimate the true water area change in wetland and its surrounding area in all seasons. [C5813]

"Multi-resolution target scattering decomposition for urban feature characterization using polarimetric SARs"

Urban areas include features (buildings) of coherent scattering as well as areas such as parks that manifest partially coherent scattering due to the significant natural variability in the scattering properties. While high-resolution coherent target decomposition (CTD) can be used for characterization of buildings, incoherent target scattering decomposition (ICTD) is more suitable for analysis of partially coherent targets [11]. In contrast to CTD, ICTD preserves the polarimetric information of the latter at the expense of the requirement for use of coarse-resolution for unbiased estimation of ICTD parameters [9]. The Touzi decomposition [10], [15] permits a unified roll invariant decomposition of both coherent and partially coherent scattering. In this paper, a multi-resolution technique is introduced to adapt the Touzi decomposition to the coherence nature of target scattering. The multi-resolution mixture CTD-ICTD decomposition is validated using polarimetric Convair 580 SAR data collected over Ottawa city. Implications on the use of the new multi-resolution decomposition for the unified analysis of coherent and partially coherent target scattering are discussed. [C5814]

"Recent advances in fully polarimetric space-SAR sensor design and its applications"

With the un-abating global population increase our natural resources are stressed as never before, and the global day/night monitoring of the terrestrial covers from the mesosphere to the lithosphere becomes all the more urgent. Microwave radar sensors are ideally suited for space imaging because those are almost weather independent, and microwaves propagate through the atmosphere with little deteriorating effects due to clouds, storms, rain, fog and haze. Globally humidity, haze and cloudiness are increasing at a rather rapid pace, whereas only 20 years ago all of those covered only 48% of the globe, today those have increased to about 62% and within another 20 years may exceed 80% for irreversible reasons; thus optical remote sensing from space especially in the tropical and sub-tropical vegetated belts will become rather ineffective, and microwave remote sensing technology must now be advanced strongly and most rapidly because operationally it is more rapidly available especially for disaster mitigation assistance. [C5815]

"Vehicular communication and safety in realization of intelligent transport system"

Attempts are made in realization of the trend noticed for smart vehicle in terms of vehicular safety and communication. A Doppler radar is established at the Laboratory and tested on road for vehicular detection. In order to improve the detection performance further and more meaningful, range, classification of vehicles, angle of arrival information are also required to be measured. Additionally communication part is also embedded into the system. The embedded system design is almost finalized. The end to end simulation efforts are going on. Parts of the implementations are also tried. With this kind of challenging efforts, the authors will like to converge two important fields of electronics 'remote sensing' and 'mobile communication' together in intelligent vehicular operation. [C5816]

"AILA-2009 and its Effects on VLF sferics"

On May 25, 2009, remarkable effects on the recording on VLF sferics over Kolkata (latitude: 22.56° N, longitude: 88.5° E) at 3 kHz and 9 kHz are observed due to severe cyclonic storm, Aila, followed by severe thundershowers and lightning. The results and analyses of the recorded data along with other characteristics will

be presented in this paper. [C5817]

"Recent advances in radio environment for radio communication in India"

The estimation performance of radio communication and radar propagation with high degree of accuracy is possible provided the results of radio environment are also available with good degree of accuracy. There are advancements on such results both for ionized and non ionized media due to the availability of sophisticated and computer controlled with data archive facility systems. Measurements of various both ionospheric and tropospheric parameters have been carried out as well as deduced by using various such measuring systems. In this presentation the research efforts carried out in recent years in India both in relation to studies on ionospheric dynamics for ionospheric communication and radio climatology both for clear air and precipitation, propagation characteristics involving fixed (terrestrial line of sight and over the horizon) and mobile and marine communication as well as attenuation of radio wave due to water vapour, rain and cloud in the area tropospheric communication have been highlighted. [C5818]

"Random Hypersurface Models for extended object tracking"

Target tracking algorithms usually assume that the received measurements stem from a point source. However, in many scenarios this assumption is not feasible so that measurements may stem from different locations, named measurement sources, on the target surface. Then, it is necessary to incorporate the target extent into the estimation procedure in order to obtain robust and precise estimation results. This paper introduces the novel concept of Random Hypersurface Models for extended targets. A Random Hypersurface Model assumes that each measurement source is an element of a randomly generated hypersurface. The applicability of this approach is demonstrated by means of an elliptic target shape. In this case, a Random Hypersurface Model specifies the random (relative) Mahalanobis distance of a measurement source to the center of the target object. As a consequence, good estimation results can be obtained even if the true target shape significantly differs from the modeled shape. Additionally, Random Hypersurface Models are computationally tractable with standard nonlinear stochastic state estimators. [C5819]

"Design of IIR filters for a limited number of samples with optimum dynamic frequency responses"

This paper presents a new design method for optimum clutter IIR filters when projection initialization is used. This method minimizes the mean squared-error between the steady-state and the dynamic frequency responses. The designed filters offer better dynamic frequency responses for a given number of samples when compared to steady-state filters without initialization or with projection initialized filters. The improvement is achieved by redesigning the filter's feedback coefficients to minimize the mean squared-error for a given number of samples. New clutter filters were successfully designed for processing different numbers of samples and their performances were studied by comparing their dynamic frequency responses with the desired steady-state frequency responses. [C5820]

"Improved analysis of spaceborne radar signals using wavelet-based techniques"

Tropical Rainfall Measuring Mission (TRMM) is an Earth Observing System (EOS) that is considered as a successful exploratory mission performed by American Nation Aeronautics and Space Administration (NASA) and Japanese National Space Development Agency (NASDA). It provides a lot of environmental information that help reducing human affects on the Earth's environment (e.g. global warming). TRMM Precipitation Radar (PR) is the first spaceborne radar that provides 3D reflectivity observations. Because of the nature of its extensive measurements variability over time and space, wavelet transform is a well-suited technique that can be used to analyze space radar data. This technique is a focused transformation in space and frequency. Bright band (BB) is an atmospheric layer with a very high radar reflectivity. It can be detected by using Multi-Resolution Analysis (MRA). Its detection can assist in precipitation classification (i.e. stratiform or convective). A modern convective-stratiform partitioning scheme is developed using wavelet transform analysis to make best use of cloud structure determined by radar reflectivity. [C5821]

"Particle filter algorithm for tracking manoeuvring target using FM signal"

In order to introduce the particle filter techniques in the passive radar detection and tracking, we present in this correspondence a comparison between classical technique of tracking that uses a maxima search in the range/Doppler grid-space, and then estimates the target position using an extended Kalman filter and a proposed particle filter that uses directly the correlation output. The passive radar receives the signals of FM stations that propagate and reflect on a manoeuvring target. [C5822]

"A novel speech-like symbol design for data transmission through GSM voice channel"

This paper introduces a new approach to design speech-like (SL) symbols in order to transmit digital data through global system for mobile communications (GSM) voice channel. Using these symbols leads to design a GSM voice channel data modem to modulate and demodulate data on enhanced full rate voice codec. Designing a set of time-symbols is an offline procedure with the aim of minimizing symbol detection error. This modem could be useful in the situations where real-time data communication with high priority is needed. Data is encoded into SL symbols to be transmitted through GSM voice channel. At the receiver side, the received SL symbols are decoded back to data. We present a full procedure of symbols design and implement it in a real system. We achieved a bit rate of 2 kbps with 1.5 ГрB— 10-5symbol error rate (SER) using the proposed method. [C5823]

"Parameters estimation for multicomponent LFM signals using EMD based fractional Fourier transform"

This paper have focused on the parameter estimation for multicomponent linear frequency modulation (LFM) signals using EMD based fractional Fourier transform. The proposed method iteratively decomposes the multicomponent LFM signals into monocomponent LFM signals and applies fractional Fourier transform (FRFT) to each LFM component, which is a mapping from the time domain to the fractional Fourier domain. Then the LFM component is detected and the parameters are estimated in terms of the maxima and their locations in the fractional Fourier domain. Simulations show that the proposed method can not only achieve high estimation accuracy but also suppress the corss-terms introduced in other time-frequency distributions (TFDs). [C5824]

"Detection and parameter estimation of multicomponent LFM signals based on Hilbert-Huang Hough transform"

The aim of this paper is the detection and parameter estimation for multicomponent linear frequency modulation (LFM) signals based on Hilbert-Huang Hough transform of the signals. The proposed method iteratively decomposes the multicomponent LFM signals into monocomponent LFM signals and applies Hilbert-Huang Hough transform to each LFM component, which is a mapping from the time domain to the parameter domain. Then the LFM component is detected and the parameters are estimated in terms of the peaks and their locations in the parameter domain. Simulations show that the proposed method can not only achieve high estimation accuracy but also reduce the pseudo interference component. [C5825]

"Doping profile effect on picosecond lasing of an internally Q-switched, high-power laser diode"

The recently demonstrated high-power (50W from a 20μm stripe) picosecond (30ps) lasing from a laser diode has led us to address the internal Q-switching phenomenon, discovered four decades ago and not yet fully understood. We found that the realization of a nanosecond or picosecond mode in a diode depends on the doping profile across the structure. [C5826]

"DSP embeded hardware for non-contact bio-radar heart and respiration rate monitoring system"

In this paper, we designed embedded-type noncontact bio-radar heart and respiration rate monitoring system. We implemented the hardware for arctangent combining, filtering and rate finding algorithm into the embedded system. We tested the hardware and compared it with the reference ECG measurements. Obtained results agree well with the ECG measurements. We propose arctangent demodulation for quadrature channel combining. Using Texas Instrument C6000 series DSP and external 12 Bit ADC, we implemented elliptic digital filter and detection algorithm for robust commercial hand held device. [C5827]

"Study on MIMO radar detection performance"

Multiple input multiple output (MIMO) radar is a new radar technique. It has many advantages over conventional phased radar in many ways such as anti-intercept of radar signal, low velocity target detection, and resolution. In this paper, we analyze the signal model and signal processing for MIMO radar. And we compare the SNR of MIMO radar with that of conventional phased array radar. It can be seen that the SNR of MIMO radar is the same as that of phased array radar. [C5828]

"Classification of convective and stratiform types of rain and their characteristics features at a tropical location"

The effect of rain attenuation in high frequency signals need proper understanding of the variation of drop size distribution (DSD) separately in convective and stratiform rain due to different characteristics. This paper presents

the analysis of variation of vertical rain rate profile for these two types from micro rain radar observations as well as the variation of DSD at ground using disdrometer, of an event observed over Ahmedabad. The bright band signature in vertical rain rate profile is used for rain classification as well as the rain classification based on ground based DSD model is also attempted. The results highlight a rain classification scheme based on lognormal DSD parameter. It is also found that large drops size is more in convective cases associated with high rain rate. It is also observed that for lower rain rates, convective cases have smaller number of bigger drops than stratiform types of rain of same rain intensity. The information will be of importance for classification for rain and rain attenuation study. [C5829]

"Comparison of TRMM estimated rainfall with ground truth over Calcutta"

The precipitation radar (PR) onboard Tropical Rain Monitoring Mission (TRMM) estimates rainfall from space covering a vast geographical area. It is necessary to compare such estimates with ground truth. In this paper PR estimated rain has been compared with that obtained from India Meteorological Department (IMD) and also a disdrometer over Calcutta. PR estimated rainfall statistics have been presented along with IMD derived rainfall statistics. Regression relationships of rainfall have been derived as a function of surface temperature (DBT) and surface dew point temperature (DPT). Also rainfall phenomena have been studied as a signature of El Niño and La Niña occurrence. [C5830]

"Improved Hough transform algorithm for radar detection"

In this paper, we describe a new algorithm for radar detection based on Hough transform which employs the slope-intercept parameter space. Unlike the conventional Hough transform, we shift the parameter space cells to perform the transform. The computation burden is reduced. Another advantage of our proposed is that those straight lines whose intercept are bigger than the radar maximum range can also be detected in our method. In addition, we also investigate the performance of the algorithm we present and show its efficiency with some simulations. [C5831]

"Recognition of radar emitter signals using spectrum atoms and Hierarchical Decision Strategy"

An effective approach to recognize the radar emitter signals is presented, which is based on a novel spectrum atoms and hierarchical decision strategy. Firstly, a new over-complete multi-scale Spectrum atom dictionary is constructed and the improved MP algorithm is applied to extract the features of radar emitter signals, the optimization of atom dictionary structure and FFT is introduced to effectively reduce the time complexity at each search step of MP. Then, some intrinsic Spectrum atoms describing features of signals are obtained which has the good properties of clustering the same and separating the different kind of radar emitter signals. Finally, a hierarchical decision strategy is exploited to identify signals automatically. Simulation results denote that the proposed approach have good performances of recognition with low SNR, which confirms the validity and feasibility of the approach. [C5832]

"Improving Ambiguity Function of Costas signal"

This paper presents the effects of modifying Costas signal in time and frequency to improve ambiguity function (AF). The effect of adding frequency spacing, linear frequency modulation, constant space time, and variable space time between sub-pulses of Costas signal are presented and compared. It is shown that a considerable reduction of side-lobe and better Doppler resolution is achieved by using variable spacing between sub-pulses of Costas signal. [C5833]

"Bounding the number of relevant objects in automotive environment perception systems"

Multi-sensor data fusion systems for environment perception in the automotive domain are regarded as a promising instrument for obtaining dependable vehicular context information. Sensor data from remote sensing devices like radar or laserscanners is transmitted via intra-car networks to electronic control units (ECU) that enable an intelligent, context sensitive vehicle behavior depending on the current traffic situation. Although new bus systems, such as Flexray, offer increased data rates, the communication resources need to be utilized efficiently. In order to do so, two aspects have to be considered: (1) The size of a single object description and (2) the overall number of perceivable objects. In this paper we focus on the latter of the two aspects. We created a flexible discrete event simulation framework that allows for an in-depth analysis of various aspects of environment perception systems. Our simulation covers scenarios consisting of different sensor-sets, traffic scenarios, fusion benefits, and algorithms for context perception. Using this framework we were able to limit the number of objects a single sensor is allowed to perceive and analyze the impact of this limitation on the overall system performance without such restrictions. Our findings include: (1) Bounding the number of relevant objects to a number between 4-8 does not affect the false negative ratio of the system, (2) the overall error and false

positive error ratio does not increase by bounding the number of relevant objects, (3) in safety-relevant environment perception systems the number of relevant objects can be reduced even further without compromising the system integrity, and (4) bounding the number of objects at an early stage of signal processing is superior to a reduction at a late stage of signal processing. [C5834]

"Micromachined millimeter-wave Butler matrix with a patch antenna array"

This paper presents a micromachined patch antenna array with an integrated 2ГрВ—2 Butler matrix (BM) beamformer. It was designed at 63 GHz and simulated using CST Microwave Studio 3D simulator. The BM is made using a low loss air filled rectangular coaxial line. The structure is constructed by bonding five layers of gold coated photoresist SU-8, each 200 microns thick. The experimental result shows a good matching achieved with return loss of -13 dB and inter-port isolation of about -22 dB at 63 GHz. [C5835]

"Laser diodes for microwave and millimeter wave photonics"

In this paper we present the different type of laser diodes that are developed at Alcatel-Thales III-V Lab in order to fulfil different functions required for radio over fibre and radar systems. The first device that is presented is a directly modulated laser with a bandwidth exceeding 20 GHz and good linearity that is used for analog wideband link. This kind of device is precious for remote delivery and distribution of wide bandwidth signals with very low attenuations. The second device we will present is a passive mode-locked quantum dash lasers that has sufficiently good phase noise performances to be used as a carrier for 60 GHz wireless transmission links. The third device we will present is a dual wavelength laser. It can be used for a wide and potentially fast tuning of the frequency generated by heterodyning two optical wavelengths on a photodetector, the photodetector behaving as a photomixer. [C5836]

"Study on analog front end of passive UHF RFID transponder"

In this paper, an overview of passive ultra high frequency (UHF) radio frequency identification (RFID) is presented. This literature review emphasis on the analog front end part of the RFID transponder based on several published papers conducted by previous researchers. A passive UHF RFID transponder chip design was proposed using 0.18 Г,Вim standard CMOS process. It is estimated to have power of 1 Г,ВiW and high efficiency that greater than 32%. This design will work in the range of frequency between 900 MHz to 960 MHz. [C5837]

"An automatic registration and mosaicking system based on contour features and wavelet transform for remote sensing images"

Image registration is an inevitable problem arising in many image-processing applications whenever two or more images of the same scene have to be compared pixel by pixel. The increased volume of satellite images has reinforced the need for automatic image registration methods. In this paper, two new feature-based approaches to automated image-to-image registration are presented. The characteristic of the first approach is that it combines an invariant moment shape descriptor with improved chain-code matching to establish correspondences between the potentially matched regions detected from the two images. This method works well for image pairs in which the contour information is well preserved, such as the optical images from Landsat and Spot satellites. For the registration of the optical images with synthetic aperture radar (SAR) images, we propose another method based on the wavelet transform, this second method uses spectral information of the images and their local wavelet transform modulus maxima to extract a set of control points. The experimental result demonstrates the robustness, efficiency and accuracy of the two algorithms. [C5838]

"The selection of working frequency for interior ballistic measurement radar"

The propagation of electromagnetic wave in gun tubes, radiated by interior ballistic measurement radar, is analyzed according to electromagnetic scatter theory and waveguide theory. With the method of numerical computation of MOM, the relationship between the corresponding RCS and the wave frequency is figured out, and the effect of multi-mode on the SNR is discussed. Finally several conclusions are brought forward on the selection of working frequency for the radar. The conclusions are further verified by the results of a couple of live tests. [C5839]

"Deletion of the signal in direct way by clean analysis in a system of coherent passive detection"

The purpose of a system of coherent passive detection is to get back the echo resulting from the reflection on the target to detect. The method by clean analysis based on the projection of signals in an orthogonal sub-space in the direct signal allows preventing the problem of interference which engenders the presence of the signal in

direct way in this type of system of detection. In the case of the presence of an echo and a direct signal, the study of the distribution of the powers of every signal by the analysis of the variation of the clean values according to the number of elements of the network of antennas or the number of sub-networks demonstrates that these signals remain quartered in their respective orthogonal sub-space without influencing in an important way the other sub-space. [C5840]

"A Method for Recovering Maneuver Targets Spectra Based on the Algorithm of Decontaminating Ionospheric Slow Phase-Path Disturbance"

Both ionospheric slow phase-path disturbance and targets' maneuver will make the targets' echoes broaden in HF radar. Although their mechanism to spread the spectra is different, they are consistent on the view of the phase of targets' echoes. Using the algorithm of ionospheric disturbance decontamination which has been successfully applied in practice, a method for recovering maneuver targets spectra has been presented in this paper. Results of experimental data of HF radar and meter-wave radar verify the correctness of such process. And they also show that the algorithm can effectively improve the quality of the targets spectra to improve the radar target detection and tracking performance. [C5841]

"Mono-Alphabetic Signal Design for Improved Target Detection in High Resolution Radar Systems"

In this paper an attempt has been made to evaluate the detection ability of mono-alphabetic sequences for the application to high resolution radar in presence of high dense additive noise environment. The performance of these sequences is evaluated in terms of their noise robustness, multiple target discrimination through coincidence detection and range resolution ability. Asymptotic figure of merit of proposed serially uncorrelated mono-alphabetic sequence are determined by employing exhaustive search algorithm rather than by analytical design. Hamming back-track algorithm is designed and used for optimization. The simulation results based on the outcomes of this design algorithm for poly-semantic sequences give improved noise robustness in HRR target detection compared to conventional pulse compression sequences. [C5842]

"Generation of Pulse Compression Codes Using NSGA-II"

Pulse compression technique avoids the transmission of a signal having small pulse width and high peak power for better range resolution by transmitting phase or frequency modulated large pulse width signal having comparatively low peak power signal. This paper demonstrates an application of non dominated sorting genetic algorithm-II (NSGA-II), a multiobjective algorithm, to generate biphasic pulse compression codes from length 49 to 59. But the aperiodic autocorrelation function (ACF) of the phase coded signals contains range sidelobes which act as self clutter in radar target detection. The efficiency of these codes depends upon the energy content in the range sidelobes of their autocorrelation functions. Peak sidelobe level (PSL) and integrated side lobe level (ISL) are the two performance measures for pulse compression codes. A code is chosen for an application if the ISL and PSL value is within tolerable limits. In this work PSL and ISL are chosen as the objective functions for generating biphasic code. [C5843]

"Efficient target identification for MIMO high-resolution imaging radar via plane-rotation-invariant feature"

Target identification has been an active researching area in past decades. In this paper, we present an identification method based on the high-resolution image from a narrowband multiple-input multiple-output (NMIMO) imaging radar system. Different from the traditional image-based method, the key idea of the proposed method is to build the plane-rotation-invariance features of a candidate target with its location parameters of 2-D scatterers, regardless of the amplitude information of a 2-D scatterer. Numerical examples are presented for testing our method. [C5844]

"Multiobjective optimization for low SAR antenna design"

With the widespread use of wireless communication systems, efforts are directed to reduce the human exposure to RF radiation. Multiobjective optimization is becoming essential to achieve satisfactory antenna performance whilst minimizing the radiation level in the human body. A technique based on the genetic algorithm is proposed to optimize a multiobjective function involving weighted goals related to the antenna performance and the near-field radiation pattern inside the human body. Electromagnetic simulation based on FDTD formulation is performed using SEMCAD X. Dispersive material characteristic is chosen for the human head phantom. Results illustrate the enhancement introduced by this technique of antenna design that could be used in multifunction communication systems. [C5845]

"A Recurrent Neural Network Approach to Pulse Radar Detection"

Matched filtering of biphasic coded radar signals create unwanted sidelobes which may mask some of the desired information. This paper presents a new approach for pulse compression using recurrent neural network (RNN). The 13-bit and 35-bit barker codes are used as input signal codes to RNN. The pulse radar detection system is simulated using RNN. The results of the simulation are compared with the results obtained from the simulation of pulse radar detection using Multilayer Perceptron (MLP) network. The number of input layer neurons is same as the length of the signal code and three hidden neurons are taken in the present systems. The Simulation results show that RNN yields better signal-to-sidelobe ratio (SSR) and doppler shift performance than neural network (NN) and some traditional algorithms like auto correlation function (ACF) algorithm. It is also observed that RNN based system converges faster as compared to the MLP based system. Hence the proposed RNN provides an efficient means for pulse radar detection. [C5846]

