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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 20-2/5

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

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

Публикации в трудах конференций

"Gabor Transform for Subband SAS Imaging"

This paper describes a method for integrating a frequency-dependent object characterization into a practical sonar imaging system. Integration of joint time-frequency (JTF) processing into broadband SAS imaging enables one to add another dimension (frequency) to the object feature space without compromising resolution. JTF processing enables a user to construct a 3-D image description around objects of interest. The Gabor transform is used to capture the local frequency behavior in the image. The Gabor coefficients are used to reconstruct multispectral images [C10382]

"Data Management and Real-time Distribution in the HF-Radar National Network"

The architecture, status and applications of a realtime data access, distribution, processing and storage system designed for networking radial data from surface current mapping HF-Radar instruments across the United States is presented. By leveraging the system design of HF-Radar sites, data access is generalized to nearly all sites while still providing alternate access options where needed. Data format convergence, while not required, is achieved for data from all systems through careful metadata mapping and code development. Object ring buffers (ORBs) and ORB communication protocol provide robust and flexible data transport while a relational database facilitates data storage. The HF-Radar Network has evolved from a prototype project to an operational status over the last 2.5 years with 4 data access sites (portals) and 1 data aggregation site (node) deployed. By early 2007, an additional portal and 2 additional nodes will be added to create a distributed network. To date, the repository contains over 356,000 radial files produced by 45 sites from 10 participating institutions. Recent development has focused on real-time total vector processing on a national scale. Base grids for the U.S. West and East/Gulf Coast of 1 km nominal resolution extending 300km offshore are created using an equidistant cylindrical projection. A community standard MATLAB toolbox for total vector processing is optimized for production on large grids and integrated into the real-time system to produce hourly surface current maps on a national scale at 1 km, 2 km and 6 km resolutions. Current applications of the HF-Radar network include an interactive radial diagnostic site for use by site operators and a prototype interactive web site providing the first images of realtime surface currents integrated across a national scale [C10383]

"Sea Surface Backscatter Distortions of Scanning Radar Altimeter Ocean Wave Measurements"

This paper examines the distortions in the measured wave topography caused by sea surface backscatter variation within the 25 to 50 m antenna footprint of the 1deg antenna beam of the NASA Scanning Radar Altimeter at its typical 1.5 to 3 km operating altitude and possible corrections to the directional wave spectra computed from the wave topography [C10384]

"Effects of Multiple Scattering on the Implementation of an Underwater Wireless Optical Communications Link"

Recent interest in ocean exploration has brought about a desire for developing wireless communication techniques in this challenging environment. Due to its high attenuation in water, a radio frequency (RF) carrier is not the optimum choice. Acoustic techniques have made tremendous progress in establishing wireless underwater links, but they are ultimately limited in bandwidth. A third option is optical radiation, which is discussed in this paper. One drawback of underwater wireless optical communications is that the transmission of the optical carrier is highly dependent on water type. This study examines some of the challenges in implementing an optical link in turbid water environments and attempts to answer how water clarity affects the overall link [C10385]

"Intrusion Detection Based on Adaptive Polyclonal Clustering"

Adaptive polyclonal algorithm is the improved one of clonal selection algorithm, and its convergence speed is much faster. This paper intends to direct a novel clustering analysis by means of the affinity function that the

adaptive polyclonal clustering strategy affects. The clustering algorithm has the advantage that it does not depend on priori knowledge and has nothing to do data distribution, effectively overcoming the disadvantage that some existing algorithms are sensitive to initialization and easy to be trapped into the local optima. This algorithm clusters large data sets with mixed numeric and categorical values effectively. The intrusion detection system based on this algorithm can deal with massive unlabeled data to distinguish between normal and anomaly and even can detect unknown attacks. The computer comparison-contrast simulations through the KDD CUP 99 datasets show that the algorithm discussed in this paper has much superior detection rate and less false positive rate when compared with AiNet algorithm, the algorithm of L. Portnoy (2000) and the algorithm of L. Jing and L. Fang (2004) [C10386]

"Development of a Method of Construction Radar-Tracking Images of the Air Targets"

In article the approach to the decision of a task of formation of authentic bidimensional radar-tracking images in conditions of movement of the flying device on any trajectory with the account of trajectory instability his flight is opened. At formation of images the principle of inverse synthesizing of the aperture is used. The estimation of efficiency neural recognition of models of the air targets under bidimensional radar-tracking images is carried out [C10387]

"Oil spill detection system-results from field trials"

The OSD system was thoroughly tested at a field trial carried out in October 2004 off the West Coast of Norway nearby the Troll field. The Norwegian Clean Seas Association for Operating Companies (NOFO) especially arranged the trial for this purpose. 6 small releases of oil equivalents were discharged, and they could be detected and followed by the system during various wind and wave conditions. Images providing an average of the back-scattered intensity from various parts of the sea surface were shown to be useful for the system operator. Continuous surveillance of local areas is particularly helpful during the hours of darkness. Later, the data were reprocessed with a new and completely automatic oil detection algorithm using methods of image segmentation and object classification and the oil was automatically detected. This algorithm is implemented in the real-time system and tested out in field trials carried out in June 2005. After the successful trials in June 2005 NOFO has bought five OSD systems. During the field trials arranged in May 2006, the Oil Spill Detection System was mounted on three different oil recovery vessels and the trials were located off the West Coast of Norway near the Frigg field. The object of this trial was for the oil detection radar, which is only one element in an oil recovery operation, to gain further operative experience in various conditions. The preliminary results of the field trials are presented in this article. Future trials should preferably include testing during weather conditions with higher wind speeds and waves [C10388]

"Radar Target Recognition Method Using Improved Support Vector Machines Based on Polarized HRRPs"

Target recognition based on high range resolution (HRR) polarized radar using support vector machines (SVMs) was studied in this paper. A fuzzy membership function was constructed based on SVM decision-making function in order to improve the performance of OAA and OAO classifiers for multi-class target, and HRR radar target recognition method using improved SVM was proposed: First, the polarized radar backscatter echoes were processed by incoherent integration and power-normalized, the location and length of target in echoes were estimated and range profiles of target were interpolated to certain radial length, then polarized profiles were integrated considering the relevancy of range profiles of same target in different polarization state, at last, the improved OAA and OAO classifiers were used for target classification. Simulation experiment results show that the proposed method has the advantage of little capacity of computation and can improve the performance of classifiers effectively [C10389]

"A New Fuzzy Unsupervised Classification Method for SAR Images"

This paper is to investigate a new unsupervised approach for the extracted objects based on synthetic aperture radar (SAR) image using improving fuzzy clustering method. The traditional fuzzy c-means clustering (FCM) is very sensitive to the initial value and the number of clusters. The accurate initial value and number of clusters are important parameters to get the accurate result in FCM. SAR image has extensive application in national economy and military field. And a typical characteristic of SAR image is that it is influenced by speckle noise. So the traditional algorithm (Melgani et al., 2000) of FCM applies directly SAR image to get the ideal result difficultly. This paper employs the textural feature in SAR image to extract the transition and propose a new fuzzy unsupervised classification method for SAR images using the transition region to define the initial value and the number of cluster adaptively. The experimental results prove the efficiency and accuracy of this unsupervised method for SAR images [C10390]

"Remote Sensing Target Recognition Based on Contourlet and Kernel Fisher Discriminant"

An efficient feature extraction method for remote sensing target recognition was proposed in this paper, which was based on contourlet and kernel Fisher discriminant (KFD). After the contourlet decomposition, the contourlet features are fused (the weight for fusion is chosen by cross validation), and then KFD was used for further feature extraction, finally k-nearest-neighbor (KNN) was used for classification. Experimental results show that the proposed feature extraction method reach a higher correct rate than KFD and the method which use KFD on the lowpass filtered images. Moreover, when dealing with large scale images our method achieves a lower computation complexity than KFD [C10391]

"A Randomized Approach for Mid-range Aircraft Conflict Detection Based on the Unscented Particle Filter"

Based on the unscented particle filter, we propose a randomized approach to estimate the detection probability in the dynamic detection system. Considering the radar observations, we present a more accurate and real probabilistic model than that proposed by Pradini et al. for the mid-range aircraft conflict detection, and a detection algorithm based on the presented randomized approach. Monte Carlo simulations indicate that the presented model and associated algorithm are efficient [C10392]

"Level Set Evolution Based Logic Fusion: A Novel Man-made Objects Segmentation from Radar Image"

Our purpose is to explore an application of level set evolution theory to seek the solution of objects (as bridge or dam) segmentation above river from radar imagery with unwelcome effects. We present a novel level set evolution formulation for improving accuracy of segmentation. Critically, a logic fusion term is constructed using logic operators defining in multi-source satellite imagery with high precision of registration by logical operations, such as union, intersection and negation, then incorporated into the general evolution equation. Under the logic framework, we combine diverse features both from radar and optical image into evolution equation so as to overcome disadvantages, such as missing information, image artifacts and weak boundary and help objects segmentation to radar image. Results of experiments on pairs of ERS and LANDSAT imagery and pairs of RADARSAT and SPOT imagery, demonstrate effectiveness and robust of our method to objects segmentation in complex cases [C10393]

"The Research of Collision Avoiding System Based on Millimeter Wave and Image Processing Technique"

A novel approach for vehicles collision-avoiding is described. This approach combines the techniques of millimeter wave with image processing. The relative speed and position information of the object is detected by utilizing millimeter wave radar and the width information of it is obtained by a CCD camera, which fixed in the vehicle. The object's width is detected by difference method with the image background rebuilt. In order to satisfy the request of the real time of the collision-avoiding system, this paper proposes a present position estimation algorithm of the motional objects so as to make up the lag of hardware processing. The simulation result shows that the collision-avoiding system based on millimeter wave and image processing makes up the deficiency of either detects by millimeter wave or image processing, it can realize the vehicle's real time and online avoiding collision and reduce the possibility of false alarm [C10394]

"Acquisition of Hydration States of Zinc Acetate Dihydrate and Aluminium Potassium Sulfate Dodecahydrate by Microwave Sensor"

A novel microwave sensor was developed to acquire the information of various hydration states of salt hydrates, which is a key parameter in chemistry, metallurgy, mineralogy and geology. Various hydration states of zinc acetate dihydrate ($\text{Zn}(\text{CH}_3\text{COO})_3 \cdot x\text{H}_2\text{O}$; $x=2$) and aluminium potassium sulfate dodecahydrate ($\text{KAl}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$; $x=12, 6$) were detected by the microwave sensor, respectively. It was found that the results obtained by the sensor were in good agreement with those determined by TG and DTA. Besides the kinetics can be detected real-timely the microwave absorption properties during losing crystalline water of $\text{Zn}(\text{CH}_3\text{COO})_3 \cdot 2\text{H}_2\text{O}$ and $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ could also be detected by the microwave sensor. [C10395]

"Texture-based Segmentation of High Resolution SAR Images Using Contourlet Transform and Mean Shift"

This paper presents an unsupervised texture-based segmentation algorithm which uses reduced contourlet transform sub-bands and mean shift clustering, to analysis the texture information of high resolution SAR images.

One step and criteria is proposed to reduce the sub-bands and other's is presented to decrease the number of dimension of the feature space. The mean shift clustering method is used to obtain the number of texture regions and the centre of the label class. Group the pixels into corresponding texture region by their simple distance to the class centre pixel. Experiments on a mixture of Brodatz texture and SAR images show the proposed algorithm of using contourlet transform and mean shift clustering gives satisfactory results. [C10396]

"Multi-scale MAP Denoising of SAR Images"

The SAR images are perturbed by a multiplicative noise called speckle, due to the coherent nature of the scattering phenomenon. The use of speckle reduction filters is necessary to optimize the images exploitation procedures. This paper presents a new speckle reduction method in the wavelets domain using a novel Bayesian-based algorithm, which tends to reduce the speckle, preserving the structural features (like the discontinuities) and textural information of the scene and a new discrete wavelet transform called Diversity Enhanced Discrete Wavelet Transform, DEDWT. The entire class of diversity improved wavelet transforms is characterized and is proved that the averager optimizes synthesis step for the minimization of the mean square approximation error. A blind speckle-suppression method that performs a non-linear operation on the data, based on a new bishrink filter variant is obtained. Finally, some simulation examples prove the performance of the proposed denoising method. This performance is compared with the results obtained applying state-of-the-art speckle reduction techniques [C10397]

"Fusion of Multi-band SAR Images Based on Contourlet Transform"

Aim at the fusion of multi-band synthetic aperture radar (SAR) images, a new fused method using the contourlet transform is presented. Contourlet transform provides a flexible multiresolution, anisotropy and directional expansion for images. Compared with wavelets, it can afford more efficient presentation of image edges. This is employed for fusing the directional high- frequency coefficients. For the lowpass coefficients, an averaging fusion rule is used. For the directional high-frequency coefficients, the higher value of edge information measurement is used to select the better coefficients for fusion. The proposed method solves the problem of losing edge information for wavelet based fusion method. Finally, the example result of two bands SAR image fusion compared with wavelet fused method shows the vision effect and the statistical evaluation factors for fusion are both improved. [C10398]

"Status Report on Predicted Current Measuring Capabilities of the Upcoming German Satellite TerraSAR-X"

The German satellite TerraSAR-X, scheduled for launch in late 2006, will permit high-resolution ocean current measurements by along-track interferometric synthetic aperture radar (along-track InSAR) in various experimental modes of operation, using different subsections of its X-band SAR antenna array with a total length of 4.8 m as individual receive antennas. Depending on antenna and receive chain settings, various InSAR time lags can be realized in combination with different noise levels, single-look resolutions, swath widths, and incidence angles. We give an overview of the possible InSAR modes and evaluate their suitability for current measurements on the basis of simulated data products. Our results indicate that interferometric stripmap data from TerraSAR-X will be clearly superior to the existing first spaceborne along-track InSAR data from the Shuttle Radar Topography Mission (SRTM); accurate current retrievals can be expected at effective spatial resolutions on the order of 500 m and usable swath widths of 15 or 30 km. Under certain conditions, also ScanSAR data with a maximum possible swath width of 100 km will be suitable. Finally, we consider fundamental relations between along-track baseline, instrument noise, and InSAR phase noise and discuss possible InSAR performance improvements of TerraSAR-X follow-on satellites [C10399]

"The Liverpool Bay Coastal Observatory-towards the goals"

A pilot Coastal Observatory was established in Liverpool Bay (eastern Irish Sea) in 2002 with an anticipated lifespan of at least 10 years. In an evolving process, near realtime measurements are integrated with coupled models in a pre-operational prediction system. The aim is to understand a coastal sea's response to natural forcing and the consequences of human activity, providing scientific underpinning for coastal management. The impact of human activity on the world's oceans and the use made of them by humanity is greatest in coastal seas. The eastern Irish Sea is an excellent study area, affected by all coastal sea processes with tidal forcing dominant and near-shore physical and bio-geochemical processes influenced by estuarine discharge where both vertical and horizontal gradients are important. The sea is subject to a range of human industrial, agricultural, fishing and recreational pressures. The time series measurements enable definition of the seasonal cycle, its interannual variability and quantification of the importance of events relative to the mean. Applications include eutrophication (the region receives significantly elevated levels of nutrient inputs), shoreline management (coastal

flooding and beach erosion/accretion), and understanding present conditions to predict the impact of climate change (for instance if the number and severity of storms, or of high or low river flows, change). The integrated, systematic measurement suite, which started in August 2002, covers a range of space and time scales, concentrating on horizontal and vertical gradients, and includes in situ surface waves and vertical profiles of current, temperature, salinity, turbidity, nutrients and chlorophyll; regional water column surveys nine times a year; shore-based phased array HF radar measuring waves and surface currents out to a range of 50 km; instrumented ferries measuring surface properties; coastal tide gauges; satellite data-infrared (for sea surface temperature)-- and visible (for chlorophyll and suspended sediment). Acoustic telemetry and the Orbcomm satellite system are the primary resource for in situ telemetry. The core measurements and infrastructure also form the basis for process studies, instrument trials, for instance a three week glider deployment, and for the incorporation of new sensors. In cooperation with the UK Met Office, and as a component of the National Centre for Ocean Forecasting, a suite of nested 3-dimensional models (the Proudman Oceanographic Laboratory Coastal Ocean Modelling System-POLCOMS) is run daily, focusing on the Observatory area by covering the ocean/shelf of northwest Europe (at 12 km resolution), the Irish Sea (at 1.8 km) and Liverpool Bay (at ~ 200m resolution). These models simulate the physical (hydrodynamic coupled with wave) environment, nutrient and plankton dynamics, and the processes influencing sediment suspension and transport. The measurements test the models against events as they happen in a truly 3-D context-most is learned when model predictions diverge from reality. The value of some of the observations is enhanced by data assimilation which benefits both the models, keeping them on track, and the observations, augmenting their spatial coverage. All measurements and model outputs are displayed on the Coastal Observatory web-site for an audience of researchers, coastal managers and the public. After nearly 4 years of operation we are beginning to build up a picture, which only continuous monitoring provides, of the interaction between a coastal sea and its major estuaries. As always more detailed measurements indicate that processes are more complicated and distributions can have large variability [C10400]

"Shipboard Measurements of Coherent Microwave Backscatter from the Ocean"

Two different coherent X-band radars have been operated from ships to collect microwave back-scatter from the ocean at low grazing angles. The data show not only the properties of the mean backscatter but also temporal and spatial effects of both surface and internal waves [C10401]

"On the use of the stochastic matched filter for ship wake detection in SAR images"

Detecting straight patterns like ship wakes on a SAR image is not easy because there is no a priori information on orientation and position, moreover, SAR images are speckle noised. This article describes a ship wake detection technique based on the discrete Radon transform and stochastic matched filtering (SMF) used in detection. The association of these two processing methods leads to a detection algorithm that only requires the knowledge of the second order statistics of the signal and the noise. Experimentation on real SAR images shows the efficiency of the technique [C10402]

"Ocean Surface Winds from Space-A Collaborative Education Effort"

Ocean surface winds play a significant role in the global ocean-atmosphere system. Surface winds drive the world's ocean currents, transport atmospheric heat and moisture, force nutrient rich upwelling areas, create surface waves and swell, and can reach destructive force in both extratropical and tropical cyclones. Although the oceans cover 70% of the Earth's surface, the network of ocean wind observations obtained from conventional buoys and ships is very sparse. The measurement of ocean surface winds using remote sensing technologies is the only means of obtaining wind information over large portions of the global ocean in a timely manner. The Ocean Surface Vector Winds Team (OSVWT) of the Satellite Oceanography and Climatology Division (SOCD) within the NOAA/NESDIS/Center for Satellite Applications and Research (StAR) has been producing satellite-derived ocean surface wind data since the mid 1990s. Wind products from several remotely sensed sources such as QuikSCAT and WindSat are available in near real time (NRT) on the Internet and are also distributed within NOAA. These wind products are used by operational forecasters, scientific researchers and the marine community. The researchers and forecasters from NOAA Ocean Prediction Center (OPC), the NESDIS StAR Ocean Winds Team and the University Corporation for Atmospheric Research (UCAR) have partnered to increase awareness of the various ocean surface wind vector products available and to develop the educational materials needed to expose these products and to educate teachers at various levels about the latest technology for measuring and interpreting remotely sensed ocean vector winds. To accomplish this it has been proposed to host an educator workshop OPC. This workshop would target educators that train professional and future mariners in meteorology, oceanography and storm avoidance. Teachers from state maritime colleges, federal academies, and professional training institutions would be among those invited--to participate. This workshop would be hosted by both researchers and forecasters and held within an operational forecast environment to

promote hands-on experience. This paper will provide background information on current and new ocean surface wind remote sensing technologies, give examples of how products are used within the operational environment, and discuss the development of training material [C10403]

"An Adaptive Single Model of Maneuvering Target Tracking"

This paper studied tracking models of air crafts, pointed out that the essence of radar tracking is to ascertain the relative bearing and elevation angular motion of the target promptly and exactly. To the question of dissatisfied with single model tracking, we modified the "current" model, and proposed a kind of single adaptive model to track angular motion. We also gave the algorithm of optimizing and estimating. Simulation results show that tracking performance of this new adaptive model is improved much more than the "current" model, and better than the interacting multiple-model (IMM) for strong maneuvering target. Furthermore the computational load of the new model is less than that of IMM [C10404]

"An Unsupervised Particle Swarm Optimization Classifier for SAR Image"

Synthetic aperture radar (SAR) image classification is becoming increasingly important in military or scientific research. SAR image classification based on unsupervised learning usually requires optimization of some metrics. Local optimization techniques frequently fail because functions of these metrics with respect to transformation parameters are generally nonconvex and irregular and, therefore, global methods are often required. In this paper, a new evolutionary approach, particle swarm optimization, is adapted for SAR image classification. The new algorithm composes of three main processes: firstly, selecting training samples for every region in the SAR image. Secondly, training these samples using PSO, and obtain clustering center of every region. Finally, output the classification result of SAR image according to clustering center obtained. To show the effectiveness of this approach, experiment with simulated SAR image was considered. The classification results are evaluated by comparing with two well-known algorithms, K-means and fuzzy K-means. According to the overall accuracy and Kappa coefficient, PSO has high classification precision and can be used in SAR images classification [C10405]

"The Application of Sea Level Pressure and Vorticity Fields derived from the University of Washington Planetary Boundary Layer Model in the NOAA Ocean Prediction Center"

The SeaWinds scatterometer onboard the NASA QuikSCAT satellite has been providing forecasters in the Ocean Prediction Center (OPC) with near-real time (NRT) ocean vector winds over large ocean areas since 1999. The OPC forecasters routinely use QuikSCAT winds in their analysis and forecast process to position frontal features, centers of high and low pressure and to determine the category and location of short term wind warning areas. QuikSCAT has also given forecasters the ability to detect hurricane force conditions within extratropical cyclones. Since QuikSCAT has been fully integrated in to OPC operations, OPC forecasters' assessment of the surface wind field over the open oceans is more accurate than ever before. As part of the warning and forecast process, OPC forecasters prepare a manual sea level pressure (SLP) analysis four times daily for both the North Atlantic and North Pacific. These OPC SLP analyses are disseminated directly to ships at sea and are heavily relied upon by the marine community for safe and economic operations. These analyses are also a key element in the forecast process as accurate initial conditions are essential to the production of precise forecasts. Although QuikSCAT's impact on the analysis and forecast process has been significant to the short-term wind warning process, this positive impact has not carried over to the analysis of the sea level pressure field over the open oceans. In an effort to improve their SLP analyses, OPC began to run the University of Washington Planetary Boundary Layer (UWPBL) model to derive SLP, surface vorticity and surface wind speed fields using the NRT QuikSCAT winds from NOAA/NESDIS as input. The UWPBL model derived SLP, surface vorticity and surface wind speed fields were made available to OPC forecasters within their N-AWIPS workstations so that they could overlay these products with other observational fields and model guidance. The SLP fields from the UWPBL model were examined daily over a three--e-month period. The model was found to produce dynamically consistent SLP fields the majority of the time. A comparison of the SLP fields derived from the UWPBL model with the OPC manual surface analyses and the Global Forecast System Model (GFS) surface pressure fields revealed that in most cases the central pressure of the cyclones were not analyzed to be deep enough by either the OPC manual analyses or the GFS model output. There were occasional instances, however where the UWPBL model produced central pressures that were unrealistically low and/or high. This problem was determined to be related to stratification issues and to the method of assimilation of available ship and buoy observations into the model to seed the pressure gradient field. This paper will present several case studies illustrating the application of UWPBL derived sea level pressure and vorticity by OPC forecasters. Comparisons of OPC manual analyses, numerical model analyses and the UWPBL fields will be shown. The UWPBL model using QuikSCAT winds as input provides very high quality sea level pressure fields associated with intense ocean storms. In particular, the retrieved sea level pressures contain strong pressure gradients in

areas of very high winds. This strength of the pressure retrieval system has made it very useful to OPC forecasters in daily operations and as a training tool [C10406]

"Detecting Small Slow-moving Sonar Targets Using Bottom Reverberation Coherence"

The detection of small targets that appear suddenly or are moving slowly in strong bottom reverberation is a challenging problem for sonar surveillance in shallow water. Based on a new reverberation model, this paper proposes a target detection scheme that provides target sub-clutter visibility in the presence of reverberation. Experimental evidence shows that the bottom reverberation as seen by a stationary sonar is coherent, or at least partially coherent from ping to ping. Therefore, the bottom reverberation from a particular range cell is modeled as a complex signal composed of a stationary or slowly varying coherent component, plus a rapidly varying diffuse component. The coherent component is easily estimated using a recursive mean estimator and then removed by a simple subtraction so that the target need only compete with the diffuse component. Experimental results show a detection gain, as measured by the coherent-to-diffuse ratio, as high as 30dB [C10407]

"The Research of General Aviation ADS-B Base on TD-SCDMA Wide Band Communication Network"

With the development of general aviation, China needs a kind of airborne communication terminal, which is affordable, reliable and convenient. This terminal can broadcast its ranging data periodically which will be received by the aircrafts in the same airspace, so it can realize ADS function. In this paper, based on TD-SCDMA international standard, it introduces two communication modes named "controlled" and "self-organized" used by the airborne terminals. Airborne terminals will realize the wideband data link through the handover flexible between two communication modes and update reserved slots table dynamic. It will assure the safety and regular of ATC through the method in this paper [C10408]

"2D Imaging Algorithm for the Evaluation of UWB B-Scans"

This paper proposes an ultra-wideband imaging radar system using B-scans for the target identification. The two dimensional inverse boundary scattering transform was successfully applied for through-wall imaging applications. Using this algorithm it is not only possible to detect the target but also to reconstruct the surface curvature of a cylinder behind a wall. Moreover, it is shown that only 24 different positions of the antennas are sufficient to estimate the target shape which results in a low computation time [C10409]

"Integrated Radar and Communication Based on DS-UWB"

Tremendous efforts have been devoted to develop the UWB technology for radar and communication applications over the past decades. With the rapidly incremental demand, there is something in exploring of integrated UWB radar and communication system for reducing cost, minimizing the radar cross and probability of intercept, etc. This paper presents an integration system of radar and communication based on direct sequence UWB (DS-UWB). It utilizes different PN code to spread the spectrum of radar and communication data to avoid jamming mutually. The simulation over an ideal AWGN channel shows that the system can work perfectly [C10410]

"UWB Signals, SA Perspectives in Radar Guidance"

Now, active or semiactive guidance of anti-air missile is commonly implemented using narrowband radar illumination signals. But the usage of wideband signals and inverse aperture synthesis for that purpose can give the new capabilities to the target tracking and missile guidance algorithms. Some simulation results are given in confirmation of that statement [C10411]

"UWB Radars for Challenging Applications"

A number of challenging radar applications (such as antipersonnel mine detection and human being detection) has been discussed. In these applications UWB technology has a number of advantages over the traditional narrow-band approach, in particular very high positioning accuracy, rigidity to multi-path propagation and target classification abilities. On a number of examples recent advances of UWB technology in radar have been demonstrated and remaining challenges have been discussed [C10412]

"Ultrawideband Signal Processing Algorithms for Radars and Sodars"

In this paper we use statistical approach to synthesize algorithms for digital signal processing in UWB noise radar and sodar. Parametrical and non-parametrical algorithms are synthesized and analyzed. 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 [C10413]

"Peculiarities of Videopulse Scanning Antenna Array Design"

Consideration is given to details of construction onboard active videopulse scanning antenna array (VPSAA) for radio-location applications. The influence of the relative sizes and the directional characteristics of individual radiators, their relative positioning on ability to maintenance of electronic scanning VPSAA in the necessary sector of space are investigated. Comparison of the directional characteristics and scanning ability of continuous aperture and antenna array is resulted [C10414]

"A Ground Penetrating UWB Radar System"

A new low-cost pulse based ultra-wideband radar system working up to 6.4 GHz has been developed. The main focus was on the use of cheap off the shelf components. Pulse generation in the transmitter was solved with a simple transistor circuitry. In the receiver the down conversion is realized with a sampling phase detector combined with a direct digital synthesizer. To control the radar system and for transmitting the digitized data to the PC a USB-controller is used [C10415]

"The GPR Response of a Subsurface Objects and its Use for Target Detection"

The present work reports the results of laboratory measurements of the real part of dielectric permittivity ϵ_{piv} and dielectric loss tangent $\text{tg}(\delta)$ of sandy and clayey soils as a function of soil moisture (X) uniformly distributed throughout the volume and of electromagnetic field frequency. Also, the theoretical research of the dependence the reflected signal shape on the humidity profile was realized [C10416]

"Software for Image Simulation in Ground Penetrating Radar Problems"

The computer program LtSEMPGt simulating GPR profiles that can display the subsurface ground structure consisting of any quantity of objects and layers of any geometrical form and with any electrical parameters, has been developed for wide application. The structure and general characteristics of basic modules of the developed software have been considered. The examples of some calculations have been cited [C10417]

"Pulse-Doppler UWB Radar"

The paper contains measurement results of moving targets by pulse-Doppler UWB radar. The description of a radar, principle of operation and technical specification are presented. Conditions and results of measurements are described. Feature of the presented measurements: Doppler signals of linear moving targets whose linear sizes exceed resolution of radar [C10418]

"The Apply of the Expert Systems of Signal Processing with Frequency and Polarizations Characteristics"

This paper is devoted to studying the principles of the system construction of the signal processing with frequency and polarizations descriptions for the complex missions of air traffic control and air supervision. The expedience of consulting model of data processing is considered [C10419]

"Small-Sized Ship Navigating Radar Boosted Accuracy Rating for the Purposes Short-Range Shipping Season"

It is shown, that the modern ship radars of a decimeter and centimetric wave band do not obey safety of float in the constrained and foreshore waters because of poor efficiency of definition accurate parameters and, hence, small information. The use of small duration of an outgoing pulse (about 70 nsec) gives high-resolution capability on range, however does not provide by virtue of lines of causes of high-resolution capability on an azimuth. In the report one of the ways of mastering the accuracy of a radar with the help of use of the "radar-attachment" working in a millimeter wave band is considered. Two types of possible build-up of the antenna systems which can be used in the specified radars of boosted precision that will enable to carry out high-resolution capability on a direction presented [C10420]

"Ultrawideband Signal Scattering from a Wirelines Buried in a Ground"

Model of ultra wideband signal scattering from the subsurface wirelines which diameter is small in comparison

with length of a sounding wave and depth of its location in ground is considered. The created algorithm allows calculating the signals reflected by a cable which axis is parallel to air-ground interface, at any polarization and direction of an illumination. Results of calculations of ultra wideband signals reflected by cables, located in a lossy, dispersive ground, for various conditions of illumination are demonstrated and discussed [C10421]

"HF Ocean Surface Radar Monitoring for Coral Bleaching in the Great Barrier Reef"

HF ocean surface radar provides a valuable multi-parameter monitoring technique for the investigation and management of coral bleaching. The physical parameters normally associated with bleaching are temperature and light, which are primarily controlled by insolation, wind, waves and currents. The radar provides a useful monitoring of wind and waves, and is the leading technology for monitoring surface currents. The deployment of an HF radar in the Great Barrier Reef at the Heron Island study area provides ideal infrastructure for the study of the physical processes which affect coral bleaching and the spread of coral disease [C10422]

"Towards a Brillouin-LIDAR for remote sensing of the temperature profile in the ocean"

For remote sensing of temperature profiles in the ocean Brillouin scattering can be exploited as a temperature tracer. Such a lidar system is capable of delivering cost-effective on-line data from an extended region of the ocean compared to conventional in situ techniques. The acquired temperature profiles can give valuable input to climate studies and weather forecasts. In this contribution we present the current status of our experimental setup, consisting of a light source based on a multistage pulsed Yb:doped fiber amplifier and a receiver unit based on an excited state Faraday anomalous dispersion optical filter. Both components are advancements of laboratory experiments and possess the potential to be operated from an aircraft [C10423]

"SeaWinds Scatterometer Wind Vector Retrievals for Hurricane Claudette Using AMSR and NEXRAD To Perform Corrections for Precipitation Effects: Comparison of AMSR and NEXRAD retrievals of rain"

The estimation of sea surface winds near and within hurricanes, with the spatial coverage of a satellite radar (scatterometer), is an important objective for public safety. It is also a significant technical challenge when intense rain is present in the scatterometer Field-Of-View (FOV). The presence of rain affects the measured Ku-band normalized radar cross section (NRCS or SIGMA_0) in three ways: rain, cloud and vapor in the atmosphere attenuate the scatterometer signal; rain backscatter augments the signal that comes from the ocean surface; finally, rain hitting the ocean surface induces surface roughening ("splash") that also augments the wind-related signal from the ocean surface. Scatterometer wind retrievals assume that variations in the the measured SIGMA_0 are solely caused by variations in the wind-induced ocean surface roughening. Hence, any rain-related effects have to be accounted for before the scatterometer measurements in rain can be used to estimate the near-surface wind velocity. The MIDORI-II mission, during 2003, carried five earth-observing sensors including the SeaWinds scatterometer and the Advanced Microwave Scanning Radiometer (AMSR). The latter's six frequency brightness temperatures are collected to derive atmospheric water-related parameters and to measure the sea surface temperature. Since its coverage was closely coincident and collocated with the scatterometer, it provided the opportunity to obtain the precipitation measurements necessary to estimate the attenuation, volume backscatter and surface roughening by the raindrops within the scatterometer beam. Corrections to the scatterometer measurements of ocean surface winds can be pursued with either empirical or physical modeling. While both methods rely on the AMSR-based geophysical retrievals, they differ in how the information is used. The empirical method compares the observed sigmaO to the NCEP-model-wind-inferred SIGMA_0 to estimate the rain corrections (attenuation and backscatter that combines the rain backscatter and the "splash") as function of the AMSR-derived geophysical parameters. The physical method estimates the three rain effects separately using parametrized relationships between total liquid water, rain rate, surface roughening, volume attenuation and rain backscatter. As such, the physical method does not take into account the NCEP model winds and the produced corrections are more directly related to the AMSR-derived geophysical parameters. The AMSR was designed to measure atmospheric water-related parameters on a spatial scale comparable to the SeaWinds scatterometer (~25km). Optimal estimates of the volume backscatter and attenuation require a knowledge of the three dimensional distribution of reflectivity on a smaller scale comparable to that of the precipitation. Studies selected near the US coastline enable the much higher resolution NEXRAD reflectivity measurements to help evaluate, understand, and improve the AMSR estimates and to conduct research into the effects of different beam geometries and nonuniform beamfilling of precipitation within the field-of-view of the AMSR and the scatterometer [C10424]

"Studying the Dynamics and Biological Significance of the Hudson River Using an Ocean Observatory"

The Lagrangian Transport and Transformation Experiment (LaTTE) was designed to quantify how physical, biological and chemical processes transform material in a buoyant river plume and to link these processes to wind forced changes in the plume structure. The three LaTTE field programs include a May 2004 pilot, a full scale effort in April 2005, and a final study planned for May 2006. In each field study, dye is released and tracked by two vessels for physical, biological and chemical sampling of the tagged water mass. The field study and data assimilation segments of LaTTE rely on a research-based coastal ocean observatory to provide a temporal and spatial context for these intensive process studies. The observatory includes a shelf-wide observational backbone (international satellites, nested HF Radars, and autonomous underwater gliders) that was locally enhanced with high-resolution relocatable moorings in the New York Bight apex for the process studies. During the experiments, a shore based operations center combined real-time datasets with forecasts from a high-resolution atmospheric model (WRF) and hindcasts from an ocean model (ROMS) to provide adaptive sampling guidance to the research vessels. Results from the April 2005 pilot and the May 2006 process study will be reviewed. During the strong outflows of April 2005, the ebb tide squirts flowing onto the shelf were observed to respond to a strong sea breeze, forming a recirculating eddy just south of the Harbor entrance. The eddy served as an incubator for biological productivity, resulting in high phytoplankton concentrations leading to depleted bottom dissolved oxygen in a location consistent with historical observations. Only a portion of the fresh river water entering the recirculation zone exited as the expected coastal current along the New Jersey shelf. Most of the freshwater was observed to flow cross-shelf along the southern flank of the Hudson Shelf Valley, consistent with historical remote sensing-- data. This newly observed transport pathway can have potentially significant impacts on material transport from the Hudson River plume onto the continental shelf. In 2006, wind driven circulation resulted in the plume advecting south along New Jersey and eventually detaching into two pieces. In 2006, wind driven ROMS forecasts were successful at predicting the transport of the river as validated by the drifters and glider data [C10425]

"Estimation of the Target Detection Radar Noise Stability at the Ultrawideband Jamming Influence"

The field structure formation of an ultra wideband signal on the input of the target detection radar receiver device with working frequency 1 GHz is considered. The algorithms of the fields temporary structure definition based on the equations Kirghoff-Kothler with the subsequent estimation of the ultra-short impulse accidental jamming power characteristics necessary for specification of accepted signals processing algorithms are offered [C10426]

"Integrated Marine Mammal Monitoring and Protection System (IMAPS): Gray Whale Target Strength Measurements and the Analysis of the Back-Scattered Response"

The central IMAPS objective is to establish a global solution for systematic assessment and protection of the marine environment for the Navy, offshore industry, and scientific research community, through the development and implementation of a comprehensive, modular tool. The limitations of current technologies are that they are individually inadequate to fully achieve mitigation objectives. Visual monitoring, passive location, high frequency active sonar, and radar all have their inherent limitations such as weather conditions, a necessity for vocalizations, maximum detection range, and sea state limitations. Therefore, there is a need for all the sources of information related to the detection and classification of marine mammals to be fused and to operate in real-time in order to provide a robust protection, assessment, and research system. The other IMPAS direction is concentrated on the design and development of the active sonar modality representing just one component of the global system. The active sonar was designed, built and tested during the Marine Mammal Active Sonar Test (MAST 04), producing whale detections and whale tracks. The experiment was conducted in January 2004 off the coast of California. One of the objectives is to distinguish whale backscattered responses from the ones generated by the environmental clutter in a waveguide. Furthermore, it aims to identify and analyze the target signature features that are necessary for enhanced active sonar detection and classification of marine mammals. Over the years there have been very few documented attempts to capture and analyze the backscattering response of whales using an active sonar system. Nevertheless, whales, mostly owing to their size, their motion, and the aspect dependence of their backscattered field, possess desirable properties that help distinguishing their scattered response from clutter and other environment related false alarms. As an initial step, data collected during the MAST04-- experiment is presented, and gray whale target strength measurements are obtained. Results are compared to the previously published whale target strengths. Additionally, an investigation is conducted in an effort to provide whale feature identification points suitable for automated detection and classification, as means of relating gray whale active acoustic signatures to their inherent characteristics and their motion. During the MAST04 experiment, the active sonar component feasibility has been demonstrated, while the second generation system is being developed for the MAST 07 experiment. Tracking and classification algorithms are being further developed and they will be implemented and tested during the upcoming MAST 07 experiment. MAST 07 will feature a lighter, autonomous, fuel cell powered active sonar system, implementing real time marine mammal detection, tracking and classification algorithms [C10427]