"A machine learning algorithm for GPR sub-surface prospection"

The paper presents a novel approach for the (semi-) automatic extraction of sub-surface layers' properties from GPR data. The methodology solves the inverse scattering problem by means of artificial neural networks which are able to map proper features derived from the electromagnetic signal onto the dielectric permittivity and thickness of the layer which has backscattered the radiation. The whole procedure is first described and then tested over a set of simulated scenarios and their corresponding GPR traces, showing high reconstruction accuracies and denoting the opportunity of a wide range of applicability. [C5847]

"A novel CMOS all-pass tunable phase shifter for phased array systems"

A new current mirror based all-pass, tunable phase shifter architecture is proposed in 0.18 μm CMOS, after a brief introduction on phase shifter applications, and comparison between different implementation methods. In the new current-mode approach the cut-off frequency of transistor is the operational limit of the proposed phase-shifter architecture and power consumption for this design is 80 microwatts. Simulations are carried out in HSpice and cover a frequency range from 1 MHz to 50 GHz. [C5848]

"Capacity & performance issues in a MIMO based MB-OFDM ultrawide band communication system"

Ultra wideband (UWB) technology is one of the promising solutions for future short-range communication which has recently received a great attention by many researchers. However, interest in UWB devices prior to 2001 was primarily limited to radar systems, mainly for military applications, due to bandwidth resources becoming increasingly scarce and also its interference with other communication networks. This research work provides performance analysis of multiband orthogonal frequency division multiplexing (MB-OFDM) UWB MIMO system in the presence of binary phase-shift keying time-hopping (BPSK-TH) UWB or BPSK-DS UWB interfering transmissions under Nakagami-m and log-normal fading channels employing various modulation schemes using MATLAB simulations. Also, provides capacity analysis showing variation of channel capacity with respect to distance well as signal-to-noise ratio. [C5849]

"Integrated full-waveform analysis of ground penetrating radar and electromagnetic induction data for non-invasive reconstruction of multilayered media"

We present a new integrated method for full-waveform modeling of zero-offset, off-ground ground penetrating radar (GPR) and electromagnetic induction (EMI) in multilayered media. For both GPR and EMI systems, a vector network analyser (VNA) is used as transmitter and receiver. The antennas and their interactions with the investigated medium are modeled in the frequency domain by means of a linear system of complex transfer functions. The air-subsurface is represented by a 3-D multilayered medium, for which Maxwell's equations are exactly solved. These approaches have been validated in laboratory conditions, demonstrating the high accuracy of the GPR and EMI models. The results show great promise for non-invasive reconstruction of multilayered media using GPR and EMI. [C5850]

"Novel technique for reducing effects of non-linear frequency sweeps in LFM ranging radars"

A new technique for overcoming VCO (Voltage Controlled Oscillator) non-linearity in FMCW (Frequency Modulated Continuous Wave) radar transceivers is presented. The proposed technique relies on correlating the output beat signal in the stretch processing technique with a pre-formed reference correlation signal that accounts for the VCO non-linearity. An overview of the FMCW radar is presented followed by a discussion of the VCO non-linearity problem with existing solutions. The proposed solution is demonstrated with supporting simulation results. The benefits of the proposed solution are stated with a suggestion of a possible simple

realization. [C5851]

"An efficient multi-objective pulse radar compression technique using RBF and NSGA-II"

The task of radar pulse compression is formulated as a multi-objective optimization problem and has been effectively solved using radial basis function (RBF) network and multi-objective genetic algorithm (NSGA-II). The pulse compression performance of three different codes in terms of signal to peak side-lobe ratio (SSR) under noisy environment, range resolution and Doppler shift are evaluated through exhaustive simulation study and are compared with those obtained by radial basis function (RBF) and auto correlation (ACF) based methods. The results demonstrate excellent performance of the proposed multi-objective method compared to its counterparts. As the number of center increases, the performance compressor also progressively increases but its complexity correspondingly increases. The proposed multi-objective method helps to select appropriate structure that makes a judicious compromise between the complexity and performance. [C5852]

"Integrated platform for continuous monitoring of children with suspected cardiac arrhythmias"

Children with cardiac arrhythmias constitute one of the most difficult problems in cardiology both in terms of diagnosis and management. In such cases continuous monitoring of ECG vital signs and environmental conditions can significantly improve the identification of a possible arrhythmia. In this study we present the design and development of a system which enables the continuous monitoring of children, from the hardware and software perspective. The system is able to carry out real-time acquisition and transmission of ECG signals, and facilitate an alarm scheme able to identify possible arrhythmias so as to notify the on-call doctor and the relatives of the child that an event may be happening. In-house monitoring of a child is performed using a sensor network able to record and transmit ECG and the living conditions, while outside the house, monitoring is performed through a GPRS/UMTS enabled device. The transmitted information can be accessed through a web based platform which facilitates basic an electronic patient record module and continuous display of monitoring information of the patient. The system design and development steps are finished and the initial tests performed on healthy volunteers proved to be very promising. [C5853]

"Experimental verification of the advantages of the transparent cathode in a short-pulse magnetron"

Recently, considerable attention has been given to the development of different means of providing rapid start-of-oscillations in pulsed relativistic magnetrons. The innovative University of Michigan's (UM's) methods of priming: cathode priming, magnetic priming and RF priming have shown improvement in the start of oscillations. At the University of New Mexico (UNM) we have been able to show via particle-in-cell (PIC) computer simulations fast start, fast rate of build-up of oscillations and significant improvement in the output characteristics of a magnetron using the transparent cathode. The three-dimensional PIC code MAGIC was used for the simulations. Experiments were performed using UNM's SINUS-6 accelerator with an applied voltage of 260 kV in 17 ns.

[C5854]

"A novel methodology for indoor positioning"

This paper presents a novel methodology that can be used to design location aware systems. Here, a sound signal is trapped between two distantly separated transceivers in an endless loop. As the transmitting medium between the two modules is air, there is a phase difference at the transmitting and the receiving end which is proportional to their separating distance. The signal, thereby circulates is a sinusoidal wave formed by summation of multiple phasors. This signal endowed with an interesting characteristics; its maximum amplitude shoot's up at separating distance equivalent to an integer multiple of single wavelength of the sound wave applied. A positioning system is designed and practically implemented applying this method, which can locate a target with in few millimeters of its true position. We have also introduced an intelligent control unit to enhance its performance. [C5855]

"Home care phonocardiography: an Italian experience"

In this work we describe an Italian experience of foetal home monitor, based on a pilot system consisting of three phonocardiograph home monitors by Pentavox. Phonocardiography is non invasive and passive in nature and allows developing of low-cost and easy to use equipments. Its application in a telemonitoring system enhances diagnostic capabilities, allowing long-term measurements. The home monitors can have telemedicine facilities as far as they can transfer data by GPRS to a remote server. Six selected patients, without effective pregnancy risk, were supplied with a lightweight ambulatory cardiotocograph (Fetaphon-home) equipped with two probes: a microphone and a pressure transducer. Monitoring covers the measurement of foetal heartbeat, uterine contractions and foetal movements. The selected patients were instructed by trained personnel in the use of the monitoring device. Patients were asked to perform the recording two times a week once and to transmit 20-min

signal to the computer sever of reference centre. The home monitoring sessions were performed in addition to the routine surveillance at the clinic; thus, the study monitoring did not replace clinic visits. Preliminary measurements on the selected pregnant women have shown that the use of this methodology significantly reduces the need of travel for patients and consequently their stress. Moreover, the obtained results, even if performed on normal fetuses, suggest that, after a short training, pregnant women are able to record and transmit long traces without troubles. Use of telemedicine system was generally well accepted by pregnant women increasing the possibility of foetal long-term home surveillance which in turn could increase the efficiency of the service offered to pregnant women. [C5856]

"Design of a Timing Signal Generator (TSG) for RADAR Using FPGA"

The paper discusses the application of VLSI technology to implement the functions of TSG of a radar system using VHDL with behavioral model, as the HDL and targeting it to a FPGA. The TSG is the heart of radar application to generate timing and control signals to operate radar in different phases like detection, tracking and acquisition, and hold mode. The advantage of TSG design with FPGA is that TSG unit assembly gets mounted into a single chip, parallel processing is done and changes at the hardware are possible through programming from remote without consumption of time and money. [C5857]

"Performance analysis of poly-semantic sequence for high resolution Doppler radar"

Superiority of poly-alphabetic sequences (PAS) for pulse compression radar over the binary and ternary sequences was established earlier. However, the enlarged alphabets in poly-alphabetic sequences deteriorate the noise and Doppler robustness at higher lengths in high resolution radar (HRR) systems. In this paper, poly-semantic sequences (PSS) with restricted alphabets $\{+1, -1\}$ are considered and their performance is analyzed in order to achieve superior detection performance for high resolution Doppler radar system in presence of high density additive noise and Doppler shift. The poly-semantic sequences are optimized by employing modified Hamming scan algorithm called Hamming backtrack algorithm (HBT) by taking figure of merit as the measure of goodness. The detection capability of poly-semantic sequences is further improved through coincidence detection of the return signal. The simulation results show that the proposed sequences give improved robustness of noise and Doppler shift for HRR target detection compared to conventional pulse compression sequences. [C5858]

"Target detection in MIMO radar using Golay complementary sequences in the presence of Doppler"

In this paper, we present a method for detecting a point target using multiple antennas when the relative motion between the receivers and the target induces a non-negligible Doppler shift. As a key illustrative example, we consider a 4 ГrB— 4 system employing a unitary matrix waveform set, e.g., formed from Golay complementary sequences. When a non-negligible Doppler shift is induced by the target motion, the waveform matrix formed from the complementary sequences is no longer unitary, resulting in significantly degraded target range estimates. To solve this problem, we adopt a subspace based approach exploiting the observation that the receive matrix formed from matched filtering of the reflected waveforms has a (non-trivial) null-space. Through processing of the waveforms with the appropriate vector from the null-space, we can significantly improve the detection performance. We provide simulation results to confirm the theoretical analysis. [C5859]

"Comparative Evaluation of Different Modulation Schemes in UWB"

UWB (Ultra Wide Band) technology is a reliable transmission scheme for wireless communication with high data rates. It is called as impulse radio, impulse radar or carrier free ultra high resolution scheme. UWB is defined as signals with fractional band width more than 20% of its central frequency or as signals with bandwidth more than 500 MHz. UWB can be characterized with ultra-short duration pulses called monopulses which has excellent immunity in interference from sensitivity or multi path effects or fading problems. The objective of the paper is to examine different types of pulse shaping and modulation schemes for UWB performance evaluation. By considering three different types of pulses and three different types of modulation techniques the BER (bit error rate) performance of the modulation techniques are evaluated in the presence of the AWGN (additive white Gaussian noise). [C5860]

"Multi-modal Registration of SAR and Optical Satellite Images"

Frequently the need arises to combine remotely sensed data taken from different sensors for improved interpretation of an imaged area. However, before this multi-sensor data fusion can be performed the image data must first be registered geometrically. In this paper we investigate the use of an information-theoretic similarity measure known as cross-cumulative residual entropy (CCRE) to perform the registration of SAR imagery and optical data. An affine transformation is implemented in the registration procedure to account for geometric errors

other than simple translation and rotation. The results of our experiments showed that the CCRE registration algorithm performed satisfactorily and provided a significant improvement over the standard mutual-information based technique. [C5861]

"SNR Estimation Method of LFM Signal Detection"

SNR estimation of LFM signal detection is often applied in radar, mobile communications, Radiolocation and seismic exploration with vibrator. The common method of LFM signal detection is correlation, which can not only be used to explain time delay in Multipath Propagation, but also to estimate SNR in detection of output signal. The records of signal plus noise before the signal detection are called System Input, while the records after the signal detection are called System Output. In this paper, SNR estimation method of LFM signal detection before System Input and after System Output is given. The simulation result indicates that this method is correct. [C5862]

"Web Services for Quality of Service Monitoring"

In this paper we present an analysis on Policy and Charging Control (PCC) functions in all IP-based multimedia networks and identify the required functionality for quality of service (QoS) monitoring. The support of "Application-driven Quality of Service" (ADQ) Parlay X Web Service to reporting function in PCC is evaluated and improvements of ADQ interfaces are suggested without violating the interface functionality. The gateway which provides Parlay X interfaces for third party applications supports Session Initiation Protocol (SIP) towards the network. A new SIP event package is suggested to support monitoring of QoS provided on SIP sessions. [C5863]

"Classification of Airborne LIDAR Intensity Data Using Statistical Analysis and Hough Transform with Application to Power Line Corridors"

Light Detection and Ranging (LIDAR) has great potential to assist vegetation management in power line corridors by providing more accurate geometric information of the power line assets and vegetation along the corridors. However, the development of algorithms for the automatic processing of LIDAR point cloud data, in particular for feature extraction and classification of raw point cloud data, is still in its infancy. In this paper, we take advantage of LIDAR intensity and try to classify ground and non-ground points by statistically analyzing the skewness and kurtosis of the intensity data. Moreover, the Hough transform is employed to detected power lines from the filtered object points. The experimental results show the effectiveness of our methods and indicate that better results were obtained by using LIDAR intensity data than elevation data. [C5864]

"Substrate integrated waveguide slot array antenna with enhanced scanning range for automotive application"

A modified substrate integrated waveguide (SIW) slot array antenna has been proposed for the low cost 24 GHz Doppler radar system. All radiating slots are connected in series using a short circuit ended SIW; therefore, its radiation beam can be steered with frequency. The modified antenna with meandering structure is proposed to enhance the scanning range. The physical slot spacing is kept at about half free space wavelength, while the electrical spacing is about 540° at the center frequency of 24 GHz. A broadside radiation is achieved at 24 GHz frequency and a $\pm 30^\circ$ continuous scanning range is experimentally confirmed with the frequency band from 23 GHz to 25 GHz. [C5865]

"A novel photonic Rotman-lens design for radar phased array antennas"

Future high performance large radar phased array antennas will require true time delay (TTD), rather than phase shifters, in order to support high bandwidth pulses over a range of scanning angles. Currently, RF Rotman lenses are used as TTD elements, offering a somewhat limited performance with respect to their RF characteristics. Recently, photonic architectures, comprising optical transmitters and receivers, together with some optical circuitry to optically process RF signals, have been proposed as candidates for inclusion within wideband RF systems, which need true time delay to cover an RF bandwidth as large as 18 GHz. In this paper a novel microwave photonic implementation of a Rotman-lens is proposed, offering improved functionality and performance. The proposed scanning unit is an optical module, where photo-detectors connected to the transmitting/receiving antennas are the interfaces, converting between the RF signals and their respective optical waves. The optical module is basically a photonic Rotman lens, quite similar in design to its RF counterpart. However, in addition to the improvement that is obtained by realizing the solution in a photonic module, the proposed photonic Rotman lens improved design is capable of realizing a linear phase profile with a varied slope, that is obtained at the output of the lens for any possible position at the input to the lens. This is in

contrast to what is currently available with the conventional RF Rotman lens, where output phase front linearity is obtained for a small and discrete number of input positions. The improved performance is obtained by numerically optimizing the curves of the photonic input and output surfaces of the lens, having an off-centered elliptical profiles, rather than the classically used spherical curvatures. Performance characteristics will be reviewed. [C5866]

"Linear FM radar operating in the Tera-Hertz regime for concealed objects detection"

Sub-millimeter and terahertz waves maintain reasonable penetration depth in certain common materials, such as cloth, plastic, wood, sand and soil. Therefore, THz radiation can detect concealed weapons since many non-metallic, non-polar materials are transparent to this type of radiation (and are not transparent to visible radiation). Target compounds such as explosives and illicit drugs have characteristic THz spectra that can be used to identify these compounds. Investigation, design and development of a sub-millimeter wave remote sensing RADAR system for homeland security applications are presented. The RADAR, operating at 330 GHz is based on transmission of a frequency modulated continuous wave (FMCW) and aimed at detection of concealed objects for ranges up to 20 m. The system consists of 2 horn-lens antennas integrated with a homodyne transceiver. The synthesized linear FM signal with a frequency span of 200 MHz at X-band is multiplied by a factor of 32 to generate the transmitted Tera-Hertz wave. Using a splitter, the signal is fed to an antenna and to a local oscillator port of a second harmonic balanced mixer. As a result, an intermediate frequency signal is obtained, containing the information on the target. Distance measurements were made by performing data acquisition and signal processing commercial programs, resulting in a range resolution better than 1 cm. Preliminary Tera-Hertz imaging was also carried out to perform a three-dimensional image of the object. [C5867]

"Algorithms of processing of radar images in radio vision systems of the car"

In the report results of researches of algorithms of secondary processing of radar images (RI) in radiovision system of automobile (ARVS) are presented. ARVS is panoramic radar of the forward view with frequency modulation (FM) of a probing signal of MM wavelength. By development of algorithms following features of RI formation are considered: the sizes of the image, system of co-ordinates, requirements on transfer speed of data, processing in real time, system of display of RI and a synchronization mode. Features of construction of algorithms of co-ordinates transformation, algorithm of time-lapse averaging, algorithm of RI quantization on intensity, algorithm of construction of a safe corridor of automobile movement, algorithm of formation azimuthal and range's portraits of road and objects are considered. Examples of application of the given algorithms are resulted at processing of experimental radar images, received by means of test stand of ARVS. [C5868]

"RF systems approach based on photonics architecture"

Processing of wide band signals and antenna beam forming by photonic means and principals offers significant advantages compared to current electronic systems. The integration of optics in RF systems like EW and RADAR or manipulating optic based principals enables to decrease the size, to increase the bandwidth, and to reduce the power dissipation far beyond what can be obtained in current electronic systems. Thus, several novel photonic architectures were suggested based on converting analog RF signals into photonics. [C5869]

"77 GHz ACC radar simulation platform"

The development of a system simulation platform for adaptive cruise control (ACC) radar working at 77 GHz is presented. The simulation platform allows us to test different radar architectures, modulation formats and detection algorithms as well as to simulate different scenarios, which improves the decision-making before and during the hardware development. [C5870]

"Target tracking in the time-frequency domain for a driving aid application"

Driving aid is an important emerging radar application. Among associated technological issues, detecting and tracking potential obstacles (cars, pedestrians, static objects ...) is of key interest. In this context, we propose an original tracking method, based on particle filtering, where the observation of the state vector is the cross-ambiguity function of the backscattered signal. Simulations for various waveforms demonstrate the improvement brought compared to the conventional approach, in which a detection step precedes the tracking. [C5871]

"Utilization of matched pulses to improve fault detection in wire networks"

A new concept to fault detection in wire networks, based on the properties of time reversal, is presented. The method, called the matched pulse approach (MP), propose to adapt the testing signal to the analyzed network, instead of using a predefined signal, as opposed to existing reflectometry methods. Through mathematical study

and numerical simulations, we show the benefits of this technique. A physical interpretation is also presented to better understand the proposed approach. [C5872]

"Development of an automotive radar model for implementation in a real-time multi-sensor simulator"

An automotive radar simulator is proposed based upon FSK or FMCW radar. The goal is to obtain the time domain signal returned from targets before digitalization for data processing. The model should account for multi-target scenario, attenuation, multi reflections and noise. [C5873]

"On retrieval of intermodulated sinusoids"

As intermodulated sinusoids are generated when a nonlinear system is subject to multiple fundamental frequencies, an approach is proposed in this paper to detect and to estimate, or simply to retrieve the intermodulated sinusoids. It is shown that both detection and estimation performance are improved by using the intermodulation relationship as an additional constraint. Although the periodogram method is used here, the approach can be readily modified to accommodate other frequency retrieval techniques. The implementation and the performance of this approach are demonstrated by simulation examples. [C5874]

"Iterative self-dual reconstruction on radar image recovery"

Imaging systems as ultrasound, sonar, laser and synthetic aperture radar (SAR) are subjected to speckle noise during image acquisition. Before analyzing these images, it is often necessary to remove the speckle noise using filters. We combine properties of two mathematical morphology filters with speckle statistics to propose a signal-dependent noise filter to multiplicative noise. We describe a multiscale scheme that preserves sharp edges while it smooths homogeneous areas, by combining local statistics with two mathematical morphology filters: the alternating sequential and the self-dual reconstruction algorithms. The experimental results show that the proposed approach is less sensitive to varying window sizes when applied to simulated and real SAR images in comparison with standard filters. [C5875]

"Design of a low-cost airborne radar target simulator based on FPGA"

In this paper, we present a low-cost airborne radar target simulator based on FPGA, which consists of three parts: control and video processing module, intermediate frequency (IF) processing module and radio frequency (RF) processing module. The system is capable of simulating target echoes with range, Doppler, direction and the other information in real time. We also elaborate the highlights of design methodology and implementation from theory to practice. The results show that using FPGA technique make The simulator based on FPGA makes the system's reliability and stability are enhanced with low-cost. [C5876]

"360°-Environment sensing and signal processing for an automotive pre-crash application"

In this paper a new and flexible 360°,B°-environment sensing system using short range radar sensors and active seat belt pretensioners is presented. To detect critical targets from a wide variety of closing angles, a total of only four radar sensors is used. The number of sensors can be changed, without altering the underlying sensor fusion and target detection algorithms. The challenges of pre-crash systems are presented and the multi-sensor fusion and signal processing algorithms are shown. To be able to react to highly dynamic driving maneuvers, an interacting multiple model filter (IMM) is used. A pre-crash algorithm for 360°,B°-environment sensing is introduced. To verify the system effectiveness, a simple, yet effective, system test has been developed. Test data is gained and evaluated for different critical situations. The presented pre-crash system serves as a basis for new driver assistance and safety functions, which helps to increase overall driving safety, even in dense traffic and urban driving situations. [C5877]

"Stochastic Event Capture Using Single Robot Moving along a Certain Track"

In this paper, we built a stochastic model that analyzes the intrusion detection quality achieved by a single moving sensor or robot moving along a certain track, based on velocity and mobility pattern. We consider the mode of intrusion events defined as follows: intrusions arrive at random points in the field of interest and fade away according to arrival and departure time distributions. In order to compare the results, two detection scenarios are studied: the robot detection scenario and the radar detection scenario. In the robot detection scenario, a robot is set to move periodically along a certain routine at a constant speed. In the radar detection scenario, radar is rotated at a constant speed in a clockwise/anti-clockwise direction. An intrusion is said to be captured if it is sensed by the moving robot or radar before it fades away. [C5878]

"Performance analysis of an autocorrelation based frequency tracker for LFM and QFM signals"

This paper provides a detailed analysis of a recently proposed algorithm for efficient frequency estimation and tracking. A correlation based Pulse-Pair (PP) method, which is an efficient technique for frequency estimation, is used for the frequency tracking. It is known that the PP method has a very low number of multiplications, but, has the disadvantage of requiring inverse tan operations in its implementation. Using an efficient recursive technique for implementing inverse tan operation the PP method is extended for frequency estimation and tracking of signals with time varying frequencies. [C5879]

"Historical data learning based dynamic LSP routing for overlay IP over WDM networks"

In overlay IP over WDM networks, there are only limited information exchanges between the two layers through the user network interface (UNI) [1] for service requests and responses. To enhance the overlay network performance while maintaining its simplicity, we propose for the first time to learn from the historical data of lightpath setting up costs maintained by the logical layer network operator(s), to facilitate the logical layer routing process. Using a simple cost updating strategy to alleviate the logical layer cost outdated issue, we present two dynamic LSP routing algorithms, namely existing link first (ELF) and enquiries-first (ENF), for the overlay network architecture. Simulation results show that the proposed algorithms achieve much better performance than the existing algorithms with or without constraint on the number of optical ports. [C5880]

"Design of a fully programmable shader processor for low power mobile devices"

In this paper, we propose a novel architecture of a general graphics shader processor without a dedicated hardware. Recently, mobile devices require the high performance graphics processor as well as the small size and low power. The proposed shader processor is a GP-GPU (General-Purpose computing on Graphics Processing Units) to execute the whole OpenGL ES 2.0 graphics pipeline by using shader instructions. It does not require the separate dedicate H/W such as rasterization on this fully programmable capability. The fully programmable 3D graphics shader processor can reduce much of the graphics hardware. The chip size of the designed shader processor is reduced less than 60% in comparison with previous processors. [C5881]

"Embedded vision systems for ship recognition"

Maritime security includes reliable identification of ship entering and leaving a nation's territorial waters. Automated systems that could identify a ship could complement existing electronic signal identification methods. The use of Forward Looking Infrared (FLIR) and Synthetic Aperture Radar (SAR) enables ship image acquisition round-the-clock but their cost and complexity means few installations are available. The use of lower cost embedded vision systems using visible light for surveillance in a low-bandwidth sensor network could complement existing surveillance methods to improve surveillance coverage. This paper presents an overview of automatic ship detection methods with a view towards embedded implementation of suitable algorithms on optical smart cameras. We present results on applying Hu's moment invariants for feature extraction on several classification algorithms. We achieved accuracies of close to 80% using the KStar and multilayer perceptron classifiers in recognizing one of four ship classes. [C5882]

"Optimizing zero-slice feature of ambiguity function for radar emitter identification"

Radar emitter identification has attracted increasing interests in the last decade. The class-dependent method in to optimize time-frequency kernel of ambiguity function (AF) needs to rank kernel points in the whole AF plane and is sensitive to sampling data length. In this paper, an ambiguity function zero-slice based feature optimization algorithm is proposed for radar emitter recognition. It efficiently extracts the zero-slice feature of AF as intermediate feature set and avoids "out of memory" problem as in large whole-plane optimization. Further, a direct discriminant ratio (DDR) criterion is employed to rank the kernel points along the obtained slice. The resulting scheme not only preserves the most discriminant features of individual emitters, but also improves the recognition accuracy greatly. The experiments on both simulation radar data from U.S. Naval Research Laboratory and real radar emitter data demonstrate the feasibility and effectiveness of the proposed method. [C5883]

"Space-time versus frequency domain signal processing for 3D THz imaging"

For the first time, to the best of the authors knowledge, a 3D image reconstruction is developed using wide beam THz radiation. The reconstruction method finds its origins in the domain of radar and sonar where it is known as Synthetic Aperture Radar (SAR) and Synthetic Aperture Sonar (SAS) respectively. The extension to the SAR/SAS reconstruction algorithms on wide beam terahertz radiation results in a high-resolution 3D image by combining the depth information (due to the penetration aspect of THz radiation) with a 2D scanning setup.

Two 3D reconstruction algorithms have been developed, one in the space-time domain and one in the frequency domain. They both have been validated and analysed using simulated data: the azimuth resolution dependence on the transmitted frequency and on the opening angle is compared between the space-time and the frequency domain algorithm as well as their respective computational load. The application of the proposed imaging techniques lays in the domain of non-destructive testing (NDT) in particular for composite aircraft samples.

[C5884]

"Model based design flow for implementing an anti-collision radar detection system"

We have presented a novel design methodology to model complex intensive data-parallel applications. The modeling is carried out using the UML graphical language and the MARTE standard. Afterwards, automatic code generation can be carried out via MDE tools and technologies. Finally the code can be synthesized and implemented on a target FPGA. We have presented an example of this process, by building a correlation based delay estimator for a anti-collision radar system. We presented some results, and we have got very promising results. In perspective to our works we plan to make optimisations to optimization on the MDE tools and compare the performances of the generated code vs a hand made one. [C5885]

"Hybrid RF mapping and ranging based localization for wireless sensor networks"

In this paper, we propose a hybrid approach to the wireless sensor network (WSN) localization problem. The proposed approach harnesses the strengths of two techniques: RF mapping and cooperative ranging, to overcome the potential weaknesses in one another. The idea is to first allow every node to obtain an initial estimate of its own position in a neighbor-independent way using a coarse-grained RF map acquired with minimal efforts. Then each node iteratively refines its own position through distance ranging to each of its neighbors, irregardless of their positions with respect to itself. Through simulation performance experiments, we show the potential of this hybrid approach as a practical localization system for WSN that can achieve reasonable localization accuracy without significant deployment efforts. [C5886]

"A fast Maximum Likelihood method for improving AMCW lidar precision using waveform shape"

Amplitude Modulated Continuous Wave imaging lidar systems use the time-of-flight principle to determine the range to objects in a scene. Typical systems use modulated illumination of a scene and a modulated sensor or image intensifier. By changing the relative phase of the two modulation signals it is possible to measure the phase shift induced in the illumination signal, thus the range to the scene. In practical systems, the resultant correlation waveform contains harmonics that typically result in a non-linear range response. Nevertheless, these harmonics can be used to improve range precision. We model a waveform continuously variable in phase and intensity as a linear interpolation. By approximating the problem as a Maximum Likelihood problem, an analytic solution for the problem is derived that enables an entire range image to be processed in a few seconds. A substantial improvement in overall RMS error and precision over the standard Fourier phase analysis approach results. [C5887]

"The high-frequency weak signal detection based on stochastic resonance"

Aiming at the issue of the traditional stochastic resonance only applicable to deal with low-frequency signals, a high-frequency weak signal detection method based on stochastic resonance is proposed. By analyzing the relationship among the traditional stochastic resonance model parameters, the input signal amplitude, the noisy signal and the signal to noise ratio of output, an additional gain is added to the original model which makes the sampling time multiplied reduced in the stochastic resonance system, in order to achieve the mapping from high-frequency signal to low-frequency signal. Studies have shown that the improved stochastic resonance model has accurately detected the high-frequency input signal. [C5888]

"Combined Ku and Ka band observations of precipitation and retrievals for GPM Ground validation"

The dual-frequency precipitation radar (DPR) aboard the GPM (Global Precipitation Measurement) core satellite is expected to improve our knowledge of precipitation processes. Ground validation is an integral part of all satellite precipitation missions which helps provide insight into the physical basis of the retrieval algorithm. A dual-frequency (Ku and Ka band) and dual-polarization ground radar will be built in near future to perform cross validation with GPM. This paper presents a new algorithm to retrieve parameters of the drop size distribution from this dual-frequency and dual-polarization ground. The method is based on combination of DFR (dual frequency ratio) and dual-polarization approach. Attenuation correction is solved within the retrieval process. The proposed algorithm is evaluated based on simulated Ku and Ka band realistic observations, for rain, melting layer and ice parts. [C5889]

"Level 1 algorithm development of spaceborne dual-frequency precipitation radar (DPR) for GPM"

Global Precipitation Measurement (GPM) started as an international mission and follow-on mission of the TRMM project to obtain more accurate and frequent observations of precipitation. The accurate measurement of precipitation will be achieved by the Dual-frequency Precipitation Radar (DPR) installed on the GPM core satellite. DPR consists of two radars, which are Ku-band (13.6 GHz) precipitation radar (KuPR) and Ka-band (35.5 GHz) radar (KaPR). Level 1 algorithm, which calculates engineering values, for processing the products of each KuPR and KaPR will be developed based on the PR level 1 algorithm. Japan Aerospace Exploration Agency (JAXA) is developing level 1 algorithm. Housekeeping (HK) and science telemetry data of the DPR is basically similar to that of PR except for pulse repetition frequency (PRF) and noise sampling. DPR will use variable PRF (VPRF) technique to obtain higher sensitivity under the limited resources on the spacecraft. Sampling methods of noise for each angle are different between PR and DPR. The information of VPRF table and noise sampling will be added to level 1 products of KuPR and KaPR. KaPR sampling simulation experiment using TRMM PR was carried out for half-day on 15 March 2007 to get the same geometry data of KaPR scanning in order to create synthetic data of level 1 products for development of higher-level algorithms of DPR and examine to make the best use of them in the critical design, operation and algorithm development for DPR. It successfully finished and we could get the simulation data with same geometry of KaPR scanning. [C5890]

"Electromagnetic wave scattering from ocean surface at low grazing angles"

Bragg scattering is widely recognized as the dominant mechanism at moderate incident angles, by which the ocean surface backscatters microwave radiation. In this paper we have shown that the validity domain of the Bragg/composite surface theory can be extended to low grazing angles by taking into account the contribution of second order scattering effects into the first order at small scale. An improved two scale model (TSM) has been investigated at low grazing angles for (radar frequencies) L-, C- and Ku-band with wind speeds of 7 m/s and 15 m/s. It is observed that for higher wind speeds the intensity of Γ_{Bragg} increases up to 8 dB. In backscattering configuration predictions of the model are compared with the experimental data at Ku-band. Comparison shows good agreement at higher wind speeds. Finally, we use the improved TSM to predict the sea scattering in bistatic configuration and compare the results with classical TSM. [C5891]

"Improving rainfall estimation from ground based radar measurements using neural networks"

Neural network is a nonparametric method to represent the relationship between radar measurements and rainfall rate. The performance of neural network based rainfall estimation is subject to many factors such as the representativeness and sufficiency of the training dataset, the generalization capability of the network to new data, seasonal changes, and regional changes. Improving the performance of the neural network in real time context is of great interest. In this paper, the goal is to improve rainfall estimation based on Radial Basis Function (RBF) neural networks. The principal components analysis (PCA) technique is used to reduce the dimensionality of the training dataset. Reducing the dimensionality of the input training data will reduce the training time as well as reduce the network complexity. More importantly, the small scale uncertainty will be removed during PCA such that the network is less likely overfitted. In addition, $\Gamma_{\text{Rain/No Rain}}$ detection is performed using an adaptive neural network running simultaneously with the rainfall estimation neural network. The $\Gamma_{\text{Rain/No Rain}}$ detection can eliminate those $\Gamma_{\text{No Rain}}$ data inputs from the training set. [C5892]

"A long-term trend observed in TRMM/PR monthly rainfall products and an evaluation of sampling error by a bootstrap method"

This study examines the trend in the 7-year monthly rainfall amounts (September 2001-August 2008) observed by the TRMM Precipitation Radar (PR). It is shown that the monthly rainfall amounts averaged in the range of 35°S to 35°N (PR observation range) tend to increase slightly over this period. This tendency can be considered to be affected by sampling errors due to the narrow observation swaths of the PR, in addition to natural variations. Therefore, this study developed the method of evaluating the sampling errors by a bootstrap method using the actual data observed by the PR. We examined the trend in the averaged rainfall amounts during 7 years considering the simulated sampling errors. As a result, the positive trend was significantly detected, even when sampling error was removed. From this, it can be concluded that this positive trend is highly likely to be due to natural variations. [C5893]

"QA for satellite sea surface temperatures using the ISAR ship-borne radiometric system"

Satellite measurements of global sea surface temperature (SST) distribution are increasingly recognised to have great importance for understanding changes in the world's climate, as well as for operational forecasting of the

oceans and atmosphere. If satellite-derived SSTs are to provide the basis of an essential climate variable (ECV) it is necessary to establish methods for independently verifying their quality. Previously the validation of satellite SST products has been performed by comparison with sea temperatures measured by contact thermometers on the hulls of moored or drifting buoys or of ships. Such sensors operate below the sea surface, within the top few metres of the water column, recording what is now referred to as SST_{depth}. Infrared radiometers on satellites measure the temperature of the surface skin of the ocean, referred to as SST_{skin}. However, significant uncertainties are introduced when validation is based on comparisons between SST_{depth} and SST_{skin} because the sea temperature is not uniform across the skin and the upper few metres, especially but not only because of diurnal variability. Such uncertainties can be eliminated by using in situ SST_{skin} measurements as the basis for a satellite SST validation approach which genuinely compares like with like. This paper describes the principles and results of such a system which has now been in place for five years. It has been used to validate SST measurements from the Advanced Along Track Scanning Radiometer (AATSR) on Envisat. Within the collaborative approach developed by the Group for High Resolution SST (GHRSSST) for merging of complementary data from different satellites, the primary role of AATSR data is to provide a reference for bias adjustment of other data. Precise validation of AATSR measurements is therefore essential for maintaining the quality of other GHRSSST products. [C5894]

"Remote sensing and geological mapping for a groundwater recharge model in the arid area of Sebt Rbrykine: Doukkala, western Morocco"

Pressure has recently been put on the water resources of Doukkala region (western Morocco) due to the development of agricultural and industrial activities, associated with strong demographic expansion. Doukkala's water resources must be better managed and remote sensing provides effective techniques for such an objective. This research illustrates the use of remote sensing for mapping the regional geology, surface hydrology and hydrogeology of the Sebt Brykine, regarded as a groundwater recharge zone for the populated plains of Doukkala. A moderate resolution DEM (30 m pixels) was needed for the hydrological and geomorphological characterization. Derivative products from DEM will also be useful for environmental studies and assessing possible impacts of climate change. Multi-sensor remotely sensed datasets were used to produce several thematic map layers at 1:100 000 scale (lithologies, geological structures, and drainage). These maps allowed the characterization of the regional aquifers and aquicludes for a better understanding of groundwater circulation. [C5895]

"Observation of mesoscale eddies by using SAR data complemented with optical remote sensing and in situ measurements"

Mesoscale eddies were observed in the Baltic Sea using optical remote sensing, SAR imagery and high resolution in situ measurement from an autonomous system on a passenger ferry. Comparison between SAR data and in situ measurements was carried out to analyze the manifestation of sea surface temperature differences and biological surface slicks on SAR imagery. Correlation between radar backscatter and biological parameters (chlorophyll a and turbidity) was observed. Locations of upwelling related cold eddies and low temperature areas were clearly detectable on radar imagery as well. Therefore, SAR data complemented with in situ measurements enables to observe the evolution of mesoscale eddies in case there is no optical remote sensing data available (i.e. under cloud cover). [C5896]

"Monitoring of Enteromorpha prolifera in Qingdao marine by exploiting the synergy of active and passive remote sensing data"

In late June 2008, Enteromorpha prolifera (E.P) bloomed in Qingdao marine, including Qingdao Olympic Sailing Center. The large scale and the fast extending speed of the E.P bloom were rare in history. The E.P bloomed just before Beijing 2008 Olympics, so it attracted the most attention around the world. Monitoring E.P from remote sensing data has the advantages of rapidness, wide coverage, low cost. But commonly used optical remote sensing is easily affected by cloud, which limits the monitoring timelines. In this paper, the theory of E.P monitoring from optical remote sensing and SAR remote sensing were analyzed. Then, the technical routes of E.P monitoring by exploiting the synergy of active and passive remote sensing data were presented. Because the SAR images are not affected by cloud, the timelines can be increased exploiting the by synergy of active and passive remote sensing data. MODIS and RADARSAT were used to monitor E.P. The monitoring results were used to analyze the beginning and spread of E.P. The monitoring results from MODIS and RADARSAT were compared. [C5897]

"Cooperation and competition based on free market in swarm system architectures for air defense"

Algorithms to perform distributed command and control functions in ground based air defense systems of

systems are presented and analyzed. In previous research we presented the benefits of using swarm architectures for this type of application in terms of no single point of failure, lower detectability and higher scalability. Here we propose some free market distributed algorithms based on the principles of negotiation and competition among the swarm of agents performing air defense missions. In our research, parameter optimization as well as experimental results in tactical scenarios are obtained through simulation. [C5898]

"Precise optical scanning for multiuse"

Many approaches for remote measurement techniques for object surfaces and approaches for 3D object recognition have been proposed; but often they still require complex and expensive equipment. Not least due to the rapidly increasing number of efficient 3d hard- and software system components, alternative low cost solutions are in great demand. We propose such a low-cost system for 3d data acquisition and fast surface registration by digitized points Cartesian coordinates matrix keeping. There are presented experimental research and computer simulation of various natural factors which can affects the normal functioning of the passive optical scanning aperture under proposition. [C5899]

"A smart repeater for weapon location radars based on time-frequency analysis"

The smart repeater is a transportable test set for the weapon location radar to evaluate its artillery-locating capabilities without having to use live artillery fire. It retransmits a radio frequency echo that represents the radar return from a shell following the simulated ballistic trajectory when it is triggered by the radar beam. In order to synthesize the echo accurately, we propose time-frequency analysis method combined with pseudo pulse compression to estimate the pulse parameters of the subject radar. Time-frequency distribution is the optimal analysis technique for a linear frequency modulation signal since it will concentrate the signal energy along its instantaneous frequency, while dispersing noise among many frequencies. Therefore we integrate time-frequency analysis with pseudo pulse compression to estimate the parameters of radar pulse such as centroid frequency, frequency modulation rate, amplitude and phase. For the sake of improving the estimation accuracy in the presence of noise and radar electromagnetic environment, both blind deconvolution and power detecting approaches are used. We preprocess the signal by blind deconvolution to extract the raw radar signal from the convolution between the raw signal and electromagnetic environment. The power detecting technique is applied to extract the peak ridge of time-frequency transformation of the signal from interference terms between the signal and noise. After the estimation, a novel method is presented which use digital modulation technique to synthesize the radar echo by inserting the proper delay, Doppler frequency and radar cross-section effects according to the locality and velocity of the simulated shell. Processing steps of the estimating and synthesizing are given in detail. Simulation results validate the effectiveness of these approaches. Development of this smart repeater has been completed and it can provide a quick, thorough performance check of the weapon location radars and minimize-the need for expensive. [C5900]

"Higher order statistics applied to image segmentation"

Recent research has shown that image segmentation, has a great importance in many areas and especially in the industrial application, such as robot animation, mobile localization, etc...[7,8] Also, in medical imaging, it is used for tumor detection and in radar imaging, it is used for target detection. This paper deals with the problem of texture segmentation using higher order statistics. We propose a novel form of the third order statistics, extend the general concept of the cooccurrence matrix, and define a frequency matrix. First order, second order and third order statistics are analysed and applied on examples related to image segmentation. It is shown that third order statistics provide higher performance and better segmentation results than other methods. The experimental results are handled on twelve Bordatz textures images and then the obtained results are evaluated on using (i) first order statistics using gray level matrix, (ii) second order statistics using co-occurrence matrix and (iii) the third order statistics using frequency matrix. The experimental results demonstrate the importance of using the high order statistic in texture characterisation for image segmentation. [C5901]

"Experimental modeling of the effect of adjacent lane traffic on the vehicular channel"

Our experimental study measures the effects of a stationary and a moving vehicle on the 22 MHz 802.11b and the 20 MHz 802.11a channel using a vector network analyzer (VNA). The experiments with the vehicle slowly passing by a transmitter-receiver pair correspond to a case study where the communication session occurs in a single lane of a multi-lane highway with a vehicle moving in the adjacent lane. We propose a corresponding ray-tracing model based on the bistatic radar equation which predicts the link power for a given car geometry and the position of transmit and receive antennas. The model converts a near field propagation problem to a superposition of a set of far field sub-problems by representing the vehicle as a set of (sufficiently small) ideally conductive flat tiles. Hence, the channel transfer function is determined as a sum of the line-of-sight (LOS)

component and the rays reflected from the tiles. The ray strengths are a function of the effective tile radar cross sections (RCSs). The carefully selected RCS model allows for a good match between the measurements and the resulting ray-tracing model. Both the model and the measurements illustrate that the change in the propagation geometry on the order of centimeters, created by a car passing in the proximity (on the order of meters), results in the change of the signal power at the receiver on the order of several decibels. [C5902]

"Collinearity problems in passive target localization using direction finding sensors"

In passive target localization using direction finding (DF), there are particular sensor-target placements that cause large biases in the estimates or the failure of estimates to converge to a unique solution. Identification of such problematic configurations is crucial for implementing estimation and tracking algorithms effectively. In this paper we propose four methods for characterizing near-collinearity problems in a sensor-target configuration which enable one to quickly and easily identify cases in which DF-based localization will fail to obtain a solution or give unreliable results. [C5903]

"A polarimetric sea surface backscattering model"

An extended Bragg scattering model, for fully polarimetric SAR data, is here proposed for describing sea surface scattering. Moreover, the model is considered to examine the scattering contributions from sea surface and detected dark areas due to the presence of anthropogenic and biogenic slicks. Experiments are conducted on fully polarimetric C- and L-band SAR data. [C5904]

"Tracking multiple mobile agents with single frequency Continuous Wave radar"

In this paper, a novel concept to determine the velocity and the location information of multiple mobile agents using Doppler radar has been introduced. Also, an expression for the minimum number of inline sensors needed to guarantee this estimation for n number of mobile agents has been obtained. Current methods use the time derivative of the displacement of adjacent position measurements to find the velocities of agents. This method is error prone, particularly, if the agents are accelerating. In our approach we incorporate direction-of-arrival (DOA) radar which tracks the location and the velocity of each and every agent in each measurement step. [C5905]