"A Regional HF Radar Pilot Product: Serving IOOS needs in the Mid-Atlantic Bight"

Surface currents are an integral component of the Integrated Ocean Observing System (IOOS) and High Frequency (HF) radar technologies provide the means to measure these data across regional scales. A national committee on surface current mapping, supported by OCEAN.US, has outlined an organizational structure for a national HF radar system. This plan separates the national system into regional centers responsible for the operation and maintenance of the network. Recently MACOORA, the Mid-Atlantic Coastal Ocean Observing Regional Association, identified HF radar as an important component of the coastal observatory. In the context of MACOORA and the regional landscape outlined in the IOOS plan, the HF radar operators from Cape Cod to Cape Hatteras have formed a consortium for the operation and maintenance of the HF radar network, including system hardware, data management, and product delivery. Through this consortium the existing pockets of systems can be operated as part of one regional network. This network consists of 11 long-range sites providing total vector coverage across a large majority of the region. Additional sites are proposed in Moriches, NY, Block Island, RI, and Martha's Vineyard, MA to completely fill in the shelf-wide coverage from Cape Cod, MA to Cape Hatteras, NC. In addition there are three higher resolution systems made up of 13 sites in operation in the Chesapeake Bay, New York Harbor, and Long Island Sound estuaries with plans for 2 more sites in Delaware Bay. This nested network makes the Mid-Atlantic Bight the most heavily HF radar instrumented region in the world. In addition to scientific research and education applications, the data has already been ingested into United States Coast Guard Search and Rescue planning tools. An overview of the network including existing products and system infrastructure will be discussed as well as plans for the continued operation and reliable product delivery supporting the regional IOOS mission. By leveraging off national efforts like the Radiowave Oceanography Working Group (ROWG) for operation and maintenance and ROADNET for data management, the MACOORA HF radar consortium has moved from small groups of systems to a single integrated regional system, a model that could be scaled around the nation [C10428]

"Development of Surveillance and Tracking Radar"

A high-resolution surveillance and tracking radar has been recently developed and tested at the Institute of Radio Astronomy. The radar is a monopulse, all-weather radar with mechanical beam steering. It works in a pulse mode, and a coherent FFT-based signal processing is utilized. The radar is equipped with a clutter suppression system and with a Kalman filtering scheme for trajectory calculation and extrapolation. The radar is suitable for long-range surveillance with a small volume-scanning time and for tracking of highly dynamic, low-sized targets. This paper describes the setup of this radar, its main components, and the signal processing technique used [C10429]

"Ultrawideband Signals: Theory, Simulation and Digital Processing"

The propagation of the pulse ultrawideband (UWB) signals in plasma media, in particular, in the near-to-Earth's plasma layers was simulated. The dispersive distortions of the UWB signal in that media were estimated. The absorption dispersion and the scattering dispersion were taken into consideration. The radar equation for the distributed target location with UWB signals was modified. The wavelet analysis of the UWB signals was performed. The obtained results with the results of the short-time Fourier transform processing were compared and in new specially constructed format were shown. New set of the analytical wavelets based on the atomic functions and called as the Kravchenko-Rvachev analytical wavelets was proposed. Two new types of UWB signals called as non-linear and fractal UWB signals were suggested. Numerical characteristics for created models of that UWB signal types were calculated. Two time-frequency transforms were proposed to apply for UWB signal analysis [C10430]

"Practical Application of Ultra-Wideband Radars"

The possibility of ultra-wideband (UWB) radar use in various fields for remote measuring of the object's motion at short distance is considered. As an illustration UWB radar in medicine for remote measuring of patient's heart activity and respiration is shown. The measuring method is described and practical results of tests are cited. The opportunity of radar application in the other areas is described [C10431]

"Combining Polarimetry with SEM in Radar Backscattering for Target Identification"

In identifying radar targets based on the poles (resonances) in the singularity expansion method (SEM), there is additional information to be gained from the residues. The polarizations of the substructure resonances can also be used as a target signature. In addition, the relative times of arrival of the various resonances at the radar can also be used as another way to construct a target image [C10432]

"Corrections to Scatterometer Wind Vectors During Hurricane Dennis Using High Resolution NEXRAD Radar Rain Corrections"

Scatterometer wind measurements in Hurricanes have excellent potential for studying ocean forcing and the forecasting of coastal storm surges and flooding potential. These observations have the advantages of wide coverage, high resolution and accuracy. However, significant errors can occur when rain causes attenuation and backscatter of the Scatterometer's microwave pencil-beam. For most of the rain conditions existing in Hurricanes, the signal returned to the satellite is larger than that reflected by the sea surface resulting in erroneously high estimates of the wind speed. One consequence can be large errors in estimates of the coastal storm surge. This study shows how NEXRAD measurements of the rain within each Scatterometer cell can be used, with a physically based electromagnetics model, to correct the affected radar cross section data. Hurricane Dennis made landfall in the Gulf of Mexico on July 10, 2005, not far from the Florida/Alabama border. There was a serious impact on the Apalachee Bay and Cedar Key region because of a anomalously high storm surge. Heavy precipitation affected the ability of the QuikSCAT Scatterometer to accurately predict this phenomena. The precipitation in this storm was continuously monitored by the NWS Tallahassee NEXRAD (S-band) radar. The mode of this instrument is to collect radar reflectivity data using conical scans at a sequence of elevations, resulting in a 3-D volume with 2 km spatial scales. This example studies herein underscores the necessity of correcting the Scatterometer's normalized radar cross section (NRCS) measurements to remove the excess backscatter and attenuation provided by rain areas that exist within the 25-by-35 km antenna footprint. High resolution NWS-NEXRAD techniques are especially useful because of the wide variability of the rain intensity, both horizontally and vertically across each Scatterometer footprint and along the incident beam [C10433]

"An Integrated Coastal Observation and Flood Warning System: Rapid Prototype Development"

This paper describes the rapid prototype development of an inaugural capability for an Integrated Coastal Observation and Flood Warning System (ICOFWS), initially focused in the tidal Potomac River. A collaboration of the Virginia Institute of Marine Science (VIMS), NOAA National Weather Service (NWS) Forecast Offices in Wakefield and Sterling, Virginia, and Mitretek Systems developed the capability for a high-resolution hydrodynamic storm-surge model, coupled with the newest generation Weather Research and Forecast model and high resolution digital elevation LIDAR data, to predict land inundation from storm events in the Washington Metropolitan Area and the tidal Potomac River. This prototype capability then uses emerging Geographic Information Systems (GIS) visualization technologies to present forecast information in a manner that can be integrated into operations systems of local jurisdiction emergency managers and other planners. Initial steps have been taken to document a proposed process to bring this capability into operational status within the standard NWS forecast cycle as a tool to support storm surge products. It is being explored for use by partners of the Chesapeake Bay Observing System (CBOS) within the Integrated Ocean Observing System (IOOS) Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) to demonstrate the interaction of organizations operating in, and providing support within, the Chesapeake Bay region, as well as potential use of this collaborative procedure within other IOOS regional associations throughout the United States. This focused systems engineering approach allows for the more-rapid-than-typical development of prototype systems that can be evaluated for use within the broader IOOS and Global Earth Observation System of Systems (GEOSS) to provide more timely support to those with the responsibility to prepare for, and react to, environmental effects on critical infrastructure and our society [C10434]

"Effect of Approximations in Fast Factorized Backprojection in Synthetic Aperture Imaging of Spot Regions"

Fast Factorized Backprojection (FFBP) provides accelerated SAS image reconstruction at the cost of a tunable level of approximation. The approximation causes image artifacts and incorrect heights in interferometry. We explain the cause and effect of FFBP approximation and compare various levels of approximation on imagery and interferometry from data collected in the field with the SENSOTEK SAS. Interferometry has shown to be more sensitive to FFBP approximation error than imagery due to its phase sensitive nature. For bistatic FFBP implementations we recommend an FFBP approximation level E_{fact} better than $1/10$ of a wavelength as a reasonable tradeoff between computational load and error [C10435]

"Road Map Extraction using GMTI Tracking"

For analyzing dynamic scenarios with many ground moving vehicles, airborne ground moving target indicator (GMTI) radar is well-suited due to its wide-area, all-weather, day/night, and real time capabilities. The generation of GMTI tracks from these data is the backbone for producing a "recognized ground picture" as well as for analyzing traffic flows. In this paper we discuss the benefits of GMTI tracking in view of extracting road map information. The resulting tracking-generated road maps are highly up-to-date and fairly precise. Moreover, their accuracy is quantitatively described. The precision of the extracted road segments can significantly be improved

using smoothed or "retrodicted" tracks. In turn, the extracted road information is exploited for the precise tracking of succeeding road targets. The proposed approach is illustrated by a simulated example including Doppler and terrain obscuration, providing hints to the achievable road map accuracies [C10436]

"An emulator of a border surveillance integrated system"

This paper illustrates an emulator of an integrated system developed for predicting its performance in a typical border control surveillance scenario. The sensor suite emulated is constituted by: one spaceborne surveillance radar, one airborne radar for long range surveillance, one radar devoted to vessel traffic control (VTC) and one infrared (IR) camera. The collected data are sent to the command & control centre which allocates the proper means for facing the "potentially hostile" target intrusion. Reaction time and probability of correct reaction in presence of an unidentified moving object have been selected as representative of the integrated system performance. A key point to note is that the visualization is nowadays considered as an enabling technology; thus a great care has been dedicated to the presentation of results via movies realization [C10437]

"Adaptive Connectivity Management for Hybrid Wireless and Mobile Networking Environment"

The adaptive management of heterogeneous wireless networks is crucial to the emerging pervasive computing paradigm. A lot of research has been carried out for the management of wireless multiaccess systems. However, little research considers a hybrid wireless environment in which the networking resources include both infrastructured backbone and dynamic ad hoc infrastructureless connectivity. This paper proposes an architecture for the adaptive connectivity management of hybrid wireless networking resources that is available to user's mobile device. Channel is introduced to wrap hybrid networking resources. The adaptations include to choose the best connection for channel creation, and to perform channel connection switching when network situation is changes. Detailed design is described in the paper [C10438]

"PolluMap: A Pollution Mapper for Cities"

PolluMap is a new automated system that monitors the air quality of urban cities and displays the information using a Web service. The system collects pollution data using mobile hardware modules, transmits the data regularly using GPRS to a back-end server, and integrates the data to generate a pollution map of the city using its geographical information system. The pollution map is available at anytime from an easy-to-view Website. Unlike previous pollution mappers, the new system provides continuous update of pollution information in addition to maximum coverage. It can be easily expanded to new areas and is cheap to employ. The system has been implemented and tested in Dubai. Initial results show the effectiveness of the proposed system [C10439]

"Multisensor Vehicle Tracking with the Probability Hypothesis Density Filter"

In this contribution we apply the probability hypothesis density (PHD) filter algorithm for joint tracking of an unknown varying number of targets to automotive environment sensing systems. We use data from a vision and a lidar sensor as well as the vehicle ESP system. After deriving a method to parametrise the algorithm systematically from detection performance statistics we proof the applicability of the method for automotive tracking based on real sensor data [C10440]

"Measurement Gaussian Sum Mixture Target Tracking"

In this paper target tracking using measurements whose probability density function can be described (approximated) by a Gaussian sum mixture is described. The approach is illustrated for two classes of these measurements. One class is the measurements obtained by acoustic amplitude/time difference of arrival measurements typically obtained using motes. The other is measurements obtained by radar with large angular measurement errors. Such measurements in a cartesian system cannot be accurately modelled by a single Gaussian pdf. By following a Bayesian approach and the target existence paradigm, two target tracking filters have been derived. A variant of IPDA-the single scan target tracking filter, and a variant of the ITS-the multi scan target tracking filter, have been derived for situations when Gaussian sum measurements are available [C10441]

"Robust tracking architecture for Mode-S Enhanced Surveillance"

The evolution of airborne communication systems and ground stations make it possible to improve the performance of tracking systems, in order to increase capacity, safety and efficiency of air traffic environments. These new systems enable downlinking several aircraft parameters for use in ground air traffic management (ATM) systems. Some of these parameters can be used for ATM system function enhancements, such as aircraft tracking. Thus, in this paper, a robust architecture is proposed using downlink airborne parameters (DAPs). This

architecture consists of two filters in parallel: one is in charge of dealing with DAPs and the other one cope with the absence of them. Results showing the improvements in performance of the whole system are presented, as well as results coming from the DAP based filter alone. Both results will be compared with the ones delivered by the conventional filter [C10442]

"Interpretation of high-resolution optical imagery with evidential fusion of spectral information and object attributes"

Since the past five years Lockheed Martin Canada is developing an advanced image interpretation system integrating classification tools and target detection operators for multispectral, hyperspectral and polarimetric SAR imagery. Improved classification maps and superior object detection and identification performances have been obtained with a pixel-driven evidential fusion of textural measurements and end-member respectively extracted from polSAR and HIS imagery. As in many applications objects to be extracted occupy several pixels in the image, the objective of current developments is to supplement the pixel-based fusion already performed with radiometric, textural, spectral features by adding specific object topological attributes (shape, size) and contextual description (spatial relationships). This paper presents a description of the new primitives and the results obtained on Ikonos imagery [C10443]

"Performance Comparison of Pulse Pair and 2-Step Prediction Approach to the Doppler Estimation"

This work concerns the use of terrestrial pulsed Doppler weather radar echo to estimate windshear hazards disastrous for airplane approach and landing. Two different methods are used to estimate the received Doppler spectrum moments. The second central moment which is the variance of the wind velocity is called width or windshear. One method is in the time domain, while the other is in the frequency domain. These simulations which lead to comparison of the results assumes that the signal portions of the spectrum are approached with Gaussian shape [C10444]

"Modified simulated Annealing Algorithm for Poly Phase Code Design"

Multiple radar systems and spread spectrum communication systems can fundamentally improve the system performance by using a group of specially designed orthogonal polyphase coded signal but the synthesis of orthogonal polyphase codes with good autocorrelation and cross-correlation properties is a nonlinear multivariable optimization problem, which is usually difficult to tackle. A modified simulated annealing algorithm (MSAA) is proposed as a statistical technique for obtaining approximate solutions to combinatorial optimization problems. The proposed algorithm is a combination of simulated annealing and Hamming scan algorithms. This algorithm is used to design orthogonal polyphase sequence sets which have good correlation properties. Some of the synthesized results are presented, and their properties are better than other known in the literature. The synthesized polyphase sequence sets are promising for practical application to multiple radar systems and spread spectrum communication applications. The convergence rate of the algorithm is also good [C10445]

"Metrics for Feature-Aided Track Association"

Track fusion over a network of sensors requires association of the tracks before the state estimates can be combined. Track association generally involves two steps: evaluating an association metric to score each track-to-track association hypothesis, and selecting the best assignment between two sets of tracks. In many applications feature-aided track association can provide better performance than association with only kinematic data (e.g., position and velocity) when the target density is high. This paper develops a general association metric to support feature-aided track association that considers similarity in both the feature and kinematic domains. The association metric is based upon the maximum a posteriori probability (MAP) approach and can be used for general target and sensor models. Special forms of the association metric are given for some common situations. Numerical results illustrate the performance of different feature association metrics [C10446]

"Positioning Awareness: an Essential Component for Mobile Multimedia Applications"

The spreading of the WiFi networks allows new applications. New problems bound to the mobility of the terminals arise. In this article, we deal with the requirements and the solutions to address the service continuity in mobility. These requirements are integrated in mobility management middleware. It requires terminal positioning. The solution proposed is trilateration for which the distances are computed according to the signal strength. To provide the service continuity, the mechanism called handover is used. It requires an anticipation which is realized through mobility prediction. The handover is done transparently by an adapted protocol. All of these functions are implemented in GeoMoVie, the mobility component in a multimedia content streaming

platform [C10447]

"Optimal Scheduling for State Estimation Using a Terminal Cost Function"

In this paper we consider state estimation problems where there are multiple independent processes evolving but the estimation scheme can only select a limited set of processes to measure at each time step. Within a Gauss-Markov framework, we show the optimality of a scheduling scheme under various scenarios. These types of problems are common in sensor scheduling applications [C10448]

"Random Set Tracker Experiment on a Road Constrained Network with Resource Management"

This paper describes the application of finite set statistics (FISST) to real-time multiple target road constrained tracking problems. We studied specific test problems where multiple modality wireless sensor networks monitored road networks of interest. Acoustic and radar detections updated a global density that tracked the number and positions of targets. The global density determines "information states" that form the basis of a closed-loop Markov decision process resource management procedure that controls sensor operation [C10449]

"Benchmark Evaluation of Multistatic Trackers"

This paper provides an overview of the special session on multistatic sonar and radar tracking at FUSION 2006. This includes background on the multistatic tracking working group, a brief description of the datasets and trackers that compose this working group at present, and a detailed discussion of a proposed set of tracker performance metrics. We identify a number of issues associated with performance assessment for target tracking. We conclude with recommendations for continued performance assessment of multistatic trackers [C10450]

"Bayesian Multistatic Tracking: Results on Simulated Data from the Multistatic Tracking Working Group"

The multistatic tracking working group (MSTWG) was formed in 2005 as an international team of experts focused on the unique challenges in the burgeoning field of multistatic tracking. This paper presents results from three common simulated data sets provided by MSTWG members. A Bayesian tracking method is described which represents the posterior probability distribution as an ensemble of sample points. The advantages of this approach are evaluated in light of standard metrics of performance, as measured on the three aforementioned data sets [C10451]

"A new class of Heuristic Polynomial Time Algorithms to solve the Multidimensional Assignment Problem"

The multidimensional assignment problem (MAP) is a combinatorial optimization problem arising in many applications, for instance in multi-target multi-sensor tracking problems. It is well-known that the MAP is NP-hard. The objective of a MAP is to match d -tuples of objects in such a way that the solution with the optimum total cost is found. In this paper a new class of approximation algorithms to solve the MAP is presented, named K-SGTS, and its effectiveness in multi-target multi-sensor tracking situations is shown. Its computational complexity is proven to be polynomial. Experimental results on the accuracy and speed of K-SGTS are provided in the last section of the paper [C10452]

"Understanding the large family of Dempster-Shafer theory's fusion operators-a decision-based measure"

Distances between fusion operators are measured using a class of random belief functions. With similarity analysis, the structure of this family is extracted, for two and three information sources. The conjunctive operator, quick and associative but very isolated on a large discernment space, and the arithmetic mean are identified as outliers, while the hybrid method and six proportional conflict-redistributing rules (PCR) form a continuum. The hybrid method is showed as being central for the family of fusion methods. All the fusion operators tested with random belief functions are validated on the fusion of radar data classifiers, and show the interest of some new PCR methods [C10453]

"Tracking Extended Targets-A Switching Algorithm Versus The SJPDFAF"

Tracking extended targets is of central interest in mobile robotics as it is a prerequisite for interaction with the environment. There are significant differences between tracking punctiform targets and tracking extended targets. Most of the existing algorithms assume the targets to be punctiform, which is not always suitable. In recent

years, two advanced algorithms for tracking extended targets have been developed by the authors-a switching algorithm and the SJPDF. The switching algorithm uses the Kalman filter and an adapted version of the Viterbi algorithm, which includes certain geometrical characteristics of the problem. The SJPDF combines the idea of particle filtering with the JPDAF. In this paper we present these two algorithms and compare them with respect to accuracy, speed and robustness in case of crossing targets. We show, that the more recently developed switching algorithm outperforms the SJPDF regarding these criterions [C10454]

"A New DCT-based Multiresolution Method for Simultaneous Denoising and Fusion of SAR Images"

Individual multiresolution techniques for separate image fusion and denoising have been widely researched. We propose a novel multiresolution discrete cosine transform based method for simultaneous image denoising and fusion, demonstrating its efficacy with respect to discrete wavelet transform and dual-tree complex wavelet transform. We incorporate the Laplacian pyramid transform multiresolution analysis and a sliding window discrete cosine transform for simultaneous denoising and fusion of the multiresolution coefficients. The impact of image denoising on the results of fusion is demonstrated and advantages of simultaneous denoising and fusion for SAR images are also presented [C10455]

"Fusion of tri-dimensional surveillance radar data"

The paper deals with the problem of impact point prediction of ballistic targets (BT) by processing measurements acquired by two 3D surveillance radars. It is assumed that the radars acquire a limited number of measurements that do not encompass the whole target trajectory; thus the established target track has to be extrapolated ahead in time in order to predict the coordinates of the impact point. The updating and testing of the data extractor (DE) of a notional tri-dimensional surveillance radar system is presented in this paper; the modified hardware and software is capable of acquiring, managing and fusing tracks pertaining to the radar system housing the DE and to other systems connected to the DE itself [C10456]

"A Performance Comparison of the PMD and IMM filters for a Mix of two Distinctively Different Classes of Target Trajectories"

The purpose of the paper is a performance demonstration of the recently introduced filter, the probability mass diffusion (PMD) filter. The application is radar tracking of targets. The estimators are optimized for each of two distinctively different classes of targets and for a 50/50% mix of the classes. The estimators used are the PMD, IMM and the Kalman filter. Both the PMD and IMM are run with two and four models, respectively. The two classes of target trajectories are agile, highly maneuverable military type aircraft and slowly maneuvering, airline type aircraft, respectively. The evaluations are performed by the use of Monte-Carlo simulations, where the target trajectories are randomly selected from distributions describing the two classes of targets. The paper shows that the performance of the PMD filter is equal or better than the IMM for the cases studied. The improvements are shown as better noise-suppression during non-maneuver segments with comparable maneuver performance. The paper also shows the importance of trajectory definitions and filter tuning. Performance advantages may differ considerably depending on the defining set of target trajectories and the priorities of the user [C10457]

"Multiple-Hypothesis Trilateration and Tracking with Distributed Radars"

A novel algorithm to associate and trilaterate detections from multiple distributed radars is presented. The algorithm provides for flexible track state representations. The coordinate system of a track is switched from the measurement coordinates (range-Doppler) to cartesian coordinates when a detection from another sensor is associated to the track. In the case of multiple targets and false alarms we run into the complication of multiple association possibilities. These can be resolved by using a multi-hypothesis algorithm. In general, correctly formed tracks will have more likely associations. Therefore, hypotheses describing these tracks will be favored. Simulations with one or two targets and different false alarm rates show the need to preserve multiple hypotheses of the world state. Tracking performance for various false alarms rates is evaluated [C10458]

"A Model for a Human Decision-Maker in a Command and Control Radar System: Surveillance Tracking of Multiple Targets"

This work presents a deterministic approach to the problem of modelling the human behaviour in a command and control radar system and it considers the fusion of information between the operator and the system. The implementation and the results of a case study are presented where a human operator performs a tracking operation of multiple targets in a sea region. The mission performed by the operator is the surveillance of a

coast area and the selection of a system action against possible threat targets, in order to check their identity. An analytical model of human memory has been investigated where the human decision maker is represented as a subsystem involved with two operational blocks, corresponding to the situation assessment process and the response selection process that he performs. The operator performance is evaluated by mean of his error probability in these two processes [C10459]

"Comparison of Fusion Methods for Successive Declarations of Radar Range Profiles"

Classification of high-range-resolution profiles is a viable method of non-cooperative target identification. In order to increase the reliability and robustness of the classification result, methods of decision-level identity fusion can be applied. Different approaches have been used for a cumulative fusion of declarations of successively recorded radar range profiles. Besides probabilistic techniques such as the Bayesian fusion, non-probabilistic methods based on Dempster-Shafer or voting algorithms have come into focus. In this paper these different approaches are compared for typical situations which can arise in aircraft identification scenarios [C10460]

"A Multiple Hypothesis Tracker for a Distributed Network of Sensors"

This paper describes the multiple hypothesis network tracker (MHNT) being developed by BAE Systems. The goal here was to design, develop and implement a tracker capable of tracking multiple vehicles moving across a network of geographically distributed static sensors, where each sensor's coverage area is small compared to the distance between sensors. Each sensor reports the time when a target crosses the sensor's coverage area sensors may also report features associated with the target. A centralized tracker receives reports from all of the sensors and, using prior information regarding target motion across the network of sensors and actual travel times, assign reports to tracks and computes the most likely set of assignments [C10461]

"Assessment of Soil Parameter Estimation Errors for Fusion of Multichannel Radar Measurements"

The application of multichannel radar measurement techniques for estimation of bare soil parameters is based on different principles of radiowave and soil surface interaction depending on radiowave frequency, polarisation and incidence angle. The accuracy of soil parameter estimation depends on the number of radar measurements and the choice of radiowave parameters. Random and systematic errors present in radar data may also have the impact on estimation results. To improve the accuracy of soil parameters estimation by fusion of multichannel radar data we propose a new method for assessment of estimation errors. It is based on local linear approximation of the radiowave scattering model and takes into account impairment characteristics, measurement conditions and radar parameters. This new method is applied to an example to illustrate how the estimation accuracy of soil moisture and roughness parameters can be improved by optimising the radar operating frequencies [C10462]

"Structural Similarity-Based Object Tracking in Video Sequences"

This paper addresses the problem of object tracking in video sequences. The use of a structural similarity measure for tracking is proposed. The measure reflects the distance between two images by comparing their structural and spatial characteristics and has shown to be robust to illumination and contrast changes. As a result it guarantees robustness of the tracking process under changes in the environment. The previously used Bhattacharyya distance is not robust to such changes. Additionally, when a tracker is run with the Bhattacharyya distance, histograms should be calculated in order to find the likelihood function of the measurements. With the new function there is no need to calculate histograms. A particle filter (PF) is implemented where this measure is used for computing the distance between the reference and current frame. The algorithm performance has been tested and evaluated over real-world video sequences, and has been shown to outperform methods based on colour and edge histograms [C10463]

"A case based reasoning data fusion scheme: application to offshore wind energy resource mapping"

A data fusion scheme is proposed for wind energy resource mapping at high spatial resolution. The resource assessment is based on wind speed and direction measurements. Remotely sensed data is a solution to get wind observations offshore. However, high spatial resolution data do not have a sufficient repetitiveness to establish reliable wind energy resource maps. The scheme proposed in this paper uses these measurements as typical situations which have to be merged with low spatial resolution data having a sufficient temporal repetitiveness. The fusion process builds a library of typical cases. To these typical cases are associated typical fields representing the information to be merged with the corresponding low spatial resolution data. In this paper, we give, firstly, the general fusion scheme. Then, we present the different tools needed by this process. We focus particularly on the definition of the typical situations. The retrieval of these situations is achieved by a

classification process. Finally, some prospects are given [C10464]

"Validation Gating for Non-Linear Non-Gaussian Target Tracking"

This paper develops a general theory of validation gating for non-linear non-Gaussian models. Validation gates are used in target tracking to cull very unlikely measurement-to-track associations, before remaining association ambiguities are handled by a more comprehensive (and expensive) data association scheme. The essential property of a gate is to accept a high percentage of correct associations, thus maximising track accuracy, but provide a sufficiently tight bound to minimise the number of ambiguous associations. For linear Gaussian systems, the ellipsoidal validation gate is standard, and possesses the statistical property whereby a given threshold will accept a certain percentage of true associations. This property does not hold for non-linear non-Gaussian models. As a system departs from linear-Gaussian, the ellipsoid gate tends to reject a higher than expected proportion of correct associations and permit an excess of false ones. In this paper, the concept of the ellipsoidal gate is extended to permit correct statistics for the non-linear non-Gaussian case. The new gate is demonstrated by a bearing-only tracking example [C10465]

"Adaptive Target Tracking in Slowly Changing Clutter"

False track discrimination performance of a target tracking algorithm in a heavy clutter environment depends on the track confirmation and the track termination thresholds. The optimum value of these thresholds depends on the environment, in particular on the given probability of detection and on the existing clutter density. When tracking ground targets the probability of target detection is nominally constant, whereas the clutter measurement density varies significantly. Previously it was shown that, for a wide range of target signal to noise (+clutter) ratio in a uniform clutter density environment, and given the opportunity to set signal detection thresholds, the optimum value of clutter measurement density is almost constant (and the probability of detection will vary). We propose a scheme where the feedback from the target tracking system corrects the detection thresholds for each sensor resolution cell to obtain the constant and optimal clutter measurement density in each cell, when the clutter statistics changes slowly. This results in better false track discrimination capabilities of the tracker and also replaces the CFAR block in the signal processing unit [C10466]

"Emitter Geolocation with Multiple UAVs"

Geolocation of radar and communication emitters based on time difference of arrivals (TDOAs) can be carried out using a network of three or four unmanned aerial vehicles (UAVs) each of which is equipped with an electronic warfare support (ES) sensor, a global positioning system (GPS) receiver, a precision clock and a limited bandwidth communication system. When the leading edge of an electromagnetic pulse is detected by an ES sensor on board a given UAV, the time of arrival and the UAV's location are transmitted to a fusion centre. The received measurements from all UAVs within the network are then cross-correlated to determine the time difference of arrivals from which emitter location can be estimated. This paper presents two sets of emitter location estimation equations. The first set is for 2-D emitter location estimates for a ground based emitter given time of arrival measurements from three netted UAVs. The second set is for an emitter that is located at an altitude and gives the complete 3-D location estimation equations given measurements from four netted UAVs. Numerical results based on three and four UAVs are presented to validate these equations [C10467]

"Analysis of radar allocation requirements for an IRST aided tracking of anti-ship missiles"

The paper presents an analysis of the phased array radar allocation demands, when tracking highly maneuverable anti-ship missiles (ASM) using a collocated radar/IRST sensor combination. The motion of the ASM is modeled using the quantized acceleration levels. The principal aim of this analysis is to determine an upper bound on the average radar update time. This bound follows from a Cramer-Rao type error bound for the estimation of linear jump Markov dynamic systems. Given a dynamic motion model of an ASM, the IRST/radar sensor characteristics and a tolerable level of target state estimation error, we can theoretically predict the maximum average update time required for the phased-array radar. The presented analysis allows us to quantify the IRST benefits in ASM defence, without a need for extensive Monte Carlo simulations [C10468]

"Radar / ADS-B data fusion architecture for experimentation purpose"

This paper describes data fusion architecture for air traffic control applications based on radar plots and ADS-B reports. ADS-B reports help to enhance accuracy of system tracks and radar plots provide track continuity over mixed ADS-B and radar coverage area. The chosen architecture makes use of all available measurements (radar data being synchronized according to revolution time period, while ADS data are taken into account in an asynchronous way) to produce a unique track for each aircraft, making global optimal data association and correcting sensor biases. The proposed architecture has been designed for experimentation purpose: it aims to

prepare a mature model based on operational feedback. Simulations are conducted on live recording and highlight the benefits of the architecture over wide area [C10469]

"Tracking Through Jamming Using Negative Information"

Advances in characterizing the angle measurement covariance for phased array monopulse radar systems that use adaptive beamforming to null out a jammer source allow for the use of improved sensor models in tracking algorithms. Using a detection probability likelihood function consisting of a Gaussian sum that incorporates negative contact measurement information, four tracking systems are compared when used to track a maneuvering target passing into and through standoff jammer interference. Each tracker differs in how closely it replicates sensor performance in terms of accuracy of measurement covariance and the use of negative information. Only the tracker that uses both the negative contact information and corrected angle measurement covariance is able to consistently reacquire the target when it exits the jammer interference [C10470]

"Ground-Based Radar Tracking of Ballistic Target on Re-entry Phase Using Derivative-Free Filters"

Radar tracking of a ballistic target in re-entry phase has been considered in this paper. The motion of the target is evaluated with the assumptions that the drag and gravity are the only forces acting on the ballistic target after it enters into the endo-atmospheric phase. With unknown ballistic coefficient, the problem is actually a case for combined state and parameter estimation. After around 1997 the central or divided difference filter was developed for nonlinear stochastic estimation, which is a derivative-free filter and takes care of the second term of Taylor series expansion. The performance of the CDF is expected to be considerably better than the EKF and close to the UKF. This paper addresses the quantitative aspects of the improvement of performance. In particular, using Monte Carlo runs, the performance of the CDF has been compared with that of the EKF, standard UKF and Square Root UKF. While the performance of the CDF is comparable with the UKF, the CDF has a higher computational efficiency compared to the UKF. These features make it one of a strong candidate for on-line implementation in ground based radar tracking [C10471]

"Bias Estimation of Multiple Radars by Quasi-Recursive Filtering"

This paper presents a method for estimating bias in radar measurements used in tracking aerospace targets. The bias-free and less noisy radar measurement is critical as it would provide correct information of target kinematics which is a necessity of the guidance law to generate the tracking commands. In a typical interception scenario, multiple radars are employed to detect and track target kinematics. Bias estimation is often difficult because of limited observability of sensor biases as there may not be a unique set of biases that explains the relative errors between measurements. The sensors involved may be dissimilar, and their corresponding bias parameters may differ in magnitude and type. The various sources of biases are sensor bias, alignment error (tilt error), and radar position uncertainty. Radar measurements are to be debiased and noise filtered effectively before they can be used singly or in conjunction with any onboard sensor for generating tracking commands. The formulation of bias estimator described here is designed for tracking systems, such as aircrafts, ships, with multiple sensors as radars, jam strobe detectors, GPS, ESM and wider variety of targets and sensors. The paper concisely states the algorithm which addresses the above mentioned problems and illustrates its performance capabilities through results obtained by applying it to a realistic ballistic target tracking scenario [C10472]

"Combined Unscented Kalman and Particle Filtering for Tracking Closely Spaced Objects"

Tracking closely spaced objects with resolution limited sensors is a difficult problem. One way to address this issue is to track these targets individually, and employ relatively complex data association approaches as a means of pairing detections and tracks. The algorithm outlined in this paper takes a different approach, and instead estimates the group velocity using an unscented Kalman filter (UKF). The UKF state estimate is then employed within a particle filter, which estimates the distribution of objects within the group. It is shown that this approach can be very effective, especially for groups of irregularly spaced objects [C10473]

"Application of the M6T Tracker to Simulated and Experimental Multistatic Sonar Data"

This paper describes the first results of applying a multi-sensor multi-hypothesis tracker, called M6T, to simulated and experimental sonar data sets. The simulated data have been generated in the context of the Multistatic Tracking Working Group (MSTWG). For a number of cases (number of sensors and number of input false contacts) we evaluate a set of metrics that describes the tracker performance. This set allows to compare different tracking algorithms [C10474]

"Bayesian Approach for Data Fusion in Sensor Networks"

We formulate the target tracking based on received signal strength in the sensor networks using Bayesian network representation. Data fusion among the same type of sensors in an active sensor neighborhood is referred to as cross-sensor fusion, conceptualized as "cooperative fusion". This data fusion is embedded in the likelihood function derivation. Fusion of signals collected by multiple types of sensors are referred to as cross-modality fusion. It is "complementary", and represented by the contribution of their likelihood functions to the state update. The tracking algorithm is implemented using particle filter. Very good experimental results are obtained using sensor data [C10475]

"The GM-PHD Filter Multiple Target Tracker"

The Gaussian mixture probability hypothesis density filter (GM-PHD Filter) was proposed recently for jointly estimating the time-varying number of targets and their states from a noisy sequence of sets of measurements which may have missed detections and false alarms. The initial implementation of the GM-PHD filter provided estimates for the set of target states at each point in time but did not ensure continuity of the individual target tracks. It is shown here that the trajectories of the targets can be determined directly from the evolution of the Gaussian mixture and that single Gaussians within this mixture accurately track the correct targets. Furthermore, the technique is demonstrated to be successful in estimating the correct number of targets and their trajectories in high clutter density and shows better performance than the MHT filter [C10476]

"Study on Algorithms of Sensor mode Management"

Based on hypothesis testing, methods of sensor management used in target detection and localization are studied. The detector used in this problem can operate in "focused mode" and "broad search mode". The former offers higher detection and localization accuracy but less coverage area than the latter. It is supposed that a signal source is to be detected and localized with a sequence of tests, each may use different mode. The goal of sensor management is to build an object function for selecting proper mode in the sequence of tests in order to improve the detection performance. In this contribution, A method of maximum a posteriori probability is presented! methods of maximum correct detecting probability and minimum cost function based on Bayesian Reasoning are discussed. The performance of the three methods are analyzed and compared. The method of maximum correct detecting probability is modified through the simulating process. [C10477]

"The Collection and Issuance System of The Hydrographic Information"

The hydrographic information system based on GPRS network achieves inquiring of remote information, by collecting the hydrographic data from the measure station and sending it to the mobile terminals. It serves for redeploying water resource and flood prevention. The system uses three tiers: measuring station-information center-mobile terminal, the measure stations use microcontroller technology to collect the data of rain and water level of rivers or reservoirs, and then send to the information center by ultrashort wave. The information center manages the hydrographic data after receiving and sends them to the mobile terminals by GPRS Network. Experiments indicate that the system runs dependable, has good real time performance, and can be widely used and has good future [C10478]

"Time Synchronization for Wireless Sensor Networks using the Principle of Radar Systems and UWB Signals"

Time synchronization is one of the important issues of wireless sensor networks (WSN). In this paper we propose a new time synchronization method for wireless sensor networks (WSN) using ultra-wideband (UWB) signals under the inspiration of the ranging principle of RADAR systems. In the proposed method, the synchronization is based on transmitting reference UWB signals at physical layer between a pair of nodes and estimating the real system time of each node. The local time instant information of the corresponding node at which the UWB signals are being sent to the other one of the pairs is used in the estimation. The dynamic system model is then established and the computer simulations are performed using Matlab simulink. The analysis and the simulation results confirm the effectiveness of the proposed method [C10479]

"Characteristics of summer aerosol at Beijing"

The vertical distribution of aerosol extinction coefficients, and relativity between aerosol and BC the within summer planetary boundary layer (PBL) over the observation site are shown in this paper. The data indicates that the aerosol is almost trapped within PBL and troposphere layer is rather stable and the main composition of aerosol in Beijing is BC. The multi-layer structure of the aerosol distribution is obvious. [C10480]

"Spatial-Temporal-Frequency Diversity in Radar Sensor Networks"