"Control of unmanned aerial vehicles performing multiple target passive detection and tracking"

Advances in a previously proposed algorithm for trajectory optimization of autonomous aerial vehicles performing multiple target tracking are presented. The algorithm involves a variant of the moving horizon control approach, built on a partially observed Markov decision process (POMDP) model of the sensor-target system. To evaluate the effectiveness of the advances a simulation involving multiple UAVs and targets is performed. [C5906]

"Light scattering by thin curved dielectric surface and cylinder"

Light scattering properties from curved surface and cylinder are important in the area of propagation and remote sensing. The radar cross sections (RCS) of a dielectric thin curved surface and cylinder are obtained by employing a quasi-static approximation. The method is applicable to the electromagnetic (EM) scattering in general. However, the simulated results emphasize light scattering, i.e. the RCS displayed rather than the electric field. The results are complemented by numerical calculations. [C5907]

"Temperature, color and deformation monitoring of volcanic regions in New Zealand"

There are many examples around the world where satellite based remote sensing has been used to successfully monitor different stages of volcanic activity. This paper describes some of the methods used and their results for monitoring two active volcanoes in New Zealand-Mt Ruapehu and Raoul Island. A time series of ASTER night-time thermal images has been successfully used to assess crater lake temperature variability; Hyperion hyperspectral imagery was tested for crater lake color monitoring with inconclusive results; and interferograms using ALOS PALSAR data were generated of Mt Ruapehu for the purpose of mapping deformation patterns. These data provide information for baseline monitoring, as no major volcanic activity was evidenced over the duration of the study. [C5908]

"FDBAQ a novel encoding scheme for Sentinel-1"

Modern operational and/or high resolution SAR satellite missions impose stringent requirements on on-board data compression such as a higher data reduction ratio, more flexibility, and faster data throughput. A novel approach is flexible dynamic block adaptive quantization (FDBAQ). This method outperforms currently used block adaptive quantization with respect to Signal-to-Noise-Ratio related to the compression ratio. The FDBAQ

method allows bit rate programmability with non-integer rates. This allows the SAR information throughput to be optimized for different types of targets and down-link scenarios using a tradeoff between thermal and quantization noise. [C5909]

"Sentinel-1 mission overview"

The ESA Sentinels constitute the first series of operational satellites responding to the Earth Observation needs of the EU-ESA Global Monitoring for Environment and Security (GMES) programme. The GMES space component relies on existing and planned space assets as well as on new complementary developments by ESA. This paper describes the Sentinel-1 mission, an imaging synthetic aperture radar (SAR) satellite constellation at C-band. It provides an overview of the mission requirements, its applications and the technical concept for the system. [C5910]

"InSAR monitoring of landslides using RADARSAT"

In this study we used both differential and corner reflector InSAR techniques to monitor landslides at different geological sites in Canada and China. Our results show the differential InSAR maps are necessary and simple first steps in understanding regional landslide motion at these sites. In the case of our Canadian site the corner reflector results compares well with our D InSAR results. [C5911]

"A statistical study of wind field distribution within extra-tropical cyclones in North Pacific ocean from 7-years of QuikSCAT wind data"

In this paper we used QuikSCAT measurements over extratropical storms that reached hurricane force (HF) wind strength in the North Pacific over a period of 7 cold seasons from 2001-2008 to study the average wind speed distribution within these intense cyclones. During this period a total of 225 cyclones with HF winds were identified and tracked in the North Pacific. December proved to be most active month with 56 separate storms reaching HF strength over the 7 year period. The peak activity was found to be over the western portion of the ocean basin. The Pacific cyclones appear to have preferred tracks and have an average heading of $\sim 50^\circ$ from north. The average storm motion was found to be ~ 24 knots. Most hurricane force events last between 6-24 hours. 50% of the 12 hour events occurred during December and 75% of the 30 hour events occurred during November and December. [C5912]

"The combined effect of surface rain and wind on scatterometer observations of surface roughness"

The wind stress on the sea surface is closely related to the sea surface roughness. When rain impacts affect this roughness, we need to learn the consequences for the air-sea momentum exchange. Our data shows that areas of highest winds correlate closely with the heaviest rainfall. Changes in the sea surface radar cross section from the combined effects of wind and rain, on scales of tens of kilometers, are being studied using the QuikSCAT scatterometer and simultaneous NEXRAD three-dimensional measurements of rain within Hurricane Ike. Buoys, NOAA HRD H*Winds and related data provide the additional wind information. From the remote sensing perspective, these results will show the dependence of the sea surface radar cross section, at Ku-band, as a function of the rainrate, wind speed and relative direction, and polarization. At this microwave frequency the surface backscatter is controlled by the centimeter-scale roughness, but at these high wind speeds the simple models based on Bragg scattering are not useful. In order to study the air-sea interaction that is related to surface fluxes (e.g., momentum, sensible heat, and latent heat) during rain events, extended experimental investigations are needed. Heavy rain in the boundary layer changes the profiles of wind and stratification which alter the surface stress and turbulent heat fluxes. The wind driven rain also creates roughness properties that need to be modeled in order to interpret the Ku-band NRCS at the two polarizations. When high winds also exist (>20 m/s), the interaction is complicated by sea spray. [C5913]

"ASI-Volcanic Risk System (SRV): A pilot project to develop EO data processing modules and products for volcanic activity monitoring, first results"

The ASI-SRV (Sistema Rischio Vulcanico) project is devoted to the development of an integrated system based on EO and Non EO data to respond to specific needs of the Italian Civil Protection Department (DPC). ASI-SRV provides the capability to import many different EO and Non EO data into the system, it maintains a repository where the acquired data have to be stored and generates selected products which will be functional to the different volcanic activity phases. The processing modules for Radar and EO Optical sensors data allow to estimate a number of parameters which include: surface thermal proprieties, gas, aerosol and ash emissions and to characterize the volcanic products in terms of composition and geometry, surface deformations in terms of

displacements and velocity. All the generated products are related to Italian active volcanoes and three test sites have been chosen to demonstrate the capability of this integrated system: Vesuvio, Campi Flegrei (Campania region) and Etna (Sicilia region). In this paper the first results obtained by means of modules developed within the ASI-SRV project and dedicated to the processing of EO historical series are presented.

[C5914]

"The medium resolution soil moisture dataset: Overview of the SHARE ESA DUE TIGER project"

To address the needs of the hydrological community for medium resolution soil moisture dataset an approach developed at the TU WIEN for the coarse resolution ERS/METOP datasets has been transferred to medium resolution SAR data. This work was performed within the ESA Tiger Innovator project SHARE and introduces an operational soil moisture monitoring service for the region of the Southern African Development Community (SADC) and Australia. The data from the ASAR onboard ENVISAT operating in Global Mode (GM) with 1 km spatial resolution were implemented for the dataset generation that provides twice weekly measurements and captures highly variable soil moisture patterns. Several validation and application studies were summarized in this paper that demonstrated the ability of ASAR Global Mode (GM) Soil Moisture for global soil moisture monitoring. The dataset can be accessed via <http://www.ipf.tuwien.ac.at/radar/share/>. [C5915]

"ERS-ENVISAT Tandem cross-interferometry coherence estimation"

ERS-ENVISAT cross-interferometry is a unique tool for a number of applications since it combines a short repeat-pass interval (28 minutes) with a long perpendicular baseline (2 km). Temporal decorrelation effects are limited and the sensitivity to topographic features is strongly enhanced. In this contribution the focus is on problems encountered during the coherence estimation in ERS-ENVISAT cross-interferometry. Because of the ERS-2 Doppler Centroid variations the azimuth common band available is often only a relatively small fraction of the PRF. Similarly, in the case of not ideal baselines, the common range bandwidth is often much smaller than the chirp bandwidth. Furthermore, high phase gradients in the cross-interferograms can significantly affect the coherence estimates. In our contribution we propose methodologies to reduce these problems in the coherence estimation. [C5916]

"High range resolution directional borehole radar for 3-D fracture delineation"

Directional borehole radar was developed for detection of three-dimensional (3-D) target localization in single-hole radar measurement. Phase differences among four dipole elements of receiving circular array uniquely determine an azimuth direction of a reflected wave. Receiving voltages of dipole elements are measured by optical electric field sensors whose high electrical isolation feature enables data acquisition of highly correlated signal between the channels. Besides, a switching unit to control resonant frequency of dipole elements was newly developed to reduce mutual coupling between the dipole elements. Laboratory experiments have demonstrated that approximately 30% frequency bandwidth enlargement is achieved by the switching operation without been affected by the mutual coupling in air. The directional borehole radar system was tested in a field test site in Kamaishi-Mine in Japan. All the boreholes available in this test site is filled with water and past borehole radar surveys conducted in this test site revealed presence of complex fracture system. Cross-hole and single-hole borehole radar measurement were conducted to clarify the performance of the resonant switching control and also to detect 3-D geometrical structure of fractures in this test site. 3-D analysis of data acquired by the directional borehole radar in a single-hole measurement clarified azimuth orientation fractures up to a range distance of 15 m with a range resolution less than 1 m. High reliability of the result was inferred from the fact that individual fracture pattern in a reflection profile showed a consistent color along the depth and also high repeatability of the result was obtained by repeating measurements. [C5917]

"Mapping and monitoring urban growth on wetlands in humid tropical context using earth observation technology: Case study of Mangrove zones around Douala in Cameroon"

Douala, the economic capital of Cameroon, is the hub of the Country in terms of Commercial, industrial, transport, fishing, agricultural, craft activities and the tourism industry. As typical of most tropical metropolis, Douala with 1.5 million inhabitants has a rapid annual population growth rate of more than 5 per cent. The spatial expansion of Douala has been greatly deterred and handicapped by its peninsular environment made up principally of a plane topography that is surrounded by the Atlantic Ocean, River Wouri and a Mangrove ecosystem. This Mangrove occupies a surface area of 2700 Km² along the Fringes of Littoral Cameroon, and typical of brackish humid environments. The main objective of this work was to show how the advance radar processing technique can enable important information to be extracted to characterize mangroves found in the west and south of Douala. This all-weather capability of radar waves is one of the main advantages of imaging radars compared to optical sensors. The Interferometric Land-Use (ILU) technique is useful for quickly assessing

of the suitability of an interferometric pair for discrimination between different land use types around the Douala city. [C5918]

"A high speed microwave interferometer used for monitoring Stromboli volcano"

This work reports on the results obtained with a high speed ground based radar interferometer applied to the monitoring of the explosive activity of Stromboli volcano, Italy. The sensor illuminated a few craters below the summit distinguishing among them according to their distances from the sensor. The sampling rate allowed tracking the craters' movements even while they were erupting providing information about both the area affected from the deformation and its extent. Radar data were compared with seismic signals from the permanent monitoring network. The comparison demonstrated that the radar interferometer is a powerful device for retrieving ground deformation before and after an explosive event. In particular, eruptions were clearly identified from the observation of peculiar characteristics of the amplitude, phase and coherence data. [C5919]

"Sentinel 1: Interferometric applications"

Here we report recent applications that extend the range of feasibility of InSAR: imaging subsurface fluid flow, estimating flow properties such as permeability, and tracking the integrity of water defense structures. [C5920]

"Efficient configurations of SAR sensors for improved range resolution"

In this paper an innovative technique for ground range resolution improvement in Multiple Input Multiple Output (MIMO) SAR systems is presented. The technique allows to achieve a maximum theoretical range resolution improvement factor greater than the number of operating SAR sensors, by exploiting both the monostatic and the bistatic acquisitions. The effectiveness of the proposed technique is validated over a simulated dataset. [C5921]

"Analysis of Sentinel-1 mission capabilities"

The Sentinel-1 mission is designed to be a source of continuous and reliable collection of C-band SAR imagery. Requirements for Sentinel-1 end to end system, as part of the complete family of GMES Sentinels, guarantee continuity of C-band SAR data and products availability to operational entities who exploit satellite radar imagery since ERS 1 operations. Typical drivers for current- and future-generation Remote Sensing LEO satellite missions are fast target access capabilities and short on-board data latency in order to speed up the operations of data download and products' delivery to the end-users. On the other hand complete or almost complete Earth surface coverage is also required from the system. Satellite orbit and sensor swath determine the access capability so that the mission timeliness performance can only improve at the cost of increasing the number of satellites (constellation concept). SAR power demand limits the satellite operational duty cycle implying the need for trade-off between frequent acquisition of the same targets and extension of acquisition surface coverage. A balance between fast access/response to (or frequent revisit of) a few regions of interest and maximization of geographical coverage within the satellite orbit repeat cycle is thus needed when none of the above goals prevail as the main mission driver. Sentinel-1 applies a new operational mission concept; SAR acquisitions by Sentinel-1A (and Sentinel-1B when the constellation will be deployed) are designed according to pre-defined operational sequences to ensure: 1. continuous and systematic acquisition of data all along the mission time (to maximize mission return and system exploitation efficiency); 2. a growing archive of ?world-wide extended? data; 3. maximum extension of coverage after any orbit repeat cycle (175 orbits in 12 days); 4. minimum possible revisit time on few selected regions (North Atlantic Maritime Transport zones, Europe and Canada) but also; 5. possibility to include and perform, as an additional mission capability, sporadic data acquisitions coming from asynchronous user orders submitted to the system following for example requests for specific imagery during emergency occurrences. The mission analysis process performed to define in detail the above operational concept is outlined in this paper and results are presented. [C5922]

"2-1/2 Dimensional bi-static GPR propagation and scattering modeling of roadways and tunnels with projected 2D FDTD"

Subsurface sensing modalities such as Ground Penetrating Radar (GPR) are increasingly being used to assess the condition of aging civil infrastructure by evaluating deterioration within roadways and bridges, and to monitor the security of national borders by the detection of underground tunnels. The need to address these issues is intensifying and, while valuable data are collected using nondestructive evaluation there is urgency for improved understanding and analysis. Simulation of GPR investigations to search for defects in bridges and the presence of underground tunnels can help to understand and analyze real world data. Three-dimensional simulations consider the full geometry of an area. When the geometry is relatively invariant in the third dimension, 2-1/2D simulations can capture most of the 3D scattering and account for bi-static transmitters and receivers located out

of the cross-sectional plane. Additionally, comparison of 3D simulation results to a library of 2D results may help to indicate the angle of GPR travel from the cross-sectional plane. [C5923]

"Physical limitations on detecting tunnels using Underground Focusing Spotlight Synthetic Aperture Radar"

This work studies the concept of Underground Focusing Spotlight Synthetic Aperture Radar (UF-SL-SAR) systems for tunnel detection applications. A general formulation for generating UF-SL-SAR imaging in realistic, randomly rough ground is developed by focusing in space and frequency at subsurface points by considering rays refraction at the nominal ground surface. Imaging results are presented for two soil scenarios: dry sand and moist clay loam. It is demonstrated that the tunnel is successfully imaged only for the sand case. [C5924]

"SAR sea ice image segmentation using an edge-preserving region-based MRF"

In this paper, we propose a novel edge-preserving region (EPR)-based representation for synthetic aperture radar (SAR) images, which is incorporated with a region-level Markov random field (MRF) model to offer an efficient approach to the segmentation of SAR sea ice images. The EPR-based representations of SAR images are constructed by applying the speckle reduction anisotropic diffusion (SRAD) algorithm and the watershed transform, which aims at suppressing oversegmentation within objects while accurately locating object edges at region boundaries in the presence of speckle noise. In combination with a region-level MRF, the EPR-based representation largely reduces the search space of optimization process and improves parameter estimation of feature model, leading to considerable computational savings and less probability of false segmentation. Relative to the existing region-level MRF-based methods, testing results have demonstrated that the proposed method achieves more than 50% reduction of computational time and improves the segmentation accuracy especially at high speckle noise. [C5925]

"OFDM MIMO radar design for low-angle tracking using mutual information"

We develop an information theoretic waveform design algorithm for target tracking in the presence of multipath. We employ a co-located multiple-input-multiple-output (MIMO) radar configuration using wideband orthogonal frequency division multiplexing (OFDM) signalling scheme. Apart from the frequency diversity provided by OFDM, we also exploit polarization to resolve the multipath signals by using polarization-sensitive transceivers. Thus, we can track the scattering coefficients of the target at different frequencies along with its position and velocity. We apply a sequential Monte Carlo method (particle filter) to track the target, while integrating an optimal waveform design technique based on mutual information criterion. Our numerical examples demonstrate the achieved performance improvement due to the adaptive waveform design. [C5926]

"MIMO radar waveform design: a divergence-based approach for sequential and fixed-sample size tests"

A multi-frame, multiple-input, multiple-output radar detection problem is considered here. Different waveform design strategies are inspected for both fixed-sample size and sequential test. The unified treatment of the two cases is a direct consequence of the divergence-based merit function used in the optimization process. It is proved that no strategy is uniformly optimal, and that the diversity order is limited by the available energy budget. [C5927]

"Golay complementary waveforms for sparse delay-Doppler radar imaging"

We present a new approach to radar imaging that exploits sparsity in the matched filter domain to enable high resolution imaging of targets in delay and Doppler. We show that the vector of radar cross-ambiguity values at any fixed test delay cell has a sparse representation in a Vandermonde frame that is obtained by discretizing the Doppler axis. The expansion coefficients are given by the auto-correlation functions of the transmitted waveforms. We show that the orthogonal matching pursuit (OMP) algorithm can then be easily used to identify the locations of the radar targets in delay and Doppler. Unambiguous imaging in delay is enabled by alternating between a Golay pair of phase coded waveforms at the transmission to eliminate delay sidelobe effects. We then extend our work to multi-channel radar, by developing a sparse recovery approach for dually-polarimetric radar. We exploit sparsity in a bank of matched filters, each of which is matched to an entry of an Alamouti matrix of Golay waveforms to recover a co-polar or cross-polar polarization scattering component. [C5928]

"Alternating projection for MIMO radar waveform design"

Recently there has been a surge of interest in waveform design for multiple-input multiple-output (MIMO) radar, and a great deal of efforts have been devoted to this topic. In this paper, we revisit an earlier examined MIMO

radar waveform design problem which optimizes both minimum mean-square error estimation (MMSE) and mutual information (MI). We formulate a new waveform design problem and provide some further results, which complement the previous study. More specifically, we present an iterative optimization algorithm based on the alternating projection method, to determine waveform solutions that can simultaneously satisfy a structure constraint and optimize the design criteria. Numerical examples are provided, which illustrate the effectiveness of the proposed approach. In particular, we find that the waveform solutions obtained through our proposed algorithm can achieve very close and virtually indistinguishable performance from that predicted in the previous study. [C5929]

"An analysis of phase synchronization mismatch sensitivity for coherent MIMO radar systems"

In this study, the hybrid Cramer-Rao bound (CRB) is developed for target localization, to establish the sensitivity of the estimation mean-square error (MSE) to the level of phase synchronization mismatch in coherent multiple-input multiple-output (MIMO) radar systems with widely distributed antennas. The lower bound on the MSE is derived for the joint estimation of the vector of unknown parameters, consisting of the target location and the mismatch of the allegedly known system parameters, i.e., phase offsets at the radars. Synchronization errors are modeled as being random and Gaussian. A closed-form expression for the hybrid CRB is derived for the case of orthogonal waveforms. The bound on the target localization MSE is expressed as the sum of two terms, the first represents the CRB with no phase mismatch, and the second captures the mismatch effect. The latter is shown to depend on the phase error variance, the number of mismatched transmitting and receiving sensors and the system geometry. For a given phase synchronization error variance, this expression offers the means to analyze the achievable localization accuracy. Alternatively, for a predetermined localization MSE target value, the derived expression may be used to determine the necessary phase synchronization level in the distributed system. [C5930]

"Front matter"

The following topics are dealt with: multisensor adaptive processing; resource allocation; game theory; eigenvalues; network beamforming; distributed space-time coding; wireless network; MIMO radar; compressed sensing; blind source separation; image processing; acoustic signal processing; array signal processing; radar sensor information fusion; approximate joint diagonalization; nonlinear filters; Monte Carlo method; MIMO communications; and cognitive radio. [C5931]

"Multiregion level-set segmentation of synthetic aperture radar images"

Due to the presence of speckle, segmentation of SAR images is generally acknowledged as a difficult problem. A large effort has been done in order to cope with the influence of speckle noise on image segmentation such as edge detection or direct global segmentation. Recent works address this problem by using statistical image representation and deformable models. We suggest a novel variational approach to SAR image segmentation, which consists of minimizing a functional containing an original observation term derived from maximum a posteriori (MAP) estimation framework and a Gamma image representation. The minimization is carried out efficiently by a new multiregion method which embeds a simple partition assumption directly in curve evolution to guarantee a partition of the image domain from an arbitrary initial partition. Experiments on both synthetic and real images show the effectiveness of the proposed method. [C5932]

"Cramer-Rao bounds for bistatic radars"

In this paper, starting from the monostatic radar ambiguity function we derive the bistatic ambiguity function and the Cramer-Rao lower bounds (CRLB) of range (time delay) and velocity (Doppler shift) of a radar target in the case of linear frequency modulated (LFM) pulses embedded in white Gaussian noise. Moreover, we compare monostatic and bistatic CRLBs as a function of number of integrated pulses, target direction of arrival and bistatic baseline length. [C5933]

"Co-located MIMO radar with orthogonal waveform coding: Cramer-Rao Lower Bound"

In this paper, we derive and analyze closed form (nonmatrix) expression of the Cramer-Rao lower bound (CRB) for the location and the velocity of moving targets contaminated by a structured noise (clutter echoes) and a background noise. The context of our analysis is the co-located MIMO (multiple-input multiple-output) radar system, i.e., we dispose of multiple antennas in transmission and reception which are close in space. In addition as it is standard in modern MIMO radar, several noncoherent orthogonal waveforms are transmitted. The analysis of the proposed expressions of the CRB allows to better understand the characterisation of the target. In particular, we prove (1) the estimation of the direction parameter and the velocity of the target are cross-linked ; (2) it is more difficult to estimate the target velocity if the radar station is moving ; (3) if the radar station

is not moving, the estimation of the target velocity is isotropic ; (4) it is more difficult to accurately localize fixed or slow moving targets and finally, the CRB for a MIMO radar is a lower bound of the one for the SIMO (single-input multiple-output) radar. [C5934]