In this paper, the spatial-temporal-frequency diversity to improve the detection performance of Radar Sensor Networks (RSN) in the presence of certain types of interference (clutter, jamming, noise and interference between radar sensors) is studied. In order to reduce the interference between radar sensors and maximize the signal-to-interference-plus-noise ratio (SINR), we propose a method using the orthogonality criterion to design waveforms for radar sensors in the network. Besides the interference between radar sensors, performance of the network depends largely on other interference, especially clutter, which is extended in both angle and range, and is spread in Doppler frequency. By using the spatial-temporal diversity, we can suppress effects of these interference. In this paper, we also propose a receiver for diversity combining in RSN. As an application example, we apply the spatial-temporal-frequency diversity scheme to improve the detection performance or reduce the missdetection probability at a low false alarm probability. Simulation results for both non-fluctuating targets and fluctuating targets show that the performance of our proposed scheme is superior to that of the single radar with the spatial-temporal diversity only. [C10481]

"Collaborative Signal Processing Using Radar Sensor Networks"

In this paper, we propose a collaborative signal processing framework using waveform diversity in radar sensor networks (RSN). We study waveform diversity using constant frequency (CF) pulse waveform and linear frequency modulation (LFM) waveform, and compare their performance in automatic target recognition (ATR) with delay-Doppler uncertainty. Simulation results show that CF pulse waveform and LFM waveform can achieve very similar performance in ATR with delay-Doppler uncertainty using radar sensor networks. The ATR performance can tremendously be improved with larger number of radars in RSN [C10482]

"SVC & K-Means and Type-Entropy Based De-Interleaving/Recognition System of Radar Pulses"

First, the paper shows a novel de-interleaving method based on support vector clustering (SVC) and K-means clustering. Secondly, it presents a notion of type-entropy and the recognition technology based on type-entropy is introduced into de-interleaving system so that a novel joint de-interleaving/recognition system of radar pulse sequence is to be presented. The simulation experiment result shows that the system can sort efficiently radar signals in the high density and complex pulses environment [C10483]

"Road Recognition in High Resolution SAR Image Based on Genetic Algorithm"

Road recognition from SAR image is a very important problem. In this paper, a new method is proposed which can detect multiple roads in an image. Firstly binary edge image is gained by Canny operator and edge refining. Secondly, edge curves are encoded by reversible chained list, and fitness function is constructed based on SAR image road models, and optimal road boundary curves are linked by improved genetic algorithm. Thirdly, complete road boundaries are detected by curve fitting. At last, mated long road edge curves are found out and road surface are stuffed. The experiment shows that this algorithm can realize roads recognition and eliminate influence of other non-road. [C10484]

"Joint IMM/MHT Tracking and Identification for Multi-Sensor Ground Target Tracking"

After giving an overview of the design of the IMM/MHT tracker, this paper discusses a joint tracking and identification approach to the multi-sensor ground target tracking problem. It is widely recognized that the requirements for the continuous tracking of important targets can only be achieved by incorporating feature data and behavioral information. Consequently, a Dempster-Shafer approach has been applied in the integration of multi-sensor classification with the target behavior so that an estimate of target type may included in the data association decision process. The ID information that may be potentially derived from HRR profiles may be combined with conventional IMM/MHT tracking techniques in order to aid the track-observation association process. Issues such as the inevitable loss of track identity due to track switching as well as the presence of confusers must be addressed. Thus, the paper discusses methods to include the effect of confusers and to efficiently reestablish track identity after a track-switch [C10485]

"Probability Evaluation in MHT with a Product Set Representation of Hypotheses"

Multiple hypothesis tracking algorithms that rely on hypothesis probabilities for pruning typically generates the n -best global hypotheses. In some cases, the probability mass is diffuse in the space of global hypotheses and a large n is desirable, implying a high computational demand. In this work, we present an alternative method for evaluation of hypothesis probabilities. Global hypotheses are then represented with exclusive product sets. Each product set has the potential of representing many global hypotheses. A method that generates the product sets is introduced, including a recursive formulation for computational tractability. In numerical evaluations, the method is compared to an optimization based method that generates the n -best hypotheses. Both an improved ability of representation, and a reduced computational demand are demonstrated in a constructed example

[C10486]

"Data Association for Infrared Search and Track System"

Data association is one of the key techniques on bearing-only tracking with infrared search and track (IRST) system. A new data association algorithm based on information fusion is proposed in this paper. Firstly, by considering the special feature of IRST system, the new method constructs several kinds of evidences that are based on the multi-type information, such as angular measurement, intensity level and so on. And then all results from different aspects are fused by utilizing Dempster combination rule. Finally, the association decision is obtained by maximizing the final mass function. The simulation results show that the proposed approach has better performance than the traditional ones. As observation conditions deteriorate, the advantage of new method becomes obvious. For uncertain data, this new data association algorithm based on evidence theory is excellent by utilizing reasonably the measurements [C10487]

"Multi-Sensor Coordination And Fusion For Automotive Safety Applications"

This paper focuses on the solution of the problem of (onboard moving vehicles) multiple sensor data fusion systems. The proposed application uses distributed architectures that operate with sensors or sensor systems and give redundant or complementary information for moving objects. This architecture ensures a modular approach allowing exchangeability and benchmarking using the output of individual trackers, whereas the fusion algorithm gives a solution to the track management problem and the coverage of wide perception areas. The test case is a multi-sensor configuration, which monitors the rear and lateral areas of traffic. Results from simulations and real data show that the given approach allows maintenance of the ID of objects and recognition of the vehicle environment with acceptable rates of false alarm and misses [C10488]

"Identity multiassignment in ESM to radar fusion"

The development of an algorithm for fusing an ESM track to multiple radar tracks is presented. This work is motivated by the difficulty of associating ESM sensor data with large measurement errors to closely-spaced radar tracks. The algorithm presents a novel approach to fusing identity information. It assigns to multiple radar tracks the identity information content of an ESM track. The identity fusion is performed using the Dempster-Shafer rule of combination. A weight based on the positional likelihood of association is included in the fusion process. Simulations of a group of targets for which angular distances are similar to the measurement errors of the ESM sensor are presented. Results show that it is possible to correctly identify a target within the group in a reasonable time interval without having to wait for the group to completely separate [C10489]

"Contact-Level Multistatic Sonar Data Simulator for Tracker Performance Assessment"

This paper provides an overview of a multistatic sonar contact-data simulation approach and a dataset generated specifically for tracker algorithm evaluation by the multistatic tracking working group (MSTWG). A brief description of the simulation approach is given, which includes simple sonar equation modeling, resulting in sensor-to-sensor target fading effects, as well as contact localization modeling. We describe the methodology by which a single data set generated using this approach is suitable to evaluate multistatic tracker performance over a range of multi-sensor detection redundancy levels [C10490]

"Towards Global Maritime Domain Awareness-"Recent Developments and Challenges""

In the era of ever-decreasing military budgets and therefore assets, improving the situational awareness of maritime domain has become a major concern. In order to find appropriate solutions, the maritime domain has to be studied having due regard to its particular difficulties and challenges. Commercial automatic identification systems (AIS), supporting multi-national programs, have the potential to become an extremely useful source of information for a composite global maritime picture. With the increasing amount of data and information provided by such commercial systems, a layered approach for maritime picture compilation is proposed, at both unclassified and classified levels of maritime data. Nevertheless, integrating different information sources to these levels, and establishing and maintaining the "recognized maritime picture" for total maritime domain awareness is still difficult requiring a number of research topics to be addressed [C10491]

"Automatic SAR Image Registration by Using Element Triangle Invariants"

Due to the presence of speckle in synthetic aperture radar (SAR) image, the existing registration algorithms, which are successfully used in optical remote sensing image, are usually not applicable to it directly. An automatic SAR image registration algorithm is proposed in this paper. Firstly, the element triangles are constructed from the point targets detected from the SAR images; then they are matched by integrating triangle

moment invariance proposed in this paper and region invariant moments; finally, the LMSE algorithm is used to estimate the affine transformation parameters, thus the SAR images can be registered automatically. The proposed algorithm is evaluated and compared with the existing methods by means of invariant moments (IM) and affine moment invariants (AMI). It is shown from Monte-Carlo simulations that the proposed algorithm is robust to detection error and partial correspondence of control points (CPs), and has higher ratio of correct matching than the methods using IM or AMI. Experimental results show that the proposed new algorithm is not only valid in the automatic registration of SAR images, but also can avoid the influence caused by speckle in feature detection and feature matching process [C10492]

"Airborne Multisensor Tracking for Autonomous Collision Avoidance"

This paper presents the tracking algorithms developed for a multisensor anti-collision system for unmanned aerial vehicles. This system will be developed by the Italian Aerospace Research Center (CIRA) within a research project named TECVOL, funded in the frame of the National Aerospace Research Program (PRO.R.A.) on UAV. The hardware setup is composed by a pulsed radar, two infrared cameras, and two visible cameras used as aiding sensors, thus the adoption of a fusion algorithm was mandatory to obtain the most accurate and reliable tracking estimate of obstacles. The paper describes the different modes and the relevant attainable performances of the developed tracking algorithm. The adopted data fusion technique for tracking is the Kalman filter. In particular, three different algorithms are compared in a typical collision scenario, namely conventional filter in rectangular coordinates, conventional filter in spherical coordinates, and extended filter in rectangular coordinates. Though all the three algorithms exhibited satisfying performances, the extended filter in rectangular coordinates resulted the most adequate for this airborne application [C10493]

"Comparison of methods for using target amplitude to improve measurement-to-track association in multi-target tracking"

Closely-spaced (but resolved) targets pose a challenge for measurement-to-track data association algorithms. Since the Mahalanobis distances between measurements collected on closely-spaced targets and tracks are similar, several elements of the corresponding kinematic measurement-to-track cost matrix are also similar. Lacking any other information upon which to base assignments, it is not surprising that data association algorithms make mistakes. This paper compares five methods for incorporating amplitude information to improve data association for multi-target tracking with Rayleigh targets. Two simple scenarios are used to demonstrate the impact of each method on measurement-to-track data association. None of the five methods perform best across the board. The analysis suggests that selection of a method for incorporating target amplitude information should be application-dependent [C10494]

"Identification of Simple Product-Form Plumes Using Networks of Sensors With Random Errors"

We consider a class of simple, idealized plumes which are specified by a product of injection and distance decay terms. The plume propagates with a constant velocity, and its distance term decays exponentially with respect to distance in a planar region. If the intensity sensors are error-free, the difference triangulation method can identify the origin of plume both in time and space within a specified precision. In our case, the sensors are subject to random, correlated errors with unknown distributions in measuring the plume intensity. The sensors are available or in place to conduct controlled experiments and collect measurements. We present a training method that utilizes the plume equation together with controlled sensor measurements to identify the plume's origin with distribution-free probabilistic performance guarantees. The training consists of utilizing the measurements to compute a suitable precision value for the difference triangulation method to account for sensor distributions. We present a distribution-free relationship between the training sample size and the precision and probability with which plume's origin is identified [C10495]

"Multistatic Sonar Simulations with SIMONA"

This paper describes a simulated data set that can be used for tracker evaluation. The data set is generated in the framework of the Multistatic Tracking Working Group (MSTWG). The simulations are carried out using the TNO SIMONA simulator, which can generate raw hydrophone data for an arbitrary number of sources, receivers, and targets. All of these can be moving or stationary. The simulations can include, for example, reverberation, ambient noise and intra-ping displacement. The simulated hydrophone data are beamformed and matched-filtered, and a contact-formation algorithm is applied. All contacts of one {source, receiver, ping} triplet are stored in a so-called contact file. These files are used by the MSTWG to evaluate and compare different tracking algorithms, the results of which are described in other papers in this special session [C10496]

"Assessment of Multi-Sensor Neural Image Fusion and Fused Data Mining for Land Cover

"Classification"

Recent studies suggest that the combination of imagery from earth observation satellites with complementary spectral, spatial, and temporal information may provide improved land cover classification performance. This paper assesses the benefits of new biologically-based image fusion and fused data mining methods for improving discrimination between spectrally-similar land cover classes using multi-spectral, multi-sensor, and multi-temporal imagery. For this investigation multi-season Landsat and Radarsat imagery of a forest region in central New York State was processed using opponent-band image fusion, multi-scale visual texture and contour enhancement, and the fuzzy ARTMAP neural classifier. These methods are shown to enable identification of sub-categories of land cover and provide improved classification accuracy compared to traditional statistical methods [C10497]

"A Track Before Detect Approach for Extended Objects"

This paper deals with target tracking for extended objects in a track before detect context. In the scope of this paper a target is called extended if its physical size is large enough to occupy multiple (radar) resolution cells, e.g. in range and/or azimuth. We show how the existing track before detect approach can be amended in order to deal with extended targets. The algorithm, that we propose, will jointly estimate on-line both the standard kinematic parameters of the target, i.e. position and velocity, as well as the size or extent of the target. The estimation is performed by means of a particle filter. It is shown that the extended target approach is significantly superior in terms of performance to a point target approach in case the target is extended [C10498]

"Throwing Down The Gauntlet: A Discussion Of Techniques For Bounding Advanced Tracking Algorithm Performance"

For many applications of radar and sensor based filtering, simulations can not represent the sole estimate of performance, provide points where threats become engagable, or determine when to use weapons' platform based sensors effectively in an engagement, etc... No significant advances have been proposed to analytically characterize performance or at least bound performance of the Kalman filter other than the use of simple two or three state constant gain filters. This paper suggests methods for characterizing filter algorithms that can be used to bound the advanced tracking algorithms that are used in a single sensor or multi-sensor environment [C10499]

"IMM Estimator for Ground Target Tracking with Variable Measurement Sampling Intervals"

Common ground target dynamic models include the nearly constant velocity (NCV), nearly constant acceleration (NCA), and nearly constant turn (NCT) models. Most of the papers on the interacting multiple model (IMM) estimator use a constant Markov chain transition probability matrix (TPM) corresponding to a constant measurement sampling interval. However, a multi-sensor ground target tracking system usually employs ground moving target indicator radar, electro-optical, infrared, video, acoustic, and seismic sensors, for which the sampling intervals are different. Modeling such systems requires using a variable sampling interval in the IMM estimator, which in turn requires the use of a non-constant TPM. An analytic expression for the TPM with variable sampling interval exists for two dynamic models. When the number of dynamic models is greater than two, the TPM can be numerically calculated efficiently. We present the technical approach for the IMM estimator with variable sampling intervals. Preliminary numerical results are presented for a maneuvering target with the NCV, NCA, and NCT models using 200 Monte Carlo simulations [C10500]

"Track Score and Target Existence"

Automatic target tracking in clutter initiates and updates both true tracks and false tracks. True tracks follow targets, and false tracks do not. False track discrimination is the procedure which confirms (vast majority of) true tracks, and terminates (vast majority of) false tracks. False track discrimination requires a measure of track quality to distinguish between true tracks and false tracks in a statistical sense. This paper compares two powerful track quality measures; the track score, as used in multi hypothesis tracking (MHT) and the probability of target existence, as used in integrated track splitting (ITS) filter. Both theoretical and simulation comparisons are presented in a single target tracking situation [C10501]

"The evidence framework applied to fuzzy hypersphere SVM for UWB SAR landmine detection"

The fuzzy hypersphere support vector machine (FHS-SVM) has stronger generalization capability than the hyperplane SVM (HP-SVM) in UWB SAR landmine detection. In this paper, the evidence framework is applied to optimize the hyperparameters of FHS-SVM. Firstly, the equivalence between FHS-SVM training and the level 1 Bayesian inference of the evidence framework is proved. Next, the FHS-SVM hyperparameter optimization

iterative method is proposed based on the evidence framework. The proposed method has been validated with the ultra-wide band synthetic aperture radar (UWB SAR) landmine detection data [C10502]

"SVM Enhancement with Application to SAR Imagery Classification"

This paper investigates enhancing the performance of support vector machines (SVMs) in the application of synthetic aperture radar (SAR) imagery classification. The approach is to replace the conventional Euclidean distance in the SVM kernel with a new similarity measure that is less sensitive to perturbations. Same-target SAR images show perturbations, in part due to the presence of speckle and in part due to small variations in radar depression angle and target orientation. It is expected that SVMs with the proposed new kernel will outperform those with the conventional Euclidean kernel. Experimental results are presented to validate this expectation for both batch and iterative implementations of SVMs. The paper also argues that the proposed approach is well-founded theoretically by demonstrating that the new kernel is still a Mercer kernel [C10503]

"New Spatial FCM Approach with Application to SAR Target Clustering"

This paper develops a new fuzzy clustering approach that is suitable for image processing applications. The developed approach is based upon the classical fuzzy c-means (FCM) and referred to as the spatial FCM (SFCM). Its effectiveness is due to two mechanisms. The first is the replacement of the Euclidean distance traditionally used to measure similarity between input images and clusters prototypes by a novel similarity measure that considers spatial relationships between image pixels and thus becomes less sensitive to image perturbations. The second SFCM mechanism for effectiveness is the addition of a similarity penalty term to FCM's objective function. The aim is to encourage clustering similar images into same clusters. The SFCM is compared to the FCM and some of its variants in the difficult application of synthetic aperture radar (SAR) target clustering. It is shown that the SFCM consistently yields better performance [C10504]

"A Novel Method of Landmines Detection Based on Improved SVM"

To detect landmines in real SAR images, detection process based on PCA and SVM techniques is proposed in this paper. Firstly, a referential deflection-optimal linear-quadratic(DOLQ) detector is presented. Then, the proposed centering PCA+SVM method is developed and compared with the above benchmark. A morphological processing procedure is used to remove the isolated spurious pixels and to form landmine objects in the binary images. Finally, the experimental results show that the novel method can constantly outperform the DOLQ detector in terms of POD(probability of detection) and the SVM method in terms of training and classification times in landmine detection. [C10505]

"A Nonparametric Sinusoid Detector with CFAR in White Noise"

A nonparametric detector called SFCD (segments frequency checking detector), the Pfa(false alarm probability) of which is constant and can be easily calculated, is put forward for the problem of detecting a sinusoid of unknown amplitude, frequency and phase in complex white Gaussian or non-Gaussian noise of unknown variance and probability distribution. The decision will be made on the basis of a statistical hypothesis test vector that is composed of a group of discrete frequency bins, which are scaled coarse frequency estimations of hypothetical sinusoid in all length-equal and non-overlapping segments of signal samples. A sinusoid is believed to exist in the received signal if all the absolute values of the difference between the first element and the others of the vector equal zero or one. The basic principle of the proposed algorithm in this paper introduced on condition of white Gaussian noise. The Pfa and Pd(detecting probability) are proved independent of the probability distribution of white noise by Monte Carlo simulation, although the performance of Pd is shown to deteriorate less than 4 dB compared with optimal parametric detector as far as samples length of 256 and Pfa of $1e-4$ is concerned [C10506]

"Radar Signals Sorting with Kohonen Neural Net"

Kohonen neural network is capable of self-organizing and recognizing clustering center, which is used in many artificial Intelligence (AI) fields. A radar electronic support measures (ESM) system must sort the received radar pulse signal to cells with the same features according to the single pulse parameters, such as radio frequency (RF), angle of arrival (AOA), pulse width (PW), etc. Considering the variety character of pulse parameters, a new definition of distance is proposed in this paper, which decreases the effect of large variety range of special parameter among them. And in order to increase the convergence speed, this paper revised the SOFM algorithm according to the effect of pulse special parameter. The computer simulation shows the validity of these improvements [C10507]

"A HRRP Recognition Method Based on KFD"

High resolution range profiles (HRRP) could accurately reflect the structure of target, so it is an important method for radar target recognition. Kernel Fisher discriminant (KFD), which is a machine learning method based on kernel function, is suitable for classification of high dimensional samples which couldn't be separated by linear classifier. In this paper, KFD were used for HRRP classification with KMOD kernel function. A multiple classifier was proposed, and better anti-noise performance was achieved with phase-subtraction alignment and a special rejecting method. The experimental results by three classes of measured HRRP data proved out the effectiveness of KFD [C10508]

"Radar Target Recognition Based on Micro-Doppler Effect"

Micro-Doppler effect is of great potential for radar target recognition since the micro-dynamics of structures on the target can be detected with it. The recognition process includes time-frequency analysis of the returned radar signal, feature extraction from time-frequency distribution images, and classification according to the feature set. In this paper, the time-frequency distribution images of four different types of micro-dynamics, which are vibration, rotation, coning and tumbling, are given and analyzed first. Then a method is proposed for feature extraction from time-frequency distribution images of micro-Doppler dynamics. Simulated experimental results have shown that high classification performances for different classifiers have been achieved [C10509]

"Multi-targets miss distance measurement based on a sequence of image processing techniques"

Multi-targets miss distance measurement is studied in this paper based on a sequence of image processing techniques. Firstly, echoes from multi-targets are represented as a gray image with spectral intensity as its gray values by time-frequency transform. Then an adaptive threshold based on constant false alarm rate (CFAR) detection is devised to convert the gray image into a binary image. Further, a set of morphological operations is used to remove background noise from the binary image. Finally, miss distance parameters of multi-targets are obtained based on randomized Hough transform (RHT). The experimental results show the efficiency of proposed method [C10510]

"Urban extraction from SAR images using local statistical characteristics and gaussian markov random field mod"

As synthesis aperture radar (SAR) represents a powerful Earth observation tool for monitoring geophysical resource globally, SAR images could be used for land description and scene analysis. Actually, various applications specifically require the detection and the analysis of urban areas from original SAR images, which is a difficult task due to the speckle signal of the images and the complexity of these scenes. In this paper, an unsupervised approach to extract urban areas from SAR images has been suggested based on local statistical characteristics and texture information described by Gaussian Markov Random field (MRF) model. First, a probability map of the urban areas is computed based on local statistical characteristics, using an fmax operator proposed by C. Gouinaud. Then the Gaussian MRF model is adopted to describe the texture of urban zones and the parameters of the model are estimated from the original image together with the probability map. Finally, the urban areas are extracted under Bayesian framework by maximum a posterior (MAP) criterion, with modeling the urban label field by Potts model. The performance of the proposed method is evaluated by experimental results on real SAR images [C10511]

"A Fuzzy Filter for SAR Image De-noising"

In this paper, a new approach to speckle filtering of synthetic aperture radar (SAR) data is presented. The idea of fuzzy window is firstly presented, where the similarity of scattering mechanism between the central filtered pixel and neighborhood pixel is depicted by the fuzzy membership function. Based on the fuzzy window, a fuzzy filter is proposed; where different pixels in the neighborhood window make different contribution to the local statistics calculation, according to their membership function value. By paying more attention to the similar scattering mechanism pixels, better performance is achieved, especially for edge/structure preserving. The effectiveness of the fuzzy filter is demonstrated using the National Aeronautics and Space Administration Jet Propulsion Laboratory airborne SAR data [C10512]

"A PDE Based Method for Speckle Noise Suppression"

The presence of speckle noise hinders observers from acquiring information of SAR images. It is desirable to remove speckle noise without features destroyed. In this paper, a PDE (partial differential equation) based method is presented to suppress the speckle noise. Unlike Perona & Malik's method, standard gradient is introduced to distinguish between the continuous areas and edges in SAR images. Since standard gradient

makes use of the statistical information to locate the edges its application in PDE brings better image enhancement results. To demonstrate the performance of our method, we apply it to real SAR images. The experiment results show that the method reduces speckle and keeps important features simultaneously [C10513]

"A Nearest Neighbor Fuzzy Classifier for Radar Target Recognition Using Combined Features"

This paper presents a nearest neighbor fuzzy classifier (NNFC), which is very suitable to process the combined features with different data types and scales. The NNFC does not require the combined features with the same data types and scales, and it is not necessary to perform any pre-processing. It uses the fuzzy membership function to process each feature of the combined features. Experiments with real satellite data show that the NNFC can effectively perform radar target recognition of multiple features combination [C10514]

"Searching for Costas Arrays Using General Particle Swarm Optimization"

Costas arrays special permutation matrices have widespread applications in many fields such as signal processing and cryptography. However, so far the basic problem-the existence problem remains unsolved. To check the existence of costas arrays for a certain order, there are two kinds of methods: algebraic constructions and exhaustive search. But algebraic constructions do not work for lots of orders, and exhaustive search has exponential computational complexity. Here stochastic search is considered. Every n times n permutation matrix has $4n^2+4n$ two-dimensional discrete autocorrelation function values. If the maximum takes 1, the corresponding permutation matrix is a costas array. Then quest for costas arrays can be viewed as an optimization problem. The optimization objective is minimizing the maximal auto-correlation function value. Swarm intelligence techniques have been applied successfully to many optimization problems. Therefore, this paper tries to search for costas arrays with general particle swarm optimization (GPSO), and preliminarily finds that GPSO is effective for costas arrays for orders less than 18 [C10515]

"Surface Current Extraction by Onboard High Frequency SAR"

To meet the requirement of extracting sea surface current information by a single station, we present the new concept of high frequency SAR (HF-SAR), and consider the feasibility of extracting sea surface current by HF-SAR. Firstly the implementation aspects are described, then system model and velocity estimation algorithm are designed, and finally simulation model to extract surface current is implemented on a single resolution cell. Additive complex Gaussian noise is included in the model of SAR echo, and also an iterative approach is adopted to estimate the parameters of chirp signals. Simulation results show that by estimating the phase parameters from azimuth echoes, the velocity estimates of surface current are obtained, and the precision is enough to meet the requirements. It indicates that HF-SAR is theoretically feasible to be used in sea surface current extraction [C10516]

"Design of Floating-point Operation Based on FPGA and it's Application"

This paper introduces the design of floating-point (FP) arithmetic units in common use based on FPGA, including the conversion between FP data and fixing-point data, FP addition, subtraction, multiplication and division. All of them are pipeline architectures and specified in VHDL, are fully synthesizable with performance comparable to other available high speed implementations. Special emphasis is put on the application of FP data in radar. As an example, the FP operation modules are used in quadrature sampling of intermediate frequency (IF) signal, to show that a much higher performance can be obtained. [C10517]

"A Method of Extracting Radar in-pulse Characteristics in Low SNR"

In low SNR, the error analysis of extracting radar in-pulse characteristics based on wavelet-ridge is not least enough. In order to improve the performance of extractible algorithm, we initiate the use of wavelet denoising. Simulation shows that the improved algorithm operates well in extracting. [C10518]

"Detection of Laser Radar Target Based on Wavelet Decomposition"

A novel approach for detecting laser radar target based on wavelet decomposition has been proposed. Usually, wavelet analysis has been used to de-noise a digital signal corrupted by noise. In our approach, we applied the wavelet decomposition in a multi-resolution sense to only get the approximation of a signal and detect the target. Without reconstruction, it is easy to realize on real time. Experiments show that our approach leads to an effective method to detect the laser target in a clutter background [C10519]

"Subpixel Processing for Target Scattering Center Extraction from SAR Images"

In high frequency region, the response of an extended target is well approximated as a sum of responses from individual scattering centers. This work presents two subpixel processing techniques for target scattering center extraction from synthetic aperture radar (SAR) or inverse SAR (ISAR) images. Using the proposed techniques, procedures for scattering center extraction are developed and used to characterize the electromagnetic (EM) scattering of complex targets. Typical results demonstrate the superior performance and usefulness of the current techniques [C10520]

"A New Algorithm for SAR Raw Data Compression by Using Wavelet Packets"

Considering the statistical independent property between phase and amplitude of SAR raw data, a new method is provided that the amplitude and phase of raw data are compressed respectively based on wavelet packet transform (WPT) after a thorough analysis on the decomposed wavelet packet coefficients of the amplitude. By using the real SAR raw data, the performances achieved in terms of certain parameters have been evaluated. The results show that this algorithm is superior to the traditional BAQ algorithm, simultaneously in terms of the reservation of phase information [C10521]

"Using Target's Polarization for Data Association in Multiple Target Tracking"

Data association plays an important role in multiple target tracking. Target's polarization information can't update target's track, but it can discriminate different targets and clutter effectively. Therefore, the non-determinacy of association is reduced. Given the target's polarization information, the generalized "nearest neighbor" algorithm is proposed according to the extended distance defined in the space-polarization joint domains. The simulation verifies that the "generalized nearest neighbor" outperforms the conventional "nearest neighbor" [C10522]

"A New Procedure for Ultra Wideband Radar Imaging from Sparse Subband Data"

In this paper, we develop a new procedure for estimating the ultra wideband (UWB) radar signatures of targets by using sparse subband measurements. Exemplary results from both simulated and anechoic chamber measured data are presented to demonstrate the usefulness of the proposed technique. [C10523]

"Using active cache to solve the bottleneck of bus in the parallel Radar signal process system"

Solving bottleneck of bus is becoming a challenging task in the design of parallel radar signal processing area. This paper has introduced a novel technology called active cache to solve this problem. By actively inserting the cache code into programs, the system will cache the remote data to local before using it. This approach is applied to the UTDSP benchmark suites, giving a good experiment result on an embedded signal processing system of four TigerSHARC101 DSPs [C10524]

"Range Estimation Accuracy Analysis of the FMCW Level Radar"

The range estimation variance Cramer Rao lower bound (CRB) of the frequency modulated continuous wave (FMCW) level radar is derived first. The CRB does not only point out the best range estimation performance the FMCW radar can achieve, it also indicates that the best performance can only be achieved by means of measuring the phase of the beat-note signal. Then the range estimation accuracies of some FFT-based range estimators are studied through computer simulation and are compared with the CRB [C10525]

"Study on Time Frequency Transformation Processing Of Stepped-Frequency Radar and Its application"

Stepped-frequency radar has the ability of high range resolution (HRR). It traditionally adopts frequency-time transformation (IDFT) processing to get the range profile (RP) of targets. Alternatively stepped-frequency radar can also use time-frequency transformation (DFT) processing, with which it is regarded as a kind of pulsed Doppler (PD) radars that uses stepped frequency pulses. This paper analyzes the DFT processing of stepped frequency radars, and its application under HPRF mode. Both theoretical analysis and simulation result prove that this radar scheme can simultaneously achieve unambiguous velocity and high resolution ranging [C10526]

"A Region-growing Phase Unwrapping Approach Based on Local Frequency Estimation for Interferometric SAR"

We propose a phase unwrapping approach. With local frequencies estimated by the maximum likelihood (ML) estimator, the unwrapped phase at the central pixel of a local image is obtained by fitting unwrapped phases with an ideal plane assumed. We take a region-growing strategy in which a quality map guides the phase unwrapping from high-quality pixels to low-quality pixels, minimizing the propagation of errors. Experimental

results, carried out on simulated data, show the advantage of the proposed approach over other approaches in accuracy, and furthermore the efficiency of the proposed approach is validated by a real-data experiment [C10527]

"Compounding segmentation method for SAR images"

Fast and accurate segmentation of synthetic aperture radar (SAR) images is important to SAR automatic target recognition (ATR). In this paper, a new compounding segmentation method is presented, based on the two-parameter CFAR segmentation method and Markov Random Field (MRF) -based segmentation approach. Following the initial segmentation obtained by the two-parameter CFAR method, the MRF-based approach is exploited only on the edge points of the targets and shadows. A comparative experimental analysis, using MSTAR (Moving and Stationary Target Acquisition and Recognition) images, of the proposed method against the other two approaches showed that the compounding segmentation method can achieve faster and more accurate results, which can be of practical use in the process of SAR ATR. [C10528]

"A Practical Kernel Criterion for Feature Extraction and Recognition of MSTAR SAR Images"

Complete kernel fisher discriminant analysis (CKFDA) is essentially a practical nonlinear feature extraction criterion based on kernel trick. The process is divided into two phases, i.e., kernel principal component analysis (KPCA) and linear discriminant analysis (LDA). This work uses two different kinds of CKFDA methods to extract the features of MSTAR SAR images: one only obtains the regular information in "single discriminant space", the other gains regular and irregular information in "double discriminant subspaces". The inspiring recognition results verify that the features not only overcome aspect sensitivity existent in SAR images, but also are robust to variants within the target classes which have small configuration differences [C10529]

"Unitary ESPRIT-Based Phase Estimation for Polarimetric SAR Interferometry"

At present, polarimetric SAR interferometry has been a new technology of measuring terrain parameters. Among the known methods of extracting interferometric phase, some methods developed from spatial spectrum estimation, such as MUSIC or TLS-ESPRIT algorithm, are being perfected. But using these methods we can not get higher phase precision due to few observation data with the SAR signals. An interferometric phase estimation method based on unitary ESPRIT can improve estimation precision by using the plural observation data and its conjugated data. In this paper, the algorithm is proposed and described in detail. Using SIR-C/X-SAR L band data, its effectiveness is tested [C10530]

"A Novel Source Number Estimator Without Complete Eigendecomposition"

In this paper, we present another novel source number estimator without the complete eigendecomposition, it is based on the Lanczos process and Sturm algorithm. Finally, for the case of a uniform circular array of six isotropic sensors spaced a half wavelength apart with additive and uncorrelated white noise, we provide a simulated data example to evaluate the proposed estimator, which is proved to be very available [C10531]

"Adaptive Threshold Setting in Acquisition of DS-UWB Signals"

An adaptive threshold acquisition system for direct sequence ultra-wideband (DS-UWB) signal is presented. The proposed adaptive scheme is based on radar constant false alarm rate (CFAR) technique. By deriving formulas for the detection probability and false alarm rate, its performance over an additive white Gaussian noise (AWGN) channel is analyzed and compared with the existing fixed threshold system. The proposed system maintains a constant false alarm probability, while the performance of the conventional fixed threshold system varies dramatically relative to the background noise. The results are supported by simulations. [C10532]

"An ESPRIT-like Algorithm for the Central DOA Estimation of Distributed Source"

In antenna array application, the propagation environment is often more complicated than the ordinarily assumed model of plane wavefronts. Here, an ESPRIT-like algorithm is suggested for estimating the central direction-of-arrival (DOA) of a source subject to local scattering, using a uniform linear array. The ESPRIT-like rotation matrix between the two subarrays is showed to exist based on the approximate closed form of the steering vector. So the DOA estimate can be obtained from the relationship between the two subarrays. The so-obtained DOA estimate does not depend on any assumption on the spatial distribution of the source and is hence robust to mismodeling. Simulations clearly demonstrate that the proposed method is not only effective, but also increases estimation accuracy compared with TLS-ESPRIT based on Taylor series expansion and DSPE algorithm. [C10533]

"A genetic algorithm-based cross-correlated back projection scheme for UWB radar imaging"

This paper presents a novel genetic algorithm (GA)- based cross-correlated back projection (CBP) scheme for the reconstruction of UWB radar images. CBP eliminates the smearing of radar images by cross correlating the array element outputs to the output of a reference element. So the performance of CBP depends largely on the selection of location of the reference element. In this work, GA is utilized to obtain the optimum location of the reference element. In comparison to standard CBP, this scheme produces images of superior quality with better cross-range resolution and smaller sidelobe levels. The performance of the new imaging algorithm is demonstrated on numerical examples. [C10534]

"A Comparison of Reference Source Signal Transmission Systems"

This paper analyzes the relationships between the Allan variance (which is used to describe the short-term frequency stability of reference source signal) and the carrier-to- noise ratio of reference source signal transmission system, compares the performances of two types of reference source signal transmission systems (narrowband and FM narrowband transmission system). The analytical results can be regarded as the foundation of design for reference source signal transmission system. [C10535]

"Adaptive Processing of Wideband Signals through Interpolation and Direct Data Domain Least Square Techniques using Semicircular Array"

A multistage analysis procedure that combines electromagnetic analysis with signal processing is used to solve a problem in radar and mobile communication. Initially, electromagnetic principles are applied to compensate for the effects of mutual coupling between antenna elements, including the effect of nonuniformity in spacing between the elements. Then a direct data domain least square methodology is implemented to yield the signal of interest. These two techniques are dealt with narrowband signal. In this paper, we show that the above methodology can be applied in wideband signals using semicircular array. The performance and accuracy of the proposed technique is observed through two simulated examples. First example, the antenna elements are to be point sources. And second example, the mutual coupling between actual elements is taken into account. The effect of mutual coupling reduces the signal bandwidth that the proposed technique can deal with. [C10536]

"Two Dimensional Direction of Arrival Estimation using Single Snapshot of Nonuniformly Spaced Planar Array"

Direction of arrival estimation (DoA) is one of the most demanding problems which one has to solve for localizing and tracking multiple rapidly moving targets as in radar, mobile communication and in other areas. In this paper, an approach is presented for two dimensional direction of arrival (2D-DoA) estimation using a single snapshot of the voltages measured at nonuniformly spaced omnidirectional isotropic point sources in a planar array. This is very useful to reach a real time or near to real time situation .The array elements are placed on a plane and arranged either exponentially or sinusoidally. The voltages induced in the antenna elements due to all signals impinging on the planar array at a particular instance of time are preprocessed by applying a transformation matrix to the measured snapshot of voltages. This electromagnetic preprocessing technique is used to compensate for the lack of nonuniformity in a planar array. Through this interpolation technique we perform 2D-DoA estimation using a modified Matrix Pencil technique. Limited numerical examples are presented to illustrate the performance and accuracy of the proposed method. [C10537]

"A Comparison of Pulse Transmission Systems"

This paper analyzes the relationships between the jitter of pulse front edge and the carrier-to-noise ratio of pulse transmission system, compares the performances of two types of pulse transmission systems. The analytical results can be regarded as the foundation of design for pulse transmission system. [C10538]

"Triply Iterative Algorithm for Extracting Statistically Independent Sources Triply Iterative Algorithm for Extracting Statistically Independent Sources"

In this paper, an efficient algorithm is developed for blind separation of multiple independent sources from observed array output signals with noises. First, a novel tri-quadratic cost function is introduced for extracting statistically independent sources from array signals. Then an efficient method is established for solving this cost function. The developed blind source separation algorithm involves three main iteration steps, but each iteration step deals with only a least-squares problem. Some numerical simulation examples are provided to demonstrate the effectiveness of the developed algorithm [C10539]

"Two-Dimensional DOA Estimation of Coherent Signals Based on 2D Unitary ESPRIT Method"

Based on URA, using 2-D spatial smoothing method, a novel method of 2-D DOA estimation under multipath environment is proposed. Using the EVESPA method to estimate the general steer matrix and do 2-D spatial smoothing with the matrix to get general smoothed covariance matrix, and then, the 2-D DOA estimations are computed by 2D unitary ESPRIT method. Without spectral peak searching, these methods can group the 2-D DOAs according the different users and pair the 2-D angles automatically. The method can estimate $[\min(M/N)-1] \times [\min(M/N)/2]$ directions at most. The effectiveness of our methods is demonstrated through some simulation examples [C10540]

"A Low Complexity Maximum Likelihood Algorithm for Targets DOA Tracking"

This work presents a low complexity bootstrapping filter for target direction-of-arrival tracking in array signal processing, and derives a Monte Carlo maximum likelihood method. Similar to bootstrapping, our new algorithm bypasses the resampling step and directly generates the maximum-likelihood estimates. This simpler target tracking method is compared against the original bootstrapping and the traditional extended Kalman filter. The performance comparison shows no performance loss for our simplified method [C10541]

"Angle-Parameterizations Range-only Target Tracking for Scalar Miss Distance Measurement System"

A new approach for estimating the scalar miss distance parameters of target is presented, which based on target tracking in space using range-only extended Kalman filter with angle-parameterizations. In this method, the region of the measurement system is divided into several subintervals, each of the subintervals runs an independent weighted EKFs in parallel with a different initial azimuth value, the combined state vector is calculated using the Gaussian mixture formulae. The new approach overcomes the problems exhibited with existing EKF range-only tracking where the angle is not "observable". Simulation results of performance demonstrate a faster convergence than the EKF, and the estimation of scalar miss distance parameters is more valid [C10542]

"2-D DOA Estimation by Minimum-Redundancy Linear Array"

Based on MRLA, a novel algorithm of 2-D DOA estimation by matrix enhancement and matrix pencil (MEMP) is proposed. Firstly, constructing a L-shape arrays by two RMRLA and using fourth-order cumulant to compute the covariance matrix of output of the two RMRLA and construct the cross cumulant matrix, and then estimate the 2-D DOA by the MEMP method. Using a new algorithm makes the 2-D angles pairing automatically. Without spectral peak searching, the method increases the valid aperture of the arrays. The effectiveness of the method is demonstrated through some simulation examples [C10543]

"A Robust Algorithm for Source Number Detection and 2-D DOA Estimation Based on Real-valued Computation"

In this paper, we present an accurate, robust, and computationally efficient source number detection and two-dimensional direction of arrival (2-D DOA) estimation method, for multiple narrowband far-field signals impinging on a uniform rectangular array. The proposed method offers several advantages over other recently proposed algorithms. First, it exhibits superior robustness to the change in signal-to-noise ratio (SNR) or the perturbation in array response. Second, except for the final eigenvalue decomposition, it is efficiently formulated in terms of real-valued computation. Finally, it makes use of the left singular vectors and eigenvalues to estimate the number of sources and 2-D DOAs, respectively. The performances of some relevant algorithms are compared via simulations, and the effectiveness of the proposed method is verified [C10544]

"2-D DOA Estimation by MEMP Based on L-shape Array"

Based on L-shape array, a novel method of 2-D DOA estimation by matrix enhancement and matrix pencil (MEMP) is proposed. Firstly, it computes the covariance matrix of output of the two linear arrays and constructs the enhanced matrix by MEMP method and then estimate the 2-D DOA by the ESPRIT method. Using a new algorithm makes the 2-D angles pairing automatically. To avoid the aperture decreasing, using fourth-order cumulant extends the MEMP method, the method increases the valid aperture of the arrays, without spectral peak searching. The effectiveness of the method is demonstrated through some simulation examples [C10545]

"A New Algorithm for Blind Separation of Cyclostationary Source from Linear Mixtures"

This paper addresses the problem of separating a cyclostationary source from linear mixtures. It first shows that

if the cyclic frequencies of the source of interest are known and different from those of the interfering sources, perfect source separation can be achieved using the proposed separation criterion. Then an algorithm is derived to perform the blind source separation. Simulation results demonstrate the validity of the proposed algorithm [C10546]

"An Optimisation Approach to Robust Estimation of Multicomponent Polynomial Phase Signals in Non-Gaussian Noise"

In this paper, we address the problem of estimating the parameters of multicomponent polynomial phase signals in impulsive noise which arises in many practical situations. In the presence of this non-standard noise, existing techniques perform can poorly. We propose a nonlinear M-estimation approach to improve the existing techniques. The phase parameters are obtained by solving a nonlinear optimisation problem. A procedure is proposed to find the global minimum at low computational cost. Simulation examples show the proposed method performs better than existing methods [C10547]

"Bistatic Ambiguity Function and DOA Estimation for PCL Radar"

In this paper detection and the accuracy of measurement of range, velocity and DOA in PCL radar for optimized parameters is considered. It is shown that, in order to measure the bistatic characteristics of a target, the monostatic ambiguity function can be processed and extract the bistatic factors by proposed algorithm [C10548]

"Inverse Tangent Based Adaptive IIR Notch Filter"

The inverse tangent based second-order adaptive IIR notch filter (ITANF) is presented in this paper. It is well known that the gradient-based adaptive IIR notch filter (ANF) has inherent low convergence speed due to the flattened error function. Moreover, the magnitude of error function depends on magnitude of sinusoid which implies that the speed of convergence of the gradient-based adaptive algorithm also depends on the magnitude of an input signal. To improve such drawback, the new inverse tangent based adaptive algorithm for a second order IIR notch filter is therefore proposed. The proposed algorithm employs the ratio of output to input signals as an error criterion where the inverse tangent value of the ratio is employed to adapt the filter parameter. It is found that the proposed algorithm provides not only high speed convergence but also high impulse noise robustness. The simulation results confirm that the performance of the proposed algorithm has been improved over the conventional ANF [C10549]

"Radar Target Recognition Using A Modified FastICA Algorithm plus GAs"

Independent component analysis (ICA) is a statistical method developed from the separation of blind signal, and now it has been successfully used in many fields. In this paper, we present an effective technique combined with a modified fastICA (M-FastICA) algorithm plus genetic algorithms (GAs) for radar high-resolution range profiles (HRRPs) feature extraction. As we all know that the most time-consuming course in fastICA is to compute the Jacobian matrix. So in this modified version, several iterations of fastICA are merged into one iteration but only needs to compute the Jacobian matrix once time. Thereby the convergence velocity of fastICA is accelerated while the performance is not degraded. To demonstrate the above feature extraction algorithm, the classification experiment on three types of radar targets are evaluated. First M-fastICA is applied to extract the independent components from the HRRPs. Then GAs is used to select the optimal basis vectors and thus build a feature subspace. The results show that the introduced method can achieve better classification performance than both PCA and ICA [C10550]

"A Novel SAR Image Matching Algorithm Based on Support Feature Point"

In this paper, a new image support feature is defined, according to various grey level of image. The comprehensive grey correlation and the feature match method, a novel SAR image fast matching algorithm is proposed based on support feature points. Relaxes Hausdorff distance is adopted as a similarity measure combined with the wavelet decomposition iteration to search the fine strategy, in the wavelet low frequency LL sub-band, carries on the image support feature point to extract. According to support feature vector the position in original image, extracts corresponding the grey value, achieves the correlation matching. As a result of support vector sparse and the global characteristic has realized the matched data effective compression, has guaranteed robust and the fast matching in SAR image [C10551]

"Linetype Structure Image Denoising Via Improved Finite Ridgelet Transform"

This paper presents an improved finite ridgelet transform (IMFRIT) approach to linetype structure image denoising. The key element of this technique is an improvement of the finite Radon transform, whereby the

transform is defined on non-square grid rather than on square one. A linetype structure denoising algorithm, which utilizes IMFRIT, is then developed. In this algorithm, referred to as the slice-based IMFRIT (SIMFRIT) algorithm, the image is first divided into several slices, and then IMFRIT denoising is performed on each slice. Experiment results show that our approach can significantly reduce the "wrap-around" effect which is an annoying problem in FRIT, and well preserve edges at the same time [C10552]

"Topography Adaptive Filtering of Phase Image Based On Residue Matrix"

At present, SAR interferometry (InSAR) is the foreland of radar remote sensing. This paper will suggest residual matrix used as the factor of filtering to interferometric phase image. Two kinds of filters for phase image are modified through utilizing residual matrix. The modified filters have different filter intensity in different areas of the phase image according to noise condition. Therefore they can realize an adaptive filtering effect and preserve topographical information and fringes in areas with steep slopes. The implementation of the filters is described in detail and the effectiveness is tested by using the interferometric phase data generated from ERS-1 repeat-pass [C10553]

"An Approximate Finite Ridgelet Transform Algorithm for SAR Image Segmentation"

The finite ridgelet transform proposed by Donoho has successful application in edge detection and segmentation of images with high-noise, but it has a drawback which is due to annoying "wrap-around" effect to the finite Radon transform. As a result, it may also produce "alias" edges and "holes" in the reconstructed image. In this paper, we present a new finite ridgelet transform based on the "natural straight line", which can overcome the above drawback and implement the inverse discrete Radon transform. At the last, we employ the proposed algorithm for segmenting the synthetic aperture radar (SAR) image and obtain satisfied segmentation result [C10554]

"Wideband Adaptive Sidelobe Cancellation Based on Stretch processing"

Wideband radar systems are vulnerable to external wideband interferences, in order to realize the high resolution target image under the wideband interferences condition, this paper presents an adaptive sidelobe cancellations (SLC) algorithm which use stretch processing. Conventional analog time delay units (TDUs) were superseded by frequency-dependent digital phase weight in the proposed method, which reduces complexity of the system and improves beamforming performance. The wideband adaptive SLC has good restrain ability to wideband jammers, as a result, it can form a high resolution target image even under strong interferences [C10555]

"ML Method at Subarray Level with Low Calibration Cost"

Most of super-resolution direction finding methods presented until now are based on the element outputs of the array. 2-D subarray level super-resolution direction finding method has an important application in phased array radars. We study ML (maximum likelihood) method at subarray level for coherent signal sources and propose the corresponding signal model. Two kinds of array manifold are introduced which are denoted as TAM (true array manifold) and DSAM (direct simplified array manifold) respectively. ML method at subarray level based on TAM has to calibrate the whole array while the method based on DSAM only needs to determine the phase centers and gains accurately. Method based on DSAM can reduce the array calibration cost largely, but the available direction finding range is 3 dB bandwidth of subarray centered at the look direction. We can estimate direction in any possible space range with beam scanning and reduce computation cost of the multi-dimensional search of ML. Simulation results express the validity of the proposed methods [C10556]

"A Novel Robust Cyclic Adaptive Beamforming Algorithm"

Cyclic adaptive beamforming (CAB) algorithm becomes an efficient blind beamforming algorithm due to its low computation complexity and fast convergence rate. However, the robustness of CAB is not enough. To overcome the shortcomings, a novel robust CAB algorithm is presented. The new algorithm is based on a combination of the ideas in the CAB algorithm and the robust capon beamforming (RCB). It still belongs to robust CAB algorithm based on diagonal loading, but the amount of diagonal loading can be calculated precisely based on the uncertainty set of steering vectors. Experiment results show the feasibility of the new algorithm [C10557]

"Time-Frequency DOA Estimation Based on Radon-Wigner Transform"

In the studies of DOA estimation based on time-frequency analysis, eliminating cross interference terms is the key to improve DOA estimation performance for the multi-signal sources situation. PWVD is the most commonly used time-frequency analysis tool for suppressing cross interference terms in WVD. However, the cross terms improvement of PWVD is not so ideal and the estimated results are not so reliable. SPWVD can suppress cross

terms better, but the time-frequency concentration performance of signal drops largely. This paper employs RWT (Radon-Wigner transform) as a time-frequency transform tool which is very suitable to describe LFM signals. This method can suppress cross terms in the background of multi sources effectively, possesses good time-frequency concentration performance, and consequently it can improve the accuracy of DOA estimation much more greatly. Simulation results demonstrate that the performances of DOA estimation based on RWT are notably improved compared with those ones based on PWVD and SPWVD [C10558]

"Change detection based on region likelihood ratio in multitemporal SAR images"

In this paper, a novel approach for change detection in multitemporal synthetic aperture radar (SAR) images is presented. The proposed approach based on region likelihood ratio feature detection exploits an edge fusion technique for the SAR images segmentation. Segmentation is the key process in change detection based on region feature and the proposed edge fusion technique of two segmentation images ensures the accuracy of the changed parts segmentation. The change-detection process is divided into three main steps: 1) two SAR images segmentation based on watershed algorithm; 2) edge fusion of two segmentation images; 3) the region likelihood ratio feature extraction for changed region detection on the fusion result. Experimental results obtained on real SAR images acquired by the ERS-1 confirm the effectiveness of the proposed approach [C10559]

"Novel Method for SAR Image Segmentation with Application to Bridge Detection"

A new method for SAR image segmentation is proposed in this paper. Region segmentation can be achieved by contour tracking, and we use the general Bayesian tracking framework to solve this problem. Due to the non-linearity of the tracking problem and the non-Gaussian noise of SAR image, Monte Carlo based particle filtering algorithm is adopted to obtain the Bayesian optimal solution. Based on the tracking framework, a particle filter based contour tracking method is proposed for region segmentation in SAR images. In this method, each particle is assigned to a linear segment with specific location and direction. The response of the local edge detector is used to calculate the particle weight while the global contextual knowledge, such as the smoothness of the region boundary, is guaranteed by the propagation of particles. The proposed method is employed for river boundary extraction on the SAR image. Furthermore, bridges over a river are detected [C10560]

"Direct Path Interference Cancellation in FM Radio-Based Passive Radar"

In passive radar based on illuminators of opportunity, one of the key problems is the suppression of the direct path interference (DPI) from the illuminator. This paper analyzes the DPI and the effect of which on passive radar in practical application, and demonstrates the importance of the suppression of DPI prior to analog to digital converter (ADC). Based on which, a new, efficient, automatic cancellation solution via hardware is brought forward. Real experiments indicate over 30 dB of the DPI suppression can be obtained [C10561]

"Partial Aperture Effect-Free Doppler Centroid Estimation Method for Airborne Side-looking SAR Based on Range-Doppler Domain Contrast Minimization"

Based on the statistical property of the range migration (RM) in the synthetic aperture radar (SAR) range compressed range-Doppler (RD) domain, a Doppler centroid estimation method for SAR is proposed. The method can mitigate the partial aperture effect (PAE) which seriously degrades the estimation accuracy of the traditional Doppler estimators for high contrast scenes. Experimental results with real data of airborne high resolution SAR support the application of the proposed method to practical SAR processing. [C10562]

"Design and Implementation of the Pulse Tracker Based on FPGA"

Many jammers can generate transmitting jamming at present. How to capture radar pulses entirely is one of the crucial factors which impact the jamming effect ultimately. A pulse tracker based on FPGA is introduced in this paper, which can track radar pulses when radar works in the fixed PRI (pulse repetition interval) pattern or staggered PRI pattern. It strongly supports the jammer to capture radar pulses entirely. It's shown that the pulse tracker can capture radar pulses exactly and improve the jamming ability of the jammer effectively [C10563]

"A New 3D Map Reconstruction Based Mobile Robot Navigation"

In order to build a precise 3D map of outdoor environment, a novel map reconstruction algorithm is proposed based on a mobile robot. The robot used a four-layer laser radar (LD_ML) to obtain space information and used a DGPS/INS (difference GPS/inertial navigation system) position system to obtain itself pose and position information. With the aim of building a complete 3D grid map, the range data of environment need be changed into a world coordinate system with the simultaneous position data of the robot. Since the outdoor environment is always complicated, the 3D grid map is built by updating z-coordinate value using obstacle detection results.

And the obstacle detection is achieved by LD_ML according to the gradient and height information of detection regions. The results of 3D grip map reconstruction testified the 3D map reconstruction algorithm was reliable and stable [C10564]

"MOMENT INVARIANTS OF OPEN CURVE FOR FUSION"

This paper presents a new set of moment invariants used for the fusion of open curve target. The moment invariants of open curve are reformulated on that of close curve. The indexes and rules for fusion of open curve target are founded on those invariants. Several retrieving methods of open curve in sparse sampling are compared to obtain appropriate ones. Determination of fusion threshold is discussed. Experiments show that these invariants were effective infusion of open curve target [C10565]

"Research on Applications of Chaff"

Through the analysis of the mechanism and motion characteristics of chaff, mathematic models are built for threaten target and chaff. To support strategy making, the applications of chaff are studied in various environments, with aspects of chaff's usage methods, timing of jamming, strength of jamming etc [C10566]

"A New Adaptive Algorithm for Despeckling SAR Images Based on Contourlet Transform"

A new adaptive contourlet transform-based technique for SAR image speckles removal is presented. It relies on realistic distribution of the SAR image's contourlet coefficients that represent mainly speckle noise on one hand and those that represent the useful signals corrupted on the other hand. The analytic model for these distributions is proposed. The shrinkage factor for despeckling is estimated at neighbourhood of the reference contourlet coefficient in each sub bands. Finally, a comparison of performance of Lee filter, Forster filter, Gamma filter, wavelet-based despeckling and contourlet transform-based despeckling is provided for both simulated and actual SAR images. It shows that the contourlet methods strongly suppress speckle, while preserving image details and sharpness [C10567]

"RESEARCH ON DUAL-INTERFACE SIM AND FINGERPRINT RECOGNITION FOR MOBILE PHONE"

Smart cards are often designed for applications of electronic purse and access control. A mobile phone with SIM card is used for voice, SMS, entertainment and some others. Here, a dual-interface SIM card is designed to take the place of the old one, while an electronic purse is built in the SIM card. Thus a mobile phone with a new SIM not only performs the original functions of phone, but also transactions of the electronic purse. In addition, fingerprint recognition method is proposed for access control to prevent unauthorized use [C10568]

"Road Curbs Detection Based on Laser Radar"

In order to provide road information for outdoor mobile robot in a complicated environment, a new road curbs extraction algorithm is proposed based on a four-layer laser radar LD_ML. According to the characteristic of road curbs that locates beside the road and presents nearly vertical relation with x-axis of the LD_ML, the algorithm includes three main steps: with the purpose of finding curbs exact position, initial curbs (beginning segments of curbs) are extracted in the range data firstly; in order to overcome the environment disturbance, then the entire curbs are obtained by using the initial curbs information and extent Kalman filter technology; in order to obtain the stable and precision road curbs information, curbs tracking method is performed at last. The experiment results testified the road curbs detection algorithm had high stability and reliability [C10569]

"A Novel Approach to Blind Source Extraction Based on Skewness"

Blind signal extraction (BSE) is an efficient way to recover the source signals from the observed signals. In this paper, a new adaptive algorithm of blind signal extraction based on the skewness was introduced for the signals whose probability distribution is not symmetric. The algorithm cooperated with the deflation procedure realizes the extraction of source signals one by one. Only third-order statistics are used in the novel algorithm, so it can reduce the computational burden effectively. Computer simulations confirm the validity and performance of the algorithm [C10570]

"35th Applied Imagery and Pattern Recognition Workshop-Title"

The topics were dealt with: 3D imaging; range distortion method; beamforming; RF image formation; data level fusion; inverse synthetic aperture radar (ISAR); image classification; image reconstruction; range-Doppler tracking; AM radar; color imagery; laser radar; image segmentation; image classification; shape estimation; image

registration; Gabor wavelet transforms; PCA; face recognition; hyperspectral imaging; multisensor fusion; X-ray image identification; artificial neural networks; Shannon sampling; video enhancement; image enhancement; data fusion; image denoising; image decomposition; stereo imaging; multiple object tracking; filtering. [C10571]

"Data Level Fusion of Multilook Inverse Synthetic Aperture Radar (ISAR) Images"

Although techniques for resolution enhancement in single-aspect radar imaging have made rapid progress in recent years, it does not necessarily imply that such enhanced images will improve target identification or recognition. However, when multiple looks of the same target from different aspects are obtained, the available knowledge base increases allowing more useful target information to be extracted. Physics based image fusion techniques can be developed by processing the raw data collected from multiple ISAR sensors, even if these individual images are at different resolutions. We derive an appropriate data fusion rule in order to generate a composite image containing increased target shape characteristics for improved target recognition. The rule maps multiple data sets collected by multiple radars with different system parameters on to the same spatial-frequency space. The composite image can be reconstructed using the inverse 2-D Fourier transform over the separated multiple integration areas. An algorithm called the matrix Fourier transform is created to realize such a complicated integral. This algorithm can be regarded as an exact interpolation, such that there is no information loss caused by data fusion. The rotation centers need to be carefully selected in order to properly register the multiple images before performing the fusion. A comparison of the IAR (Image Attribute Rating) curve between the fused image and the spatial-averaged images quantifies the improvement in the detected target features. The technique shows considerable improvement over a simple spatial averaging algorithm and thereby enhances target recognition. [C10572]

"Modeling of Target Shadows for SAR Image Classification"

A recent thrust of non-cooperative target recognition (NCTR) using synthetic aperture radar (SAR) has been to complement the extraction of scattering centers by incorporating information contained in the target shadow. When classifying targets based on the shadow region alone, it is essential that an image be well clustered into its respective shadow, highlight, and background regions. To obtain the segmentation, the intensity and spatial location of a pixel are modeled as a mixture of Gaussian distributions. Expectation-maximization (EM) is used to obtain the corresponding distributions for the three regions within a given image. Anisotropic smoothing is applied to smooth the input image as well as the posterior probabilities. A representation of the shadow boundary is developed in conjunction with a Hidden Markov Model (HMM) ensemble to obtain target classification. A variety of targets from the MSTAR database are used to test the performance of both the segmentation algorithm and classification structure. [C10573]

"Simulation of Post-ADC Digital Beam-Forming for Large Area Radar Receiver Arrays"

In order to provide instantaneous three-dimensional radar measurements spanning the entire vertical extent of the ionosphere, the planned EIS-CAT_3D incoherent scatter radar system includes multiple receive-only antenna arrays, situated at 90-280 km from the main transmit/receive site. These employs band-pass sampling at 80 MHz, with the input signal spectrum contained in the 6th Nyquist zone. This paper presents simulations and methods used to investigate use of a post-ADC fractional-sample-delay (FSD) system necessary to perform true time-delay beam-forming. To test the feasibility and limitations of the system an extensive simulation tool has been developed. The simulation system is implemented in Matlab to provide cross-platform compatibility and can be applied to any similar system. Performance degrading aspects such as noise, jitter, bandwidth and resolution can be included in the simulations. The use of FIR-filters in the base-band of a band-pass sampled signal to apply true time-delay beam-forming is shown to be feasible [C10574]

"Performance of automotive spread spectrum radars"

The use automotive collision warning radars for improving the road safety is a well recognized opportunity, and a lot of proposals have been already evaluated, in theory and practice. Many research efforts have been devoted about the application of radars against automotive collisions. In this paper we present an approach based on the classic direct sequence spread spectrum method, where the pseudo noise sequences consist of gold codes or chaotic signals. By exploiting the degrees of freedom they offer, in conjunction with their good correlation properties, chaotic signals are potentially able to improve the system efficiency compared with gold codes, by increasing the radar detection capability [C10575]

"A MIMO LMS Adaptive Equalization Approach in Simulated Radar Emission"

MIMO technology has attracted a lot of attention in the area of wireless communications such as radar applications, in term of increasing the spectral efficiency. This research paper presents the model of simulated

radar emission environment for RWR testing using MATLAB. For the first phase of the research, the radar emission environment is modeled by modeling four directions of signals as continuous wave with different amplitude to represent their emission of power. These four directions are a distribution of 360 degrees from the aircraft. These signals are propagated through their own transmission channel, showing that they are coming from four different propagation transmissions. A LMS equalizer has been adopted to equalize and analyze the incoming signal. The main purpose of this research is to find an alternative way of testing the radar warning receiver in an indoor approach rather than taking a costly outdoor testing session from the aircraft [C10576]

"Novel Techniques for Error Minimization in SAR RF and Interferometric Signal Processing"

A lot of efforts have been put in so far in the satellite/air borne SAR interferometric RF signal processing to develop easier yet accurate methods of generating topographic maps and other earth deformations due natural hazards. However, there still remain short comings while taking into account certain important factors during various processing steps, which cause un-bearable errors. In this paper efforts have been made to encompass all areas in the conventional SAR interferometry where the processing errors are encountered. Methods and relationships have been developed including use of different RF wave polarizations to obtain accurate topographic maps and invert the errors. The relevant processing steps have been identified and recommendations have been made with the help of simulation results to bridge the gaps between the desired and the actual SAR signal processing. The necessary steps involved in wave transmission and processing the received data to the geometrically compensated digital models have been explained with the help of developed algorithms and resulting simulations [C10577]

"A Novel Approach Based on Wavelet-ICA for SAR Image Speckle Suppression"

In this paper we propose a novel speckle suppression method based on the joint of wavelet transform (WT) and independent component analysis (ICA). The method employs ICA to process the wavelet coefficients of images, extracting the independent components which represent the uncorrupt images. Experimental results based on SAR (synthetic aperture radar) images of MSTAR (moving and stationary target acquisition and recognition) dataset show that the proposed method suppresses speckle effectively, and outperforms ICA and Lee filter [C10578]

"A Design Method of Parameters for Airborne Conical Scan Pulsed Doppler Radar Seeker"

The look-down mode of an airborne pulsed Doppler radar seeker is important for the detection of a moving ground target. The performances of airborne pulsed Doppler radar seeker operating in look-down mode are strongly influenced by the presence of ground clutter. In this paper the different clutter characteristics of airborne conical scan pulsed Doppler radar seeker in searching and tracking mode are analyzed, and a novel design method of parameters for the seeker is proposed. Then a design instance is given to validate the practicability of this method [C10579]

"An Improved Target Detection Method on Wavelet-Based Fractal Scaling Analysis"

Wavelet-based fractal scaling analysis is a new method based on fractal geometry for detecting small targets within sea clutter. But the fractal dimension of sea clutter is affected by not only the presence of a target but also sea wave propagation directions, which will degrade accuracy of detection under various sea and weather conditions. An improved method using spatial Hurst parameter differences is provided to overcome the above drawback. Experiments with IPIX real-life radar data have shown that the novel method is more robust and accurate than wavelet-based fractal scaling analysis method [C10580]

"A Novel Range Alignment Algorithm for Real Time ISAR Imaging"

Translational motion compensation is the key problem in inverse synthetic aperture radar (ISAR) imaging. It is usually accomplished in two steps: range alignment and phase compensation. The calculation load of range alignment is the heaviest in ISAR imaging processing. In order to meet the requirements of real time ISAR imaging, a novel range alignment algorithm is proposed in this paper. This algorithm is a combination of the frequency domain algorithm and the accumulated cross correlation algorithm and is implemented in two steps. The analysis of its computational complexity and the tests with real data demonstrate the efficiency and the accuracy of the algorithm [C10581]

"Approaches of Single Channel SAR Combining ATI for GMTI"

This paper investigates a detector based on polynomial curve fit for slow ground moving target indication (GMTI) with a single channel synthetic aperture radar (SAR) multi-look along track interferometry (ATI). In addition to the

steps of constructing multi-look using overlapped or unoverlapped windows, imaging, phase compensation and performing interferometric processing involved in common techniques of ATI used for single channel clutter suppression, the approach in this paper farther divides real parts of single channel ATI signals into numerous regions, calculates histograms of imagery parts of signals and adjudges threshold for special region by predetermined probability of false alarm (Pfa), and finally the detector is obtained by higher order polynomial curve fit throughout the data area. Another new method of moving target validation via multi-look sample covariance matrix is also proposed. Simulation results show the effectiveness of these methods in the detection of moving targets submerged in strong clutter [C10582]

"A Modified State-space Method for Estimating Parameters of High Frequency Inverse Scattering"

Estimating parameters of inverse scattering is very important for studies of characteristics of radar targets. In this paper, a modified state-space method for estimating parameters is presented. Unlike the original algorithm, a new Hankel matrix is constructed and incorporated an iterative method to refine the estimates. The validity and effectiveness of the method are proven theoretically and experimentally [C10583]

"Fast Estimation of BPSK Signal Parameters"

Based on the principle of correlation detection, a new algorithm of recognizing the binary-phase coded pulse compression radar signal is proposed, which is simple to realize. The simulation shows that the method can effectively complete the BPSK signal parameters estimation, and is superior to that using wavelet, under low signal-to-noise rate (SNR). [C10584]

"A Novel Target Recognition Method Based on Neural Network and Gray Correlation"

In order to solve target recognition problems, D-S reasoning method based on information fusion is applied. The key problem to D-S reasoning is basic probability assignment function, so the algorithm implementation of D-S reasoning is a serious problem. For the special traits of target recognition, a new method of constructing basic probability assignment function based on neural network and gray correlation analysis is presented. Examples of recognizing the radar emitter purpose have been selected to demonstrate the new method. Experimental results show that this information fusion method is accurate and effective [C10585]

"Optimization of Subarray Partition Based on Genetic Algorithm"

Suboptimum performance may be obtained by partially adaptive processing at the subarray stage where the problem of how to group the subarrays is an important task. In this paper, an effective subarray partition method based on genetic algorithm is proposed, which divides a uniform linear array employing amplitude tapering into contiguous subarrays of unequally sized. In the genetic algorithm, the crossovers are prevented by including an appropriate penalty term in the cost function. The simulation results are given to show that the subarray configuration has few obvious grating lobes while its clutter suppression performance is close to that at the element stage [C10586]

"Similarity Parameter in Polarimetric SAR Interferometry"

The similarity parameter is used to measure the similarity between two different scattering matrixes. In this paper, the similarity parameter is introduced into polarimetric SAR Interferometry (Pol-In-SAR). For two scattering matrixes of every scattering cell, the similarity parameter can be used to register the pairs of images received by two flights and fuse the polarimetric information to enhance the coherence and reduce the phase noise. The quality of the interferometric phase is improved remarkably and the number of residues is reduced sufficiently. This is helpful in generating an accurate digital elevation model (DEM) [C10587]

"A Composite Tracking Approach Based on the Multi-sensor Network"

The development trend of the future warfare is a kind of battle mode centered on the network. A revolutionary approach to air defense has been extensively evaluated recently. The approach is a new cooperative engagement capability (CEC) that allows combat systems to share sensor measurement data associated with tracks with rapid timing and precision to enable the battlegroup units to operate as one. The composite tracking approach researched in this paper is the first step to accomplish CEC. The capability of discovering the hidden targets such as the cruise missile skating over the sea can be strengthened by the multi-sensor network. The sensor blind area can be furthest decreased and the composite picture can be built in order to make the timely and efficient response [C10588]

"Clutter Suppression Approach to Airborne Phased Radar with Non-sidelooking Array Based on CMT"

The non-sidelooking array is different from the sidelooking array in that its Doppler frequency of the clutter spectrum varies with the range and its clutter degree of freedom (DOF) is increased, so that the conventional STAP methods are not feasible. The clutter distribution of airborne non-sidelooking array radar is analyzed and investigated in detail, and a new clutter suppression approach to airborne phased radar with non-sidelooking array based on covariance matrix taper (CMT) is proposed. The simulation results verify the effectivity of the method [C10589]

"The Advanced Simulation System for MMW Imaging Radar Seeker onboard Air-to-air Missile"

Millimeter wave (MMW) radar is booming in application to target seeker onboard the air-to-air missile (AAM), which has the capability to obtain all-weather radar images for auto target recognition (ATR) and intelligent active homing guidance. An advanced simulation system for MMW imaging radar seekers of AAM was introduced in this paper. The system is composed of parameter initialization module, signal simulation module and image formation module. It is capable of investigating and demonstrating the system performance of MMW radar seeker. The modeling of radar signal and the geometric model for missile-to-target were presented in particular. The echo signal for major radar operation modes could be generated by the system, including high-resolution range profile (HRRP) mode, Doppler beam sharpening (DBS) mode as well as the high-resolution burst-SAR mode. The image formation algorithms for each radar operation mode were integrated in the system to generate highly accurate radar imagery. Computer simulation results for an actual aircraft were presented, which validate the correctness of the simulation system. It is an advanced tool for the investigation of imaging algorithms and the optimization of the system parameter selection, as well as the demonstration of the radar scenario [C10590]

"Scattering Centers Measurements Using a Modified Matrix Pencil Method"

A modified matrix pencil (MP) method is discussed with applications to the scattering centers measurements in step-frequency radar system. Comparison with the Kumaresan-Tufts (KT) method, a parameter estimation method belonging to the "polynomial" method, is given out, and it is shown the MP method is more robust than the KT method with respect to noise and to the pencil parameter changes. Also the MP method has the computational advantage over the KT method. Results compared with the IFFT method show that the resolution and precision of the MP method are both higher than those of the IFFT method. The MP method is more sensitive to noise than the IFFT method when the signal-to-noise ratio (SNR) is low. But the robustness can be significantly improved by using the mean of the estimates [C10591]

"Radar-Communication Integration Based on DSSS Techniques"

With the rapidly incremental demand in electronic devices, there is something in exploring multifunctional RF systems for reducing cost, minimizing the radar cross and probability of intercept, etc. This paper presents an integration system of radar and communication based on DSSS (direct sequence spread spectrum) technique, an attractive technique which is highly secure and robust. It utilizes different PN code to spread the spectrum of radar and communication data to avoid jamming mutually. Additionally, it uses BPM to gain better performance. The simulation over an ideal AWGN channel shows that the system can work perfectly [C10592]

"A New Method of Integration and Detection for Continuous Range Profiles"

The problem of integration and detection of range spread target in colored Gaussian noise is studied. A new method of continuous range profiles' detection is proposed. As the fourth-order cumulant has a good function to restrain Gaussian noise, we regard the fourth-order cumulant's solution as a kind of nonlinear transform and get a new integration between frames. Both the analysis of theory and the result of simulation show that this algorithm has a better performance than usual algorithm of energy integrating detection for the integration of continuous range profiles [C10593]

"Detection, Location and Imaging of Fast Moving Targets Using Non-uniform Linear Antenna Array SAR"

In this paper, a new system called non-uniform linear antenna array SAR (NULA-SAR for short) is proposed. Using multiple complex images formed by multiple antennas with special configuration, NULA-SAR can not only suppress the stationary clutter, but also locate and image both slowly and fast moving targets accurately. Numerical experiments are presented to demonstrate the effectiveness of NULA-SAR [C10594]

"Angle-tracking for Two Unresolved Targets by High Resolution Spectrum Analysis and Pipeline Technique"

The missile seeker under consideration uses monopulse techniques to measure the target angular displacements. When two unresolved targets are present, the target DOAs (direction of arrival) are extracted with large errors. A novel method is proposed which implements high resolution spectrum analysis and pipeline technique to extract the angular information correctly. Furthermore, the data rate of the DOA measurements is maintained. Therefore it gives a better tracking performance comparing with some classical methods. [C10595]

"ESTIMATION OF MISS DISTANCE PARAMETERS BASED ON DOPPLERLET TRANSFORM AND MATCHING PURSUITALGORITHM"

Based on the theory of linear transformations, a novel time-frequency representation is presented for the echoes of targets with rectilinear trajectories and constant accelerations in the scoring system. First, time-frequency atoms called Dopplerlets are constructed based on the characteristics of Doppler frequency of echoes. Second, the continuous and discrete Dopplerlet transform is derived and the matching pursuit algorithm is presented. Third, the miss distance parameters are estimated based on the Dopplerlet transform and matching pursuit algorithm. Experimental results are provided to demonstrate the effectiveness and feasibility of the proposed method [C10596]

"Classification of Radar Emitter Signals Using Cascade Feature Extractions and Hierarchical Decision Technique"

An effective approach to classify the radar emitter signals is presented, which is based on a cascade feature extractions and a hierarchical decision technique. Firstly, the instantaneous autocorrelation, improved by non-ambiguity phase expansion and moving average, is used to extract the primary instantaneous frequencies of radar signals. Then, a successive normalization-based feature re-extraction algorithm is performed on the previously extracted instantaneous frequencies to obtain the classification characteristics vector. Finally, a hierarchical decision classifier is exploited to categorize signals automatically. Simulation results demonstrate the effectiveness and feasibility of the proposed scheme of signals classification. [C10597]

"Motion Parameter Measurement of Multiple Air Targets for a Multi-frequency Continuous Wave Radar"

Some approaches are proposed to measure the Doppler velocity, range, azimuth angle and elevation angle of air targets for a multi-frequency continuous wave (MFCW) radar. The effectiveness of the proposed approaches is shown by the results of processing both simulated and real data. A novel real-time signal processing system is designed to accomplish the proposed approaches [C10598]

"Fusion-based Target Tracker for Sector Scan Radar"

This paper presents a fusion-based target tracker (FBTT) for tracking a target detected by sector scan radar. The tracker employs two Kalman filters (KF) in dual-path structure. Estimation of target state in minimum mean square sense (MMSS) is obtained through fusing estimations exported from two Kalman filters, respectively. With the framework proposed here, most prevalent maneuvering target tracking algorithms in annular scan radar system can be readily applied for sector scan radar without the overburden of computation. Performance comparison between FBTT and Kalman filter is demonstrated through simulations. Benefit and validity of the proposed method is verified [C10599]

"A New Index For Effectiveness Measure Of Jamming To Synthetic Aperture Radar"

In this paper, the information theory is utilized to evaluate the jamming effect on SAR. Entropy could reflect the spatial detail information, and cross entropy could show the divergence and discrimination information of the two kinds of probability distribution. We investigated the cross entropy and presented the improved cross entropy as an index to evaluate the jamming effect. The method was tested on SEASAT-A raw data. In the simulation, the entropy and improved cross entropy were compared, and the results show that this evaluation index, improved cross entropy, is available [C10600]

"PHD Filter of Multi-target Tracking With Passive Radar Observations"

Ronald Mahler's probability hypothesis density (PHD) provides a framework for the passive coherent location of targets observed via a T/R-R type passive radar measurements. We apply a particle filter implementation of the

Bayesian PHD filter to target tracking using bearing and velocity measurements from a transmit/receive antenna and receiver pair (T/R-R). The tracking results are compared to those obtained when the same tracker is used with bearing-only measurements. The PHD particle filter handles ghost targets well and has improved tracking performance when incorporating velocity along with the bearing measurements [C10601]

"Interference Suppression for Ship-Based Passive Synthetic Impulse and Aperture Radar"

Interference statistic characteristic is theoretically analyzed in ship-based passive synthetic impulse and aperture radar (SIAR) scenario. Covariance matrix at interested range bin is estimated using echoes from some positive and all negative frequency range bins after stretching with cosine weight for co-channel interference suppression. Thereafter, Karhunen-Loeve transformation is applied to the echo received for co-channel interference suppression provided that its power is stronger than radar echoes. Meanwhile, the suppression approach of nonstationary interference owing to multipath propagation is proposed whereby fast-time STAP updated for PRI to PRI, while the slow-time statistical properties of first order sea clutter output are unaffected by fast-time STAP fluctuation. Effectiveness of interference suppression is confirmed by real data [C10602]

"Detection of unknown nonlinear fm signals by time-frequency morphological filtering"