"Water conditions monitoring system based on GPRS"

This paper presents a method to transmit data through public web. It is characterized by less investment, operation reliability and low operating cost. It also elaborates the automatic monitoring system of small drainage basin water conditions based on GPRS. That system has been applied to reservoir region of some hydroelectric power station in North China and achieved the real-time and automatic monitoring of water conditions. [C5935]

"The Discrete Fourier Transform of Direct Digital Synthesis in the presence of phase truncation"

This paper introduces an accurate and simple method by using Discrete Fourier Transform (DFT) to calculate the spectrum of Direct Digital Synthesis (DDS) in the presence of phase truncation. The analysis results show the relationships between spectrums of different output signals and different Frequency Control Words (FCW). By obtaining the spurious spectrum location and the spurious amplitude we can compute the Spurious Free Dynamic Range (SFDR) directly. This method greatly reduces the amount of computation and has the guiding significance in the practical application. [C5936]

"A high-speed data acquisition system based on FPGA"

In this paper, a signal acquisition system for continuous-wave lidar is present in two ways. One is the hardware design, the other is the device design and application program design using FPGA with USB2.0 interface. The sampling rate of this system is up to 300Mps. The signal correlation and accumulation is processed by using FPGA with 512M RAM. The experimental results show that it can be used in a variety of systems. [C5937]

"Design and implementation of HPRF stepped frequency radar echo simulator"

A HPRF stepped frequency radar echo simulator for performance evaluation and test of radar system is introduced in this paper. The echo model of HPRF stepped frequency radar is analyzed, and its expression, considering range ambiguity and relation between intermediate frequency bandwidth and range window, is given. This paper proposed an implement scheme of HPRF stepped frequency radar echo simulator based on DAC chip AD9736. The simulator can generate kinds of radar baseband and intermediate frequency waveforms realtime, including clutters and noise if needed. It also supports data replay and provides common digital interface such as Ethernet, RS422 etc. So the simulator has the feature of universal usage. Finally, testing result demonstrates the effectiveness of the simulator. [C5938]

"Welcome from the general chairs"

On behalf of the entire CAMSAP organizing team, it is our great pleasure to welcome you to CAMSAP 2009 in Aruba, Dutch Antilles. This is the third edition of this biannual workshop on computational advances in multi-sensor adaptive processing. The workshop will consist of 12 invited sessions and 5 contributed sessions including many presentations by world-class speakers. In addition, we are fortunate to have a team of world-renowned plenary speakers. Fred Daum (Raytheon, USA) will present a physics based approach to nonlinear filters. Bart De Moor (KU Leuven, Belgium) will talk about multilinear rank approximation problems and extremal eigenvalue problems. Erik G. Larsson (Linköping University, Sweden) will explore the role of game theory in resource allocation. Rabinder Madan (Office of Naval Research, Arlington, VA, USA) will introduce the latest trends in radar sensor information fusion. Shoji Makino (University of Tsukuba, Japan) will address blind separation of convolutive mixtures of audio signals received by acoustic arrays. And, Arye Nehorai (Washington University, USA) will give a presentation on the statistical design of 3D microarrays with position-encoded microspheres. [C5939]

"Direction finding for MIMO radar with colocated antennas using transmit beamspace preprocessing"

The problem of direction finding for multiple targets in mono-static multiple-input multiple-output (MIMO) radar systems is considered. Assuming that the targets are located within a certain spatial sector, we focus the energy of multiple (two or more) transmitted orthogonal waveforms within that spatial sector using appropriately designed transmit beamforming. The transmit beamformers are designed so that match-filtering the received data to the waveforms yields multiple (two or more) data sets with rotational invariance property that allows applying search-free direction finding techniques such as ESPRIT. Unlike previously reported MIMO radar ESPRIT-based direction finding techniques, our method is applicable to arbitrary arrays and achieves better estimation

performance at lower computational cost. [C5940]

"MIMO radar: From a different perspective"

MIMO radar is an emerging topic receiving an increasing amount of attention mostly aimed at developing concepts and understanding potential capability. As an emerging topic MIMO radar doesn't have an IEEE definition and if taken literally includes many techniques that have existed much longer than the term itself. In this paper we set MIMO in the context of diversity sensing and draw on the physical interpretation implied by differing concepts to explain expected performance. In this way we present MIMO and related techniques as new and largely unexplored series of radar system design freedoms that offer additional capability. This provides a powerful new paradigm based on diversity for future radar sensors with enormous potential when combined with cognitive processing. [C5941]

"Analytical performance evaluation for HOSVD-based parameter estimation schemes"

Subspace-based high-resolution parameter estimation schemes are used in a variety of signal processing applications including radar, sonar, communications, medical imaging, and the estimation of the parameters of the dominant multipath components from MIMO channel sounder measurements. It is of great theoretical and practical interest to predict the performance of these schemes analytically. Since they rely on the estimate of the signal subspace obtained via a singular value decomposition (SVD), significant contributions to the perturbation analysis of the SVD have been made in the last decades. [C5942]

"Multi-static synthetic aperture radar image formation"

In this paper, we consider a multi-static synthetic aperture radar (SAR) imaging scenario where a swarm of airborne antennas, some of which are transmitting, receiving or both, are traversing arbitrary flight trajectories and transmitting arbitrary waveforms without any form of multiplexing. The received signal at each receiving antenna may be interfered by the scattered signals from multiple transmitters and the additive thermal noise at the receiver. Standard bi-static SAR image reconstruction algorithms result in artifacts in reconstructed images due to these interferences. In this paper, we employ microlocal analysis in a statistical setting to develop a novel filtered-backprojection (FBP) type analytic image formation method that suppresses artifacts due to interference from multiple transmitters while preserving the location and orientation of edges of the scene in the reconstructed image. [C5943]

"Geodesic neighborhoods for piecewise affine interpolation of sparse data"

We propose an interpolation method for sparse data that incorporates the geometric information of a reference image. The idea consists in defining for each sample a geodesic neighborhood and then fit a model (affine for instance) to interpolate at the current point. In the field of remote sensing for urban areas, two widely used techniques are laser range scanning (LIDAR) and stereo photogrammetry. Both techniques have a common drawback, for a variety of reasons the information they provide is sparse or incomplete. But in both cases it is fair to assume that a high resolution image of the scene is available, and we propose in this paper a diffusion algorithm that takes into account the geometry of the image u to refine the range data. This allows us to interpolate the data set while respecting the edges of u . The core of the algorithm is a fast method for computing geodesic distances between image points, which has been successfully applied to colorization by Yatziv et al. and supervised segmentation by Bai et al. The geodesic distance is used to find the set of points that are used to interpolate a piecewise affine model in the current sample. This first interpolation result is refined by merging the obtained affine patches using a greedy Mumford-Shah like algorithm. The output is a piecewise affine interpolation of the data set that respects both the given data and the radiometric information provided by u . [C5944]

"Contribution of airborne full-waveform lidar and image data for urban scene classification"

Airborne lidar systems have become an alternative source for the acquisition of altimeter data. In addition to multi-echo laser scanner systems, full-waveform systems are able to record the whole backscattered signal for each emitted laser pulse. These data provide more information about the structure and the physical properties of the surface. This paper is focused on the classification of full-waveform lidar and airborne image data on urban scenes. Random forests are used since they provide an accurate classification and run efficiently on large datasets. Moreover, they provide measures of variable importance for each class. This is crucial to analyze the relevance of each feature for the classification of urban scenes. Random Forests provide more accurate results than Support Vector Machines with an overall accuracy of 95.75%. The most relevant features show the contribution of lidar waveforms for classifying dense urban scenes and improve the classification accuracy for all classes. [C5945]

"Unsupervised seabed segmentation of synthetic aperture sonar imagery via wavelet features and spectral clustering"

An unsupervised seabed segmentation algorithm for synthetic aperture sonar (SAS) imagery is proposed. Each 2 m Γ B— 2 m area of seabed is treated as a unique data point. A set of features derived from the coefficients of a wavelet decomposition are extracted for each data point. Spectral clustering is then performed with this data, which assigns the data points to clusters. This clustering result is then used directly to effect a segmentation of the SAS image into different seabed types. Experimental results on four real, measured SAS images demonstrate the promise of the proposed approach. Importantly, accurate image segmentation results are achieved on the large, challenging images without the aid of any training data or parameter estimation. [C5946]

"A novel wavelet domain statistical approach for denoising SAR images"

In this paper, we present a novel Bayesian-based speckle suppression method for Synthetic Aperture Radar (SAR) images within the framework of wavelet analysis. We introduce two-dimensional Generalized Autoregressive Conditional Heteroscedasticity Mixture (2D-GARCH-M) model as an extension of two-dimensional GARCH (2D-GARCH) model and use it for statistical modeling of SAR images subbands. Similar to 2D-GARCH model, this new model can capture heavy tailed marginal distribution and the intrascale dependencies of wavelet coefficients. Also, 2D-GARCH-M model introduces additional flexibility in the model formulation in comparison with 2D-GARCH model, which can result in better characterization of SAR images' subbands and improved restoration in noisy environments. Then, we design a Bayesian estimator for estimating the clean image wavelet coefficients. Finally, we compare our proposed method with various speckle suppression methods applied on actual and synthetic SAR images and verify the performance improvement in utilizing the new strategy. [C5947]

"SAR image despeckling using undecimated directional filter banks and mean shift"

The granular appearance of speckle noise in synthetic aperture radar (SAR) imagery can make it difficult to visually and automatically interpret SAR data. Speckle reduction is a prerequisite for many SAR image processing tasks. In this paper, a novel method of SAR image despeckling is presented that uses undecimated directional filter banks (UDFB) and mean shift clustering. The UDFB is obtained by manipulating the resampling matrices in the Bamberger directional filter banks (DFB), such that low computational complexity is preserved, while achieving shift invariance that could be useful in pattern recognition and image denoising applications. A nonparametric estimator of the density gradient is employed in the joint spatial-range domain of the directional bands obtained by the UDFB. Examples included at the end of the paper illustrate typical performance results obtained using this method. [C5948]

"Application of DSM theory for SAR image change detection"

Synthetic Aperture Radar (SAR) data enables direct observation of land surface at repetitive intervals and therefore allows temporal detection and monitoring of land changes. However, the problem of radar automatic change detection is made more difficult, mainly with the presence of speckle noise. This paper presents a new method for SAR image change detection using the Dezert-Smarandache Theory (DSmT). First, a Gamma distribution function is used to characterize globally the radar texture data and allows mass assignment through Kullback-Leibler distance. Then, local pixel measurements are introduced to refine the mass attribution and take into account the context information. Finally, DSmT is carried out by comparing the modelling results between temporal images. The originality of the proposed method is on the one hand, the use of DSmT which achieves a plausible and paradoxical reasoning compared to classical Dempster-Shafer Theory (DST). On the other hand, the given approach characterizes the radar texture data with a Gamma distribution which allows a better representation of the speckle. The radar texture is being usually modeled by a Gaussian model in previous DST and DSmT fusion works. [C5949]

"Structure-preserving speckle reduction of SAR images using nonlocal means filters"

This paper proposes a structure-preserving speckle reduction (SPSR) algorithm for synthetic aperture radar (SAR) images by exploiting self-similarity of structural patterns based on nonlocal means filter. The SPSR algorithm is featured by discerning pixels of similar structural patterns, which is crucial for a despeckling process to avoid blurring image structure. To alleviate the impact of speckle noise to similarity measure, a two-stage filtering scheme is introduced into the SPSR algorithm. Filtering at the first stage aims at an accurate approximation of true structural similarity, followed by the filtering at the second stage to group pixels with similar neighborhood in a large area. Compared to the traditional Lee filter, enhanced Lee filter and the speckle reducing anisotropic diffusion (SRAD), evaluation results have shown that the SPSR algorithm substantially

improves the despeckling performance especially on structure preservation and speckle reduction in homogeneous regions. [C5950]

"Compressed sensing for Synthetic Aperture Radar imaging"

In this paper, we introduce a new Synthetic Aperture Radar (SAR) imaging modality that provides a high resolution map of the spatial distribution of targets and terrain based on a significant reduction in the number of transmitted and/or received electromagnetic waveforms. This new imaging scheme, which requires no new hardware components, allows the aperture to be compressed and presents many important applications and advantages among which include resolving ambiguities, strong resistance to countermeasures and interception, and reduced on-board storage constraints. [C5951]

"Total variation restoration of speckled images using a split-bregman algorithm"

Multiplicative noise models occur in the study of several coherent imaging systems, such as synthetic aperture radar and sonar, and ultrasound and laser imaging. This type of noise is also commonly referred to as speckle. Multiplicative noise introduces two additional layers of difficulties with respect to the popular Gaussian additive noise model: (1) the noise is multiplied by (rather than added to) the original image, and (2) the noise is not Gaussian, with Rayleigh and Gamma being commonly used densities. These two features of the multiplicative noise model preclude the direct application of state-of-the-art restoration methods, such as those based on the combination of total variation or wavelet-based regularization with a quadratic observation term. In this paper, we tackle these difficulties by: (1) using the common trick of converting the multiplicative model into an additive one by taking logarithms, and (2) adopting the recently proposed split Bregman approach to estimate the underlying image under total variation regularization. This approach is based on formulating a constrained problem equivalent to the original unconstrained one, which is then solved using Bregman iterations (equivalently, an augmented Lagrangian method). A set of experiments show that the proposed method yields state-of-the-art results. [C5952]

"Classification of water regions in SAR images using level sets and non-parametric density estimation"

This paper presents a semi-supervised algorithm for the classification of water regions in SAR images. The proposed technique is based on region based level sets and non-parametric estimation of the probability density function (PDF) of the pixel intensities. The level set framework allows automatic topology adaptation and provides the regularization while the PDF's are estimated in each region using Parzen windows. Using non-parametric density estimation gives the method the flexibility to be used with different kinds of SAR data. To illustrate the performance of the proposed algorithm, the method is applied to the problems of river mapping and coastline extraction in real amplitude SAR images. [C5953]

"SAR image classification using the InSar coherence for soil degradation cartography in the south of Tunisia"

In this work we demonstrate the potentiel of the InSAR coherence in classifying regions threatened by the desertification. We propose to combine features from InSAR amplitude and coherence images into a single 3D space in which every pixel is represented by its three-values vector (master image, slave image, coherence image) then to apply the multichannel Fuzzy C-Means (FCM) clustering algorithm. Our motivation behind this proposition lies first in the fact that correlation between both of InSAR images can reduce considerably effects of the noise while preserving image details. The second fact is that coherence represents a complementary information to the SAR image amplitude that can well indicates the spatial homogeneity behavior of each contextual class. Two ERS-1 SAR images over the region of Ben Guerdane, in the South-East of Tunisia, are considered for validation. [C5954]

"Lidar waveform modeling using a marked point process"

Lidar waveforms are 1D signal consisting of a train of echoes where each of them correspond to a scattering target of the Earth surface. Modeling these echoes with the appropriate parametric function is necessary to retrieve physical information about these objects and characterize their properties. This paper presents a marked point process based model to reconstruct a lidar signal in terms of a set of parametric functions. The model takes into account both a data term which measures the coherence between the models and the waveforms, and a regularizing term which introduces physical knowledge on the reconstructed signal. We search for the best configuration of functions by performing a Reversible Jump Markov Chain Monte Carlo sampler coupled with a simulated annealing. Results are finally presented on different kinds of signals in urban areas. [C5955]

"Classifying urban landscape in aerial LiDAR using 3D shape analysis"

The classification of urban landscape in aerial lidar point clouds is useful in 3D modeling and object recognition applications in urban environments. In this paper, we introduce a multi-category classification system for identifying water, ground, roof, and trees in airborne lidar. The system is organized as a cascade of binary classifiers, each of which performs unsupervised region growing followed by supervised, segment-wise classification. Categories with the most discriminating features, such as water and ground, are identified first and are used as context for identifying more complex categories, such as trees. We use 3D shape analysis and region growing to identify $\Gamma, B_{\text{planar}}, B_i$ and $\Gamma, B_{\text{scatter}}, B_i$ regions that likely correspond to ground/roof and trees respectively. We demonstrate results on two urban datasets, the larger of which contains 200 million lidar returns over 7km². We show that our ground, roof, and tree classifiers, when trained on one dataset, perform well on the other dataset. [C5956]

"2D tree detection in large urban landscapes using aerial LiDAR data"

We present a scalable approach to tree detection in large urban landscapes using aerial LiDAR data. Similar to our previous work in 2006, our current method consists of segmentation followed by classification. However, unlike our previous work, the current approach does not use color information or aerial imagery, and hence is more generally applicable. Also, our current approach has been successfully tested on two very large datasets, which are many orders of magnitude larger than the dataset used in 2006. Specifically, we use a North American dataset, containing 125 million LiDAR returns over 3 km², and a European dataset, containing 200 million LiDAR returns over 7 km². For both datasets, we report precision and recall rates of over 95%. [C5957]

"Variational model-based 3d building extraction from remote sensing data"

In this paper, we introduce a variational framework towards automatic 3D building reconstruction from optical and Lidar data. Multiple 3D competing building priors are considered under a recognition-driven way. These models, under a certain hierarchical representation, describe the space of solutions and under a fruitful synergy with an inferential procedure recover the observed scene's geometry. Our formulation allows the cue with the higher spatial resolution to constrain properly the boundaries detection procedure ensuring, in this way, optimal results in terms of accuracy. Such an integrated approach is defined in a variational context, solves segmentation in both spaces, addresses fusion in a natural manner and allows multiple competing priors to determine the pose and 3D geometry from the observed data. Very promising experimental results demonstrate the potentials of our approach. [C5958]

"Object extraction from high resolution SAR images using a birth and death dynamics"

We present a new approach to extract predefined objects, such as trees and oil tanks for instance, from high resolution SAR images. We consider a stochastic approach based on an object process also called marked point process. The objects represent trees or oil tanks which are modeled by disks in the image. We first define a Gibbs density that takes into account both prior information and the data. The energy we define is composed of two terms, one is a prior, penalizing overlaps between objects, and the other is a data term, which measures the suitability of an object in the SAR image. The problem is then reduced to an energy minimization problem. We sample the process to extract the configuration of objects minimizing the energy by a fast birth-and-death dynamics, leading to the total number of objects (trees or oil tanks in our case). This approach is much faster than manual counts and does not need any preprocessing or supervision of a user. [C5959]

"Fusion and inversion of SAR data to obtain a superresolution image"

The Synthetic Aperture Radar (SAR) data obtained from a single emitter and a single receiver gives information in the Fourier domain of the scene over a line segment whose width is related to the bandwidth of the emitted signal. The mathematical problem of image reconstruction in SAR then becomes a Fourier Synthesis (FS) inverse problem. When there are more than one emitter and/or receiver looking the same scene, the problem becomes fusion and inversion. In this paper we report on a Bayesian inversion framework to obtain a Super Resolution (SR) image doing jointly data fusion and inversion. We applied the proposed method on some synthetic data to compare its performances to other classical methods and on experimental data obtained at ONERA. [C5960]

"Landmines recognition system using thermovision techniques"

Sub-surface and buried landmines, with the surrounding environment constitute a complex system with variable characteristics. Infrared thermography techniques are attractive candidates for this kind of applications. They can be used from a considerable standoff distance to provide information on several mine properties, and they can

also rapidly survey large areas. This paper presents a robust method for landmine detection and recognition. It uses the mean-shift algorithm to segment the acquired infrared image. The segmented image retains pixels associated with mines together with background clutters. To determine which pixels represent the mines, a second phase of segmentation is applied to the output of the mean-shift algorithm by using a self-organizing maps (SOM) algorithm. Depending on the resulted cluster intensity variations, the chips extracted from the segmented image are processed to extract mine signatures. After that, the extracted signatures are scanned horizontally, vertically, and diagonally to build a cluster intensity variation profile. This profile is statistically compared with the known mine signature profiles. The proposed system is applied on series of time variant mid-wave infrared images (MWIR), and the test result show that the system can effectively recognize the mines with low false alarm rate. [C5961]

"Distributed waveforms for networked meteorological radars"

Distributed waveforms for resolving ambiguities for Doppler weather radar systems are presented in this paper. The novel approach is a network-based technique where spatially distributed monostatic radars are used to mitigate ambiguities in the measurements. The networked waveform system offers many advantages. First, it decouples the range ambiguity and velocity ambiguity from each other, whereas range and velocity ambiguities are coupled together in a waveform for single radar. Second, the networked waveform can be designed to measure very high velocities without the need for complex waveforms and advanced processing at each radar node. This minimizes the computational load on each node. Third, it can be used with low cost transmitter that has limited ability to support complex waveforms as opposed to a significantly expensive single radar system with complex waveforms. Fourth, the networked waveform system can be designed to meet a specific requirement over the coverage region without being restricted by limitation of an individual radar node in the network. Fifth, the distributed waveform enables direct estimation of dealiased wind field, which is critical for kinematic analysis of storm structure. Based on the results obtained from simulation it is observed that distributed waveform can provide high unambiguous velocities. A distributed waveform was implemented with a four node radar network and preliminary results show that the networked approach is a viable solution. [C5962]

"Analysis of range-angle coupled beamforming with frequency-diverse chirps"

Recently range-dependent (or time-varying) beamforming has been presented as a method to spread transmit energy over a desired spatial extent via a linear frequency shift across the waveforms transmitted at each element of an array. This element-level waveform diversity yields additional degrees of freedom relative to traditional beamforming techniques for which some sensing benefits have been suggested. In this paper, chirp waveforms with slightly different starting frequencies are analyzed to characterize the associated range-dependent beampattern. Specifically, it is determined that by utilizing this particular waveform structure, the energy transmitted over a pulse duration can be spread in a practically linear manner within the spatial extent specified by two angles despite the nonlinear relationship between spatial and electrical angles if the set of frequency-diverse chirps are appropriately parameterized. Additionally, a space-range ambiguity diagram is formulated. The ambiguity is discussed for the traditional and frequency-diverse array scenarios. [C5963]

"MIMO radar angle-doppler imaging via iterative space-time adaptive processing"

We consider using multi-input multi-output (MIMO) radar to improve the ground moving target indication (GMTI) performance, especially for slowly moving targets, for airborne surveillance systems. The increased virtual aperture afforded by MIMO radar systems enables many advantages, including enhanced spatial resolution, improved parameter identifiability and better performance for GMTI. To obviate the need of secondary data for space-time adaptive processing (STAP), we apply herein a user parameter-free and secondary data-free fully automatic weighted least squares based iterative adaptive approach (IAA) to angle-Doppler imaging via a standard MIMO scheme, two simplified MIMO schemes (which employ switching strategies for transmission), and also a conventional single-input multi-output (SIMO) scheme. The high-resolution angle-Doppler images formed by IAA, using the primary data only, are provided to compare the performance of the three MIMO schemes as well as the SIMO scheme. [C5964]

"Panel discussion: MIMO radar-fact or fantasy?"