A new energy integration detection scheme is proposed to detect an unknown nonlinear frequency modulated (FM) signal buried in strong complex additive white Gaussian noise (CAWGN). In this scheme, the Smoothed-Pseudo Wigner-Vill Distribution (SPWVD) is used to realize local coherent integration of a signal and thresholding and mathematical morphological filtering are jointly used to extract the time-frequency (TF) support region of the signal from the time-frequency distribution (TFD) image of an observation. The simulated results show that the proposed scheme is effective in strong noise background. The scheme can be applied to the target detection in the over-the-horizon radar (OTHR), such as the sky wave OTHR and the surface wave OTHR. [C10603]

"Radar Target Signature Processing While Measuring in Near Field"

Radar target signature is usually measured in near field using step frequency radar system, and Fourier-based methods are conventionally applied to signature processing, but bias lies between near field and far field. RCS is an important signature, which may be extrapolated by simple signal processing algorithm, some results are shown. The one-dimension downrange profiles are also researched based on a model, which is the foundation of image technology. While two dimension scattering centers distribution is measured, ISAR processing technology is used. We often solve the question by digital signal processing, electromagnetic field methods are also necessary to calculate wave scattering and illuminating, if two approaches are combined, maybe some interesting results can be obtained, which is a trend [C10604]

"Signal reconstructing least-squares algorithm for chirp signal parameters estimation"

In this paper, we proposed signal reconstructing least-square (SRLS) technique for estimating the chirp rate and initial frequency of chirp signal. The technique is simplicity, accuracy, and ease of on-line or off-line implementation. At low input signal-to-noise ratio, the estimates are unbiased and achieve Cramer- Rao bound (CRB). Simulation demonstrated the effectiveness and performance. [C10605]

"A Method for Ship Target Extracting from Broadened Bragg Lines in Bistatic Shipborne SWR"

The Doppler frequency shifts of the sea echoes in bistatic shipborne surface wave radar (BS-SWR) are simultaneously modulated by the velocity components projected from the motion of the radar transmitter and receiver and, therefore the Doppler spectrum in BS-SWR is much more complex than it's counterparts in monostatic mode. The characteristics of the broadened first-order bistatic Bragg lines are first analyzed in this paper and, then a model of radar return received by an arbitrary element in the receiving antenna array is proposed. Finally, a method for ship target extracting from broadened Bragg lines in BS-SWR is presented, which is based upon the azimuth differences between the Bragg waves and the moving targets whose Doppler spectrum fall into the same Doppler resolution cell. Simulation results show that the method suggested in this paper is effective in the bistatic shipborne surface wave radar applications [C10606]

"Study on the Optimal and Adaptive Search of Multifunction Phased Array Radar"

The beam agility and controllability of system parameters provide phased array radar systems the capability of concurrent multifunction and the potential of high adaptability. It is very important to allocate the constrained radar resources to the radar tasks adaptively according to the dynamic change of the environment and the operational requirements in order to optimize the overall performance of the systems. The optimal model of the

allocation of the radar resource is presented based on the quantified radar load in this paper. The parameter optimization of the search function of a Pulse-Doppler phased array radar is investigated, the method to design optimal search in an adaptive way is formulated and the impact of the model parameters on search performance is analyzed through simulations. [C10607]

"Recovering Spheres from 3D Point Data"

The National Institute of Standards and Technology is involved in developing standard protocols for the performance evaluation of 3D imaging systems, which include laser scanners and LADARs (laser detection and ranging). A LADAR is an optical device that typically yields voluminous 3D "point clouds" by scanning scenes. In many applications, a model of an object which is present in the scene has been specified, and the task amounts to recovering this object from scan data. Specifically, the recovery of spheres from point clouds will be addressed, aiming at estimating the location of their centers and, if not known beforehand, their radii. This information can be used, for instance, to "register" LADAR data to a specified coordinate frame. Two experiments recovering spheres based on best-fitting data points are reported. Sphere fitting based on orthogonal least squares is compared to a novel approach, minimizing instead the squares of range errors incurred in the direction of the scan. [C10608]

"Advanced Techniques for Watershed Visualization"

Analytical shaded relief is commonly used for visualization of digital elevation models (DEMs). Sometimes, the quality of unaltered analytical shaded relief can be lacking for identification of streams and water divides. Hydroshading is a technique that provides enhanced capabilities of visualization of hydrologically-meaningful topographical features. In this research, hydroshading algorithms are applied to NASA's Shuttle Radar Topography Mission (SRTM) DEM datasets. The visualization technique is applied to coastal and inland watersheds in Mississippi (Saint Louis Bay and Luxapallila, respectively). The testing of hydroshading in these two areas shows that the technique is more effective in areas with moderate topographical relief than in low relief terrain. Combining hydroshading with standard three-dimensional visualization identification of water. Hydroshaded DEMs were used to manually delineate Luxapallila and Saint Louis Bay's Wolf River catchments. Delineation results are comparable to output of standard automated delineation produced by GIS software (BASINS). [C10609]

"Nonlinear Equalization for RF Receivers"

This paper describes the need for high performance computing (HPC) to facilitate the development and implementation of a nonlinear equalizer that is capable of mitigating and/or eliminating nonlinear distortion to extend the dynamic range of radar front-end receivers decades beyond the analog state-of-the-art. The search space for the optimal nonlinear equalization (NLEQ) solution is computationally intractable using only a single desktop computer. However, we have been able to leverage a combination of an efficient greedy search with the high performance computing technologies of LLGrid and MatlabMPI to construct an NLEQ architecture that is capable of extending the dynamic range of radar front-end receivers by over 25dB [C10610]

"Segmentation and Classification of Human Forms using LADAR Data"

High resolution LADAR (laser detection and ranging) images of scenes containing human forms have been automatically segmented and simple algorithms have been developed for recognizing human forms in various positions in both cluttered and uncluttered scenes. Registration of LADAR and color CCD images is suggested as a method to enhance the ability to segment both types of images. [C10611]

"3D Image Reconstruction and Range-Doppler Tracking with Chirped AM Ladar Data"

The Army Research Laboratory (ARL) has been developing its patented chirped amplitude modulation (AM) ladar technique for high resolution 3D imaging and range-Doppler tracking. The concept of operation, hardware configurations, and test results for this technique have been presented in detail elsewhere. Heretofore, the signal and image processing techniques used at ARL to reconstruct and display 3D imagery and range-Doppler plots have only been published partially and only in internal reports. In this paper we present the multiple-return range and range-Doppler signal processing algorithms, the model-based "superresolution" processing algorithm for range precision enhancement, and the 3D image reconstruction, processing, and display algorithms, along with representative examples from laboratory and field test data. [C10612]

"Real-Time 3D Ladar Imaging"

A prototype image processing system has recently been developed which generates, displays and analyzes

three-dimensional ladar data in real time. It is based upon a suite of novel algorithms that transform raw ladar data into cleaned 3D images. These algorithms perform noise reduction, ground plane identification, detector response deconvolution and illumination pattern renormalization. The system also discriminates static from dynamic objects in a scene. In order to achieve real-time throughput, we have parallelized these algorithms on a Linux cluster. We demonstrate that multiprocessor software plus Blade hardware result in a compact, real-time imagery generation adjunct to an operating ladar. [C10613]

"Automatic Alignment of Color Imagery onto 3D Laser Radar Data"

We present an algorithm for the automatic fusion of city-sized, 2D color imagery to 3D laser radar imagery collected from distinct airborne platforms at different times. Our approach is to derive pseudo-intensity images from ladar imagery and to align these with color imagery using conventional 2D registration algorithms. To construct a pseudo-intensity image, the algorithm uses the color imagery's time of day and location to predict shadows in the 3D image, then determines ambient and sun lighting conditions by histogram matching the 3D-derived shadowed and non-shadowed regions to their 2D counterparts. A projection matrix is computed to bring the pseudo- image into 2D image coordinates, resulting in an initial alignment of the imagery to within 200 meters. Finally, the 2D intensity image and 3D generated pseudo-intensity image are registered using a modified normalized correlation algorithm to solve for rotation, translation, scale and lens distortion, resulting in a fused data set that is aligned to within 1 meter. Applications of the presented work include the areas of augmented reality and scene interpretation for persistent surveillance in heavily cluttered and occluded environments. [C10614]

"Digital image processing with dynamical neural networks for resource management: simulation experiments"

In this paper, we presented some results of the extended simulations of the images of the real-world applying to the maximum entropy variational analysis algorithm with computational implementation of the recurrent neural networks to the natural resource management. To the try the computational efficient of the new propose, we are applying two metrics to the quantitative evaluation, the improvement output signal to noise ratio and mean square error. Furthermore, we present a numerical examples of the natural resource management, specifically on the Lerma river to the illustrate the efficiency of the proposed approach. To other hand, the simulation examples, can show the efficiency qualitative of the proposed approach. [C10615]

"A Study of Ground Clutter Suppression with a Regression Filter"

This paper explores the realization and computational complexity of the regression filter for ground clutter suppression. Ground clutter suppression performance of regression filter is compared with an existing ground clutter filter now used in CINRAD WSR-98D. Through simulations, it is demonstrated that the regression filter is a good choice for ground clutter suppression in CINRAD WSR-98D [C10616]

"Model-Driven Development of Radar Control Software"

Model-driven development aims to separate the logic of a program from its implementation technology. In this paper, we reported on a project that applies model-driven architecture approach to multifunction experimental radar. Due to the dynamics of radar software projects, a certain degree of adaptability is required to minimize costs of incorporating last-minute software specification changes in the development process. We also evaluate some UML tools in the market. [C10617]

"An Effective ADBF Method at Subarray Level for Plane Phased Array"

ADBF at subarray level has important applications in phased array radar. This paper presents a sort of signal model of two-dimension ADBF at subarray level, suitable for any plane phased array. The conventional two-dimension ADBF at subarray level can be obtained by generalizing ADBF at element level, but its limitation is that adaptive processing makes the SLL (sidelobe level) of the adaptive pattern increase remarkably. We introduce two-dimension ADBF at subarray level based on MOD (mismatched optimum detection). This method can suppress the SLL effectively, but introduces bigger SINR loss. Therefore, this paper combines the conventional ADBF at subarray level and the method based on MOD, which can meet the performance requirements of SLL and SINR simultaneously. Simulation results indicate the validity of the introduced method [C10618]

"An Enhanced Wireless LAN Positioning Algorithm based on the Fingerprint Approach"

As ubiquitous computing gained much attention in recent years, location estimation in wireless LAN becomes a

hot topic. Previous research work suggests the use of the averaged received signal strength (RSS) as fingerprint can achieve high accuracy for location estimation. In a library environment, however, the accuracy of such traditional approach is barely acceptable. It is because library contains considerably large number of metal bookshelves, and limited number of access points. Worse yet, the layout of these access points in the library is fixed for connection to the Internet, and therefore it is hard to change the environment to adapt for location estimation system. In this paper, we introduce an enhanced fingerprint (EFP) algorithm, and tested it in a library environment. The experiment result showed that the proposed EFP algorithm can have more than 30% of improvement in accuracy over traditional approaches without changing anything in the library environment

[C10619]

"Signal Processing of Earthquake Precursor at ELF Band"

In this paper, the signal processing technology of EM precursors for predicting earthquakes is discussed. The observed signals contain local signals related to earthquakes as well as global background noise which is stronger than the local signals. A method of global noise elimination by independent component analysis (ICA) is discussed. The second signal processing is to extract the sign of anomaly relevant to earthquake prediction. For the processing, the linear predicting coefficient (LPC) method is applied. The LPC error is well acknowledged as a precursor of large earthquakes exceeding magnitude seven [C10620]

"A Novel Algorithm of Time-Registration for 4D Trajectory based on GNSS's time"

Worldwide air traffic levels are growing at a rate expected to double the current traffic level. In order to control and ensure the aircrafts, most large airport surface have multi-sensors coverage, with not necessarily synchronized sensors, so a data fusion scheme is essential to provide a coherent and stable output. The multi-sensors include radars, VHF data link, and satellites, and form a surveillance network. The current technology air traffic control fusion systems are stretched to their limit and are prone to large delays during the peak summer travel season. There is doubt that the current systems can be scaled up to meet the expected demand levels and surveillance trajectory. Many air traffic management automation systems have been proposed to increase controller capability, and some are in operation. While ATM automation systems will help handle more traffic, it is still doubtful that they can grow to meet the doubling in traffic levels foreseen. In order to complete the function, the data come from the multi-sensors must be processed and then fused, so that the fusion trajectory comes into being. Fusion data come from PSR, SSR, ADS and VDL, time-scales are different. Before the 4D fusion trajectory comes into view, time-registration of the data must be implemented. Thereby registration is the vital problem for the data fusion of the multi-sensors network. This paper presents a novel algorithm of time-registration for 4D trajectory based on GNSS's time for ATM. Because of the difference of surveillance data's time-scales, general time-registration methods have many difficulties and risks for so many kind data. We find that there is connection between the surveillance data and GNSS's time, so the data's time-scales can be unified to GNSS's time benchmark respectively, and then the unified data can be fused, the 4D fusion trajectory comes true. Using the GNSS's time fusion systems can further improve the controller trajectory accuracy and can be used to increase airspace capacity [C10621]

"Nonlinear Least-Squares Frequency Offset Estimator and Its Simplified Versions for Flat-Fading Channels"

In this paper, the nonlinear least-squares (NLS) estimator for frequency offset in flat-fading channels is systematically derived. A simple interpolation technique is introduced to improve the estimation accuracy of the resulting NLS estimator, especially when the number of zeros padded in FFT is insufficient. Furthermore, we propose an approximated NLS estimator which significantly simplifies the implementation complexity of the full structure NLS estimator. All the estimators derived in this paper do not require any information about the channel correlation as needed for most of the existing techniques. The simulation results show that the performances of two simplified NLS estimators are as good as that obtained from the full structure NLS estimator [C10622]

"A Simple Resolver-to-DC Converter"

In this paper, a simple resolver-to-DC converter is presented. The realization method is based on the proposed OTA-based sin-1 function circuit. The proposed converter provides a simple configuration and produces an output signal, which is linearly proportional to the shaft angle. Performances of the proposed circuit are discussed in detail and confirmed by the experimental results [C10623]

"Airborne Squinted Spotlight SAR Imaging using Polar Format Algorithm"

Though several reconstruction methods have been studied in stripmap-mode SAR with a squint angle, it is still

difficult task to obtain the high quality images in the case of the spotlight SAR with a squint angle. In general, the polar format algorithm has been used for the processing of the airborne squint-mode spotlight SAR. However, the PEA has limitations of the scene size and the squint angle. Thus, to compensate the shortcomings, we analyze the errors and introduce a compensation technique based on the subarea technique and the Taylor approximation [C10624]

"Tracking Filter with Motion Compensation for Ship-borne Radar"

This paper presents a tracking filter with motion compensation for ship's maneuver in a ship-borne radar tracking system. The ship's maneuvers are described by displacement and rotational motions in the ship-centered east-north frame. The effect of the maneuver is compensated by incorporating the state displacements in the tracking filter and taking a coordinate transformation of the measurements using the information derived from the ship's navigation system. The simulation results via 500 Monte-Carlo runs show that the proposed method follows the target successfully and provides consistent tracking performance during ship's maneuvers while the conventional tracking filter without ship motion compensation fails to track during such periods [C10625]

"Non-Destructive Inspection of Multiple Concrete Cracks Using Ultrasonic Sensor"

Non-destructive testing (NDT) of concrete cracks are very important for the maintenance and safeguard of concrete structures. Numerous methods with varying detecting devices have already been developed for this purpose. Although detection of a single crack within the concrete is somewhat easy, simultaneous detection of multiple numbers of cracks in the direction of depth is extremely difficult due to the fact that many reflected waves are often overlapped and that the reflected waves are spindle oscillatory types. The present paper proposes a method to identify multiple numbers of cracks inside the concrete using a multi-reflected wave model and a pattern matching technique. The method uses the pattern matching technique to detect the optimum times of flights (TOEs) of the reflected waves from multiple cracks and thus determines the crack depths. Using this method, not only the depths of the multiple cracks but the attenuation of the reflected waves relative to each other can also be determined. Experiments will show that the method is effective [C10626]

"Sensor Fusion Based Fuzzy Rules Learning for Humanitarian Mine Detection"

In this paper, a sensor fusion based fuzzy rules for humanitarian demining are presented. A fuzzy learning algorithm for extracting fuzzy fusion rules from experimental data of robot-manipulated ground penetrating radar (GPR) and metal detector (MD) is presented. The inputs to the fuzzy learning algorithm are features extracted from both a GPR and an MD while its output is a set of fuzzy rules. Applying the learnt fuzzy fusion rules and knowing GPR and the MD features of a given scan, it is possible to decide if there is a land mine and its approximate depth underground. The features chosen for this fusion algorithm are the peak amplitude of a processed GPR output signal and the peak value of the cumulative sum of amplitudes of MD output signal for the same scanned area. Experimental test results are presented for verifying the validity of the proposed learnt fuzzy fusion rule base [C10627]

"Enhanced Discrimination for Boundary and Material of Buried Objects in Concrete Structure using Microwave Subsurface Radar"

In this report, a novel signal and image processing method for microwave subsurface radar is proposed, which enables to estimate the internal construction in concrete structures. By using proposed method, enhanced information of buried objects such as boundary and material are discriminated. As the objects are buried near the concrete surface, signal processing is complicated because a reflected wave is often interfering with a transmitting wave in an observed signal. In order to reduce an influence of the interference, transmitting wave subtracting method is adopted, which calculates the difference between the observed signal and a typical transmitting waveform identified from the observed signal without buried objects, and boundary and material of the buried objects are discriminated precisely. Next, a boundary back projection histogram method is newly proposed. The boundary model fitness whose shape is the normal distributions having characteristics of the original model fitness is introduced to sharpen the boundary on electrical characteristics in propagation medium (which represents the boundary of the buried object). The boundaries of the buried object are discriminated clearly in the back projection images calculated by using boundary model fitness. An effectiveness of these proposed methods has confirmed by experimental application to several concrete structure samples [C10628]

"Non-Destructive Inspection of Concrete Structures Using an Acceleration Pickup"

The present paper proposes a method for detecting cracks or honeycombs in concrete structures using an acceleration pickup. The sensor on the concrete surface observes the stationary waves which are generated

inside the structures depending on the depth of the crack (if there is a crack) or the bottom of the structure (if there are no cracks or honeycombs). The method measures the depths of the reflection planes (such as cracks or honeycombs) accurately by modeling the sensor output as an output of a linear dynamic system with unknown parameters and by applying a maximum likelihood method. The method is shown to be quite effectively applied to measure the depths of cracks and honeycombs [C10629]

"Guidance and Navigation of Hayabusa Spacecraft for Asteroid Exploration and Sample Return Mission"

The Japanese asteroid exploration spacecraft Hayabusa autonomously performed touchdown two times in November 2005. The autonomous guidance and navigation capability is installed aboard the spacecraft. The GNC system collects the laser altimeter, laser range finders and navigation cameras information aboard and is designed to estimate where the spacecraft is and to decide the path correction maneuvers. The programmed function includes the image processing designed to detect an artificial target marker location to approach and cancel the relative velocity. A terrain alignment maneuver is also accomplished by both altitude and attitude control. This paper presents how autonomous guidance and navigation was performed in Hayabusa mission [C10630]

"3DTV-Panoramic 3D Model Acquisition and its 3D Visualization on the Interactive Fogscreen"

Future 3D television critically relies on mechanisms for automatically acquiring and visualizing high quality 3D content of both indoor and outdoor scenes. The envisioned goal is that a photo-realistic 3D real-time rendering from the actual and potentially arbitrary viewpoint of the beholder who is watching 3DTV becomes possible. Such scenes include movie sets in studios, e.g., for talk shows, TV series and blockbuster movies, but also outdoor scenes, e.g., buildings in a neighborhood for a car chase or cultural heritage sites for a documentary. The goal of 3D model acquisition is to provide the 3D background models where potential 3D actors can be embedded. We present both the 3D acquisition and semi-immersive 3D visualization to give an impression how a future 3D television system could be like [C10631]

"Matching Radar and Satellite Images Employing the Hausdorff Distance for Ship Positioning and Trajectory Estimation"

The paper describes a technique to match satellite and radar images using the Hausdorff distance (HD). Minimization of the average of a truncated array of sorted Hausdorff distances is used to get estimates for the radar location, together with sensor bias errors and its platform speed vector. The technique is applied to maritime navigation, where geo-referenced satellite images (UTM) are matched to radar scan images. Good estimates are obtained for these variables, thus providing an alternative method to obtain a vehicle's location in GPS-denied environments or for indoor autonomous navigation [C10632]

"Ultrasound Despeckling Using an Adaptive Window Stochastic Approach"

A novel stochastically driven filtering method to despeckle B mode ultrasound images is presented. This method is motivated by viewing the pixel values as a stochastic process and removing outliers, where outliers are defined by local extrema. These outliers are removed by local averaging. This produces another image with new outliers (local extrema) and the process is iterated. With each iteration homogeneous regions become smoother while edges that defined these regions are preserved. By allowing a dynamically varying window to determine the local mean, we achieve equivalent results with fewer iterations [C10633]

"Variational Unsupervised Segmentation of Multi-Look Complex Polarimetric Images using a Wishart Observation Model"

We address unsupervised variational segmentation of multi-look complex polarimetric images using a Wishart observation model via level sets. The methods consists of minimizing a functional containing an original data term derived from maximum likelihood Wishart approximation and a classical boundary length prior. The minimization is carried out efficiently by first order expansion of the data term and a new multiphase method which embeds a simple partition constraint directly in curve evolution. Results are shown on both synthetic and real images. Quantitative performance evaluation and comparisons with another method are also given [C10634]

"On Measurement of the Depth and the Diameter of Steel Bars in Reinforced Concrete Using Electromagnetic Wave (Radar)"

The present paper analyzes the propagation paths of the electromagnetic wave of a radar in reinforced concrete

using Snell's law. Using the derived paths, the depth and the diameter of the reinforcing bars are measured by making a pattern matching between the modeled received wave signal and the actual received wave signal of the radar. The dielectric constant of the concrete is also measured together with the depth and the diameter, because the propagation speed is a function of the dielectric constant. Lastly, the effectiveness of the method is demonstrated by experiments. Especially, a high accuracy of measurement is achieved for the depth, while concerning the diameter one or two units in JIS standard is obtained and thus a new additional device is also suggested [C10635]

"Oversampled Time Estimation Techniques for Precision Photonic Detectors"

The use of oversampling to reduce I/O requirements of time-to-digital converters for arrays of high precision photonic detectors is considered. Simulation results show that the high linearity offered by oversampled converters can be applied to time estimation. The averaging and lowpass filtering inherent in these techniques reduce jitter and enhance estimates of mean time delay. Various sigma-delta TDC architectures are studied in the presence of background illumination noise with reference to time-of-flight Ladar and time-correlated fluorescence detection applications [C10636]

"Unifying the Experiment Design and Constrained Regularization Paradigms for Reconstructive Imaging with Remote Sensing Data"

In this paper, the problem of estimating from a finite set of measurements of the radar remotely sensed complex data signals, the power spatial spectrum pattern (SSP) of the wavefield sources distributed in the environment is cast in the framework of Bayesian minimum risk (MR) paradigm unified with the experiment design (ED) regularization technique. The fused MR-ED regularization of the ill-posed nonlinear inverse problem of the SSP reconstruction is performed via incorporating into the MR estimation strategy the projection-regularization ED constraints. The simulation examples are incorporated to illustrate the efficiency of the proposed unified MR-ED technique [C10637]

"Self-Synchronization Strings in Huffman Equivalent Codes"

Possession of self-synchronization strings (SSSs) is a favorable feature of Huffman equivalent codes. In this paper, first, we show that SSSs in a Huffman equivalent code are in fact codewords or concatenation of codewords and then give a method to find those short SSSs without exhaustive search. Second, we present a closed-form solution to show how often the SSSs can be encountered in a coded sequence [C10638]

"The Application of GSM and GPRS Technology in Monitoring System for HVDC System Earth Pole"

The paper presented application and realization of GSM and GPRS network in on-line monitoring system of earth pole system. In its on-site unit, which is solar energy technology, the value of the current, temperature and depth of water variables are obtained from different sensors. These data are preprocessed in a DSP chip and then transmitted GSM and GPRS wireless communication networks. Based on software of system management, the operating condition of HVDC system earth pole can be diagnosed. The monitoring system raise the fault alarm for based on SM. [C10639]

"Analog-to-Information Conversion via Random Demodulation"

Many problems in radar and communication signal processing involve radio frequency (RF) signals of very high bandwidth. This presents a serious challenge to systems that might attempt to use a high-rate analog-to-digital converter (ADC) to sample these signals, as prescribed by the Shannon/Nyquist sampling theorem. In these situations, however, the information level of the signal is often far lower than the actual bandwidth, which prompts the question of whether more efficient schemes can be developed for measuring such signals. In this paper we propose a system that uses modulation, filtering, and sampling to produce a low-rate set of digital measurements. Our "analog-to-information converter" (AIC) is inspired by the theory of compressive sensing (CS), which states that a discrete signal having a sparse representation in some dictionary can be recovered from a small number of linear projections of that signal. We generalize the CS theory to continuous-time sparse signals, explain our proposed AIC system in the CS context, and discuss practical issues regarding implementation [C10640]

"Highly Reliable and Accurate Level Radar for Automated Legal Custody Transfer and Inventory Management"

Accuracy and reliability on liquid level measurements in bulk storage tanks are getting increasingly important for

oil and gas industry in which revenue losses from incorrect measurement are becoming more costly, specifically in legal custody transfer and custom monitoring. In this paper, a robust and self-adaptive radar gauging system for high-precision continuous level measurements is presented. The radar system has a compact size and is explosion proof. It consists of a stepped frequency continuous wave (SFCW) transmitter and receiver with monostatic gas-tight antenna. The frequency range is from 9.5 to 10.5 GHz. With most advanced processing software algorithm implemented in the microprocessor, the accuracy of plusmn 0.3 mm over whole measuring range is obtained. Even if under severe conditions, an accuracy of plusmn 1 mm can still be attained. By means of the advanced level radar system the fine accuracy can become attainable under worst-case scenarios. Whereby the authentic custody transfer and inventory management are guaranteed [C10641]

"The Institution of Engineering and Technology Seminar on the Future of Civil Radar"

The following topics were dealt with: civilian coastal radar; surveillance technology; automotive millimetre-wave radar; and short range radar [C10642]

"A Strategy Improving Registration Accuracy Progressively for INSAR Complex Image"

Registration accuracy of InSAR is a key index in the procedure of the processing InSAR data. To obtain better measuring results, A multi-steps matching method is proposed to improve registration accuracy progressively for InSAR complex image. First, we calculate the approximate offsets by using software EnView. Then, we perform pixel level's primary matching and sub-pixel level's precise registration. The primary matching algorithm is based on texture structure information. Considering that the presented algorithms are based on the amplitude map and ignore the integration, the algorithm by using global relaxation matching on account of the phase is proposed in the last matching step to reduce the matching errors and improve matching precision. The experiment verified the nicer validity of this algorithm. [C10643]

"A New Data Association Algorithm for Multiple Passive Sensors"

This paper is concerned with the dynamic problem of associating measurements from S bearing-only sensors in the presence of clutter and missed detections. A new algorithm is investigated. Firstly, an S-D assignment method is utilized to partition LOS measurements and eliminate spurious measurements as possible. Then, the estimated positions of probable targets are sent to the following association algorithm (CJPDA) as the secondary measurements. Finally, iteration filter is implemented and the known tracks are maintained. Combining the two approaches reasonably, the proposed method generalizes the static S-D assignment to the dynamic S-D one and achieves good association performance. A simulation experiment is provided to compare the new algorithm with the wi-best S-D assignment by means of accuracies and the time requirements. The results demonstrate the effectiveness and efficiency of the proposed method. [C10644]

"A Real Time Signal Processing for an Anticollision Road Radar System"

This paper describes the real time processing unit used for an anticollision road radar system. This radar based on a numerical correlation between the transmitted signal and the received signal is under development. The signal uses orthogonal codes to ensure a multiple access communication between all vehicles in near area. In this paper, a real time processing unit associated to an original anticollision radar is presented. The studied radar is based on spreading spectrum coded radar waveforms at 76-77 GHz and a numerical correlation receiver. This sensor associated to other sensors like Lidar and Camera will be used on-board vehicles for more safety on road. The studied receiver computes the numerical crosscorrelation between the received signal and a replica of the transmitted code to allow an optimal detection. The appropriate coding and processing have been used to implement a laboratory radar mock-up. The real time processing is tested in order to show their performances and disadvantages when applied to obstacles detection. The main idea is to achieve an efficient real time detection using a simple and low cost system. [C10645]

"The Implementation of Indoor Location System to Control ZigBee Home Network"

This paper implements the indoor location system to control ZigBee home network. Indoor location system requires periodic update data from a location information service to determine the user's current position data. This paper implements the indoor location home control system which uses ZigBee. We have implements IPS-M (indoor position system-M), IPS-I (indoor position system-infrastructure), IPS-G (indoor position system-gateway) to indoor location based home control system. The IPS-I device has active beacons that periodically transmit signals to a passively listening IPS-M device, which in turn estimates distances to the beacons. Because the active mobile architecture receives simultaneous distance estimates at multiple receivers from IPS-M device, it is likely to perform better tracking than the passive mobile system in which the device obtains only one distance estimate at a time and may have moved between successive estimates. In the IPS-M (Indoor Position System-

Mobile) architecture receives wireless signals (e.g., radio and ultrasound) from an IPS-I (indoor position system-infrastructure) device, allowing the IPS-I to track the IPS-M. We implements ZigBee stack to control home network system with indoor location data [C10646]

"Evaluation of Integrated ACC(Adaptive Cruise Control)/CA(Collision Avoidance) on a Virtual Test Track"

Recently, a virtual test track (VTT) is used effectively for vehicle system development and human factor study. The VTT regenerates various realistic driving conditions in the laboratory. This paper presents a design and validation of VTT based on rapid control prototyping (RCP). The evaluation of the control scheme is conducted using real-world vehicle driving data on a VTT. Realistic driving situations are reconstructed on the VTT by using manual driving radar sensor data in the laboratory. In order to validate the driving simulator, the driving data on a VTT is compared with human driving data measured on actual traffic way. Vehicle acceleration and inverse time to collision (TTC-1) are analyzed for the investigation of human driver behavior [C10647]

"Measurement of Speed, Height and Direction of SeaWaves Using Optical Range Sensors"

The present paper proposes a sensing system for the speed, the height and the direction of sea waves. The measurement of the three quantities is achieved using three optical range sensors which are adequately located over the sea near the platform. For realizing this, the sensor outputs are modeled as outputs of a linear dynamic system and a Kalman filter and maximum likelihood method are applied. Not only a case of one sea wave but also a case of two overlapping sea waves with different directions are considered. The validity of the system is finally verified with simulations and experiments [C10648]

"Wide-area Surveillance Sensor with Leaky Coaxial Cables"

This paper presents a microwave sensing system for wide-area surveillance that comprises two leaky coaxial cables, one for transmitting and the other for receiving. The sensor detects an intrusion by measuring the electromagnetic field level, which fluctuates when an intruder approaches and passes through the surveillance area. In this research, we have succeeded in specifying an intrusion point by applying the spread-spectrum technique. Results from a field test prove that the detection algorithm could detect the motion of an intruder without experiencing interference from shaking trees or rainfall [C10649]

"Tri-Band Rectangular Spiral Slot Antenna with L-Shaped Slot Antenna for WLAN and Radar Applications"

Tri-band rectangular spiral slot (RSS) antenna with an L-shaped slot antenna insertion is introduced in this paper. The antenna was designed on the substrate with 2.2 of dielectric constant and 1.575 mm of thickness. FDTD method was adopted to evaluate the proposed antenna characteristics A rectangular spiral slot antenna was designed to support dual-frequency at 2.44 GHz and 8 GHz. An L-shaped slot antenna was inserted to obtain more resonant frequency at 5.2 GHz. The simulation results revealed that the proposed antenna could be used to support tri-band of frequency which is compatible to IEEE 802.11a or HIPERLAN (5.2 GHz) standard, IEEE 802.11b/g (Wi-Fi 2.44 GHz) standard and 8.0 GHz satellite or radar communications [C10650]

"Obstacle Detecting System of Unmanned Ground Vehicle"

This paper describes obstacle detecting system of unmanned ground vehicle system. Obstacle detecting system has a function to detect obstacles in front of the vehicle by using sensors. In general, vision, laser scanner, RADAR, LADAR and ultra sonic sensor are used for detecting obstacle. In this paper, we introduce our obstacle detecting system using vision and laser scanner for UGV [C10651]

"Speckle Noise Estimation with Generalized Gamma Distribution"

Speckle noise is an inherent property of a synthetic aperture radar (SAR) image, and it generally tends to reduce the image resolution and contrast. The speckle noise estimation is an important prerequisite, whenever SAR image is used for object segmentation. Among the many methods in statistical description that have been proposed to perform the estimation, there exists a class of approaches that use a multiplicative model of speckled image formation, such as Rayleigh distribution, K-distribution, Weibull distribution etc. In this paper, generalized gamma (GG) distribution is used to estimate the noise characteristics. GG distribution is especially attractive because it contains several distributions as special cases, viz. Rayleigh, exponential, Weibull, and log-normal. The major parameter of the GG distribution is estimated according to maximum likelihood (ML) principle. The proposed method works successfully when the solution is located in the parameter space. For verifying the performance of the proposed scheme compared to the other methods, we use x2goodness-of-fit (GOF) test

[C10652]

"SiGe BiCMOS for Analog, High-Speed Digital and Millimetre-Wave Applications Beyond 50 GHz"

This paper explores the application of SiGe BiCMOS technology to mm-wave transceiver with analog and digital signal processing. A review of 10-80Gb/s SERDES performance across 3 SiGe BiCMOS and CMOS technology nodes reveals remarkable similarities with digital CMOS IC scaling and points to the benefits of a SiGe BiCMOS roadmap. Examples of 40-Gb/s equalizers, track-and-hold amplifiers and ADCs with mm-wave sampling clocks are provided, along with GHz-range opamp filters and 65-GHz wireless transceivers. Automotive radar and imaging applications in the 80 -100 GHz range are also briefly discussed [C10653]

"Development of a Cost-Effective, Selective-Epi, SiGe:C HBT Module for 77GHz Automotive Radar"

The development of a selective-epi, SiGe:C HBT module for 77GHz automotive radar applications is described. A cutoff frequency (f_T) of 185GHz, in conjunction with a maximum oscillation frequency of 260GHz has been achieved through the implementation of a self-aligned selective-epi base structure and a simple, cost-effective collector construction without buried layer or deep trench isolation [C10654]

"UWB Signal Generation, Acquisition and Processing using Wavelet Functions"

Over the past 15 years, extensive research work has been carried out to develop the ultra-wideband (UWB) technology for communication applications, and to resolve the practical challenges in implementing an efficient UWB communication system. In this paper, we present an overview of the application of wavelet functions for UWB communication system. The focus will be on the UWB signal processing. Following a brief review of the characteristics of application specific UWB signal, application of wavelet functions in UWB signal generation, acquisition, and processing will be described [C10655]

"Mobile Ravin: Intrusion Detection and Tracking with Organic Airport Radar and Video Systems"

Currently, airport perimeter intrusion detection primarily relies on visual surveillance by security personnel and is often augmented with video cameras. This approach is limited to day light hours and degrades with bad weather. We are developing a proof of concept system, mobile RAVIN, that detects intrusions as small as a human, works at all hours and all weather conditions, and provides rapid situational awareness to security personnel. The mobile RAVIN (radar and video integrated on mobile object architecture) system has been installed and tested at Seattle-Tacoma International Airport (SeaTac) in February 2006. It uses the airport security display processor (ASDP)-an integrated radar signal processor, track processor, and display processor system that derives threat information from the FAA's airport surface detection equipment (ASDE-3) ground surveillance radar systems. This approach leverages existing airport assets to provide a cost effective suite of security sensors. The mobile RAVIN system performs filtering and tracking on the ASDE-3 radar data, initiates and maintains video tracks of objects, and fuses radar and video tracks for operator display. It also allows operators to slew a video camera to a radar track location which reduces false alarms and nuisance alarms. Finally, we developed a display to show the radar and video tracks overlaid on a map of the airport [C10656]

"A Remote Imaging System Based on Reflected GPS Signals"

This paper describes a method for utilizing reflected Global Positioning System (GPS) signals to form an image of targets within a region of interest. The principle is based upon a type of bi-static synthetic aperture radar (SAR) in which a matched filter technique is employed to perform the image reconstruction. This method relies upon the fact that each component of the received signal resulting from a reflection from an individual target is subjected to a unique chirp. A major challenge to be tackled is the appalling signal to noise ratio associated with the received reflected GPS signals. Another difficulty is the masking of the reflected signals by power in the tails of the autocorrelation function of the direct signals which cannot be totally suppressed. Moreover, the reconstruction method results in an undesirable point spread function (PSF) which seriously smears the reconstructed image. We simulate the entire GPS signal generation and image reconstruction process as faithfully as possible within the limitations of the available computational effort. We are able to demonstrate that a spatial resolution of the order of the L1 wavelength (19 cm) is theoretically possible from realistic observation distances provided that sufficient coherent correlator integration time is allowed and that the direct signals can be sufficiently suppressed. For the rather simplified organization of targets within the simulation we are able to show that the image smeared by the PSF is able to be cleaned by means of a Wiener filter based deconvolution method. [C10657]

"Autonomous Rail Track Inspection using Vision Based System"

This paper proposes a rail track inspection technique using automated video analysis. This system is aimed to replace manual visual checks performed by the railway engineers for track inspection. We suggest a combination of image processing and analysis methods to achieve high performance automated rail track inspection. This paper addresses the problem of finding missing clips and finding blue clips which have been recently replaced in place of damaged clips. The experimental results show high performance in machine vision based inspection on a large sample of real train video [C10658]

"Inverse Scattering from Bodies with Impedance Boundary"

A plane wave falls onto the body with an impedance boundary. Magnitude of the back-scattered spherical wave is compared with that of the wave scattered from the body of the same shape, having zero impedance. The impedance (in general, variable over the boundary) can be created such that the back scattering will be noticeably smaller than that from the smooth metallic body. This can be made, e. g., by cutting a set of channels on the boundary, i.e., by crimping. Such a way of the radar protection can be applied also near the edges and vertices where usage of the absorbing coating is not effective enough [C10659]

"The Irregular-Shaped Fractal Antennas for Ultra Wideband Radio Systems"

This paper proposes a novel design of a multiband fractal antenna of irregular shape using two-dimensional fractal clusters. The algorithm of generating fully reproducible fractal clusters is developed. The multiband behavior of the fractal-cluster based antennas is studied by means of numerical analysis. In comparison to regular-shaped fractal antennas more frequency bands and better matching are achieved. The spatial-frequency antenna characteristics are studied under feeding point displacements. As shown by numerical results, small displacements of feeding point allow to control the radiation pattern in certain frequency bands. The larger feeding point displacements are demonstrated to shift antenna frequency bands [C10660]

"On Transient Radiation of a Linear Impedance Antenna Exited by the Electron Bunch"

A linear impedance antenna of transient radiation exited by the electron bunch scattered on its end face is considered. The radiation is analyzed at the stage of a bunch approach to the antenna. The radiation is an induced or diffraction one and has a nature of forced oscillations. The radiation spectrum has an extremum. The dispersion equation of an antenna is derived. The expressions for the components of the discrete spectrum of the current force and the strengths of electric and magnetic fields, radiated by the antenna, are constructed as a series in the antenna eigen functions. It is shown, that the antenna element is radiative if the strengths of extrinsic and intrinsic electric fields are in phase and in antiphase accordingly to the antenna current. In this case the extrinsic electric field strength accelerates the conductivity electrons and the intrinsic electric field strength brakes electrons, producing the radiation of latter ones [C10661]

"Coupling Effects in Resistive UWB Antenna Arrays"

The self- and mutual impedances of elements in the dissipative antenna array are known to involve radiative resistances and loss resistances. This paper is dedicated to analyzing the structure of the mutual impedance between resistive load elements and its effect on the radiation efficiency of the array [C10662]

"Method of Ultrawideband Linear Antenna Array Matching"

Using a linear waveguide-slot array with one input in the center on the left and on the right as an example, a method of ultra wideband matching a linear array was offered. The use of this method will solve the problem of array design with any number of radiators [C10663]

"Impulse Formation by Spatial-Time Phase Encoding"

This paper comprises of the analysis of basic properties of the spatial-time signal upon emission of the phase-shift keyed signal by each element of the active phased antenna array. Mathematical modeling results are presented in terms of the phase-shift/code-shift keyed (FKM) signals with random even phase distribution [C10664]

"Diffraction Waves on a Spherical Resonator Segment"

The application and the generalization of the regularization tasks of the diffraction of electromagnetic waves on a sphere with the circular aperture are proposed. We examine the diffraction of the plane wave, on sphere. We solve auxiliary integral equations of Abel's type and select main parts of functional equations by introducing the

small parameters. As a result we obtain disconnected linear algebraic equations of second kind of Fredholm's type. New possibilities of improvement of computational algorithms and different characteristics of spherical antennas (radiation pattern, radiation power, field profiles of different resonant modes, radar cross section, wideband signals) are discussed [C10665]

"Qualitative Analysis of Elementary Antennas Impulse Radiation"

The aim of this paper is to study the non-stationary structure of simple antenna fields (the electric dipole, the vibrator, the system of dipoles) with the help of the qualitative theory methods for the ordinary differential equations (ODE). The qualitative analysis is of interest because numerical research meets the certain difficulties in vicinities of the vector field critical points, and qualitative methods are effective in these cases in particular. Therefore the combination of qualitative and numerical methods is the most expedient and economical approach in the analysis of electromagnetic fields. The strategy of qualitative theory application to the analysis of pulse fields of simple antennas in free space, and also the results in this area received to the present time are discussed [C10666]

"Widening UWB System Coverage Zone by Repeaters-Regenerators"

The Federal Communications Commission (FCC) of the USA has limited communication coverage zone for pulse UWB systems by implementing power density mask on all transmitting devices. As result the UWB coverage area is not exceed a hundred meters. But it is possible to increase this area, still fulfilling the FCC limits, by adding one or more UWB repeaters around or along the path toward a destination receiver(s). The paper deals with the idea of such repeaters-regenerators and their implementations [C10667]

"Height Reconstruction in Highly Sloped Area Using Multi-frequency InSAR Data"

With the emerging of multi-frequency InSAR system, extraction of 3-D and variation information of earth surface using multi-frequency InSAR data has drawn more attention. Methods based on maximum-likelihood estimation (MLE), combining with some conventional phase unwrapping algorithm can be used to achieve this purpose. In this paper, MLE integrated with weighted multigrad phase-unwrapping method for high-sloped terrain profile reconstruction is presented and studied in detail. The performance of this method is also analyzed. Experiment result using simulated InSAR data shows that the method can be used to reconstruct high-sloped terrain with relatively high accuracy [C10668]

"Inversion of Forest Parameters Based on Genetic Algorithm using L-Band Polinsar Data"

Based on the basic principle of PolInSAR and the coherent scattering model of random volume over ground, the inversion of forest parameters of PolInSAR can be characterized by a six-dimensional non-linear parameter optimization problem. However, the global optimal can't be obtained using the traditional gradient-based optimization algorithms. Therefore, a global optimization inversion scheme of forest parameters of PolInSAR based on genetic algorithm is presented. We generate a validity test using SIR-C L-band repeat-pass PolInSAR data of the area of Tien Shan, China. The preliminary results accord with the range of the parameters of the fact. Performances of different GAs and effects of different parameters are compared. SGA is influenced by the mutation rate strongly, but GA with tournament of two generations is independent of the mutation rate [C10669]

"Autonomous Time-Frequency Morphological Feature Extraction Algorithm for LPI Radar Modulation Classification"

An autonomous (no human operator intervention) feature extraction algorithm that can be used for classification of low probability of intercept (LPI) radar modulations using time-frequency (T-F) images is presented. The approach uses erosion and a new adaptive threshold binarization algorithm embedded within a recursive dilation process to autonomously determine the modulation energy centroid (radar's carrier frequency). The modulation is then cropped from the original T-F image and the adaptive algorithm is used again to compute a binary feature vector for input into a multi-layer perceptron classification network. Classification results for five simulated radar modulations are shown to demonstrate the feature extraction approach and quantify the performance of the algorithm [C10670]

"Phase Distortion Correction for See-Through-The-Wall Imaging Radar"

See through the wall (STTW) applications have become of high importance to law enforcement, homeland security and defense needs. In this work surface penetrating radar is simulated using basic physical principles of radar propagation. Wavenumber migration is employed to form 2D images of objects found behind a wall. It is shown that this technique cannot properly image with the wall present because of an unknown phase delay

experienced by the electromagnetic waves as they pass through the wall. Two approaches are taken to estimate this phase by looking at the direct backscatter signal from the wall. The first is a dual phase approach, which uses a non-parametric technique to find the phase at every frequency. The second method is a dual frequency approach. The two frequencies are close enough together that the reflection coefficients are approximately equal. This approximation allows for more observations than unknown parameters. The surface reflection coefficient, back wall coefficient, and phase are simultaneously determined using an iterative, non-linear (Newton-Raphson) successive approximation algorithm. Comparisons are performed for a simple scenario of three point scatterers with and without phase correction [C10671]

"SAR Image Speckle Removal using Bamberger Pyramids"

We present the application of Bamberger pyramids to the removal of speckle noise from SAR images using subband domain shrinking. Bamberger pyramids provide better directional selectivity than the commonly used 2D UDWT allowing better representation of edges and geometrical structures. We show that Bamberger pyramids provide superior speckle removal and edge retention properties when compared to the 2D UDWT, and the commonly used Lee MMSE filter [C10672]

"Multichannel Autofocus Algorithm for Synthetic Aperture Radar"

The autofocus problem in synthetic aperture radar (SAR) is considered, where phase errors in the acquired signal data result in imagery that is improperly focused. We present a new non-iterative approach to SAR autofocus, termed the multichannel autofocus (MCA) algorithm, that allows the image focusing operator to be determined directly using a linear algebraic formulation. Specifically, we exploit the multichannel redundancy of the defocusing operation to create a linear subspace framework, where the unknown perfectly-focused image can be expressed in terms of a known basis expansion. By invoking an additional assumption on the underlying image support, the framework becomes sufficiently constrained so that a unique focusing filter can be solved for. The MCA approach is found to be computationally efficient and robust, and does not require prior assumptions about the characteristics of the SAR scene; the performance of previous SAR autofocus techniques relies upon the accuracy of priors such as sharpness metrics or dominant point scatterers. We present experimental results characterizing the performance of MCA in comparison with conventional autofocus methods, and discuss the practical implementation of the technique [C10673]

"Detection of Roads in SAR Images using Particle Filter"

A novel method is presented to detect roads in synthetic aperture radar (SAR) images. A multi-segmented poly-line model is introduced to provide a more accurate description of the road as well as to ensure the road curve's smoothness in the model level. We then solve the road detection problem using the Bayesian tracking theory, where the particle filtering algorithm is adopted to provide a simple and consistent framework. The effectiveness and robustness of the proposed method is demonstrated by experimental results [C10674]

"Tree Detection in Aerial Lidar and Image Data"

In this paper, we present an approach to detecting trees in registered aerial image and range data obtained via LiDAR. The motivation for this problem comes from automated 3D city modeling, in which such data is used to generate the models. Representing the trees in these models is problematic because the data is usually too sparsely sampled in tree regions to create an accurate 3-D model of the trees. Furthermore, including the tree data points interferes with the polygonization step of the building roof top models. Therefore, it is advantageous to detect and remove points that represent trees in both LiDAR and aerial imagery. In this paper we propose a two-step method for tree detection consisting of segmentation followed by classification. The segmentation is done using a simple region-growing algorithm using weighted features from aerial image and LiDAR, such as height, texture map, height variation, and normal vector estimates. The weights for the features are determined using a learning method on random walks. The classification is done using weighted support vector machines (SVM), allowing us to control the mis-classification rate. The overall problem is formulated as a binary detection problem, and receiver operating characteristic curves are shown to validate our approach [C10675]

"3-D Geometry Compression using Multiscale Plane Based Representation and Zerotree Based Coding"

In this paper, we present a novel geometry compression scheme for compactly representing 3-D sampled data. The proposed framework is based on the octree structured multiscale geometry representation, where local surface is expressed by multiscale plane descriptions. To reduce planar redundancy between different scale plane approximations in the multiscale pyramid, the multiscale plane pyramid is decomposed and the resulting refinement pyramid is encoded using the zerotree based coding method. The decomposition captures the

geometry innovation to refine coarse geometry. Moreover, the zerotree based coding method offers the ordered bitstream according to the contribution for reconstructing the geometry innovation. Therefore, we demonstrate that the proposed algorithm compactly represents the 3-D point samples yielding progressive refinement of the surface geometry [C10676]

"Aligning Curves Under Projective Transform and its Application to Image Registration"

A method to accurately align plane curves related by projective transform is described in this paper. Superior accuracy and efficiency are achieved by the use of super-curve and B-spline fusion. A super-curve is formed by superimposing two transform related and aligned curves upon each other. The B-spline fusion technique uses a single B-spline to approximate the super-curve and to align the two curves at the same time. The eight-parameter projective transform is decomposed into a simple two-parameter projective transform and an affine transform, for which a linear solution can be found. Therefore the search in the traditional eight dimensional space is reduced to a two dimensional search. The major contribution of the paper lies in the novel use of a single B-spline to represent two curves, whereas in previous approaches each curve is represented with a separate B-spline. This use of a single B-spline gives higher resolution from the two point sets instead of one. So the final result is more robustness to sampling noise. It also provides a simple and integrated framework in solving the curve matching and the transform recovery problems simultaneously [C10677]

"2006 IEEE International Conference on Image Processing"

The following topics are dealt with: source/channel coding; distributed image and video coding; biomedical image segmentation; steganography and steganalysis; content summarization and clustering; fingerprint and iris analysis; image registration/alignment and mosaicking; stereoscopic and 3-D coding; visual tracking; deblurring and image restoration; face/facial expression detection and recognition; interpolation and inpainting; network-aware multimedia processing and communications; edge detection; transcoding; machine learning; image fusion; video networking and communications; watermarking; low-level indexing and retrieval of images; wavelets and filter banks; video streaming; video surveillance; soft computing in image processing; authentication and cryptography; forensics; radar imaging; block matching-based motion estimation; knowledge-based image processing for classification and recognition; biometrics; magnetic resonance imaging; image enhancement; image quality assessment; 3DTV: extraction, representation, compression and transmission; remote sensing [C10678]

"Monotonic Iterative Algorithms for SAR Image Restoration"

We present an iterative algorithm for restoring synthetic aperture radar (SAR) images with arbitrary gaps in spatial frequency. In some SAR applications a contiguous frequency band is not recorded which results in gaps in the SAR image spectrum. These gaps manifest themselves as artifacts which degrade the quality of the associated SAR image. Maximum a posteriori (MAP) techniques allow one to compensate for these spectrum gaps but can result in a difficult high-dimensional optimization problem. By using concepts collectively known as optimization transfer or MM-algorithms, one can easily design efficient iterative algorithms that are tuned for a particular objective function and have provable convergence properties. In this paper we will review MAP-based SAR image restoration, derive an iterative algorithm that monotonically minimizes the associated objective function, and demonstrate it on actual SAR imagery [C10679]

"Discerning Objects from Ground and Target Pose Estimation in Ladar Data using Robust Statistics"

In this paper we present a novel way to analyze LADAR images and model its data. Having an aerial LADAR image as data source, our aim is to extract a parametric description of the ground of our scenario in order to discern between the data samples that belong to the ground and those that belong to vehicles, objects or clutter. In the second part of this paper we estimate the pose of the interesting objects by building its corresponding oriented 3D bounding box. Our method uses robust statistics in order to extract proper descriptions of both the ground and the oriented bounding boxes of the objects. Specifically, we use two robust parameter estimators: The least median squares and the Helmoltz tradeoff estimator, part of our prior work, depending on the percentage of outliers that may be present in the different steps of our approach [C10680]

"Regularized Speckle Reducing Anisotropic Diffusion for Feature Characterization"

For tissue characterization in medical ultrasound imagery or terrain characterization in synthetic aperture radar imagery, it is necessary to preprocess imagery to reduce granular, texture-alike noise called speckle. This preprocessing is difficult when it is needed to preserve delicate image details that are buried in speckle. Speckle

reducing anisotropic diffusion (SAR) is a partial differential equation-based method developed for this purpose. Toward its improved performance for point/linear features, we introduced a novel regulator called energy condensation integral and developed a regularized SRAD (reg-SRAD) via minimization. The reg-SRAD generates outputs with increased resolution for point and linear features while retaining the characteristics the SRAD-filtering speckle with regional features enhanced. The performance of the method has been illustrated using synthetic and real ultrasound data, and radar imagery as well [C10681]

"Semi-Supervised Image Classification in Likelihood Space"

This paper studies the problem of using limited amount of labeled data and large amount of unlabeled data in the training of a generative model for image classification, and proposes a likelihood space approach to improve the classification performance. Frequently when labeled data is limited, unlabeled data can help to improve classification performance if the assumption of the generative model structure in the classifier is correct. But classification accuracy can be degraded if the model structure assumption is incorrect. In this paper, we compare raw data space classification and likelihood space classification in semi-supervised learning framework, and we show that the classification performance can be improved in likelihood space when model is misspecified. We apply this likelihood space semi-supervised learning method in automatic target recognition on SAR images, and experimental results demonstrate the effectiveness of this proposed approach [C10682]

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{no data available} [C10683]

"Self-Phased & Retrodirective Array: Radar Applications for Ultra-fast Cueing & Re-acquisition"

In this article, phase conjugation in radar is studied. A method developed by ONERA (Van Atta, 1955) is used and then the performances of the process are evaluated. Comparisons between phase conjugation and classical radar processes are established [C10684]

"Utilising signal absence in SAR imagery for moving target detection"

SAR images of moving targets are blurred, defocused and displaced from their true location making them difficult to detect from their direct energy returns. This paper presents an alternate technique for detecting such targets by exploiting the phenomenon that the shadow projected by the target produce a null in the SAR imagery. The target shadow is presented at its true location and tracks the target as it moves along in the scene. A change detection technique has been developed that processes a sequence of highly overlapped SAR images. Initial detections thus obtained then seed a shadow delineation process that simultaneously delineates the shadows of the moving targets over multiple images. The technique has been successfully demonstrated on real SAR imagery for detecting and locating moving targets [C10685]

"The Diversity of Chaotic Waveforms in Use and Characteristics"

This paper serves to provide a thorough introduction to chaotic signal generation and chaotic radar waveform modulation, emphasizing the diversity and ease of variation of such waveforms. Results of their adaptation to a specific waveform performance objective are presented as is their potential use as target matched waveforms [C10686]

"Transmit Notched Bandwidth Waveforms"

First Page of the Article [C10687]

"Novel FEC Schemes for UWB: Design, Modelling and Performance Analysis"

In this paper, the authors present the design and modelling aspects of UWB turbo codes and UWB SCCCs, along with their performance analysis in comparison with the FEC method recommended by the UWB specifications. The authors consider both the direct spread and multi-carrier versions of UWB in the presence of additive white Gaussian noise (AWGN) channel as well as IEEE 802.15.3 channel models. The results obtained show that UWB turbo codes yield a coding gain of 3-4 dB at an error floor of 10^{-6} compared to the convolutional encoding and Viterbi decoding (CEVD) method. In addition, UWB SCCC yields a coding gain of 1-2 dB at an error floor of 10^{-3} in comparison with the UWB turbo codes. However, convolutional codes perform better than turbo codes at higher signal-to-noise ratios and turbo codes seem to yield a better performance than SCCCs at lower input block sizes [C10688]

"Diversity: On the Evolution to MIMO and Beyond"

This paper considers the evolution to multiple input, multiple output (MIMO) communications, which has its origins in both spatial processing and temporal processing. In the context of this paper, the term 'spatial processing' is taken to include classical/adaptive beamforming and sub-space analysis, whereas the term 'temporal processing' is taken to include the subjects of error control coding, interleaving and equalisation. The objective of this paper is therefore to provide an outline of some of the principal developments within both spatial processing and temporal processing, in order to relate MIMO to the prior art. The emphasis on this paper is on the results which steered this notion of diversity to yield MIMO. The benefits of MIMO have been achieved by integrating the functionality contained within both spatial processing and temporal processing. As shown within this paper, historically, the original motivation within spatial processing was to enhance target location and accuracy in terms of resolution and bias. Temporal processing, in the case of communications engineering, however, was driven by the need to control the number of digital errors between the transmitter and receiver. Each of these two subjects was for a significant number of years treated independently, and excellent process had been made in both. However, a significant barrier within each of these two subjects was the limitation of system processing capability, particularly in terms of both speed and memory. Improvements in the categorisation of physical phenomena associated with a range of wireless channels, and the processing power of recent hardware have enabled the realisation of MIMO to be achieved. As hardware capabilities improve and greater effort is made at the integration of the functionality between the various layers within a communications system, system efficiency and performance can be maximised. The technologies which will be instrumental in achieving this goal are likely- to include techniques as diverse as artificial intelligence, higher order statistics and the synthesis of natural phenomena (e.g., the use of chaotic models) [C10689]

"Interference-Mitigating Waveform Design for Next-Generation Wireless Systems"

A brief historical perspective of the evolution of waveform designs employed in consecutive generations of wireless communications systems is provided, highlighting the range of often conflicting demands on the various waveform characteristics. As the culmination of recent advances in the field the underlying benefits of various multiple input multiple output (MIMO) schemes are highlighted and exemplified. As an integral part of the appropriate waveform design, cognizance is given to the particular choice of the duplexing scheme used for supporting full-duplex communications and it is demonstrated that time division duplexing (TDD) is substantially outperformed by frequency division duplexing (FDD), unless the TDD scheme is combined with further sophisticated scheduling, MIMOs and/or adaptive modulation/coding. It is also argued that the specific choice of the direct-sequence (DS) spreading codes invoked in DS-CDMA predetermines the properties of the system. It is demonstrated that a specifically designed family of spreading codes exhibits a so-called interference-free window (IFW) and hence the resultant system is capable of outperforming its standardised counterpart employing classic orthogonal variable spreading factor (OVSF) codes under realistic dispersive channel conditions, provided that the interfering multi-user and multipath components arrive within this IFW. This condition may be ensured with the aid of quasi-synchronous adaptive timing advance control. However, a limitation of the system is that the number of spreading codes exhibiting a certain IFW is limited, although this problem may be mitigated with the aid of novel code design principles, employing a combination of several spreading sequences in the time-frequency-and spatial-domain. The paper is concluded by quantifying the achievable user load of a UTRA-like TDD code division multiple access (CDMA) system employing loosely synchronized (LS) spreading codes exhibiting an IFW in comparison to that of its counterpart using OVSF codes. Both systems' performance is enhanced using beamforming MIMOs [C10690]

"Range Resolution Improvement in Passive Coherent Location Radar Systems Using Multiple FM Radio Channels"

Passive coherent location (PCL) radar systems that use single FM radio channel signal as illuminator of opportunity have limited range resolution due to low modulation bandwidth and high dependence on the content that is being broadcasted from the FM station. An improvement in range resolution is obtained by using multiple adjacent FM channels, emitted from co-sited transmitters, which is often the case in large towns in countries, where the FM channel allocations are relatively weakly regulated. The proposed scheme computes the autocorrelation function of the signal directly received from the FM co-located transmitter, and compares it to the cross-ambiguity function, obtained from direct and target scattered signals. The geometry of the problem is like in the case of monostatic radar. The range information is obtained by the delay between the cross-ambiguity function and the autocorrelation function. It is shown that down to -37dB signal to noise ratio (SNR) the autocorrelation function of 7 FM channels with different contents can be successfully extracted from the cross-ambiguity function. The detection of the time delays is a linear estimation problem. The issue of time-delay estimation is a known topic of research. A powerful estimator can be found [C10691]

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{no data available} [C10692]

"The Institution of Engineering and Technology Forum on Waveform Diversity and Design in Communications, Radar and Sonar"

The following topics are dealt with: waveform diversity; radar; sonar, navigation; radio channels; target tracking; MIMO communication; UWB communication [C10693]

"The Application of Speech Recognition Techniques to Radar Target Doppler Recognition: A Case Study"

This paper reports some preliminary results of an examination into the feasibility of recognising the Doppler signatures of targets using speech recognition processing techniques. The rationale is that human operators typically listen to the Doppler audio output from the surveillance radar to detect and possibly identify targets. A feature of speech recognition is that pre-processing is used that takes account of the voice mechanisms that produce speech and the characteristics of the human ear. Three different recognition techniques, with identical pre-processing, were implemented. After validating the recognition algorithms with speech the recognisers were retrained with Doppler signals from a number of sources. It was found that the best of the speech recognisers, HMM-GMM, was also the best of the Doppler recognisers with 88% recognition. The work has been compared with that of others using a similar technique and a good agreement has been found. Some recent discoveries in neuroimaging are quoted that suggest that the human brain and that of several other mammals performs visual recognition in a manner common in speech recognition [C10694]

"Commentary"

{no data available} [C10695]

"50 Million Years of Waveform Design"

Echo locating mammals such as bats, whales and dolphins have been using waveform diversity for over 50 million years. They vary the PRF, the power and the frequency content of the transmitted waveforms. This has enabled them to evolve highly sophisticated navigation techniques and the ability to forage for food. Moreover, recent developments in technology means that it is now possible to replicate many of the methods employed by mammals in synthetic systems such as radar and sonar. Thus echo locating mammals potentially offer valuable insights that might allow improvements in these synthetic sensor counterparts enabling autonomous navigation of platforms and automatic target classification. In this paper the authors examine the waveforms used by bats as a function of orientation and intent. The information is presented in terms forms well known to the radar community and includes, power spectra, ambiguity functions. From this analysis the authors are able to derive understanding as to how bats are exploiting waveform diversity and how this can be copied in radar and sonar systems [C10696]

"Waveform Diversity in Intelligent Sensor Systems"

Waveform diversity in distributed radio frequency (RF) sensor systems offers the potential for breakthrough performance enhancements in the detection and identification of natural and manmade objects. This paper discusses advances in relevant technology and emerging applications to radar [C10697]

"Programme"

{no data available} [C10698]

"An Improved Algorithm for Uniform Linear Array Based on the Fourth-order Cumulant"

This paper thoroughly analyses the MUSIC-LIKE algorithm based on the fourth order cumulant and the principle of uniform linear array extension. An improved algorithm is presented that can convert the fourth cumulant matrix of M_2 times M_2 into the $(2M-1)$ times $(2M \text{ times } 1)$ matrix. The method keeps the amount of the virtual element of MUSIC-LIKE algorithm to uniform linear array and eliminates massive redundant data as well. Computer simulations show that the extension ability of this method is the same as MUSIC-LIKE and that the method reduces the time and computation cost [C10699]

"Robust Time Delay Estimation Based on Sigmoid Transform in the Presence of Impulsive Noises"

A large class of physical phenomenon observed in practice exhibits impulsive, which can be modeled as alpha-stable distribution. Although methods based on fractional lower-order moments (FLOMs) have proven successful in dealing with non-Gaussian impulsive processes, they require in general the previous knowledge or estimation of characteristic exponent in order to choose an appropriate parameter value. In this paper, based on sigmoid transform, a robust approach for time delay estimation (TDE) is introduced in the presence of impulsive noise, referred to as sigmoid cross-correlation (SCC). Compare with algorithms based on FLOMs, the SCC method needs not to choose any parameter and is used under any characteristic exponent. The reason for the robustness of the SCC algorithm under the lower order alpha-stable noise condition is that sigmoid function transforms the lower order alpha-stable process into a second order alpha-stable process. Simulation studies show the novel method is robust for very impulsive environments [C10700]

"Estimation of instantaneous frequency rate for multicomponent polynomial phase signals"

In this paper, we present a two dimensional matched phase transform. For multi-component polynomial phase signals (mc-PPS) whose phase order is beyond five, their instantaneous frequency rate (IFR) will be local maxima in the transform. However their cross-terms seldom emerge as local maxima. IFR of signal component is continuous function of time, but local maxima produced by cross-terms have not this property. So one can realize the estimation of IFR of each component at all time instant by this transform. Accuracy is theoretically analyzed and compared with simulation result [C10701]

"A New Algorithm for Sparse Aperture Extrapolation"

An algorithm for estimating full aperture with sparse data is proposed in this paper. For wide vacant aperture in sparse data, by measuring sparse data actually, accurate sparse data frequency domain energy distribution estimate can be obtained with parametric approaches. With estimated power spectrum as prior information, minimum weighted norm as the restraint, underdetermined equations are solved to interpolate vacant aperture, thus wide aperture data segment estimate is obtained. This algorithm can be effectively applied to ISAR imaging in sparse data. Resulting simulation and actual data processing results confirm validity of the proposed algorithm [C10702]

"Robust Despeckle for SAR Image Using Multiscale Autoregressive Model"

We propose a novel, robust and multiscale despeckling method, based on the robust multiscale scale-recursive estimation algorithm of multiscale autoregressive (MAR) model on dyadic tree. First, a suitable MAR model, which provide a powerful framework for describing random process and fields that evolve in scale, is selected to model SAR image. Then, filtering for the image is given based on the robust scale-recursive optimal estimation algorithm. The proposed algorithm is not only computationally efficient but also capable of generating error statistics, as desired. Experiments over SAR images confirm the robustness of the filtering algorithm we proposed [C10703]

"Applying a High Efficient Time-Frequency Analysis Method in DOA Estimation"

In the studies of DOA estimation based on time-frequency analysis, eliminating cross interference terms is the key to improve DOA estimation performance for the situation of multi-signal. The SPW time-frequency analysis is used in this paper to make DOA estimation. SPW combines the virtues of WVD and STFT that it not only possesses quite high time-frequency concentration performance but can also suppress the cross terms in WVD. Furthermore, it can overcome the shortcomings of SPWVD that many excellent characteristics of WVD are lost and the time-frequency concentration performance of signal drops correspondingly due to the windowing and the smoothing processing. Simulation results demonstrate that the in multi-source situation, compared with the methods based on PWVD and SPWVD, the method based on SPW improves the DOA estimation precision much more greatly [C10704]

"Modified Adaptive Chirplet Decomposition and Its efficient Implementation"

A new algorithm of signal decomposition-modified adaptive chirplet decomposition (MACD) is presented to overcome the deficiency of basis functions with linear time-frequency relations. The chirplet atom is extended to quadratic frequency modulated signal, and it can approach the nonlinear time varying components of the original signal. At the same time, a efficient algorithm is presented by computing the cubic phase (CP) function of the signal, it is shown that the CP function is concentrated along the instantaneous frequency rate law, and the peak of the CP function yields the estimates of the coefficients of quadratic and cubic phase, the time center and the amplitude. Then the initial frequency and the time extent can be obtained by the dechirp technique. The scheme

of the algorithm is shown in this paper, and the results of echolocation signal from brown bat demonstrate the validity of the method proposed [C10705]

"An efficient algorithm for designing biorthogonal cosine modulation filter banks with low delay"

A linearization method to design biorthogonal cosine modulation (BCM) filter banks is proposed. In our proposed method, both the objective function and the perfect reconstruction condition are expressed as the quadratic function of the prototype filter coefficients. By using the Lagrange multiplier approach, the design procedure is formulated as solving the linear equation iteratively to obtain the desirable prototype filter. The main advantages of the proposed method are simple design procedure and computational efficiency. A design example is presented to demonstrate the validity of the proposed algorithm [C10706]

"CMOS Impulse Radar"

A novel CMOS impulse radar for CMOS implementation is proposed exploring the concept of swept-threshold sampling. Time-domain signal processing with counter-based integration in parallel structures is used. With continuous time delay line based parallel sampling topologies we achieve a sampling rate in excess of 20GHz. A functional CMOS impulse radar is implemented in silicon with measured system performance [C10707]

"The Application of Spatial Diversity to Target Location"

The application of multi-rate processing to target location is considered in this paper. This technique is shown to refocus the corresponding ambiguity function, giving rise to the possibility of enabling diversity to be used for the benefits of enhancing both accuracy and resolution of a target. Attention is paid to the geolocation of radio frequency (RF) emitters; however, this technique can be applied to either passive or active target location, and in a range of different environments including satellite, airborne and terrestrial intercept. This work extends a former study which had presented the notion of the generalised correlation function (GCF), a technique which readily enables a smeared ambiguity function to be re-focused. An example is provided to illustrate the impact of motion between sensors upon the ambiguity function and the corresponding refocusing, through the use of multi-rate sampling, is presented [C10708]

"Multi-User UWB-IR Systems with Interleaved Coding-Modulation on Multipath Fading Channels"

Interleaved coding-modulation (ICM) is a recently proposed method for ultra-wideband impulse radio (UWB-IR) systems. ICM exploits the concept of chip interleaving, allowing to alleviate the problem of inter-symbol and inter-pulse interference commonly present in high data rate UWB-IR systems. In this paper, the authors extend previous work on ICM to scarcely populated multi-user scenarios. The authors propose a design of a deterministic chip interleaver based on time-hopping hyperbolic congruence sequences. The authors also review the main parameters of the random and hyperbolic interleavers. Our results indicate that the proposed type of interleaver yields similar performance to random interleavers but with the advantage of simpler implementation [C10709]

"Wavelet Quasi-Superresolution in Marine Applications"

Possible marine applications of superresolution are in both military and civilian purposes, such as computer vision, target recognition, detection, identification, surveillance, synthetic aperture radar, etc. In this paper, a new algorithm for superresolution is proposed. The algorithm is based on wavelet theory and morphological structure of the image. Quasi-superresolution means usage of a single image for analysis instead of several. Wavelet quasi-superresolution can be applied with less complexity than standard superresolution, because wavelet interpolation of interlaced data and statistics of different images are skipped. New criterion for comparison of original and processed image is proposed. The result is single scalar which is easy to compare [C10710]

"Estimation of Value Added Services in Bosnia and Herzegovina"

Intention of all operators is to expand its profit as well as to attract the business subscribers as they generated more traffic and have a high ARPU. The non voice services are the way to attract business subscribers, by identifying the needs of the companies for the non voice services. In the article we present situation on Bosnia and Herzegovina market and the possible way to earn revenue by offering the value added services based on GPRS. Different VPN models are shortly described and some of possible ways of assembling the non voice services are introduced [C10711]

"Architecture of IP Multimedia Subsystem"

IP multimedia subsystem (IMS) is standardized network architecture for telecom operators that want to provide mobile and fixed multimedia services. IMS-enabled networks provide access to these services from both IP networks and circuit-switched PSTN/PLMNs. This paper describes the IMS architecture and explains its benefits. It concentrates on the main IMS system components and briefly summarizes their key system functions. However, the IMS is a rapidly evolving standard and modifications to the IMS architecture are envisaged. This paper provides a base for future research and work in this domain [C10712]

"Laboratory Model of a Monopulse Radar Tracking System"

The development, construction and testing of a student laboratory model of radar system that can be used for monopulse tracking is described. The laboratory model will be used for student laboratory exercises as a part of a basic course on radar systems. The system is based on a Sigma-Delta hybrid for processing signals obtained from two horn antennas. The composition of the model is described. Student exercises and measurements on the model are proposed [C10713]

"Spectral Efficiency and Spectral Sharing for Civil Radar Systems"

This study investigated the practical issues for implementing radar filters, techniques to reduce radar emissions, waveform based techniques to improve spectral sharing in share bands, and concepts for reducing radar emissions to CW like bandwidth. This study performed the ground work for spectral sharing and increasing future civil radar efficiency. In addition the costs, reduced spectral usage and other benefits were quantified [C10714]

"Passive Radar Tracking"

PCL radar in particular examining the detection and tracking of air targets when only Doppler bearing information is available. A demonstration of target acquisition and subsequent tracking will be given [C10715]

"The Application of Passive Sensors in ATC"

First Page of the Article [C10716]

"Frequency-Dependent Modeling of Ultra-WideBand Pulses in Human Tissue for Biomedical Applications"

Due to the recent advances in ultra wide-band (UWB) radar technologies, there has been widespread interest in the possible medical applications of UWB microwave radar. To facilitate the development of signal processing algorithms, numerical methods may be used to generate representative backscattered signals. Two techniques for modelling the propagation of electromagnetic waves (UWB pulses) in human tissue, are presented: the planar technique and finite difference time domain (FDTD) technique. A four layer biological model is considered with three layers of normal tissue, and one layer of cancerous soft tissue (sarcoma). The two modelling techniques are used to predict the response of the model to the UWB input signal, with particular emphasis on the response of the sarcoma layer. It will be shown that both the Planar technique and the FDTD technique identify the presence of the soft tissue sarcoma quite easily. However the FDTD technique predicts more subtle phenomena such as multiple reflections, albeit at a higher computational cost [C10717]

"Embedded Narrow Pulse Measurement in Digital CMOS"

This paper examines an embedded low-power technique for the single-shot measurement of narrow pulse signals. The circuit serves as an embedded diagnosis tool for the characterization of compressed pulses for ultra wideband sampling schemes, pulsed radar systems, measurements of clocks with very small duty cycles, single event transients in digital circuits, among many other applications. The circuit relies on a new fast voltage-crossing detector to convert a differential input pulse with width to be characterized, into same polarity edges separated by the pulse width to be measured. Those edges are then in turn stretched further using time amplification making them easily detectable by low-resolution time-to-digital converters (TDCs). Dynamic current generation techniques are used in the front-end detector to greatly reduce the power consumption. The proposed circuit is compact and introduces only a few tens of femtoFarad capacitive loading. The circuit was implemented in a 0.18- μm CMOS process. Experimental results confirm the feasibility of the proposed technique [C10718]

"HYCAM: A RCS Measurement and Analysis System for Time-Varying Targets"

The measurement of the radar cross section (RCS) of time-varying targets, which variation of reflectivity are caused by geometrical or radioelectrical deformations has to tackle sever constraints. Indeed the measurement

time must be short enough so that the phenomenon under study can be considered as stationary. Besides, the frequency bandwidth of the system has to be wide enough for a fine analysis of the phenomenon. Both constraints induce thereby an increasing amount of data to be processed. However recent evolutions of digital high speed technologies enable to overcome these difficulties. An ultra-wideband digital system, named HYCAM, and dedicated to the measurement and the realtime analysis of the RCS of time varying targets, has been designed. The transmitted waveform is an OFDM (orthogonal frequency division multiplexing) phase coded signal, which minimizes the ratio between the peak power and the mean power. An instantaneous indoor measurement of a time varying target has been carried out by an experimental system [C10719]

"Magnetic Sensors for Navigation and Security Applications"

Magnetic sensors are key elements in many security, military, and navigation systems. Fast development of new sensor types such as AMR (Anisotropic MagnetoResistors), GMR (Giant Magneto-Resistance), SDT (Spin-Dependent Tunelling) and GMI (Giant Magneto-Impedance) brings new opportunities; but not all new is better. The purpose of this tutorial is to critically review the principles and properties of modern magnetic sensors and show how they presently are employed in navigation and security applications and what is their future potential. The emphasis will be given for mine and UXO (Unexploded Ordnance) location. 1. Principles and techniques:- principles of DC magnetic sensors suitable for security applications (incl. AMR, GMR, SDT and miniaturized resonant and fluxgate sensors)-eddy-current methods-induction magnetometers-electromagnetic methods including ELF and Ground Penetrating Radar-imaging techniques, signal processing, recognition-gradiometric techniques, sensor fusion-calibration and error corrections 2. Applications-Mine detection-UXO location-Detection and recognition of vehicles (incl. submersible)-Detection frames and other sensors for border security-Magnetic labels and anti-theft systems-Navigation systems-Magnetic tracking-Distance measurement-Distributed sensors and sensor areas [C10720]

"Advances in Short Range Radar"

Short range UWB radar systems have significantly improved in capability over the last few years. Availability of high performance, low cost RF and processing components has delivered a number of improvements: multiple functions can be offered from a single system; size and power consumption has been reduced which in turn has led to lighter weight systems; and simplification of the RF front end. Ability to offer 3D location of scattering responses provides a significant advantage in fusion with video devices. Additional processing power has led to increased interest in synthetic aperture radar (SAR) techniques for ground based radar systems [C10721]

"Keynote Address: Challenges for Radar in Future Port Operations-An Operator's View"

First Page of the Article [C10722]

"Programme"

{no data available} [C10723]

"Commentary"

{no data available} [C10724]

"Providing Safety, Security and Integrity: Technology for Civilian Coastal Radar"

Coastal civilian radar presents some unusual challenges to the radar designer. In this paper we present an overview of the application and a summary of current technology. Finally, with the application goals in mind a speculation is presented on possible future technology impact [C10725]

"Automotive Millimetre-Wave Radar, Current Applications and Future Developments"