The Special "MIMO Radar-Fact or Fantasy?" Session at the 4th International Waveform Diversity and Design Conference will be comprised of 20 minute technical presentations by each of the five invited speakers who were selected based on the quality of the papers that they had presented at other venues, their preeminence in the technical community as judged by their professional positions, their published journal papers or books, as well as their potentially controversial opinions on the potential benefits and pitfalls, that could result from the introduction of MIMO architectures into modern radar systems. The final 20 minutes of this 2 hour special

session will be a open panel discussion involving the five prior speakers and Marshall Greenspan as the panel discussion moderator. [C5965]

"The Frequency Diverse Bistatic System"

In this paper we analyze the frequency diverse array (FDA), modifying some of its characteristics. Through a reconsideration of the organization of the array, which we termed *Idquowavelength arrayrdquo* (WA), a new pattern, *dasiaorthogonalpsila* to the standard phased array, can be achieved. The bistatic combination of a WA and a receiver originates the *dasiafrequency diverse bistatic systempsila* (FDBS), which can be a significant application of this concept. [C5966]

"Stepped-Frequency Waveform radar demonstrator and its jamming"

In this paper we present some applications of the stepped-frequency signal waveform designed for the obtention of HRRP (High Resolution Range Profiles) and ISAR (Inverse Synthetic Aperture Radar) images for their ulterior use in NCTI (non-cooperative target identification). For this purpose, we have developed a stepped-frequency radar demonstrator, capable of generating very stable in phase coherent pulses. A careful study thereof is presented, providing examples of actual targets as measured by the radar and discussing the main advantages and disadvantages of this waveform. On the other hand, jamming could severely affect the reliability of measurements at wartime. Consequently, we have also evaluated the impact of deception jamming on this waveform by creating a prototype jammer which can simulate both static and dynamic targets. [C5967]

"Waveform-agile sensing for range and DoA estimation in MIMO radars"

We propose an agile sensing algorithm to optimally select the transmission waveform of a multiple-input, multiple-output (MIMO) radar system in order to improve target localization. Specifically, we first derive the Cramer-Rao lower bound (CRLB) for the joint estimation of the antenna reflection coefficients and the range and direction-of-arrival of a stationary target using MIMO radar with colocated antennas. The resulting CRLB, that is a function of the transmitted waveform, is then compared to the estimation performance of a maximum-likelihood estimator. We configure waveform parameters to minimize the trace of the predicted error covariance by assuming that the covariance of the observation noise is approximated by the CRLB for high signal-to-noise ratios. In particular, we optimally select the duration and phase function parameters of generalized frequency-modulated chirps to minimize the estimation mean-squared error under constraints of fixed transmission energy and constant time-bandwidth product. [C5968]

"Autocorrelation and modulus constraints in radar waveform optimization"

Two methods of constraining the waveform auto-correlation sequence (ACS) in a radar waveform optimization problem are compared. The first method directly constrains the envelope of the waveform ACS, whereas the second method indirectly constrains the waveform ACS through the imposition of a similarity constraint. Both methods are imposed in conjunction with constraints on the waveform modulus. The resulting nonlinear programming problems were formulated for a specific example, and solved using standard numerical algorithms. The results indicate that the similarity constraint may not be a useful means of constraining the waveform ACS when the waveform modulus is simultaneously constrained. The results also demonstrate that phase-only optimization can provide a significant decrease in computation time while providing near optimal results. [C5969]

"A comparative study of target localization in MIMO radar systems"

In the paper, a study of target localization performances is presented for coherent multiple-input multiple-output (MIMO) and single-input multiple-output (SIMO) radars systems with widely separated elements. The evaluation is based on the best linear unbiased estimator (BLUE), providing the localization mean squared error (MSE) in a closed-form solution. This estimator elucidates the relation between the radar locations, target location, and localization accuracy through the use of the geometric dilution of precision (GDOP) metric. Contour maps of the GDOP relate a given deployment of sensors and the achievable accuracy to the at various target locations. This metric is shown to represent the spatial advantage of the system. The best achievable accuracy for both configurations is derived. MIMO radar systems with coherent processing are shown to benefit from higher spatial advantage, compared with SIMO systems. The advantage of the MIMO radar scheme over SIMO is evident when considering the achievable accuracy for a radar system with M transmitters and N receivers, rather than 1 transmitter and MN receivers. It is shown that MIMO radar, with a total of $M + N$ sensors, has twice the performance (in terms of localization MSE) of a system with $(MN + 1)$ sensors. [C5970]

"Transmit coding with a range ambiguity"

Often a requirement of radar is a high pulse repetition frequency, as such range ambiguities are a consequence of this requirement. One approach to resolve said ambiguities is to use a non-uniform PRF. The interest in this paper is to utilize a uniform PRF and pulse diversity to resolve a single or multiple range ambiguities through temporal coding. An algorithm will be introduced that is completely scalable to any type of scenario that will quickly create a custom set of M unique transmit codes that can be used at every pulse of the transmitter in order to resolve range ambiguities. [C5971]

"Cramér-Rao lower bounds for the joint estimation of target attributes using MIMO radar"

We derive the Cramer-Rao lower bound (CRLB) on the covariance of the joint estimates of the parameters of moving targets using measurements from multiple-input, multiple-output (MIMO) radars. We first derive the CRLB for MIMO radars with colocated antennas for estimating the target's direction of arrival, range and range-rate. We then demonstrate that the CRLB for phased array radars is a special case of the CRLB for MIMO radars with colocated antennas. We also derive the CRLB for MIMO radars with widely-separated antennas for estimating the target's location and velocity, and we compare it to the CRLB for the multistatic radar. For both types of MIMO radar systems, we show that the CRLB is related to the parameters of the transmitted waveforms, as demonstrated with numerical simulations. [C5972]

"Polyphase sequences with good correlation properties"

Design of sequences with good auto and crosscorrelation properties is one of the main tasks in several applications, including multi-user radar, sonar, and communications. In this paper we describe a new construction of polyphase sequences with optimal correlation properties. The construction includes, as special cases, a family of finite chirps and two previously proposed families of communications sequences. The main tool used in the construction is the finite Zak transform. The construction suggests several further generalizations that can be obtained by operating exclusively on subgroups of the permutation group. [C5973]

"Frequency agile stepped OFDM waveform for HRR"

High range resolution (HRR) is an important feature for radar, aiming at target classification. The range resolution is inversely proportional to the bandwidth of the transmitted signal. Pulse burst waveforms can achieve HRR at low expenses when the carrier frequency increases from one pulse to the next, stepping and synthesizing the wide bandwidth. In such a stepped frequency approach the resolution is determined by the bandwidth of the total pulse burst. With the orthogonal frequency division multiplexing (OFDM) waveform, the time/frequency pattern of the transmitted radar signal is fully flexible while the waveform can be generated easily by IFFT. The novelty of this paper is to demonstrate how the combination of frequency agility and HRR processing into one system can benefit from the OFDM flexibility. An elementary scenario with a single stationary or low speed point target is assumed. [C5974]

"GMTI MIMO radar"

Multiple-input multiple-output (MIMO) extensions to radar systems enable a number of advantages compared to traditional approaches. These advantages include improved angle estimation and target detection. In this paper, MIMO ground moving target indication (GMTI) radar is addressed. The concept of coherent MIMO radar is introduced. Comparisons are presented comparing MIMO GMTI and traditional radar performance. Simulations and theoretical bounds for MIMO GMTI angle estimation and minimum detectable velocity are presented. The simulations are evaluated in the time domain, enabling waveform design studies. For some applications, these results indicate significant potential improvements in clutter-mitigation SINR loss and reduction in angle-estimation error for slow-moving targets. [C5975]

"MIMO phased-array for SMTI radar"

Summary form only given. Waveform diversity techniques for radar have gained considerable interest over the past several years. Novel radar waveforms have been proposed to improve detection performance and metric accuracy (i.e., angle estimation performance). This paper explores the potential for using a waveform diversity technique known as Multiple Input, Multiple Output (MIMO) radar to improve the detection performance of slow moving surface targets from a moving radar platform. The MIMO radar system achieves superior performance by transmitting unique uncorrelated waveforms from each antenna subaperture as opposed to the traditional approach of transmitting a single coherent waveform across the entire aperture. The results show that the radar system minimum detectable velocity (MDV) can be reduced by exploiting the ability of a MIMO system to effectively increase the radar antenna aperture. [C5976]

"Clutter rank Of MIMO radar with a speical class of waveforms"

In this paper, the rank of clutter covariance matrix (CCM) is studied for space-time adaptive processing (STAP) implemented on the multiple-input multiple-output (MIMO) radar with waveform diversity. It is found that the clutter rank is dependent on the rank and structure of the covariance matrix of the transmitting waveforms, and that clutter rank of orthogonal waveforms acts as the upper bound for all kinds of waveforms. More specifically, three simple rules are proposed to estimate the clutter rank for one special class of waveforms. This class of waveforms, though we call it special, indeed can include coherent waveforms, orthogonal waveforms, as well as part of partially correlated waveforms. In this way, the method of estimating the clutter rank for both coherent and orthogonal waveforms are herein unified. The application of these rules only requires the computation of the waveform covariance matrix (WCM) and a polynomial based on the WCM, thus it is convenient and computationally efficient. The proposed rules are well verified by simulation results and also general enough to be suitable for both conventional space time radar systems and the MIMO radars with orthogonal waveforms.

[C5977]

"MIMO radar: Snake oil or good idea?"

MIMO communication is theoretically superior to conventional comm. under certain conditions, and MIMO comm. also appears to be practical and cost effective in the real world for some applications. It is natural to suppose that the same is true for MIMO radar, but the situation is not so clear. Researchers claim many advantages of MIMO radar relative to phased array radars (e.g., better detection performance, better angular resolution, better angular measurement accuracy, improved robustness against RFI & ECM & multipath, etc.). We will evaluate such assertions from a system engineering viewpoint. In particular, there are serious tradeoffs of MIMO vs. phased array radars relative to cost, system complexity and risk, considering numerous real world effects that are not included in most theoretical analyses. Moreover, in many cases one can achieve essentially the same radar system improvement with phased array radars using simpler less expensive and less risky algorithms. We evaluate roughly a dozen asserted advantages of MIMO radar relative to phased arrays.

[C5978]

"Constant-modulus partially correlated signal design for uniform linear and rectangular MIMO radar arrays"

A method for generating partially correlated signals that result in arbitrary rectangular transmit beampatterns in a MIMO radar system is described. These signals are computed using frequency-offset complex exponentials (1-D) or Kronecker products of frequency-offset complex exponentials (2-D), followed by pointwise multiplication of the transmit signal vectors by a scalar pseudo-noise spreading sequence. Except for the spreading sequence, which can be pre-computed, the signals are given in closed form and thus require no numerical optimization. The transmit beampattern shape is controlled by one scalar parameter in 1-D and two scalar parameters in 2-D. The transmit beampattern is the convolution of a rectangle with a sincsquared function in 1-D, and the separable product of such functions in 2-D. The signals are constant-modulus, have desirable temporal autocorrelation properties, and are simple to compute.

[C5979]

"Constant envelope OFDM for power-efficient radar and data communications"

This paper offers a tutorial treatment of constant envelope OFDM, covering power efficiency and spectral efficiency tradeoffs and discusses recent advancements in applying CE-OFDM to radar. A dual-use architecture is proposed offering both radar and communications capabilities on a common platform.

[C5980]

"Optimal spatial sampling of hyperspectral imagery for fusion with panchromatic video in multitarget tracking"

Hyperspectral imagery (HSI) data has proven useful for discriminating targets, however the relatively slow speed at which HSI data is gathered for an entire frame reduces the usefulness of fusing this information with panchromatic video. Additionally, the volume of HSI information collected affects the computational performance of software exploiting the information. Paradoxically, it is too much information and we cannot get enough of it. A new sensor under development has the potential of overcoming this problem. It has the ability to provide HSI data for a limited number of pixels while providing panchromatic video for the remainder of the pixels. The HSI data is co-registered with the panchromatic video and is available at each frame. This paper investigates the exploitation of this new sensor for target tracking. The first challenge of exploiting this sensor is to determine where the gathering of HSI data will be the most useful as compared to collecting panchromatic. We optimize the selection of pixels for which we will gather HSI data. We refer to this as spatial sampling. Spatial sampling is solved using a utility function where pixels receive a value based on their nearness to a target of interest (TOI). The TOIs are determined from the tracking algorithm providing a close coupling of the tracking and the sensor control. The weighting of the different types of TOIs is accomplished by a multiobjective genetic algorithm.

Experiments compare fused versus non-fused tracking performance. [C5981]

"Extensible simulator for waveform diversity testing"

Exotic waveforms can be formulated, and assessed, using purpose-written waveform generators and matched receivers. However, more comprehensive testing in an environment similar to operational conditions requires a large investment in coding. Furthermore, even bespoke simulators are usually written for the monostatic case, and have limited facilities to handle multiple transceivers distributed in space and time. These considerations led to the development of FERS, the flexible extensible radar simulator, which has been launched as an Open Source initiative. The simulator can handle an arbitrary number of transmit / receive nodes, targets, all distributed in time and space. Waveforms and signal processing can be added in a simple way through a well defined interface. This paper discusses the needs for such a simulator, its design, the high performance computing aspects and concludes with some examples. [C5982]

"A signal level simulator for netted radar waveforms evaluation"

When evaluating the performances of radar waveforms, it is crucial to understand how the signal is affected by multiple interactions with the environment and the system hardware. Analysis of complex radar systems, such as multistatic and netted designs (see Fig. 1) is often intractable without the application of a dedicated radar simulation system. Recent research into radar simulation has focused primarily on synthetic aperture radar (SAR) systems and is not entirely applicable to traditional radar systems concerned with the location and tracking of remote targets. A complete simulator has been designed for the accurate simulation of raw returns in complex, multistatic and netted radars and is applicable to pulsed and continuous wave (CW) systems, and both active and passive radar systems. The flexible simulator for multistatic radars (FERS) can be used to simulate radar systems with arbitrary waveforms and arbitrary numbers of receivers, transmitters and scatterers. In this paper, algorithms for the simulation of raw radar return signals are presented, based on interpolation and modification of the transmitted signal and modelling of the radar hardware and environment. The algorithms are expected to be especially valuable for the simulation of emerging radar technologies, such as Passive Coherent Location (PCL), netted radar and phased array radar. Preliminary results, presented in this paper, suggest that these algorithms can simulate physical systems with excellent accuracy. [C5983]

"FPGA Implementation of the Ternary Pulse Compression Sequences with Good Discrimination Factor Values"

Ternary codes have been widely used in radar and communication areas, but the synthesis of ternary codes with good discrimination factor is a nonlinear multivariable optimization problem, which is usually difficult to tackle. To get the solution of above problem many global optimization algorithms like genetic algorithm, simulated annealing, and tunneling algorithm were reported in the literature. However, there is no guarantee to get global optimum point. In this paper, a novel and efficient VLSI architecture is proposed to design Ternary Pulse compression sequences with good discrimination factor. The VLSI architecture is implemented on the field programmable gate array (FPGA) as it provides the flexibility of reconfigurability and reprogramability. The implemented architecture overcomes the drawbacks of non guaranteed convergence of the earlier optimization algorithms. [C5984]

"Voice over Data over GPRS/ EDGE Networks"

GPRS or the general packet radio service is a non-voice value added technology that allows data communication over mobile phones in an Internet Protocol (IP)-based network [11]. This paper focuses on the transmission of voice over the existing data channel in GSM/GPRS networks using a Web server. Since the data channel in any network is economically viable for transmission, a mechanism to transfer voice over the existing network can prove to be a boon. Because of the fact that general packet radio service has a data rate from 56 to 114 kbps (In case of EDGE it goes upto 177.6 kbps) and has a continuous connection to internet via the GGSN & SGSN and is based on the packet switched network, so if the voice at one end be broken into data packets and transmitted through a Web server, can be reassembled at the other end. This whole process can be termed as Voice over data over Mobile (VODOM). Obviously GPRS based voice packet service should cost extremely less than the traditional circuit switched voice service. [C5985]

"Fully Integrated Millimeter-Wave VCO with 32% Tuning Range"

In this paper, the authors present a fully integrated VCO with 32% tuning range centered at 38.9 GHz. The VCO was designed using a commercially available, inexpensive 0.8 μm Si/SiGe HBT technology with f_{T} and f_{max} of 80 and 90 GHz, respectively. It consumes 195 mW DC power and provides an output power of more than 5 dBm. A phase noise of -93 dBc/Hz at 1 MHz offset was measured for the free running VCO. [C5986]

"A Comparison of Si CMOS and SiGe BiCMOS Technologies for Automotive Radars"

This paper compares CMOS FET and SiGe HBT technologies for automotive applications and discusses limitations and opportunities for further development of both. SiGe circuits have demonstrated very promising performance, especially for the stringent reliability requirements and high temperature operating conditions set by the automotive industry. Their introduction to radar systems will occur in the near future. In the long run CMOS devices have the potential to become competitive in performance and offer opportunities for further reductions in manufacturing costs. [C5987]

"Adaptive OFDM radar for detecting a moving target in urban scenarios"

We address the problem of detecting a moving target in an urban canyon using an orthogonal frequency division multiplexing (OFDM) radar and exploiting the multipath reflections. The multipath propagation increases the spatial diversity of the radar system and provides different Doppler shifts over different path. In addition, the use of broadband OFDM signal provides frequency diversity to the system. We develop a parametric measurement model that accounts for the multipath components at multiple frequencies as well as Doppler shifts. Then, we develop a statistical detection test and evaluate its performance characteristics. Based on this, we propose an algorithm to optimally design the spectral weights for the next transmitting waveform. We present a few numerical examples to illustrate our analytical results. We demonstrate the achieved performance improvement due to the exploitation of multipath propagation, OFDM signalling, and adaptive waveform design. [C5988]

"Mitigation of radar range ambiguities via waveform diversity"

The USAF is considering a number of radar systems as a method to achieve persistent intelligence, surveillance and reconnaissance (ISR) over the Earth's surface. A comprehensive approach must be taken that identifies feasible radar system parameters, geometry, area coverage and processing approaches that will provide needed moving target indication MTI (both ground and air) performance. From the signal processing perspective, there are a number of unique technical challenges facing this concept. Issues which will need to be addressed include the restriction of antenna aperture and the need to locate and detect targets at shallow grazing angles. These and other phenomenology will impact the ability of algorithms implemented by the system to perform image formation, target detection and parameter estimation. This paper presents a new approach to the problem of radar range ambiguities in synthetic aperture radar (SAR) imagery and surface moving target indication (SMTI). By using a combination a priori knowledge of the collection geometry, orthogonal waveforms and an alternative approach to traditional matched filter processing, it can be shown that the effects of the ambiguities can be mitigated and provide image quality and SMTI performance with little degradation as compared to the non-ambiguous case. [C5989]

"Passive Coherent Location as Cognitive Radar"

Cognitive radar describes a generic radar system that is capable of adapting its transmission waveforms and cooperation with other sensors in order to achieve superior detection, recognition and tracking of targets. For example, the sensors of a cognitive radar system might use the illumination signals to carry broadcast data, allowing the sharing of target information. In this paper we postulate that it would be possible to implement a cognitive version of passive coherent location (PCL) which has much in common with the broad cognitive radar concept, but adapts only to the waveforms it senses in the environment, and exploits those that are most useful to it for target detection. In addition, it would model the terrain to improve coverage and provide countermeasures against direct signal saturation. By its name, PCL does not transmit, but relies on emissions from other radiating systems, such as broadcast services, other radars, cellular radio, WiFi, and so on. It is clear that such a system, consisting of multiple, cooperating receivers, can achieve excellent performance in the presence of deliberate jamming, difficult terrain and attempts at target stealth. In the civilian radar domain, the technology offers opportunities for bandwidth conservation. [C5990]

"MIMO Radar with Frequency Diversity"

We propose a new multiple-input, multiple-output (MIMO) radar system with colocated antennas that can greatly reduce target fluctuations. This is achieved by employing frequency diversity. The proposed MIMO radar system results in a radar array with frequency-division multiplexing that can also incorporate beamforming to design the transmission beam pattern. After presenting an overview of existing MIMO radar systems and their related signal models, we provide a detailed description of the proposed frequency diversity technique and the corresponding transmitter and receiver structures. Furthermore, we present a maximum likelihood estimation algorithm that incorporates frequency diversity with MIMO radar, derive the corresponding Cramer-Rao lower bound, and demonstrate its improved performance using numerical results. [C5991]

"Optimization and waveforms for compressive sensing applications in the presence of interference"

Compressive sensing concepts have potential applications to multiple RADAR problems, which include moving target indication, and RADAR imaging in two and three spatial dimensions. Currently known sufficient conditions for reliable sparse signal reconstruction do not seem to be directly applicable or practical for some traditional RADAR problems. But experiments and mathematical invariance properties of some reconstruction methods indicate that useful products can often be obtained using these methods for circumstances outside the usual conditions. [C5992]

"Range sidelobe suppression in a desired Doppler interval"

We present a novel method of constructing a Doppler resilient pulse train of Golay complementary waveforms, for which the range sidelobes of the pulse train ambiguity function vanish inside a desired Doppler interval. This is accomplished by coordinating the transmission of a Golay pair of phase coded waveforms in time according to the 1's and -1's in a biphasic sequence. The magnitude of the range sidelobes of the pulse train ambiguity function is shown to be proportional to the magnitude spectrum of the biphasic sequence. Range sidelobes inside a desired Doppler interval are suppressed by selecting a sequence whose spectrum has a high-order null at a Doppler frequency inside the desired interval. We show that the spectrum of the biphasic sequence obtained by oversampling the length-2M Prouhet-Thue-Morse (PTM) sequence by a factor m has an M th order null at all rational Doppler shifts $\theta = 2\pi l/m$, where l and m are co-prime integers. This spectrum also has an $(M-1)$ th-order null at zero Doppler and $(M-h-1)$ th order nulls at all Doppler shifts $\theta = 2\pi h/(2m)$, where l and m are again co-prime and $h \leq M-1$. [C5993]

"Adaptive waveform design in rapidly-varying radar scenes"

We consider a waveform-agile sensing algorithm for designing transmitted waveforms in rapidly-varying radar scenes to improve target detection performance. Specifically, we first track the scattering function of rapidly-varying sea clutter in low signal-to-clutter ratios (SCRs) at each burst by estimating the clutter's space-time covariance matrix. Simultaneously, we schedule the waveform to be transmitted in the next burst by minimizing the sea clutter influence based on the estimated clutter statistics. The effectiveness of our waveform-agile sensing approach is demonstrated by detecting a moving target in heavy sea clutter using configured waveforms, and then comparing the resulting performance to that of detecting the target using fixed-parameter linear frequency-modulated waveforms. [C5994]

"Orthogonal multicarrier phased coded signal for netted radar systems"

Orthogonal multicarrier radar waveforms have been designed for netted radar systems, where several radar stations are active simultaneously. The waveforms are phase-coded using orthogonal Golay complementary sets, derived from Reed Muller codes. These codes constrain the PMEPR of the signal to a maximum of 3 dB. Besides, ambiguity functions and cross-ambiguity functions with low sidelobes have been obtained. The possibility to encode data relative to the transmitter configuration (position, direction of the beam,...) in the radar waveform is also demonstrated. [C5995]

"Practical considerations for intra-pulse radar-embedded communications"

This paper examines some of the practical aspects of waveform design for intra-pulse radar-embedded communications. Specifically, the generation of communication waveforms at the tag is considered for the case when forward scatter (i.e. multipath) is present thus altering the received version of the radar waveform at the tag and potentially producing a mismatch between the tag and desired receiver. Also, because it may be difficult to precisely determine the exact temporal length of the incident radar waveform (especially when multipath is present), the communication waveform design process may employ a larger than necessary temporal extent to ensure the incident waveform is completely captured. The impact of this temporal expansion of the communication waveforms is considered where it has been found to actually improve performance (in the absence of multipath). As such a rule-of-thumb for the total expanded time-bandwidth product is determined as a function of observed symbol error rate performance. [C5996]

"Compressed Sensing for UWB Radar Target Signature Reconstruction"

Ultra-wideband radar target impulse response is characterized by few significant scatterers that can be directly associated with the target geometry such as wing tip, engine inlet, etc. Although there are few scatterers of interest, the UWB nature of the radar sensor requires extensive frequency domain measurements or highly sampled time domain signatures. This requirement is simply a consequence of Nyquist sampling criterion despite

the limited number of scatterers along the range (fuselage) of the target. This paper employs the relatively new concept of "compressed sensing" for generating an UWB target signature with as little measurements as possible. The paper applies the concept of compressed sensing to synthetic target models then extends the same approach to real radar signatures recorded in a compact range environment. The results indicate the feasibility of reducing the number of samples needed to accurately characterize and identify target scattering centers. [C5997]

"Weak Signal Detection Based on Chaotic Prediction"

In this paper, a weak signal detection method based on radial basis function (RBF) neural networks is discussed. The principle of weak signal detection with a background noise predictor is that the predictor trained by chaotic time series has a small prediction error, and the prediction error becomes relative large when the input contains a source or target. By exploiting the short-term predictability of the input signal, a one-step-ahead prediction model is proposed as the basis of designing an RBF neural network. To enhance the detection performance in noisy background, the extended Kalman filter (EKF) is applied to perform the training and better parameter estimates can be acquired compared to the conventional RBF network training method. The performance of detection for low signal-to-noise ratio (SNR) is analyzed. Computer simulations show that the proposed method is effective for weak signal detection. [C5998]

"A Single-Stage Target Tracking Algorithm for Multistatic DVB-T Passive Radar Systems"

In this contribution, a particle filter (PF) is proposed for tracking a single target illuminated with a digital-video-broadcasting terrestrial (DVB-T) signal in a multistatic radar system. This algorithm utilizes a single-stage scheme, i.e. it estimates the target position trajectory in a Cartesian coordinate system directly from the signal reflected by this target. The multiple stages adopted in the conventional approaches are unnecessary. The proposed algorithm augmented with successive interference cancellation can be used to track individual targets in a multiple-target scenario. Simulation studies show that this PF exhibits lower complexity and better performance than two conventional algorithms using multiple stages. [C5999]

"Modeling and Denoising Wigner-Ville Distribution"

Due to the bilinear nature of Wigner-Ville and other time-frequency distributions, they produce poor results in the presence of additive noise. Though smoothed versions of the Wigner-Ville distribution (WVD) such as smoothed pseudo Wigner-Ville distribution (SPWVD) can suppress the noise effect, they still contain considerable noise. In this paper, we introduce a novel noise suppression method for WVD and its smoothed version, SPWVD, based on non-linear, non-Gaussian modeling of these distributions. We demonstrate that these distributions have significantly non-Gaussian statistics that are appropriately described by two-dimensional generalized autoregressive conditional heteroscedasticity (GARCH) model. Then, we apply a maximum a-posteriori (MAP) estimator for estimating the clean distributions based on GARCH modeling. Furthermore, we apply denoised distributions for estimating the instantaneous frequency (IF) of signals such as radar's Doppler frequency. Experimental results demonstrate the efficiency of proposed method in denoising WVD and SPWVD and also in IF estimation. [C6000]

"Pothole Detection and Warning System: Infrastructure Support and System Design"

Many on-going projects in the field of vehicular networks are working in the direction of providing driver with relevant information about roads and traffic movements. In this paper, we propose a novel Wi-Fi based architecture for Pothole Detection and Warning System which assists the driver in avoiding potholes on the roads by giving prior warnings. The system consists of access points placed on the roadsides for broadcasting data, which can be received by Wi-Fi enabled vehicles as they enter the area covered by the influence of the access points. The mobile nodes can also broadcast their response as feedback which when received by access point can be utilized for backend server processing. The pothole detection application proposed in this paper enables the driver to receive information of the potholes on the roads in the vicinity of the moving vehicle. The application can be integrated in the vehicle so as to alarm the driver in the form of a visual signal, audio signal or even trigger the braking system. Simulations demonstrate the advantages of using our approach for constructing pothole detection systems. Many such similar applications can be deployed over the framework provided by the system to assist navigation on roads. [C6001]

"Real-time Parameter Estimation of Space-borne SAR Based on FrFT"

Space-borne synthetic aperture radar is widely used in the military field. To counter space-borne SAR, it is necessary to estimate the parameters of space-borne SAR in real-time. After Receiving the signals of SAR, fractional Fourier transform is applied to both single pulse and pulse train, which can estimate the parameters in

real-time. Theory analysis and Numerical simulation show this method has high accuracy. [C6002]

"A 15GHz Bandwidth High Efficiency Power Distributed Amplifier for Ultra-Wideband-Applications Using a Low-Cost SiGe BiCMOS Technology"

In this paper the analysis, design and characterization of a 15 GHz power distributed amplifier for ultra-wideband radar and sensing applications are presented. The amplifier is fabricated in a low-cost 0.25 μm SiGe BiCMOS technology with a transit frequency f_{tof} of 25 GHz. The circuit integrates four common-emitter gain cells, which are capacitively coupled to the base line for power optimization. Collector line tapering has been used for efficiency improvement. 13.5 dBm output power has been measured at the 1 dB compression point (P1dB) in the desired frequency range with an associated gain of 9.5 dB and a gain flatness of ± 0.5 dB with total power consumption of 140 mW. The peak power added efficiency (PAE) at P1dB is 13.8%. The chip size of the compact amplifier is 1.45 mm². Good agreement between simulation and measurement was achieved. [C6003]

"A High-Linearity, X-Band, SiGe Low-Noise Amplifier for Improved Dynamic Range in Next-Generation Radar and Wireless Systems"

We present a high-dynamic range (HDR) X-band LNA implemented in silicon-germanium (SiGe) technology targeting high-performance radar and wireless communications applications. To our knowledge, this is the first Si-based LNA to achieve over 30 dB gain, 30 dBm of OTOI, and 2 dB noise figure at X-band. System-level performance simulations clearly show the benefits of using HDR LNAs in the receive chain. The performance of this SiGe HDR LNA compares very favorably with other state-of-the-art LNAs, highlighting the capabilities of SiGe technology for these types of applications. [C6004]

"Turbo Iterative Signal Processing"

A Turbo iterative method for signal processing is proposed. This method is a kind of multi-systems collaborative signal processing through iteration: several independent systems work in rotation, and each system takes feedback information from the other systems as a priori condition. We have applied such a Turbo iterative signal processing (TISP) method on speech signal enhancement, and on SAR (synthetic aperture radar) image filtering, segmentation and fusion. Some practical results presented in this article show that the Turbo iterative algorithm converges after 5-10 iterations and it improves greatly the signal processing performance. The TISP also shows an effective machine learning method, that is making a discussion between several independent systems through Turbo iteration. [C6005]

"Sparse Signal Representation for Complex-Valued Imaging"

We propose a sparse signal representation-based method for complex-valued imaging. Many coherent imaging systems such as synthetic aperture radar (SAR) have an inherent random phase, complex-valued nature. On the other hand sparse signal representation, which has mostly been exploited in real-valued problems, has many capabilities such as superresolution and feature enhancement for various reconstruction and recognition tasks. For complex-valued problems, the key challenge is how to choose the dictionary and the representation scheme for effective sparse representation. We propose a mathematical framework and an associated optimization algorithm for a sparse signal representation-based imaging method that can deal with these issues. Simulation results show that this method offers improved results compared to existing powerful imaging techniques. [C6006]

"Iterative Space-Time Adaptive Processing"

To reduce the need of secondary data and/or accurate prior knowledge of the clutter statistics in space-time adaptive processing (STAP), we present herein a user parameter-free and secondary data-free fully automatic weighted least squares based iterative adaptive approach (IAA) to angle-Doppler imaging for airborne surveillance radar systems. [C6007]

"Latency-Information Theory: A Novel Latency Theory Revealed as Time Dual of Information Theory"

This paper outlines a space-time duality study started in 2003 and leading to a latency-information theory (LIT) that unifies information theory with a novel latency theory revealed as time-dual. While information theory guides the design of communication systems, latency theory does the same for recognition systems. A unified recognition-communication system is an intelligence system and LIT illuminates its design. LIT naturally arose from the author's desire to systematically address the design of a real-world intelligence system for DARPA's knowledge-aided sensor signal processing expert reasoning (KASSPER) program. This work has led to practical intelligence system solutions that yield outstanding target detections under severely taxing environments, while

also exhibiting several orders of magnitude savings in prior-knowledge storage-space, processing-time, and implementation complexity over standard schemes. Moreover, it has led to the discovery of a mathematical-physical duality guiding life system designs. [C6008]

"Monte-Carlo Based Estimation Methods for Rapidly-Varying Sea Clutter"

We consider two Monte-Carlo based methods for characterizing the scattering function of rapidly-varying sea clutter. The first method uses multiple particle filtering to estimate the clutter space-time covariance matrix by exploiting the structure of the matrix. This method is then compared to a baseline approach that estimates the clutter covariance matrix based on the Weibull distribution approximation. Both methods are evaluated by formulating a detection problem that simulates a small moving target in heavy sea clutter. [C6009]

"A Novel Statistical Approach for Speckle Filtering of SAR Images"

Synthetic aperture radar (SAR) images are inherently affected by a signal multiplicative noise known as speckle, which is due to the radar wave coherence. In this paper, we introduce a new method to reduce speckle noise in SAR images, based on statistical modeling of wavelet coefficients. We use two-dimensional generalized autoregressive conditional heteroscedasticity (GARCH) model for statistical modeling of images wavelet coefficients. By using this model, we are capable of taking into account important characteristics of wavelet coefficients, such as heavy tailed marginal distribution, and the dependencies between the coefficients. Furthermore, we use maximum a-posteriori (MAP) estimator for estimating the clean image wavelet coefficients. Finally, we compare our proposed method with some denoising methods, and quantify the achieved performance improvement. [C6010]

"Cognition is the Key to the Next Generation of Radar Systems"

Motivated by the echo-location system of a bat, I described the idea of cognitive radar in 2006 for the first time. This paper expands on this novel idea. In particular, the paper focuses on a cognitive tracking radar, the implementation of which comprises two distinct functional blocks, one in the receiver and the other in transmitter with a feedback link from the receiver to the transmitter. To sense the radar environment, the receiver uses approximate Bayesian filtering, which is closely realized by a new nonlinear sequential state estimator, named the Cubature Kalman filter. To control the radar illumination, the transmitter uses an incremental dynamic programming, known as the Q-learning algorithm. [C6011]

"A Hybrid MIMO Phased-Array Concept for Arbitrary Spatial Beampattern Synthesis"

Multiple-input multiple-output (MIMO) radar is a multiple aperture technology characterized by the ability to transmit diverse signals at each aperture. This is in contrast to traditional phased-array radar whereby a single signal is transmitted with a phase shift applied at each element to enable steering of the transmit beam. The hybrid MIMO phased-array radar (HMPAR) concept is an outgrowth of the monostatic MIMO construct, in which all sensors have the same view of the far-field target. In the HMPAR, the full transmit array is partitioned into sub-arrays which can be electronically steered in different directions and driven by separate transmit waveforms; furthermore the configuration of the array into sub-arrays can be changed. Here we explore the variety of transmit beam patterns that could be achieved using such a system. [C6012]

"Adaptive Noise Waveform Design for Radar"

This paper introduces an adaptive radar waveform technique where a standard LFM waveform is used as an initial seed. The seed waveform is changed using a phase-only adaptive technique to minimize the resulting waveform's power in specific areas associated with in-band and adjacent-band spectral regions. Adjacent-band power minimization reduces interference to other spectral users, while in-band power minimization improves the waveform performance in matching interference environments. The resulting waveform retains a constant modulus which is valuable for practical transmitters, yet exhibits a variable degree of phase noise. Results are shown for three levels of computational convergence in the power minimization process. Ambiguity functions are plotted for each waveform to illustrate waveform performance characteristics such as radar resolution, target ambiguities, sidelobe response, and Doppler tolerance. [C6013]

"Hardware Design of Signal Processing System Based on DSP"

Millimeter wave short range combined detection technology refers to that combining millimeter wave radar with radiometer and taking full advantage of the active range measurement and passive radiation characteristics of target to realize target bearing decision and target recognition, which is the development trend of millimeter wave detection technology and greatly improves the performances of millimeter wave detector. This paper takes

TMS320VC5410 DSP chip as the core and utilizes the high-speed signal processing ability, rich on-chip resources and flexible external interfaces of C5410 DSP chip to finish the hardware design of signal processing system, including the following modules, such as AD sampling, memory extension, system power and system clock, etc, finally debugs the system and sums up the debugging experience. [C6014]

"Improved waveform design for target recognition with multiple transmissions"

This paper presents a matched waveform technique for target class identification, i.e., a multiple hypotheses testing (MHT) framework. This technique is shown to improve classification performance of SNR-based matched waveforms derived from a probability-weighted spectral variance (PWSV) approach. The technique, which allows for real-time adaptive waveform transmission, is also shown to be computationally efficient. [C6015]

"Multistatic waveform design for seeing through the wall"

We present the matched illumination based waveform design for improved detection of targets behind walls and in enclosed structures using a multistatic radar system. The generalization of the matched illumination waveform design concept for through-the-wall multistatic operation bridges the problem to multiple-input multiple-output (MIMO) operation and puts in context the offering of MIMO to urban sensing and imaging of targets in enclosed structures. [C6016]

"Virtual radar antenna beamforming using orthogonal coding waveforms"

In this paper, an innovative approach to form virtual radar antenna beams is proposed. These virtual beams are shown to be equivalent to those obtained with a traditional phased array of the same size in term of antenna gain and resolution. These beams are formed through digital filtering and using orthogonal coding waveforms. It is shown that using multiple beam forming filters, multiple virtual beams can simultaneously be formed, each having maximum gain and finest resolution. [C6017]

"Radar based automatic target system"

This paper describes the novel application of both dual tone CW and ISAR techniques to measure the position of a small high velocity projectile as it passes through a defined sensory virtual plane, so forming the basis of an automatic targeting system for live fire training. Simulation and initial experimental results are presented, as well as a general description of the system. [C6018]

"The use of geometric diversity for spectral dominance in underground imaging"

Underground imaging of dielectric and conductive anomalies performed using ground penetrating radars (GPRs) requires expensive wideband systems to increase the resolution. The advent of tomographic principles in multi-monostatic GPRs dramatically improved the imaging capabilities and suggested the possibility of reducing the bandwidth of the probing waveform. In this work we propose to extend the tomographic principles to the case of below-ground distributed sensing, thus taking advantage of the geometric diversity. We show that, by using geometric diversity, the frequency content required to image below-ground targets is drastically reduced to virtually a single monochromatic signal, thus achieving full spectral dominance in the waveform design. [C6019]

"Best bases selection for wavelet domain communication systems towards dynamic spectrum access"

The ever growing demand for wireless services has placed enormous burden on valuable resources such as spectral bandwidth. This has resulted in a major rethinking in resource allocation policies culminating in an explosion of research activity towards dynamic spectrum access (DSA) for optimum spectrum usage. wavelet domain communication system (WDCS) has been propounded as a suitable candidate for DSA. WDCS uses transform domain processing where wavelet analysis is used to gauge the environment, identify interference zones and reshape the transmission waveform profile. In this article we present a survey on the performances of various wavelet families for a packet based WDCS. The attempt is to understand the impact of waveshapes on the performance of the WDCS. Various wavelet families including Daubechies, Coiflet, Symlet, Maximally Frequency selective wavelets, Meyer and Bi-orthogonal wavelets are considered. The results of this study will be useful in deducing the best bases for WDCS system design in the context of DSA applications. [C6020]

"Simulation of the front-end of a MEMS based ultra narrow band tomographic imaging system"

This paper describes a simulation architecture used to simulate an ultra narrow band radar tomographic imaging (UNBRaTI) system. The work is being performed at Rochester Institute of Technology. The paper lays the

groundwork for an effort to develop a systems level approach for the simulation and analysis of an UNBRaTI system using traditional radio frequency (RF) components as well as micro-electro-mechanical systems (MEMS) based components. The utility of the approach is its ability to apply sound systems engineering principles and techniques to compare and contrast traditional RF components with MEMS based components and their effects on system level performance. The simulation has been architected for ease of scalability in order to analyze basic to complex system configurations. [C6021]

"Multistatic ambiguity function-A tool for waveform selection in distributed radar systems"

The multistatic ambiguity function has been proposed as a tool for analyzing and designing multistatic radar systems. It was demonstrated through previous examples that multistatic radar system performances (e.g. probability of detection, range and velocity resolution) can be improved by shaping the multistatic ambiguity function through waveform selection, sensor positioning and adequate weighting of different receivers. In this work we study P3, P4 and Frank polyphase codes when applied in multistatic radar systems and illustrate the significance of adequate waveform selection. [C6022]

"Signal direction finding for low complexity radar"

We propose a novel beamforming algorithm for a three element system that suppresses an interference signal while still being able to measure a target's interferometer phases. Unlike most direction-of-arrival (DOA) estimation algorithms, our algorithm does not use a grid search. Instead the estimates result from a closed form solution, a great advantage in time sensitive applications. The derivation of the algorithm is presented, and its statistical performance is examined with simulations. Additionally, our numerical results demonstrate that our algorithm not only requires lower computation but also is capable of achieving more reliable DOA estimates than those found with the well known multiple signal classification (MUSIC) algorithm. [C6023]

"Real-Time Monitoring and Pre-alarm System for Dangerous Mountains in the Railway Line"

There appear frequently natural phenomena such as collapse, landslide along the railway line, which badly threaten the transport safety of the railway. This system adopts the method of auto-monitoring, and the monitoring content is the earth's surface deformation. At the front, through high-accuracy displacement sensor, the deformation signals of the dangerous mountains can be acquired, then data collection is carried out at the regular intervals, using the GPRS wireless communication technology, and the real-time monitoring and pre-alarm for dangerous mountains can be achieved. This method is simple, convenient and penetrating, with lower-cost and higher -accuracy. [C6024]

"Integrated Quantum Dot Schottky Diodes for RECTENNA (Rectifying Antenna)"

In this paper we will present our latest research results of integrated quantum dot Schottky diodes and integrated silicon antenna for RF applications. Both, the quantum dot Schottky diodes and the antenna are integrated on Si substrates forming a simple mm-wave detection system, the rectifying antenna (RECTENNA). Within this work a specific antenna design, 1-dimensional array (single line antenna), will be shown. First S-parameter measurement results up to 110 GHz are very promising for system application in the 80 GHz automotive radar frequency band. [C6025]

"Chaotic Signals with Weak-Structure Used for High Resolution Radar Imaging"

Recently, signals generated via chaotic maps for radar imaging have been studied. Chaotic signals are easy to be generated and applied, but not all chaos-based signals are suited for high resolution radar imaging. The autocorrelation and ambiguity functions of many chaos-base modulated signals are poor, so they aren't suited for radar imaging. Up to now, there has no reference to summarize which kinds of chaotic maps are fitted for high resolution radar imaging, or why they have these radar imaging properties. In this paper, we presented that chaotic maps with weak-structure, which have bigger Lyapunov exponent and bigger extending velocity, are similar to noise, and have good properties for high resolution radar imaging. We presented some chaotic maps with weak-structure, too. By simulating, It was demonstrated that, after many kinds of modulations, the autocorrelation and ambiguity functions of modulated signals generated via chaotic maps with weak-structure have good characteristic and these chaotic signals are suited for high resolution radar imaging, while those chaotic signals without weak-structure aren't.. [C6026]

"Feature Extraction Using Wavelet Transform for Radar Emitter Signals"

In this paper, an approach for intra-pulse feature extraction of radar emitter signals is proposed based on wavelet transform. On the basis of the multi-resolution characteristics of wavelet transform, two energy

entropies, as a two-dimensional feature vector to reveal the difference of radar modulation signals, are respectively extracted from approximation coefficient and multi-scale detail coefficients preserved through inter-scale correlations denoise in wavelet transform domain. In order to demonstrate the effectiveness and feasibility of the proposed approach, computer simulations indicates that the entropy features of ten typical radar emitter signals extracted by wavelet transform have good performance of clustering and suppressing noise when SNR is 0dB. In addition, proposed approach can separate the same modulation signals with different parameters.