Over the past ten years millimetre-wave automotive radar has matured from laboratory prototype to mass production for vehicle applications. Manufacturers are now producing the second or third generation of sensors as designs mature, volumes increase and costs are reduced. New application with greater potential for even larger production volume and lower cost are now being developed. Automotive radar systems are being developed and deployed in the 24 GHz band using narrowband modulation. Development work is also underway to produce ultra-wideband radar sensors using the 76-81 GHz band. Current applications for radar in vehicles includes adaptive cruise control, and stop & go and blind spot warning. Future applications include lane change warning, rear closing vehicle warning, collision warning, pedestrian detection, cross traffic warning, collision mitigation, side impact pre warning and air bag pre warning [C10726]

"TarsierГ,B®, a unique Radar for Helping to keep Debris off Airport Runways"

The Tarsierreg millimetre wave FMCW radar is a unique system that has been developed by QinetiQ specifically for the detection of unwanted debris on airport runways. The speaker describes the stringent radar requirements, the evaluation of a prototype system and the subsequent full productisation. Examples are shown from the recent installation of four radar units at Vancouver International Airport [C10727]

"A-SMGCS Surveillance Technology-Challenges and Opportunities"

Summary form only given. Advanced surface movement guidance and control systems (A-SMGCS) are being deployed worldwide. These systems provide controllers with improved situational awareness that enhances surface airport movement and enables advanced tower cab functionality. Without accurate, timely, and robust surface surveillance systems, a modern A-SMGCS would not be feasible. This representation will explore the fundamental capabilities of A-SMGCS and the underlying dependence on surveillance system technology [C10728]

"Database Generation for Non-Cooperative Air Target Identification"

Summary form only given. In this paper we will discuss the approach that we have evolved for populating a database with representative training data for the purpose of non-cooperative target identification (NCTI) of air targets by radar. Such NCTI should help to augment procedures like IFF to reduce the risk of fratricide and allow early designation of targets such that threats can be engaged before significant risk to vulnerable assets. This paper will focus on the use of synthetic data generated from limited information, such as photographs, to represent target types for which we don't have access to real radar measurements over any or a sufficiently representative range of aspects and configurations. This can often be the case for hostile aircraft types. Subscale models and computer electromagnetic predictions are both common methods that researchers have explored to simulate the radar returns from real aircraft. Both have advantages and disadvantages but the former is thought to be a feasible approach with current technology. We will discuss the methodology required for subscale model generation and subsequent use of the data to populate classifier databases and how to quantify the fidelity of the data such that confidence in classification result can be quantified and thus classifier performance as a whole estimated [C10729]

"Flash and Persistent Point Scatterer Feature Extraction from Radar Images"

The talk will discuss the modelling of flashes buried within radar range compressed, or raw data. It will be shown how variants of the CLEAN algorithm can speedily efficiently extract all the flashes. Persistent point scatterers are regarded here as a special case of flashes, of long duration in the time/angle domain. A 'flash representation' of a target closely related to its ISAR image is shown. The talk will discuss efforts to validate the flash representation against flashes direct from CAD models, or from electromagnetic prediction codes such as QinetiQ's SPECTRE. Implications for feature-based ATR, scatterer interpretation, and human interpretability of radar images will be discussed [C10730]

"SAR 3D Scene Reconstruction Using Fourier Imaging Techniques"

Synthetic aperture radar (SAR) images are conventionally collected from platforms following a straight and level flight path. The resulting Fourier domain data exist on a 2D plane which is projected onto the ground plane for imaging, producing a 2D image of the target scene. To obtain a 3D image of the target scene interferometric SAR is typically employed, this involves determining the phase difference between two independent SAR images. However if the SAR data is collected from a nonlinear 3D flight path then the Fourier domain data exist on a 2D surface with extent in all three dimensions. Scene reconstruction from this type of flight path has been covered in the literature previously; however the algorithms used for scene reconstruction are computationally intensive. This paper covers 3D scene reconstruction using Fourier imaging techniques. A 3D equivalent to the polar format algorithm (PFA) is used for scene reconstruction, where the 2D data surface is resampled onto a regular rectangular 3D grid of points to allow use of the fast Fourier transform (FFT). The irregularly sampled 2D surface is mapped to another domain where resampling to the regular rectangular 3D grid points near the surface is a simpler operation. The FFT is then performed in each direction to reconstruct the target scene. This method of scene reconstruction has been simulated in MATLAB and the results obtained have been compared to results obtainable from the same data using a matched filter (MF) based approach. The results from two different nonlinear 3D flight paths are discussed to demonstrate the algorithm, an orthogonal aperture and a circular curved arc. The results of the simulations show that Fourier imaging methods can provide a less computationally intensive alternative to the methods discussed in the literature [C10731]

"Target Classification Using Bistatic SAR Images"

In a radar system, a bistatic configuration is the more generic version of a monostatic configuration. Hence, it is expected and has also been verified to a large extent, that bistatic configuration can increase the range of applications of radar systems. This has given rise to the recent thrust in research activities in bistatic radar development. However, it is an established convention that the new version of a system should be able to perform all the tasks, that its older version could perform 1. Hence, the applications that are currently possible using a monostatic system 2, should be achievable using a bistatic system. One such application is that of automatic target recognition (ATR), for which monostatic radars have proved to be quite effective. The present paper would present some experimental results, which in turn would establish the feasibility of bistatic ATR. In the present paper, ATR exercises have been performed on bistatic synthetic aperture radar (SAR) images. These SAR images have been generated synthetically, using an electromagnetic simulator. In the main paper, few sets of experiments along with their results would be discussed, to analyse various aspects of the bistatic ATR problem. First of all, the dependence of bistatic ATR performance on the bistatic angle of imaging, would be analysed. Bistatic ATR performance decreases with an increase in the bistatic angle of imaging. The reason behind this would also be expounded. In the second set of experiments, the performance of monostatic and bistatic ATR would be compared. It would be shown that contrary to held reserves, bistatic ATR performance is not drastically worse than the monostatic ATR performance. Lastly, the effect of multi-polar bistatic data on ATR performance would be looked into. Even though, multipolar data analysis in bistatic domain is more complicated, still multipolar data do give more information (than single polarisation data) about the target and help in improving the bistatic ATR performance. Conclusions from the work presented in the paper, are quite encouraging. Even though bistatic data handling is more complicated, still a good ATR performance can be achieved by using bistatic radar. Bistatic multi-polar data is also exploitable. These conclusions in turn make a case for further research into bistatic radar systems [C10732]

"Template Based Micro-Doppler Signature Classification"

The micro-Doppler signature of a target is a time varying frequency modulation imparted on the radar echo signal by moving components of the target. Battlefield radar output the baseband signal as audio and soldiers listening on headphones are able to identify the target from its micro-Doppler signature. Automation of this capability is desirable for improved reliability and reduction in classification time. For the first time dynamic time warping (DTW), a speech recognition technique, has been applied to the problem. Its performance has been compared with the common k-nearest neighbour (k-NN) classification method since both approaches utilise a template library [C10733]

"A Doppler-Based Target Classifier Using Linear Discriminants and Principal Components"

This paper describes the design of the automatic target classifier which has been introduced into the AMSTAR battlefield surveillance radar. It discusses the requirements which have driven the design of the classifier, the data which is used to make the classification, the choice of linear discriminant analysis as one of the classification techniques used and the use of principal components analysis to simplify the training of the discriminator. It also discusses the addition of other classes by the use of other data about the targets. It includes a discussion of the testing of the classifier and the performance achieved [C10734]

"Target Recognition in Synthetic Aperture and High Resolution Sidescan Sonar"

The accurate detection and identification of underwater targets continues as a major issue, despite, or perhaps as a result of, the promise of higher resolution underwater imaging systems, including synthetic aperture sonar and high frequency sidescan. Numerous techniques have been proposed for computer aided detection to detect all possible mine-like objects, and computer aided classification to classify whether the detected object is a target or not. The majority of existing techniques employ supervised classification systems which are reliant on training data. The success of these systems can be highly dependant on the similarity of the test data to the training data, which includes the effect of the background region on which the target was located. This paper will briefly discuss and compare two possible solutions to this problem. The first is a model based system for classification and the second utilises an augmented reality simulator to produce training data [C10735]

"High Resolution Radar Imaging of the Sea Surface"

Applications are reviewed of high resolution radar sea surface imagery to remote sensing, wide area surveillance, target detection and tracking. The limitations imposed by sea surface motion on SAR imaging are discussed and illustrated, along with methods to exploit the motion such as along track interferometry. Ships on the sea are subject to roll, pitch and yaw motions, which defocus SAR imagery; analysis and signal processing to

characterise and overcome the difficulties are described. Real aperture images of the sea are shown to contain detailed information on the propagation of surface waves, which may be used in algorithms to detect anomalies such as small surface vessel; these are also described and demonstrated [C10736]

"Passive and Active MM-Wave People Screening Systems"

A passive mm-wave people screening imager is discussed. Frames extracted from video sequences are presented showing good detection of threat objects. Active imaging based on an FMCW concept is discussed and some initial images presented [C10737]

"Algebraic Methods for Function Reconstruction: Application to System Identification"

We consider functions that have a known structure but involve a number of unknown parameters. Specifically, we consider classes of functions that involve sums of exponential terms. The values of the function and some of its derivatives are given at a finite number of points and it is of interest to uniquely reconstruct the function from the given data. In this paper we consider this problem and suggest algebraic methods of solution. We also show how these methods can be used as the basis of algorithms for system identification. The methods are simple, mathematically rigorous and analytical in nature. In the case of low order systems they can be very easily presented and executed. These attributes make the techniques very appealing for introductory treatments of the subject matter for students in systems and control [C10738]

"A comparison of Pose Estimation algorithms for Machine Vision based Aerial Refueling for UAVs"

This paper focuses on the analysis of the performance of specific 'detection and labeling' and 'pose estimation' algorithms within a machine vision (MV)-based approach for the problem of autonomous aerial refueling (AAR) of UAVs. A robust 'detection and labeling algorithm' for the correct identification and sorting of the optical markers is proposed; a sorted list of marker positions is then provided as input to the 'pose estimation' algorithm. A detailed study of the performance of two specific 'pose estimation' algorithms (GLSDC and LHM) is performed with special emphasis on the required computational effort as well as on the robustness and error propagation characteristics. Extensive simulation studies demonstrate the performance of the LHM and GLSDC algorithms and show the importance of a robust 'detection and labeling' algorithm. The simulation effort is performed using a detailed modeling of the AAR maneuver according to the USAF refueling method [C10739]

"The Institution of Engineering and Technology Seminar on High Resolution Imaging and Target Classification"

The following topics were dealt with: high resolution imaging; target classification; radar imaging; sonar; military radar; speech recognition; SAR; and Doppler radar [C10740]

"Automatic Target Recognition: The Problems of Data Separability and Decision Making"

This paper treats the problem of target recognition as a decision process. The nature of the decision to be made has a bearing on the data gathered and the subsequent processing. A key factor in the processing is the separability, i.e., the ability to distinguish, of radar images of similar but distinct objects. A number of recognition algorithms are considered and their suitability for data sets of various types is discussed. In addition some simple measurements of the transfer functions of two targets are considered. Observation suggest that the examples have characteristics that may make them readily separable. As with all recognition techniques the quality and quantity of training data available will place a limit on the performance of any recognition technique and this discussed in the text. The view is formed that a single technique is unlikely to be successful and several techniques cued by gross-features of the image may be more appropriate [C10741]

"Target Classification by Radar"

Target classification by radar has enormous potential with many important applications. So far, with a couple of notable exceptions, this has proved to be an extremely challenging problem with no obvious solution. The chief method for improving the quality of information gathered has been to improve resolution in both range and cross-range dimensions. Recent advances, chiefly in digital technology means that radar systems are now able to operate varying parameters such as frequency, waveform, PRF, bandwidth on a pulse by pulse basis. Additionally, there is emerging evidence that geometric diversity when gathering measurements to be used for classification is an equally important factor. This paper will examine the relationship between radar design parameters and data collection strategies as a basis for solving the problem of radar target classification [C10742]

"Target Classification for Air Defence Radars"

Radar is evolving rapidly from being a sensor which detects and tracks targets to a high resolution imaging sensor with target classification capabilities. This paper addresses the techniques being developed for air defence radars. The application of target classification functions in fire control radars which support missile systems and multi-function phased array radars is discussed. The main high resolution techniques employed are range profiling, ISAR, frequency/spectral analysis and range-frequency imaging. Typical aircraft images measured are presented. The level of maturity of the hardware and signal processing technology to support these modes is discussed. The key technical, operational and practical issues which drive the design and application of high resolution modes for these types of radars are presented. Factors which determine the type of target classification mode which can be employed include the: operational frequency of the radar, time available for the application of the high resolution waveform, pulse repetition frequency, radar bandwidth available, basic architecture of the radar, and mission of the radar system. The other critical issue for the practical employment of target classification modes is that of the target signature database. Classifier algorithms are used to provide the match between the signature measured by the radar and reference signatures of targets of interest held in a database to provide an estimate of the target class. The assembly and maintenance of the target signature database is discussed and techniques employed are presented [C10743]

"Analysis of Distributed Intelligent Agent Model for QoS Dynamic Scheme in GSM/GPRS Network"

In this paper we study dynamic quality of service scheme in GSM/GPRS wireless network. A load balancing architecture constructed by distributed intelligent agent has been presented to support real time or burst data services. Fuzzy neural network was employed to predict GPRS traffic by learning examples. Meanwhile, we have presented a traffic estimation algorithm and a simple decision mechanism to deal with special applications such as burst data transmission. The simulation shows that distributed intelligent agent architecture could significantly reduce packet delay, route cost and relieve GPRS bottleneck [C10744]

"Carrier Phase Coherence as a Sequential Correlation Issue"

First Page of the Article [C10745]

"PMD Based Mobile Node Position Monitoring"

First Page of the Article [C10746]

"Flight Test Evaluation of Various Terrain Referenced Navigation Techniques for Aircraft Approach Guidance"

First Page of the Article [C10747]

"Measurement of Backscattered GPS Signals"

First Page of the Article [C10748]

"The Application of GPS on the Buoy Monitoring System"

First Page of the Article [C10749]

"A Deep Integration Estimator for Urban Ground Navigation"

First Page of the Article [C10750]

"Flash-LADAR Inertial Navigator Aiding"

First Page of the Article [C10751]

"TARSUS -A New Generation State of the Art Tactical Artillery Survey and Gun Laying System"

First Page of the Article [C10752]

"Visual tracking with probabilistic data association filter based on the circular hough transform"

This paper proposes a robust visual tracking framework to track circle-like objects in cluttered environment. Instead of using the resulting positions after circle detection and tracking in the image domain, we directly

perform the visual tracking task in the parameter space which describes the measurement features. The visual tracking technique is combined with targets generation closely. We utilize the probabilistic data association filter (PDAF) to filter the detected measurements with noise and disturbance. The likelihood ratio through the Hough transform is employed to modify the evaluation of the association probability and make the estimate more reliable. Furthermore, the joint probabilistic data association filter (JPDAF) is used to deal with the multiple circle-like objects tracking. The likelihood variation of each target is introduced with JPDAF as a basis of the predictions for different targets. The overall performance has been verified in several challenging experiments [C10753]

"Model-based estimation of off-highway road geometry using single-axis LADAR and inertial sensing"

This paper applies some previously studied extended Kalman filter techniques for planar road geometry estimation to the domain of autonomous navigation of off-highway vehicles. In this work, a clothoid model of the road geometry is constructed and estimated recursively based on road features extracted from single-axis LADAR range measurements. We present a method for feature extraction of the road centerline in the image plane, and describe its application to recursive estimation of the road geometry. We analyze the performance of our method against simulated motion of varied road geometries and against closed-loop detection, tracking and following of desert roads. Our method accommodates full 6 DOF motion of the vehicle as it navigates, constructs consistent estimates of the road geometry with respect to a fixed global reference frame, and requires an estimate of the sensor pose for each range measurement [C10754]

"A hybrid vision + ladar rural road follower"

We present a vision- and ladar-based approach to autonomous driving on rural and desert roads that has been tested extensively in a closed-loop system. The vision component uses Gabor wavelet filters for texture analysis to find ruts and tracks from which the road vanishing point can be inferred via Hough-style voting, yielding a direction estimate for steering control. The ladar component projects detected obstacles along the road direction onto the plane of the front of the vehicle and tracks the 1-D obstacle "gap" due to the road to yield a lateral offset estimate. Several image- and state-based tests to detect failure conditions such as off-road poses (i.e., there is no road to follow) and poor lighting due to sun glare or distracting shadows are also explained. The system's efficacy is demonstrated with full control of a vehicle over 10+ miles of difficult roads at up to 25 mph, as well as analysis of logged data in diverse situations [C10755]

"Thermo-Electric Simulation of a 77GHz Radar Transmitter Chip for Automotive Applications"

The paper presents the thermal design process of a transmitter chip by means of analytical solutions and numerical simulation. Thermo-electrical models representing the heat transfer mechanisms were developed. Parametric simulation studies have been applied for the device optimization. Special emphasis was put onto the multi-scale problem that appears with very small heat sources and dimensions in the square-micrometer range respectively. Submodeling technique is used to manage associated numerical difficulties. A parametric model is generated for a transmitter module with multiple transistor blocks on single chip. The model is validated by analytical solutions for heat sources on finite regions and associated experimental temperature measurements on wafer. Solutions and results of the parametric design studies are presented [C10756]

"A Development of WAAS-Aided Flight Inspection Truth System"

First Page of the Article [C10757]

"Quartz Dual Axis Rate Sensor (QDARS)"

First Page of the Article [C10758]

"Overcoming some of the issues in maintaining large urban area 3D models via a web browser"

This paper discusses recent work, in the VEPs Interreg project, that has been examining how to optimise operator based digital 3D modelling, of urban and rural environments, where the increasing availability of highly accurate LiDAR scanning offers appropriate remote sensed data. From this data bare earth digital terrain models (DTMs) can be processed semi-automatically, then draped with aerial imagery. Although both the resulting DTMs and geo-referenced aerial photography are of increasing detail and availability, buildings and similar structures are difficult to automatically extract at a level of detail that provides a credible sense of presence at street level. The LiDAR data itself is currently not captured often or extensively enough or at a sufficient level of detail that it could be relied on to keep VR analogues of real places up to date through an automated process alone, without

additional modelling. Significant costs in modelling and updating urban settings to convey presence thus remain, be it through a combination of photogrammetry, CAD drawings and manual editing. It is argued that these costs are likely to limit large area 3D modelling to either broad brush overviews (as provided by Google Earth) or to credible presence models in those few locations where the high cost is justifiable, but in which, once the primary purpose of the model has been served, acceptance of the continuing cost of maintenance to reflect change is unlikely. Where updating of high presence models does happen this paper puts forward the view that currently, due to cost, it is likely to be piecemeal and take place over a long period of time. The paper describes one approach to reducing these costs by empowering heterogeneous groups of people to share the tasks of digitising and updating buildings that convey a credible sense of presence [C10759]

"A t-distribution based particle filter for target tracking"

From a Bayesian perspective, target tracking is the problem of generating an inference engine on the state of a target using a sequence of observations in time, which is to recursively estimate the probability density function (PDF) of the target state. Previous approaches to density estimation have mostly focused on Gaussian filters in practice, but these are well known sensitive to outliers. In this paper, the new particle filter is developed based on Student-t distributions, which are heavier tailed than Gaussians and hence more robust, called the Student-t distribution particle filter (SPF). To estimate PDF of the target state based on samples, a new expectation conditional maximization either (ECME) algorithm is developed and embedded in the SPF. The new ECME algorithm has a faster convergence rate than that of the existing EM algorithms. Under the Student-t distribution assumption, it has been shown that the Student-t distribution particle filter is asymptotically optimal in terms of the number of particles. Simulations have demonstrated the effectiveness and the improved performance of the SPF over Gaussian filters and the bootstrap filter (SIR), and have shown that it is more robust than SIR [C10760]

"New electronic funds transfer services over IP"

This paper shows a complete description of a new EFT (electronic funds transfer) service over IP for the current payment terminals. These new EFT services carry all the electronic transactions from the POS (point of sale) terminals to the authorization centres (host) through an IP network with special TCP-X.25 gateways. These services establish a secure connection with the gateways to make the electronic transactions. This work presents two kind of solutions depending on the transmission technology used: GPRS (general packet radio service) or ADSL (asymmetric digital subscriber line). The security of the system has been the main objective of this investigation. This paper describes all the security algorithms implemented and it presents the results obtained in a real installation [C10761]

"The virtual but real patient in the ICU"

We intend to take the patient virtually from the ambulance to the I.C.U. (intensive care unit), and the staff from the I.C.U. virtually to the ambulance. We propose a low-cost system of hybrid communication equipped with a wireless device in narrow band (radio-modem), with analysis, treatment and safe transmission of data in real time, which are received in movement and in situations out of range (due to orographic barriers), through UMTS/GPRS and a microcomputerized system (radio-cable) with Ethernet connection, for establishing transmissions via cable (Internet-virtual net). The system has shown to be valid with the information obtained, even if the repeater units are not situated in the best places for transmission of signals [C10762]

"Comparison of several ballistic target tracking filters"

In this paper, we compare several nonlinear filtering methods, namely, extended Kalman filter (EKF), unscented filter (UF), particle filter (PF), and linear minimum mean square error (LMMSE) filter for a ballistic target tracking problem. We cast EKF and UF into a general linear recursive estimation framework and reveal their pros and cons. We pinpoint using the LMMSE filter for possible analytical solutions rather than starting with approximations such as system linearization or unscented transform. We compare the performance of EKF, UF, LMMSE filter and Gaussian PF for a ballistic target tracking problem. The estimation accuracy is also compared with the posterior Cramer-Rao lower bound (PCRLB). Our simulation results confirm that the LMMSE filter outperforms EKF and UF in terms of tracking accuracy, filter credibility and robustness against the sensitivity to filter initial condition. Its accuracy is slightly worse than that of Gaussian PF but with much lower computational load. We conclude that the LMMSE filter is preferred for the ballistic target tracking problem being studied [C10763]

"Dual Wideband Antenna Analysis for Linear FMCW Radar Applications"

This paper is a work about the importance of wide frequency deviation, Deltaf, in linear FMCW radar applications

and the design and measurement results of the antenna thought to be suitable for these applications. First, working principle of linear FMCW radar is briefly told. Afterwards, it will be mentioned about the benefits of choosing high frequency deviation in these radars such as suppressing the distortion effects caused by modulation frequency harmonics, obtaining high range resolution and providing frequency diversity. A brief design and measurement results of the antenna, which is considered for the applications of this type radar and increases the frequency deviation to 400 and 900 MHz in two different frequencies, where it is typically 100-150 MHz due to the narrowband antennas, will be presented in next part [C10764]

"Dogrultu Yogunluk Fonksiyonu Ile Radar Goruntu Isleme"

In this paper, an alternative target density function (TDF) is proposed to image the radar targets. While the target density function is developed by a new technique in direction density function (DDF) form, it is obtained by considering a novel range and scanning angle plane different from the conventional methods. Although the imaging technique is obtained via the linear phased array radars, the problem associated with beamforming is bypassed in this algorithm [C10765]

"AutoVision-flexible processor architecture for video-assisted driving"

Summary form only given. Future automotive security systems will benefit from visual scene analysis based on a fusion of video, infrared, and radar images. Today we have already functions like lane departure warning and automatic cruise control (ACC) for pretty well defined driving environments, such as highways and primary roads. Recent research activities concentrate on more complex environments, such as city traffic with a wide variety of traffic participants moving in an unpredictable manner, e.g. bikes, pedestrians, children, and even animals, and under changing weather and lighting conditions. The ITRS semiconductor roadmap for microelectronics forecasts a continued doubling of transistor capacity per chip every 2 to 2.5 years enabling billion transistor ASIC designs in the near future. Multi processor system on chip (MPSoC) solutions with 8, 16 or even more standard RISC CPU cores, mega-bytes of fast (ns access latencies) on-chip SRAM memories, giga-byte per second interconnect buses or NoC (network on chip) meshes, high-speed serial I/Os and, last but not least, million gate equivalent dedicated hardware accelerator functions in eFPGA (embedded field programmable gate array) logic are becoming reality on a single silicon substrate. Examples of current research projects shall illustrate our perception on how this tremendous increase in functionality and computational performance per chip area may impact automotive control unit (ACU) architectures for driver assistance applications. The AutoVision processor is a dynamically reconfigurable MPSoC prototype where video-specific pixel processing engines are on-the-fly loaded or exchanged without interrupting regular system operations. For the time being, pixel processing engines cover functions such as object edge detection or luminance segmentation, and are implemented as dedicated hardware accelerators to ensure real-time frame processing capabilities of the AutoVision processor. Dynamic replacement of processing engines ensures an automatic and area efficient adaptation to various driving conditions. Segmented objects are, in a subsequent step, characterized by means of standard MPEG-7 descriptors and entered as search criteria into traffic scene analysis databases. Goal is to obtain a clean distinction between passenger cars, trucks, and big rectangular traffic signs, and to identify pedestrians or bikers in complex traffic situations. The AutoVision processor project is supported by the German Research Foundation (DFG) in the special emphasis research programme "reconfigurable computing" [C10766]

"Wideband Optical TTD SAR Antenna"

Optical beam forming networks (OBFN) are an interesting alternative for the design of wideband antenna arrays. They are potentially more power efficient and lighter than their microwave counterparts. These two characteristics make them especially appealing in space remote sensing applications. However, in a practical implementation of OBFN in a real SAR system, different architectural and technological tradeoffs need to be assessed. Taking as an example a free-space OBFN (D. Dolfi et al., 1991) and an existing SAR mission (M. Lisi et al., 1993), this paper studies the impact of different OBFN parameters like scalability, insertion loss and crosstalk in the performance of the antenna array system [C10767]

"A SAR-Based Algorithm for Imaging of Landmines with GPR"

First Page of the Article [C10768]

"GPR Data Processing Using the Component-Separation Methods PCA and ICA"

First Page of the Article [C10769]

"Velocity and Acceleration from Unaided Carrier Phase"

First Page of the Article [\[C10770\]](#)

"Synthesis of Metamaterial Coatings for Cylindrical Structures by an Ant-Colony Optimization Algorithm"

First Page of the Article [\[C10771\]](#)

"Impact of synchronization on signal-to-noise ratio in a distributed radar system"

Distributed radar systems are a subset of distributed sensor networks. They are classified as a system of systems due to the processing done at each sensor system and by the network as a whole. The potential signal-to-noise (SNR) gains of a distributed radar system are proportional to N^2 , where N is the number of sensors in the network. This potential is dependant on an assumption that the network transmitters and receivers are synchronized; this paper investigates this assumption. The focus of this work is the frequency, phase, and pulse synchronization of the pulses as they interact at the target. Feedback is discussed as a means of maintaining synchronization. The best case is for a reflected pulse to be in phase and overlap completely; the worst case is for the pulses to reflect in a manner that is non-overlapping. SNR decreases in a sinusoidal manner as synchronization is lost [\[C10772\]](#)

"Pulse transmission scheduling for a distributed system of cooperative radars"

We introduce a simultaneous pulse transmission scheduling scheme for a distributed wireless network of cooperative tracking radars. Rather than treat each of the radars as an independent system, we model the individual radars as part of a system-of-systems and coordinate simultaneous transmissions across the network to produce constructive pulse collisions at the target. It is shown that this scheduling algorithm couples improved target discrimination due to spatial diversity with a reduced per node power requirement due to increased signal-to-noise ratios at the receivers. This simultaneous scheduling strategy is combined with a detection and localization multistatic time-scheduled strategy in a two-phase hybrid approach. Algorithms are developed for both phases that minimize inter-pulse interference and communication overhead while maximizing pulse repetition rate. Potential error sources are identified and studied for both the radar transmissions as well as the underlying communication network [\[C10773\]](#)

"A New Microwave Axial Tomograph for the Inspection of Dielectric Materials"

First Page of the Article [\[C10774\]](#)

"3D Building Detection and Modeling from Aerial LIDAR Data"

This paper presents a method to detect and construct a 3D geometric model of an urban area with complex buildings using aerial LIDAR (Light Detection and Ranging) data. The LIDAR data collected from a nadir direction is a point cloud containing surface samples of not only the building roofs and terrain but also undesirable clutter from trees, cars, etc. The main contribution of this work is the automatic recognition and estimation of simple parametric shapes that can be combined to model very complex buildings from aerial LIDAR data. The main components of the detection and modeling algorithms are (i) Segmentation of roof and terrain points. (ii) Roof topology Inference. We introduce the concept of a roof-topology graph to represent the relationships between the various planar patches of a complex roof structure. (iii) Parametric roof composition. Simple parametric roof shapes that can be combined to create a complex roof structure of a building are recognized by searching for sub-graphs in its roof-topology graph. (iv) Terrain Modeling. The terrain is identified and modeled as a triangulated mesh. Finally, we provide experimental results that demonstrate the validity of our approach for rapid and automatic building detection and geometric modeling with real LIDAR data. We are able to model cities and other urban areas at the rate of about 10 minutes per sq. mile on a low-end PC. [\[C10775\]](#)

"Borehole radar performance characteristics and applications for underground change detection"

Low-frequency borehole radars have proven useful in recent years as tools for locating underground features, such as rock fissures and voids. In fact, these radar systems are now commercially available at multiple operating frequencies. Most of the borehole radar applications to date have utilized the systems in a tomographic mode because of its capability to locate a target between two boreholes. In this paper, we focus on the use of a borehole radar system in a reflective mode because of its capability to detect a target anywhere in the vicinity of the radar. As expected, the detection range of the system is severely limited due to two-way attenuation through the earth. Nonetheless, we show that it is possible to form a roughly focused range-vs.-

depth image of the region surrounding the borehole. More importantly, by developing and implementing some straightforward signal processing techniques, we are able to detect the introduction of a target into an adjacent borehole in both the focused and the unfocused imagery. [C10776]

"Low sidelobe pattern synthesis and subspace projection"

It is important to maintain low sidelobes where possible when performing adaptive beamforming or STAP in phased array radar systems in order to mitigate the effects of any inadequately suppressed interference. This paper presents a new algorithm for incorporating a low sidelobe pattern synthesis technique into subspace based beamforming methods. It is computationally efficient and also flexible as it can be used in conjunction with GSLC and direct beamforming approaches, the multi-stage Wiener filter and fast projection techniques. Simulation results demonstrate success in lowering sidelobe levels with several subspace methods in both spatial beamforming and STAP configurations. [C10777]

"A versatile bistatic & polarimetric marine radar simulator"

We present a versatile simulator for marine radars that can, in particular, be used in multistatic configurations. Today, most simulators modelize the sea clutter by a random noise; however, no obvious relation exists between physical parameters (e.g. wind speed or salinity) and the shape of the probabilistic law of noise. On the contrary, we modelize the whole acquisition chain: antennas and their polarization, the shape of the emitted signal, etc. Realistic sea surfaces are generated using the two-scales model on a semi-deterministic basis, so as to be able to incorporate the presence of ship wakes. We present pseudo-raw signals obtained with our simulator. These signals can be further processed and fed to a ship detection and tracking chain. We aim at using this simulation as a tool to benchmark these algorithms and improve them by adding knowledge on the physical uncertainties and the sensor imprecisions. [C10778]

"Evaluation of antenna architectures for angle estimation of endo-clutter targets in airborne adaptive radars"

Adaptive beamforming techniques such as space-time adaptive processing (STAP) combine spatial and temporal degrees of freedom to detect slow moving targets in strong clutter backgrounds. Many techniques exist for choosing the spatial and temporal degrees of freedom. In general these techniques are typically evaluated based on their ability to provide good target detection performance using performance metrics such as signal to interference plus noise ratio (SINR). Since adaptive radars must also provide target location information it is important to also consider how the choice of spatial degrees of freedom will impact direction-of-arrival estimation performance. This paper will investigate the DoA estimation performance of various airborne array architectures including elements and fixed beams (beam-space). It will be shown that in some interference scenarios the spatial degrees of freedom required for good detection performance differ from those required for good DoA estimation performance. [C10779]

"Implementation of method for operating multiple high frequency surface wave radars on a common carrier frequency"

The increasing use of high frequency surface wave radar (HFSWR) for the surveillance of coastal regions is faced with the problem of limited channel availability in the electromagnetic spectrum. Thus there is a need for multiple radars to share a common frequency channel. Proof-of-concept work is presented here for a method to operate multiple radar systems on a common carrier frequency. A review is provided of an existing concept where a common waveform is modulated by tones varying by a few hertz across the different radars. The signals from the different radars are separated by either pulse-domain filtering or Doppler processing. An experiment has been performed that demonstrates the feasibility of the method. Limitations of the method are considered in terms of the linearity of the propagation channel. [C10780]

"On optimal resource allocation in multifunction radar systems"

Recent studies have focused on the problem of resource allocation in systems in which multiple applications contend for multiple resources in order to satisfy their application level requirements. Multifunction radar system is an example of such a system in which multiple targets are tracked by the radar system simultaneously requiring processor and energy resources of the radar system. Lee et al. (2003) studied the problem of maximizing the overall tracking quality of the multifunction radar system by applying optimization procedures offline. The optimization methods employed in this work first considered the sampling frequency alone as a resource and optimized this resource by using the approach of Seto et al. (1996). Later in the same study, sampling frequency and computation time are attempted to be optimized together by using the Q-RAM approach.