[C6027]

"WDD'09 Agenda-at-a-glance"

{no data available} [C6028]

"Classification of flowers by bats: comparison with the radar case"

In recent years, with the development of high range resolution radars, the desire to be able to identify targets under all weather and clutter conditions has become of great importance. This is an activity carried out with great success by echolocating mammals such as nectar feeding bats that are able to detect and select flowers of bat-pollinated plants even in a dense clutter environment. In this paper data consisting of acoustically generated high range resolution profiles of four bat pollinated flower heads are analysed. Multi perspective classification performance is assessed and compared with the radar case. There are close parallels that suggest lessons can be learnt from nature. [C6029]

"A Low-Cost, High Resolution, 360° Phase/Gain Shifter in SiGe BiCMOS"

A quadrature phase shifter has been implemented in a 0.25 μm SiGe BiCMOS technology. The phase shifter core consists of a novel high resolution (2times5 bit) direct digitally controlled dual-path programmable gain amplifier driving a successive two pole passive polyphase filter. Since this core is a fully differential device, on-chip baluns have been employed to decrease the number of off-chip components to the minimum. Multi-tanh gmstages are employed to increase linearity. The circuit features 50 Ω -compatible single-ended in- and outputs and a full 360deg phase shifting range. To the author's knowing, the presented phase shifter is the first to be designed for commercial S-band (2.9 GHz ... 3.1 GHz) shipborne radar systems as specified in IEC standard 62388. It generates 1024 equally distributed phase/amplitude states with a maximum relative deviation of below 2%. Therefore, the circuit is a suitable solution for cost-sensitive phased array applications with high precision requirements. [C6030]

"ESD-Protected 24 GHz LNA for Radar Applications in SiGe:C Technology"

This paper presents an ESD-protected 24 GHz single-stage differential cascode LNA in Infineon's B7HF200 SiGe technology. It is designed to fulfill high robustness requirements for industrial or automotive applications. Performance variation of key parameters has been analyzed in measurement over a wide range of temperatures from -25degC to 125degC. The amplifier offers a gain of 12 dB and noise figure of 3.1 dB at the center frequency of 24 GHz. The circuit exhibits high linearity of -8.7 dBm and -1.8 dBm input-referred 1dB compression point and IIP3, respectively. The LNA consumes 12.6 mA from a single 3.3 V supply. The ESD hardness has been investigated using a Transmission Line Pulse (TLP) system. The circuit exhibits minimum 1.3 A failure current on the RF pins, which corresponds to HBM protection above 1.5 kV. The chip size including the pads is 0.32 mm².

[C6031]

"Advances in tactical laser radar"

Laser radar has enjoyed significant advances over the past decade. Novel sensor topologies, compact laser illuminators, and advanced signal processing have enabled the construction of low power, portable 2-D and 3-D laser vision systems. The applications of such systems range from surveillance, targeting, weapons guidance, and remote scene measurement, to target identification and atmospheric characterization. This paper serves to assemble some recent significant examples of laser radar in the context of emergent tactical applications. Strengths and limitations of competing topologies are also examined. [C6032]

"Range estimation algorithms comparison in simulated 3-D flash LADAR data"

Range estimation algorithms have been applied to simulated 3-D flash laser radar data to test for accuracy and bias. Simulated data is modeled after hit mode performance of the Advanced Scientific Concepts 3-D flash laser radar camera. Hit mode is a mode of operation that stores buffered samples into memory only after a set number of photoelectrons have been observed by the detector. In hit mode, waveforms may not be centered within the range gate and may not contain the true peak of original waveform. Under these conditions traditional

range estimation techniques could prove ineffective. A peak estimator, matched filter, and maximum likelihood estimator were tested for performance as waveforms shift position within the range gate. This paper suggests the best scenario for implementing each algorithm and shows the overall effectiveness of the matched filter when incorporated in the time domain. 1000 trials with noise were conducted for each waveform position and performance was judged based on mean square error and standard deviation of the range estimations. [C6033]

"Performances of variable step-size adaptive algorithms in non-Gaussian interference environments"

Two variable step-size normalized least mean square (VSS-NLMS) algorithms, namely the non-parametric VSS-NLMS and switched mode VSS-NLMS, are reformulated into complex signal form for STAP applications. The performances of these two VSS NLMS algorithms in Gaussian and compound-K clutters are evaluated via a phased array space-slow-time STAP example. We find that the misadjustment behaviors are inconsistent with the excess MSEs which is a better measure of STAP performance. Both VSS-NLMS algorithms outperform conventional fixed step-size (FSS) NLMS algorithms with fast convergence and low steady-state excess MSE. The SM-VSS-NLMS provides a better performance compromise than the NP-VSS-NLMS with much lower steady-state excess MSEs and slightly slower convergence speeds. The performance gain of both VSS algorithms reduces in heavy-tailed clutter environments than that in Gaussian clutters. Their robustness against impulsive interference is better than conventional FSS-NLMS. [C6034]

"Cognitive MIMO sonar based robust target detection for harbor and maritime surveillance applications"

Robust detection of various hostile threats is vital to protect Navy ships and other facilities within harbor and maritime environments. Traditional single-input single-output (SISO) sonar transmits single acoustic waveform by single projector, which has a few disadvantages including low target detection probability, low resolution, vulnerability of interception by the enemy, sensitivity to jamming, etc. Multi-input multi-output (MIMO), typically applied to communications and radar solutions, is an emerging technology that can be applied to sonar to overcome many of the SISO sonar disadvantages. In this paper, cognitive monostatic/bistatic/multistatic MIMO sonar approaches are proposed. MIMO sonar transmits different orthogonal acoustic waveforms from multiple projectors with different spatial distributions. Through space-time-waveform diversity, MIMO sonar is able to apply coherent processing techniques over the received signals, and acquires more diversity gains. The cognition concept proposed in the literature for radar and wireless communication is applied to MIMO sonar to improve its robustness and adaptability. The advantages of proposed cognitive MIMO sonar will be demonstrated by Monte Carlo computer simulations and compared to the SISO techniques. [C6035]

"Novel Waveform Generation Principle for short-range FMCW-Radars"

The FMCW-radar-principle is widely used for short range radar systems. The basic idea for FMCW-radars is to generate a linear frequency ramp as transmit signal. There are too widely used principles for range-Doppler-processing: generation of ramps with different slopes and generation of a sequence of short ramps processed by a two-dimensional FFT. The developed ramp generation sequence also applies two-dimensional Fourier transforms, but allows to reduce the baseband bandwidth. The principle can be also regarded as an extension of a frequency stepped-CW-radar with intertwined ramps. In the following the method is derived for systems with and without I/Q-demodulator and first measurement results on a 24 GHz-system are presented. The waveform generator has been implemented on a FPGA. [C6036]

"A 29 -1 up to 25Gb/s M-Sequence Generator IC for UWB Radar Applications in a Low-Cost SiGe BiCMOS Technology"

In this paper the analysis, design and characterization of a fully integrated multi purpose m-sequence generator for UWB radar signal generation and broadband power amplifier testing is presented. The generator can generate m-sequences of 511 bits length up to data rates of 25.52 Gb/s. A mixer is included to shift the spectrum to higher center frequencies to fit into FCC or ECC UWB masks. The generator is fabricated in a low cost 75-GHz ft0.25 μm SiGe BiCMOS technology and occupies 1 mm² chip area. The power consumption is 151 mW from a 2.85 V supply. A simple, intuitive calculation algorithm is given to find the feedback taps for a phase shifted m-sequence. [C6037]

"Automotive SAR for Parking Lot Detection"

In this paper a new concept for a radar based parking lot detection system is presented. The synthetic aperture radar algorithm together with a special motion compensation algorithm are implemented in a Matlab simulator for

verification of the overall system. A detailed model for any motion of the vehicle is discussed and the influence of different deviations of the vehicle motion from a straight line are discussed. The simulation results demonstrate that the motion compensation algorithm together with a standard low-cost accelerometer can yield very useful images of typical parking scenes. [C6038]

"Helicopter Assisted Landing System-Millimeter-Wave against Brown-Out"

Catastrophy management, alpine and sea rescue as well as military operations are unimaginable without the advantage of helicopters. The possibility of landing in areas with none infrastructure is essential. At this the pilot is confronted with different environmental conditions witch handicap a controlled navigation. Dust and snow are the two most dangerous conditions during the approach for a landing, also troubled water surface with spindrift can compromise a rescue mission over sea. Today pilots have to navigate the landing by sight and optical sensors which are useless under brown-out conditions all types. No information about height and drift with the necessary precision can be given. Radar sensors offer this capability of transmission through dust, snow, fog, and spindrift. Employing an appropriate signal processing, also the necessary drift information can be extracted from the Doppler shift of the radar. A propotype radar in the millimeter range was build on, based upon distributed and networked modules, to extract precise height and drift information: This informations are fed into the avionic system of the helicopter and used as an aid for landing and take-off during adverse environmental conditions. The paper presents the design of the miniature millimetre wave radar modules, the design of the broadband high gain antennas and the implementation into the system. [C6039]

"Tracking a ballistic target by multiple model approach"

Radar tracking of a ballistic object flying in the Earth's atmosphere is a very complex issue to cope with, due to the need of (suboptimal) nonlinear filtering techniques. When the characteristics of the target are poorly known, and an identification problem is added, a solution is represented by a multiple model approach. This paper investigates the problem by evaluating a number of parameters which affect the solution. The multi modal approach is compared with a generic extended Kalman filter. A theoretical limit for the performance is computed by means of the posterior Cramer-Rao lower bound. [C6040]

"Performance limits for monopulse matched filter samples"

Via jointly processing multiple (sum, azimuth- and elevation-difference) monopulse matched filter samples it is possible to extract and localize several (more than two) targets spaced more closely than the classical interpretation of radar resolution. This paper derives the Cramer-Rao lower bound (CRLB) for sampled monopulse radar data. [C6041]

"Analysis of information contained at correlation treatment of the reflected from the radar target signals received by system of two radars with small base workings on different frequencies"

In this paper mutual correlation treatment of the narrow-band signals of two different frequencies of one wavelength band reflected from the radar targets and received by system of two radars with small base is examined. Thus the mathematical model of reflecting characteristics of radar target is used. [C6042]

"High-resolution electromagnetic imaging in a plain layered structure"

Problems of detection and localization of electromagnetic sources in a dielectric layered medium is considered in this paper. As it is shown interfaces of the layer medium has significant influences on formation of scattered field. To solve the problem, it is proposed to use combination of high-resolution approach to localization of sources and conception of dyadic Green function for a layer medium. In case of near field observation, the parameter content of high-resolution Capon's method was modified to obtain better spatial resolution of sources when scattered field is measured by a linear array at multiple frequencies. [C6043]

"A variable step-size Imp algorithm for heavy-tailed interference suppression in phased array radar"

A new variable step-size least mean p-norm (VSS-LMP) algorithm is proposed for phased array radar application with space-time adaptive processing to combat heavy-tailed non-Gaussian clutters. The algorithms automatically change the step size according to the estimated p-th and $(2p-2)$ -th moments of the error, where $1 \leq p \leq 2$. The algorithm is evaluated via a space-slow-time STAP example and the excess mean square error (MSE) and misadjustment results show that the proposed VSS-LMP converges fast and reaches lower steady-state error than the fixed stepsize LMP. It also provides a better compromise between convergence speed and low steady state error than existing VSS least mean square (LMS) algorithms in both Gaussian and compound K clutter environments. [C6044]

"Detection and diagnosis of radar modeling errors using covariance consistency"

Often, detection-based tracking algorithms are developed without much regard for the effects of either the radar's analog signal processing or its digital signal-processing algorithms. In this paper, we combine the effects of the radar's signal processing and tracking algorithms to assess the combined effect on covariance consistency of various algorithms. To do this, we first define the terms detection, detection primitive, and measurement. Next, we provide a detailed dataflow diagram for the processing chain of an electronically-scanned radar so that we can examine the propagation of truth data through various coordinate frames relative to radar signal processing. We examine issues related to expressing truth data in different frames and different relationships among targets. We describe in detail many of the algorithms in the signal-processing chain of typical monopulse radar and finally analyze and demonstrate the covariance consistency of various algorithms in the radar processing chain. When properly applied, covariance consistency analysis can be used to detect and correct inconsistent algorithms, invalid assumptions, and coding errors. The techniques described in this paper provide insight in determining system covariance requirements and may be used to ensure that both the design and implementation of radar processing algorithms provide good covariance consistency. The example simulations provide a baseline for algorithm covariance consistency, examine some common approximations used to simplify radar simulations, and demonstrate the effect of implementation errors that actually occurred during model development. [C6045]

"CLEAN technique in strip-map SAR for high-quality imaging"

The maximum obtainable resolution of a strip-map synthetic aperture radar (SAR) system can be retained by simply avoiding weighting, or tapering, data samples in the along-track compression process. However, this will lead to hazardous artifacts caused by strong sidelobes of the corresponding adjacent scatterers whose interference might severely weaken the desired targets or even introduce false targets. On the other hand, some residual artifacts, even after tapering process, may still deteriorate the quality (contrast) of the SAR image. These issues can be remedied by applying the so-called CLEAN technique, which can mitigate these ill-effects in strip-map SAR imagery while maintaining the maximum resolution. This, indeed, is carried out as a post processing step, i.e., after the azimuth compression is accomplished, in the SAR system. The objective of this paper is to extend the CLEAN technique to strip-map SAR system to produce high-quality images with a very good along-track resolution. The algorithm is then applied to data from a ground-based circular SAR (CSAR) system to verify its implementation as well as this new application of the CLEAN technique. [C6046]

"An adaptive compensation of moving target doppler shift for airborne radar"

Accurate estimation and compensation of the moving target Doppler shift are essential for the moving target detection of the airborne radar system. In this paper, an algorithm for the real-time estimation and compensation of the moving target Doppler shift due to the moving radar platform and target is presented for the airborne stepped frequency radar system. Under the condition of a small number of sample points, this new algorithm employs the twice compensation method in order to estimate and compensate the mean Doppler shift using high speed DSP based on Doppler FFT processing. Using simulated radar data, the moving target Doppler spectrum is measured and analyzed. The results of simulations show that this new algorithm can reduce the number of sample points and enhance the anti-interfering performance yet still obtain good Doppler estimation and compensation. [C6047]

"Matched filter implementation on FPGA for integrand code using a real-valued shift-orthogonal finite-length sequence"

In this paper, we proposed the compact construction of a matched filter for integrand code, which do not require the high-rate clock pulse in two-valued PWM (pulse width modulation) code, using a real-valued shift-orthogonal finite-length sequence, which has a sharp a periodic autocorrelation function with zero sidelobes except at left and right shift-ends. This matched filters is implemented on a field programmable gate array (FPGA) corresponding to 400,000 gates. A proposed matched filter for the sequence of length 129 can be constructed by the circuit scale of about 47% compared with conventional filter. [C6048]

"Analysis of the four-horn monopulse for LEO satellite tracking using the exact model"

Special techniques are used in the ground stations in order to track the LEO satellites. Each of these techniques has its own advantages and disadvantages which are used depending on the relative conditions. One of the most well-known of these techniques is monopulse. The feed of the monopulse tracking technique, used in ground stations, has different structures. The most popular of these feeds have four and five horns. In this paper the four-horn monopulse technique as the classic feed in LEO satellite ground station using exact beam model

is analyzed. Also, the effect of the angular offset of feed horns respect to antenna axis on the total performance of this technique such as error bias and variance is investigated. [C6049]

"A Real-Time Observation scheme for UMTS networks"

In this paper, we propose a real-time observation scheme for UMTS networks. There is a 3GPP specification for subscriber and equipment trace, but it only provides the basic aspects of subscriber and equipment trace. Thus, it is very hard to define and develop various parameters for effective trace. Now we define three types of real-time observation scheme-event trace, periodic trace, and call observation. We called these types of call tracing method real-time observation, and propose the data format for three schemes. Using these schemes, we can be able to keep real-time observation on a specific mobile more effectively. [C6050]

"Voice communication over GGSN/SGSN"

SGSN and GGSN are the two core network elements of the general packet radio service which enables Internet to become mobile. It allows mobile users to access text based data services without continuously occupying a specific radio channel (which is not the case when you access voice channel). This paper successfully discusses the possibility of exploiting the data communication features of GGSN/SGSN to transmit voice packets, using a web server. This can help GPRS grow beyond its capability. As the data channel is considered to be economically viable in any network, If a mechanism is devised to use mobile's data channel for voice communication too, it will obviously be preferred over the conventional non-mobile based VOIP service. Because of the fact that general packet radio service through the GGSN/SGSN element can transfer data at the rate of 56 to 114 kbps (For EDGE it is 177.6 kbps) and has a continuous connection to internet via the core network elements, so if the voice at one end be broken into data packets and transmitted through a web server, can be reassembled at the other end. This process wont make a big hole in the customer's pocket and can easily make the VOIP go mobile, using the same network elements. While the traditional circuit switched network makes a quite big hole if the call is a long distance. [C6051]

"Essential of Digital Dividend Review"

OFCOM issued 2 consultation reports about dasiadigital dividend review (DDR)psila in June 2008. We can review the purpose & bandwidth of cleared spectrum by digital switchover. In these reports, you can see the purpose of digital dividend spectrum, the steps & time of frequency auctions and etc in detail. Also, we can see the consultations of OFCOM about digital dividend spectrum. OFCOM proposed not to impose 1) dasiaUse it or lose itpsila conditions, 2) dasiaRoll-out obligationspsila, 3) dasiaOpen access conditionspsila, 4) dasiaInformation provisionpsila and 5) dasiaSpectrum capspila. [C6052]

"A Novel Space-Borne Antenna Nulling Method Based on Multi-target Direction Finding Algorithm"

To be sure that the telecommunication satellite can work well in the complexity electromagnetic environment and electromagnetic jamming, a novel space-borne antenna multi-jamming direction finding and nulling method is presented in the paper. Firstly, single-snapshot DOA estimation algorithm in frequency is presented to estimate the DOAs of multiple interferences, and then nulling algorithm that keep the shape of the main-lobe is implemented according to the prior accurately estimated DOA compared with conventional sidelobe cancelling algorithm, the presented algorithm solves the problems of both nulling depth and main-lobe shape keeping nicely. Simulation results and performance analysis demonstrate that the proposed antenna nulling algorithm is effective and feasible. [C6053]

"Road traffic monitoring using a wireless vehicle sensor network"

With the advancement of micro-electro-mechanical systems (MEMS) technologies, wireless sensor networks have opened new vistas for a wide range of application domains. These sensor nodes usually comprise small, low-power devices that integrate sensors and actuators with limited on-board processing and wireless communication capabilities. One of the most important applications is target tracking and monitoring. Here a novel wireless vehicle monitoring system that is able to detect, classify and determine the direction of travel of vehicles on a two-lane road is proposed. Each vehicle detection node features multiple sensors including magnetometer, accelerometer, infrared and acoustic microphone with a two-node structure for cooperative monitoring. The results show that the system was capable of classifying the vehicle type (using vehicle weight) and their directional of travel with high accuracy. [C6054]

"WAVELETS: A Novel Approach for 1D and 2D Image Analysis and Synthesis"

Wavelets are mathematical functions that catch up data into different frequency components and study each

component with a resolution matched to its scale. They have advantage over traditional Fourier methods in analyzing physical situations where the signal contains discontinuities and sharp spikes. Wavelets were developed independently in the fields of mathematics, quantum physics, electrical engineering, and seismic geology. Interchanges between these fields during the last ten years have led to many new wavelet applications such as image compression, turbulence, human vision, radar, and earth quake prediction. Proposed methodology provides image compression and de-noising better than existing technologies. [C6055]

"A minuscule distances' measurement using K-band Doppler technology"

This paper discusses a new approach to measure very short distances between objects using two frequency Continuous waveforms and based on a K-band Doppler technology. The system's operation is performed using two-frequency radar to obtain expeditiously and highly accurate measurements for stationary and moving objects. Experiments have been conducted and a mathematical presentation of the system's model has been formulated along with computer-based simulations to study the performance and to validate the effectiveness of the proposed system's model. The obtained results demonstrate the capability of the system to adapt a short distance range. [C6056]

"A comparison of channel access concepts for high-precision local positioning"

In this paper, we review channel access concepts for two competitive radiolocation systems, high-precision location system (HPLS) and local positioning radar (LPR), which share similar physical layers, but operate with different bandwidths. After a short review of the advantages of ultra-wideband signaling as employed by LPR, we spotlight tradeoffs in the servicing of multiple terminals. While HPLS supports both dynamic and static channel access, LPR is limited to static frequency multiplexing. The characteristics of these approaches are highlighted with theoretical analysis and simulation results. [C6057]

"Automatic Creation of Massive Virtual Cities"

This research effort focuses on the historically-difficult problem of creating large-scale (city size) scene models from sensor data, including rapid extraction and modeling of geometry models. The solution to this problem is sought in the development of a novel modeling system with a fully automatic technique for the extraction of polygonal 3D models from LiDAR (Light Detection And Ranging) data. The result is an accurate 3D model representation of the real-world as shown in Figure 1. We present and evaluate experimental results of our approach for the automatic reconstruction of large U.S. cities. [C6058]

"State dependent measurement equations in local positioning"

For target tracking applications it is a well-known technique to model the motion behavior by a finite set of motion models. This contribution discusses two cases in the area of local positioning where the measurement equation is taken from a finite set of possibilities, depending on the actual state of the object. The first case is a multi antenna scenario where it is unknown which antenna actually receives the signal. The second case is a piecewise linear setup utilizing hyperbolic projections. In this approach two different measurement equations in two different coordinates frames are simultaneously valid. The application of the discussed state dependent measurement equations is demonstrated on two real scenarios. [C6059]

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











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
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