However, the method presented failed to be extendable to accommodate additional resource variables. In the present study, two improvements over the solution approach are presented. Firstly, the optimization problem for a tracking radar system is extended so as to enable the consideration of the average power of the transmitted signal as a resource which can be optimized besides sampling frequency and computation time. By this extension, a novel optimization algorithm is proposed to optimize the average power together with the sampling frequency and computation time. Secondly, it is also shown that the extendible method presented can also be applied for the two variable case and produce comparatively more favorable results as compared with the Q-RAM based solution. [C10781]

"Transmitter noise compensation-a signal processing technique for improving clutter suppression"

A new signal processing technique, referred to as transmitter noise compensation (TNC), has been developed at the Naval Research Laboratory (NRL) to improve the capability of existing radars to suppress returns from strong clutter. This technique compensates for intra-pulse transmitter noise, as well as power supply instabilities, by capturing and processing an accurate replica of each transmitted pulse. Subsequently, through pulse-to-pulse comparisons, the measured transmit errors are used to derive a digital filter which compensates for the transmitter noise in the digital signal processor (DSP). This paper describes the transmitter noise compensation technique, its theory of operation, and the results from an experimental effort to demonstrate its feasibility. This experiment has confirmed the validity of the TNC concept and demonstrated an improvement of 15 dB or higher. [C10782]

"End-to-end modeling and simulation of GMTI target detection from space"

The design of space based radars for detection of ground moving targets must consider several factors to be operationally effective. The high speed of the satellite coupled with unknown motion patterns of the ground moving vehicles requires efficient detection and geolocation algorithms, as well as dynamic tasking of the satellite. An end-to-end simulation of the process has been constructed and a realistic scenario has been analyzed in terms of the detection statistics and effects of satellite and spacecraft motion and deformation errors. Three analytic META models have been constructed to evaluate antenna and signal processing architectures, while maintaining an effective simulation throughput. The effects of these META models on signal to noise ratio, probability of detection and minimum detectable velocity are examined. Examination of key measures of performance provides insight into sensor design and tasking requirements. [C10783]

"Feasibility of STAP for passive GSM-based radar"

In this paper, we examine the feasibility of applying space-time adaptive processing (STAP) to bistatic passive radars using illuminators of opportunity. The transmitters considered are GSM base stations and are non-cooperative. Although STAP has been extensively applied to signals from pulse-Doppler radars, it was never applied to arbitrary signals arising from illuminators of opportunity. We show that by computing the appropriate mixing product, we essentially convert the signal of opportunity to a pulse-Doppler like signal, hence making the application of STAP to arbitrary signals straightforward. We finally confirm these theoretical results by using real measurements. [C10784]

"Performance of multistatic space-time adaptive processing"

In this paper, we analyze the benefits of using multiple airborne radar systems viewing a scene from different directions. The filter outputs from multiple radars employing space-time adaptive processing (STAP) are combined to increase signal-to-interference-plus-noise ratio (SINR) and detection performance. The performance improvement is analyzed by looking at the detection probability and the probability of false alarm of the combined system with and without bistatic components of the multistatic system. Performance is compared to a multi-radar system employing a decentralized method of detection. Sensitivity to training data availability for adaptive filtering is also considered. [C10785]

"Focusing ISAR images using the AJTF optimized with the GA and the PSO algorithm-comparison and results"

Algorithms based on the genetic algorithm (GA) and the particle swarm optimization (PSO) algorithm were designed for focusing inverse synthetic aperture radar (ISAR) images that suffered from degradation due to Doppler smearing. These algorithms optimized the adaptive joint-time frequency (AJTF) algorithm by replacing the exhaustive search as the primary search tool used to determine focusing parameters. The use of the PSO for ISAR image focusing is a unique application of this evolutionary search. Performance of the GA and the PSO were compared with the PSO producing the optimal results of being able to focus a 211pulse ISAR image in 9 seconds or 24% of the cost function calculations required for an exhaustive search. This paper also introduces a

new method of determining basis function suitability using the fast Fourier transform. [C10786]

"Beamspace space-time adaptive processing for conformal array radars"

This paper presents a beamspace space-time adaptive processing (STAP) approach to conformal array radar applications. The spatial channels in beamspace STAP are designed to have the same phase center, but different beam orientations and/or shapes. The joint-domain localized (JDL) algorithm and $\Sigma\Delta$ -STAP (employing sum and difference beams) are two special cases of beamspace-STAP. This paper develops a theory for a generalized beamspace STAP and applies it to conformal arrays. The desired beam pattern characteristics for beamspace STAP are identified with supportive examples. In practice, the beam pattern sidelobe structure is not controllable because of near-field effects, mutual coupling, and various other errors. A practically feasible design that employs a low sidelobe mainbeam combined with a few non-tapered beams (sum and/or difference beams) is developed in this paper. An iterative method is used to synthesize the desired conformal array patterns for beamspace-STAP. Several beamspace-STAP examples for a cylindrical array and a dome-shaped array, as representatives of conformal arrays, perform very well and the results are consistent with the theory. [C10787]

"A noncoherent approach to radar localization through unknown walls"

A simple and practical noncoherent approach to through-the-wall radar detection and localization in the presence of unknown walls is presented. The technique corrects for the shifts introduced in target location estimates due to ambiguities in the wall thickness and dielectric constant. Data is collected using three independent monostatic single-antenna radar units, employing stepped-frequency signals, at two or more different standoff positions of the radar system from the wall. In post-data acquisition processing, one of the wall parameters assumes a fixed value. Localization is then performed, for different assumed values of the other parameter at different standoff positions, using a trilateration-based technique that incorporates the presence of the wall. Target displacement trajectories, each corresponding to a different standoff position, are then formed and the cross-over point is estimated to be the target location. The results show that the radar system is able to correctly locate targets behind unknown walls. [C10788]

"Multi-mission multi-mode waveform diversity"

Previously, the authors presented a novel method for achieving range-dependent beamforming through the use of a frequency diverse array. The frequency diverse array concept was developed using a quasi-stationary waveform assumption. This concept can be extended to non-continuous wave signals for narrowband and wideband applications such as moving target indication (MTI) and synthetic aperture radar (SAR). Alternative implementations are described, which offer the potential for achieving MTI and SAR simultaneously. [C10789]

"Space-time transmit signal construction for multi-mode radar"

This paper addresses the problem of constructing, selecting, and/or evaluating non-separable space-time transmit functions for radar transmitters. By expressing a constrained space-time transmit function as a superposition of space-time basis functions, this problem is recast as finding an optimal set of superposition weights, which are collected and expressed as complex transmit vectors. Optimality in this problem is defined as the transmit vector that results in an optimal radar measurement, and thus depends on the radar task, target scenario, and receiver construction. After discussing the properties of the ideal (but unobtainable) radar measurement, an information theoretic criterion is presented as a logical method for selecting optimal transmit vectors. A numeric simulation demonstrates the efficacy of this method. [C10790]

"Novel SOA-based switch for multiple radio-over-fiber service applications"

An all-optical 343 SOA-based switch is demonstrated for routing radio-over-fiber signals. It is demonstrated that different RF signals, such as terrestrial digital TV and wireless LAN, can be routed simultaneously with a switching guard-band of only 500 ns. [C10791]

"A new bi-processor SmartPhone: evaluation of the performance generating GPRS data traffic"

In this work we introduce a new type of SmartPhone: a bi-processor SmartPhone equipped with a network interface GSM/GPRS/EDGE/UMTS. The architecture used, with two processors, is introduced to take advantage from the subdivision of the functionalities realized through the two processors. This results in a better distribution of different functions, all above when multi-media traffic is considered. Moreover the interaction between the two processors has to be realized in a convenient manner to better take advantage from the sub-division. The form of communication established between the two processors we have chosen is the serial communication based on the standard RS232. Before to realize the product we propose to evaluate the performance of a similar

project. To do this last we built a simulator focusing our attention on the communication between the two processors and we generated different types of data traffic (voice call, sms, etc.). Furthermore we considered GPRS connections on our simulator to verify that a similar architecture, when correctly developed and dimensioned, can support this type of data traffic [C10792]

"A new multi-sensor registration"

A new multi-sensor registration is discussed in this paper. Registration is the process whereby various bias errors are removed from multi-sensor position reports so that they can be accurately combined and utilized for multi-sensor tracking and display. Current ATC systems use a NAS (National Airspace System) registration algorithm to calculate the bias errors. To overcome the shortcomings of the NAS registration, a multi-sensor registration algorithm based on a least squares minimization is proposed. This algorithm can be used to efficiently calculate the bias errors for all the radars simultaneously in the system. The implementation of this algorithm needs a certain number of target report pairs for registration calculation, but there is no requirement for large number of samples; as such there is no need to wait for a long time before the biases are obtained. Unfortunately, this direct least-square method is not feasible for large scale registration problems. [C10793]

"Pseudo-convex Contour Criterion for Hierarchical Segmentation of SAR Images"

The hierarchical segmentation of SAR (Synthetic Aperture Radar) images is greatly complicated by the presence of coherent speckle. We are exploring the utilization of spatial constraints and contour shapes in order to improve the segmentation results. With standard merging criterion, the high noise level of SAR images results in the production of regions that have variable mean and variance values and irregular shapes. If the first segments are not correctly delimited then the following steps will merge segments from different fields. In examining the evolution of the initial segments, we see that the merging should take into account spatial aspects. Particularly, the segment contours should have good shapes. In this paper, we examine how the pseudo-convex envelope of a region can be used to evaluate the region contour. We present a pseudo-convex measure adapted to the geometry of image lattice. We show how the pseudo-convex envelope can be calculated. We present measures comparing contour shapes and using the perimeter, the area and the boundary length of segments. We use a hierarchical segmentation algorithm based upon stepwise optimization. A stepwise merging criterion is derived from the multiplicative speckle noise model. The shape measures are combined with the merging criterion in order to guide correctly the segment merging process. The new criterion produces good segmentation of SAR images. This is illustrated by synthetic and real image results. [C10794]

"Multi-Object Tracking Through Simultaneous Long Occlusions and Split-Merge Conditions"

A fundamental requirement for effective automated analysis of object behavior and interactions in video is that each object must be consistently identified over time. This is difficult when the objects are often occluded for long periods: nearly all tracking algorithms will terminate a track with loss of identity on a long gap. The problem is further confounded by objects in close proximity, tracking failures due to shadows, etc. Recently, some work has been done to address these issues using higher level reasoning, by linking tracks from multiple objects over long gaps. However, these efforts have assumed a one-to-one correspondence between tracks on either side of the gap. This is often not true in real scenarios of interest, where the objects are closely spaced and dynamically occlude each other, causing trackers to merge objects into single tracks. In this paper, we show how to efficiently handle splitting and merging during track linking. Moreover, we show that we can maintain the identities of objects that merge together and subsequently split. This enables the identity of objects to be maintained throughout long sequences with difficult conditions. We demonstrate our approach on a highly challenging, oblique-view video sequence of dense traffic of a highway interchange. We successfully track the large majority of the hundreds of moving vehicles in the scene, many in close proximity, through long occlusions and shadows. [C10795]

"Target Classification and Pattern Recognition Using Micro-Doppler Radar Signatures"

Micro-motions, such as vibrations or rotations of an object or structures on the object, induce additional frequency modulations on returned radar signal, which generates sidebands about the object's Doppler frequency, called micro-Doppler by V.C. Chen et al. (2002). In this paper, we investigated statistical classification methods for target classification using their micro-Doppler signatures. At this stage only simulated data are studied, and two models are used to generate simulation data: point scatter model and RCS model. Both models are tested and compared for their performance on target classification [C10796]

"A Sequential Vehicle Classifier for Infrared Video using Multinomial Pattern Matching"

Vehicle classification is a challenging problem, since vehicles can take on many different appearances and sizes

due to their form and function, and the viewing conditions. The low resolution of uncooled-infrared video and the large variability of naturally occurring environmental conditions can make this an even more difficult problem. We develop a multilook fusion approach for improving the performance of a single look system. Our single look approach is based on extracting a signature consisting of a histogram of gradient orientations from a set of regions covering the moving object. We use the multinomial pattern matching algorithm to match the signature to a database of learned signatures. To combine the match scores of multiple signatures from a single tracked object, we use the sequential probability ratio test. Using real infrared data we show excellent classification performance, with low expected error rates, when using at least 25 looks. [C10797]

"Experimental verification of environmental models for adaptive detection and estimation in HF skywave radar"

Performance of adaptive detection algorithms such as GLRT, AMF, and ACE are usually evaluated assuming training data consisting of i.i.d. Gaussian noise samples. While this assumption is often true, radar signal processing and spatial over-sampling in the array may introduce correlation between data samples spatially and temporally. Even in cases where the external noise is i.i.d. Gaussian, this sensor induced correlation can significantly change the convergence rate, discrimination capability, and false alarm rate of adaptive detectors. Receiver per element measurements from a large HF radar array are used to confirm these effects and the potential performance impact on hypothesis testing performance is examined. [C10798]

"An approach for multiple moving targets detection and velocity estimation"

The purpose of range tracking and velocity estimating for multiple moving targets is to accurately track the location of the targets and their differential changes. In this paper, an approach for multiple moving targets detection and velocity estimation in radar is proposed. By using transformable periods and symmetrical LFM (TPS-LFM) waveform, multiple moving targets detection is possible. Since this radar waveform will increase the complexity of signal processing. To resolve this problem, an effective algorithm based on discrete match Fourier transform (DMFT) is proposed for chirp rate estimation and used to overcome the difficulty of parameter estimation for multiple moving targets. The signal model and the detection method are discussed and some simulations are performed. Theoretic derivation and computer simulations show that multiple moving targets can be easily detected with high range resolution and high velocity resolution, and under certain conditions, the false detections of unnecessary targets and failures to detect necessary targets, which used to be major problems in detection performance, can be substantively reduced. Its usefulness in multiple moving targets detection and velocity estimation in various radar, such as automotive collision avoidance radar (ACAR) and moving target indicator (MTI) radar, are confirmed. [C10799]

"Adaptive processor convergence improvement using reiterative projection statistics"

Adaptive radar processors form estimates of the statistics of the received interference (such as clutter and/or jamming) and receiver noise processes using measured samples (i.e., snapshots) of the signal environment. Snapshots that contain the signal of interest (i.e., targets) and/or other outliers are, in practice, frequently interspersed within a set of more homogeneous interference snapshots. This condition often results in poor convergence in terms of signal to interference-plus-noise ratio (SINR) and ultimately, probability of detection. In this paper, a previously developed projection statistics (PS)-based outlier detection technique is extended to a reiterative and prewhitened form, similar to a recent reiterative generalized inner product (GIP) technique. We compare SINR convergence performance of reiterative GIP and reiterative prewhitened PS, among other methods, in the presence of multiple outliers. The results show that reiterative prewhitened PS is superior to reiterative GIP and to the other methods in terms of SINR convergence criteria. [C10800]

"Swathbuckler: HPC processing and information exploitation"

This real-time system recorded raw returns and processed continuous strip-map, high-resolution ([C10801]

"Optimal solution of finite dimensional filtering problems via solution of linear ODEs"

The work of Yau and collaborators on finite dimensional filters is a major advance in the solution of the general nonlinear filtering problem. In this paper, the solution of Yau and Lai for a large class of finite dimensional Yau filters (that includes the linear filter) is further simplified. The complete solution of the finite dimensional filtering problem is given in terms of a system of linear ordinary differential equations, which are easy to implement. A natural and numerically stable numerical techniques, suggested by group theoretical techniques, is also presented. [C10802]

"The effects of Doppler and pulse eclipsing on sidelobe reduction techniques"

Radar sidelobe reduction techniques based on deconvolution generally rely on an accurate estimate of the system point spread function (PSF). Targets traveling at nonzero velocity induce a Doppler shift and have an altered PSF, which reduces sidelobe reduction performance. Also, in situations where a target is close to the radar, pulse eclipsing occurs- reflected energy arrives at the receiver while it is switched off during transmission. Eclipsing has the effect of a range-varying PSF, which also reduces sidelobe reduction performance. This paper describes a method to account for both Doppler and pulse eclipsing using the thresholded minimum mean square error (MMSE-T) sidelobe reduction algorithm. A new procedure for estimating noise power, which is required by the algorithm, is presented. Simulation results show the modified algorithm is able to reduce sidelobes such that a weak target obscured by the sidelobes of a 40 dB stronger target is clearly revealed, assuming the weak target would be detectable alone. These results hold when the true target velocities are not known as long as a reasonable estimate is obtained through tracking or Doppler processing of the strongest targets. A qualitative comparison of MMSE-T with the iterative re-weighted least squares (IRLS) algorithm shows it to be the better of the two. [C10803]

"Reinterpreting the CLEAN algorithm as an optimum detector"

This paper gives a short review of the CLEAN algorithm and shows how it can be implemented as a deconvolver in place of a correlator. The paper then derives an optimum detector (with appropriate assumptions) that provides detection of closely spaced Rayleigh distributed objects in the presence of additive white Gaussian noise (AWGN). These two processors are shown to both be deconvolvers for infinite signal to noise ratio. The range-time cut of the ambiguity diagram indicates that both algorithms have outstanding range-time sidelobes (under the condition of infinite signal to noise ratio). The optimum detector is not a uniformly most powerful test because it incorporates target amplitude into the detector. However, in many practical situations estimates of this parameter may be available. [C10804]

"Nonquadratic regularization for waveform optimization"

An adaptive algorithm for eigen-based waveform optimization is presented. The algorithm is capable of improving the matched filter signal-to-interference-plus-noise ratio (SINR) of a radar operating in a colored interference environment while simultaneously constraining the shape of the matched filter response. To arrive at the algorithm cost function, the asymptotic behavior of the interference covariance matrix is examined, and a p-norm regularization term is considered. The resulting cost function consists of one term to improve SINR, and another term to constrain the shape of the matched filter response. This provides the waveform designer with a means of trading between SINR performance and matched filter response for a given application. The simulated performance of various steepest descent algorithms applied to waveforms in a colored interference environment is presented. These results show that a low-complexity stochastic gradient algorithm (in the spirit of LMS) is capable of improving radar performance in band-limited interference. [C10805]

"Splitting Algorithm for Cases with Single Detection from Sonar Data for Two Tracks"

The purpose of this paper is to analyze data association problem in sonar applications. Bearings only tracking algorithms are used because the range information is distorted in water. A method is proposed to associate detections with established sonar tracks using the distribution of the received signal. Using a single detection when two target's bearings are close to each other, may result in poor tracking capability. Splitting a single detection from two targets is a new method which has the potential to keep weaker target's track alive. This method is compared with PDA (probabilistic data association) filters. Monte Carlo simulation results are also given [C10806]

"Approximating Representation Coefficients From Non Ideal Samples"

Many sources of information are of analogue or continuous-time nature. However, digital signal processing applications rely on discrete data. We consider the problem of approximating L_2 inner products, i.e., representation coefficients of a continuous-time signal, while having the possibly non-ideal signal samples, as the only available data. By adopting a generalized sampling scheme, a minimax solution is suggested. We then compare our approach with the piecewise-constant approximation method, commonly used for this problem [C10807]

"Single-Stage Waveform Selection for Adaptive Resource Constrained State Estimation"

We consider the problem of optimal waveform selection. We would like to choose a small subset from a given set of waveforms that minimizes state prediction mean squared error (MSE) given the past observations. This

differs from previous approaches to this problem since the optimal waveforms cannot be computed offline; it requires the previous observations. Since the optimal solution to this subset selection problem is combinatorially complex, we propose a convex relaxation of the problem and provide a low complexity suboptimal solution. We present a specific model and show that the performance of this suboptimal procedure approaches that of the optimal waveforms [C10808]

"Estimating the Standard Deviation of Some Additive White Gaussian Noise on the Basis of Non Signal-Free Observations"

Consider n -dimensional observations where random signals are present or absent in independent and additive white Gaussian noise (AWGN) with standard deviation σ_0 . On the basis of recent results in statistical decision theory, this paper presents a new algorithm for estimating σ_0 when the signals are less present than absent and have unknown probability distributions. The bias, the consistency and the minimum attainable mean square estimation error of the estimator we propose are still unknown. However, experimental results are very promising. When the minimum-probability-of-error decision scheme for the non-coherent detection of modulated sinusoidal carriers in independent AWGN is tuned with the estimate instead of the true value σ_0 , the binary error rate obtained tends rapidly to the optimal error probability after a few hundred observations [C10809]

"Alternative Constraint Strategies to the Esmi Algorithm in Radar Systems"

This paper considers interference cancellation in radar systems when the signal environment is non-stationary and focuses on the extended sample matrix inversion algorithm (ESMI) first proposed by Hayward (1996). An explicit expression of the signal to noise plus interference ratio (SINR) obtained by this ESMI algorithm is given and analyzed. Compared to the SMI algorithm, it is shown that the performance improves for mainlobe jammers but degrades for sidelobe jammers. To overcome this drawback, an alternative constraint strategy is proposed which attains the good performances of the standard ESMI algorithm whatever the position of the jammers. Finally, the explicit expressions of these SINR are compared to Monte Carlo simulations w.r.t. implementation conditions [C10810]

"Performance Analysis of 1D Scattering Center Extraction From Wideband Radar Measurements"

Performance bounds on the estimates of position, intensity and geometry parameter of scattering centers based on wideband radar measurements are presented in analytic forms. The resolution limit for wideband radar and the SNR threshold for identifying scatterer's geometry are further deduced. Though the results are obtained from the Cramer-Rao bound (CRB) matrix for damped exponentials (DE) after simplification, their validity and adaptability for geometric theory of diffraction (GTD) based scattering data have been verified by simulations [C10811]

"Efficient Wideband Spreading Function Estimation Using Arbitrary Shaped LFM Signals via Hermite Decompositions"

In active imaging, information such as range and velocity of a target can be obtained by transmitting a signal and processing the received signals. Signal processing of acoustic signals scattered from distributed targets has become an increasing attention to the researchers. The delay-scale wideband spreading function (WSF) is often used to characterize the distributed targets environment. This paper presents an efficient technique for estimating WSF using Hermite decomposition. In realistic sonar and radar, it may be necessary to detect more than one target simultaneously. Under this scenario, resolution is a major concern to be considered to separate multiple targets. This paper focuses on the applications of Hermite decomposition to efficiently compute WSF and the use of multiple transmissions to improve resolution [C10812]

"Signal Detection in Clutter Using Maximum Entropy Pdf Estimation Based on Fractional Moments"

In this paper, we introduce a new method to improve the detection performance of weak unknown radar signals in the presence of unknown clutter. We use maximum entropy (MAXENT) probability density function (PDF) estimation with a new approach based on a few sampled fractional moments (FM). These moments; i.e, their fractional orders, are obtained from the observed sample variates. Using the fractional moments instead of the integer moments the estimated PDF is quite close to the true PDF. The test statistics is a fractional polynomial of very low order of the received samples [C10813]

"Three-Way Arrays for Harmonic Retrieval: the Colored Noise Case"

In this work, we deal with multilinear representations of an harmonic process composed by a mixture of complex

sinusoids contaminated by a colored Gaussian noise of unknown probability density function. high-order statistics, and in particular fourth-order cumulants (FOC), are popular tools to mitigate the effect of the colored noise and can be viewed as a natural enhancement of the noisy mixture. As the FOC of an harmonic process is a multilinear function, it seems natural to map this quantity onto a structured multi-way array (aha. tensor). However, an harmonic process can be understood as a pure stationary random process or as a deterministic process corrupted by a stationary noise. In this paper, we explore the relation existing between these two models in the context of the multilinear decomposition theory [C10814]

"Adaptive Radar Detection of Distributed Targets in Partially-Homogeneous Noise Plus Subspace Interference"

This paper addresses adaptive radar detection of distributed targets embedded in noise plus interference assumed to belong to an either known or unknown subspace of the observables. We assume that a set of noise-only data is available (the so-called secondary data). Detection algorithms have been derived modeling noise vectors, corresponding to different range cells, as zero-mean, complex normal ones, sharing the same structure of the covariance matrix up to possibly different power levels between primary and secondary data. The common structure and the power levels are unknown at the receiver. The performance assessment confirms the effectiveness of the newly-proposed detection algorithms also in comparison to previously-proposed ones [C10815]

"Target Detection in Abruptly Non-Stationary Doppler-Spread Clutter"

This paper addresses the problem of target detection in the presence of Doppler spread clutter which is neither stationary during a coherent integration time (CIT) interval nor across different range bins. This phenomenology occurs, for example, in over-the-horizon skywave HF radar where propagation through moving ionospheric inhomogeneities spreads the surface clutter and the clutter statistics can change quite abruptly during a CIT and across range bins. In these cases, the performance of conventional adaptive techniques suffers from a lack of adequate training data. The method proposed here breaks the full CIT into smaller sub-CIT's which are then extrapolated using low order AR models. The Doppler spread clutter is thus effectively modeled as an abruptly time varying autoregressive (ATVAR) process. Subsequent Doppler processing and coherent combining of the extrapolated sub-CIT's is then performed with improved signal-to-clutter gain since only a small proportion of the sub-CIT's are corrupted by abrupt non-stationary behavior. Moreover, nearly full coherent signal gain against noise is maintained. Initial processing on experimental radar clutter data with injection of a simulated target illustrates that this approach can provide an SCNR improvement of more than 5 dB compared to conventional Doppler processing [C10816]

"Computationally Efficient Time-Varying Isar Imaging"

By exploiting the relative motion between the target and the radar, high-resolution images of moving targets can be produced using inverse synthetic aperture radar (ISAR). Recent studies have shown that accurate ISAR images can be obtained using the non-parametric high-resolution Capon and APES spectral estimators. In this paper, we propose a computationally efficient time-updating of the two-dimensional (2-D) Capon and APES spectral estimators using their inherent time-varying displacement structures. Numerical simulations indicate that the proposed implementation offers a significant reduction in computational complexity as compared to other recent implementations [C10817]

"GLRT-Based Direction Detectors in Noise and Subspace Interference"

In this paper we propose decision schemes to distinguish between the H_0 hypothesis that range cells under test contain disturbance only (i.e., noise plus interference) and the H_1 hypothesis that they also contain signal components along a direction which is a priori unknown, but constrained to belong to a given subspace (H) of the observables. The disturbance is modeled in terms of complex normal noise vectors plus deterministic interference assumed to belong to a known subspace (J) of the observables. At the design stage we resort to either the plain generalized likelihood ratio test (GLRT) or the two-step GLRT-based design procedure. Moreover, we assume that a set of noise only (secondary) data is available. A preliminary performance analysis, conducted by resorting to simulated data, shows that the one-step GLRT performs better than the two-step GLRT-based design procedure [C10818]

"A Joint Estimation Algorithm for Multiple Sinusoidal Frequencies"

Accurate estimation of sinusoidal frequencies from noisy observations is an important problem in many applications including radar, sonar, and data communications. Among many algorithms is the iterative filtering algorithm (IFA), proposed by Kay, which provides a computationally simple procedure yet capable of accurate

frequency estimation especially at low signal-to-noise ratio (SNR). However, the convergence and other numerical/statistical properties of IFA have not been established beyond simulation. This paper makes several important contributions: (a) it shows that the poles of the AR filter must be reduced via a shrinkage parameter to accommodate possibly poor initial values; (b) it shows that the AR estimates in each iteration must be bias-corrected to produce more accurate frequency estimates; a closed-form expression is provided for bias correction; and (c) it shows that for a sufficiently large sample size, the resulting algorithm, called new IFA, or NIFA, converges to the desired fixed-point which constitutes a consistent frequency estimator. Numerical examples, including a radar data example, are provided to demonstrate the findings [C10819]

"Estimation of the Coherence Function with the MVDR Approach"

The minimum variance distortionless response (MVDR), originally developed by Capon for frequency-wavenumber analysis, is a very well established method in array processing. It is also used in spectral estimation. The aim of this paper is to show how the MVDR method can be used to estimate the magnitude squared coherence (MSC) function, which is very useful in so many applications but so few methods exist to estimate it. Simulations show that our algorithm gives much more reliable results than the one based on the popular Welch's method [C10820]

"An Algorithm for Parameter Estimation of Multicomponent Chirp Signals"

This paper presents an algorithm for estimating the parameters of multicomponent chirp signals. The estimator is based on the cubic phase function (CPF), which is efficient to estimate the parameters of monocomponent polynomial phase signals (PPS) with order is less than or equal to 3. When the CPF is dealing with multicomponent chirp signals, the spurious peaks arise and thus the identifiability problem occurs. A new approach based on the transformation called product cubic phase function (PCPF) is proposed to remove this problem. This estimator offers a number of advantages with respect to CPF including improved noise rejection, suppression of cross terms, and elimination of spurious peaks. The algorithm is verified by simulation results [C10821]

"A Quartic Algorithm For Squint Sar Imaging"

In this paper some improvements of non-linear chirp scaling (NCS) approach are proposed and a modified algorithm based on the NCS is described. The improvements include three main aspects. A quartic polynomial model is adopted to represent SAR signal in range-Doppler domain and 2-D frequency domain to improve precision. A constant scaling factor is employed to replace the reference frequency in the NCS, which makes NCS more flexible. A second chirp scaling operation is added to the end of the NCS so as to remove scaling effect on range direction of SAR image. Those improvements make NCS applicable to process highly squinted SAR data from a large range swath at a fine resolution [C10822]

"Cramer-Rao Bound Analysis on Multiple Scattering in Multistatic Point Scatterer Estimation"

The resolution improvements of time reversal methods through exploiting nonhomogeneous media have attracted much interest recently with broad applications, including the destruction of kidney stones, underwater acoustics, radar, detection of defects in metals, communications, and mine detection. In this paper, we analyze the effect of inhomogeneity generated by multiple scattering among point scatterers under a multistatic sensing setup. We derive the Cramer-Rao bounds (CRBs) on parameters of the scatterers and compare the CRBs for multiple scattering using the Foldy-Lax model with the reference case without multiple scattering using the Born approximation. We find that multiple scattering could significantly improve the estimation performance of the system. For the case where multiple scattering is not possible, e.g., where only a single target scatterer exists in the illuminated scenario, we propose the use of artificial scatterers, which could effectively improve the estimation performance of the target despite a decrease in the degrees of freedom of the estimation problem due to the introduced unknown parameters of the artificial scatterers. Numerical examples demonstrate the advantage of the artificial scatterer [C10823]

"An Improved Partial Adaptive Narrow-Band Beamformer Using Concentric Ring Array"

Partial adaptation is often used to reduce the computation and improve the tracking ability of an adaptive array. In some practical situations, the received signal to be processed contains some interferences whose characteristics are known. The previously proposed partially adaptive concentric ring array is not able to utilize the prior information of known interferences without sacrificing the number of degrees of freedom, which causes higher steady state error and smaller number of interferences that can be cancelled. We propose in this paper an improved partially adaptive concentric ring array that can utilize the prior knowledge to improve the performance and maintain the same number of degrees of freedom. The proposed method designs the non-

adaptive weights to remove the known interferences, and is shown to provide much faster convergence speed and lower steady state error than the original method [C10824]

"A Non-Search Optimal Control Solution for a Team of MUAVS in a Reconnaissance Mission"

We consider a team of miniature unmanned air vehicles (MUAVs) in a multi-static radar scenario. Time delay and Doppler measurements made at the UAVs are transmitted to a base station which is tracking a target. The base then transmits heading commands to the MUAVs to reduce the tracking error. Optimal solutions that attempt to minimise a function of the error covariance or maximize the observability of the system are computationally difficult to implement. We present a simpler approximate method that yields a closed-form solution and performs comparably to the optimal approaches [C10825]

"Waveform Scheduling in Wideband Environments"

The time-variation due to Doppler scaling effects, coupled with scattering due to multipath propagation, can severely limit the performance of wideband systems. In this paper, we examine the dynamic configuration of transmitted waveforms for agile sensing to increase tracking performance in wideband environments. Using wideband frequency modulated waveforms, we present an algorithm for predicting the mean square tracking error and selecting the waveform that minimizes it in a target tracking application with a nonlinear observations model. The algorithm is based on the Cramer-Rao lower bound on the measurement errors that is computed using the wideband ambiguity function. Using simulations, we demonstrate the improved performance provided by scheduling over fixed configurations [C10826]

"Fast Incremental Techniques for Learning Production Rule Probabilities in Radar Electronic Support"

Although Stochastic context-free grammars appear promising for recognition of radar emitters, and for estimation of their respective level of threat in radar electronic support systems, well-known techniques for learning their production rule probabilities are computationally demanding. In this paper, three fast incremental alternatives, called graphical EM (gEM), tree scanning (TS), and HOLA, are compared from several perspectives-perplexity, generalization error, time and space complexity, and convergence time. Estimation of the execution time and storage requirements allows for the assessment of complexity, while computer simulation using a radar pulse data set allows to assess the other performance measures. Results indicate that gEM and TS may provide a greater level of accuracy than HOLA, and that computational complexity may be orders of magnitude lower with HOLA. Furthermore, HOLA is an on-line technique that allows for incremental learning of probabilities to reflect changes in operational environments [C10827]

"Robust Audio Watermark Decoding by Supervised Learning"

Most of the watermark (WM) decoding schemes use correlation-based methods because of their simplicity. In these methods, the WM signal embedded through a secret key is assumed as uncorrelated with the host signal. This is a hard restriction that can never be achieved and correlation between the received signal and the secret key becomes greater than zero even though the received signal is un-watermarked. Mostly a decision threshold specified semi-automatically is used at the decoding site. Since the audio watermarking is a nonlinear process that guarantees the inaudibility, there is no analytic way of determining an optimal threshold value that makes the WM decoding problem harder. This paper introduces a learning scheme followed by a nonlinear classification thus eliminates the threshold specification problem. The decoding process is modelled as a three-class classification problem and support vector machines (SVMs) are used in the learning of the embedded data. The decoding and detection performances of the developed system are greater than 98% and 95%, respectively. When the watermark-to-signal-ratio (WSR) is higher than -30 dB, system false alarm ratios remain less than 2%. It is shown that the introduced WM decoding method is robust to additive noise and most of add/remove and filter attacks of StirMark [C10828]

"STAP for Clutter and Interference Cancellation in a Hf Radar System"

An alternative skywave line-of-sight (SkyLOS) high frequency radar architecture has been proposed for early detection and tracking of ballistic missiles. It consists of a skywave over-the-horizon (OTH) radar augmented by one or more ground-based systems for line-of-sight reception in the illuminated region. The line-of-sight systems provide additional Doppler-time profiles of the target with different observation geometry to improve flight trajectory estimation. Targets compete for detection against powerful clutter and interference from manmade and natural sources. We introduce a practical STAP technique to deal with operational signal environments and demonstrate its performance on live SkyLOS data [C10829]

"SOI-KF: Distributed Kalman Filtering With Low-Cost Communications Using The Sign Of Innovations"

We derive and analyze distributed state estimators of dynamical stochastic processes, whereby low communication cost is effected by requiring the transmission of a single bit per observation. Following a Kalman filtering (KF) approach, we develop recursive algorithms for distributed state estimation based on the sign of innovations (SOI). Even though SOI-KF can afford minimal communication overhead, we prove that in terms of performance and complexity it comes very close to the clairvoyant KF which is based on the analog-amplitude observations. Reinforcing our conclusions, we show that the SOI-KF applied to distributed target tracking based on distance only observations yields accurate estimates at low communication cost [C10830]

"Optimal Threshold Policies for Hard-Kill of Enemy Radars With High Speed Anti-Radiation Missiles (HARMS)"

In modern network centric warfare (NCW) there is a dedicated platform (airplane) assigned to every group of aircraft that specializes in the hard-kill of the enemy guidance-radars by deploying high speed anti-radiation missiles (HARM)s. In this paper we consider the problem of optimal launch control of the HARMS. We formulate the optimal trade-off between the cost of the HARMS and the latency in performing the hard-kill of the enemy radar as a partially observable Markov decision process (POMDP). Next, by reformulating this POMDP as a Markovian search problem, we prove that optimal missile launch control policies are threshold-based policies in nature. We then present optimal threshold policies that unlike their POMDP counterparts are computationally efficient and inexpensive to implement in real time combat systems. Numerical results demonstrate the effectiveness of these threshold based missile deployment algorithms [C10831]

"Radar Signal Classification Using Pca-Based Features"

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, though widely reported by remote-sensing researchers, has not been exploited much by automatic target recognition (ATR) community. In the present paper, PCA has been used in SAR-ATR using the MSTAR data base, and comparison has been made with the conventional conditional Gaussian model based Bayesian classifier (M.D. DeVore and J.A. O'Sullivan, 2002). The results have been compared based on percentage of correct classification, receiver operating characteristics (ROC), and performance with limited amount of training data. By all standards of comparison, the PCA based classifier was observed to outperform the conditional Gaussian model based Bayesian classifier (CGBC) or at the worst it performs at par. And given the computational and algorithmic simplicity of PCA based classifier, the new algorithm was concluded to be a highly prospective candidate for real time ATR systems [C10832]

"Channel Phase Estimate in Time Variant SIMO Systems"

This paper introduces a novel ML based approach to channel identification for time variant SIMO (single input multiple output) systems fed by a stochastic process. We focus on the particular case where the unknowns are represented by the channels phases, that find applications in radar interferometry. Starting from the rigorous formulation of the ML estimator, we derive an approximation that makes use of mixers and FIR filters only. The computational efficiency and the robustness versus model errors of the resulting estimator make it suitable for its implementation is an adaptive framework. An application in topography reconstruction from real SAR (synthetic aperture radar) data is presented [C10833]

"Nonlinear Fusion of Multiple Sensors with Missing Data"

We introduce a new algorithm, multiple imputation particle filter, to solve the problem of data fusion with missing data in nonlinear state space models. The new algorithm is then applied to the problem of fusing observations by multiple asynchronous radars. Simulated data is used demonstrate the effectiveness and performance of the fusing algorithm [C10834]

"Analysis of the Degradation in Source Location Accuracy in the Presence of Sensor Location Error"

It is well known that sensor location uncertainty can seriously deteriorate the source location accuracy. In this paper, we provide the analysis of how much degradation the source location accuracy is expected to be with respect to the amount of sensor location error. We first derive the source location MSE when the estimator assumes no sensor location error but in fact there is. Then, the CRLB is evaluated and compared with the one

without sensor location error. The analytical results allow us to decide whether a new algorithm to account for the sensor location error is necessary to improve the source location accuracy [C10835]

"A Monte-Carlo Method for Initializing Distributed Tracking Algorithms"

Distributed processing algorithms are attractive alternatives to centralized algorithms for target tracking applications in sensor networks. In this paper, we determine an initial probability distribution of multiple target states in a distributed manner to initialize distributed trackers. Our approach is based on Monte-Carlo methods, where the state distributions are represented as a weighted set of discrete state realizations. The filter state vector consists of the target positions and velocities on the 2D plane. Our approach can determine the state vector distribution even if the individual sensors alone are not capable of observing it. The only condition is that the network as a whole be able to observe the state vector. A robust weighting strategy is formulated to account for missed detections and clutter. To demonstrate the effectiveness of the algorithm, we simulate a network with direction-of-arrival nodes and range-Doppler nodes [C10836]

"Sar Images Improvements by Using The S-Method"

Synthetic aperture radar processors are generally made with the stationary targets in mind, hence commonly used technique for the SAR signal analysis is a two-dimensional Fourier transform. Moving targets induce Doppler-shift and Doppler spread in the returned signal, producing blurred or smeared images. Standard techniques for these kinds of the problems are motion compensation and time-frequency analysis application. Both of them are computationally intensive. Here, we will present a numerically simple S-method based approach, already applied in the ISAR imaging. This approach improves readability of the SAR images what will be analytically proved and demonstrated on the simulated SAR setup [C10837]

"A Real-Time Optimal Resource Allocation Approach in a Radar System"

Recent studies have focused on the problem of resource allocation in systems in which multiple applications contend for multiple resources in order to satisfy their application level requirements. Q-RAM assumes a system with multiple concurrent applications, each of which can operate at different levels of quality based on the system resources available to it. The goal of the model is to be able to allocate resources to the various applications such that the overall system utility is maximized under the constraint that each application can meet its minimum needs. However, Kuhn-Tucker optimality conditions are not satisfied at the result of the Q-RAM approach, which is based on Kuhn-Tucker conditions. In this work Q-RAM approach is modified and a new algorithm is proposed. Results of the modified Q-RAM algorithm (MQ-RAM) satisfy the Kuhn-Tucker optimality conditions. The performance of the MQ-RAM algorithm is compared with that of Zoutendijk algorithm. A simplified radar optimization problem is solved by proposed optimization approach [C10838]

"Image Watching System with Remote Direct Based on Mobile Communication"

Nowadays mobile communication has become widespread. Mobile phones are used not only voice communication but also to send different data types (voice, image, text), for entertainment (listening music, playing games), for remote access and remote control. Now, mobile phones have become handy computers. The mobile phone manufacturers which stand in competition with each other have begun to put on the market new models which have new capabilities. Mobile phones software development market has grown up with these developments. The developers who interested in this technology must challenge with many obstacles. One of these obstacles is the documentation shortness. By passage of time this technology will become prevalent and samples codes and documents will increase. In this way development time period will decrease and costs will drop [C10839]

"Seismic Imaging and Detection of Underground Tunnels"

To investigate the problem of detecting and imaging underground tunnels, an experimental system that utilizes seismic waves has been constructed. Seismic reflections from the tunnel are transformed into a 3D image using a synthetic aperture time- delay backprojection algorithm. Results from experimental data show that the tunnel is directly visible in the backprojected image. Nevertheless, tunnels with low signal to noise ratio (SNR) are located using 2D and 3D Radon Transforms followed by a detection algorithm. A simulation is performed on the performance of the Radon transform for detecting lines in noisy images and it is shown how lines in very low SNR images can be detected. Also it is observed that longer lines have higher probability of detection at the same noise level. [C10840]

"Airborne Multi Function Electronically Scanned Array Radar Simulation"

Multifunction (multimode) phased array radars are used for ground, air or maritime surveillance. Electronic scanning feature of these radars provide fast and accurate beam direction as well as short sampling intervals. In this paper, simulation of an airborne multifunction electronically scanned array (ESA) radar (MFESA) is presented [C10841]

"Performance Improvement of Track Initiation Algorithms with the Incorporation of Doppler Velocity Measurement"

In this study, to obtain the analytical expressions of false track initiation probability, elevation and Doppler velocity measurements extracted by a phased array radar are incorporated for the first time into the commonly used track initiation algorithms. With this study, the measurement set is expanded from a merely range and azimuth to include elevation and Doppler velocity. The analytical expressions of false track initiation probability depend on the parameters of the signal processing unit of the phased array radar, such as false alarm probability, true detection probability, signal-to-noise ratio and detector threshold. Furthermore, such expressions remove the necessity of very time-consuming simulations. The results indicate that using position and Doppler velocity measurements provide a reduction of false track initiation probability by a factor of 9 to 34 depending on the value of velocity and acceleration thresholds while supplying the design criterion of the true track initiation probability, $g_{0.7}$ [C10842]

"Electronic Warfare Support Measures (ESM) Subsystem Model in a Simulated Tactical Environment"

In this study, an airborne electronic warfare support measures (ESM) subsystem model in a simulated tactical environment and the used algorithms and techniques in this model are described. The software is developed as a subcomponent of an extensively simulated tactical environment. The simulation includes the modeling of the motion of the air, land and maritime vehicles and modeling of the radar, ESM, and the data link subsystems on an air vehicle. The developed ESM model is also capable of responding to the defined operator commands and used for training of the operator [C10843]

"Simulation of Real Beam Ground Mapping Mode of a Pulsed Radar"

A Matlabcopybased realistic simulation software is developed for real beam ground mapping (RBGM) mode of a pulsed airborne radar. The developed software successfully simulates the effects of basic radar parameters for the real beam mapping mode. A zero level digital terrain elevation data (DiTED) is used for terrain model. Radar return is calculated for a stationary antenna at a given height from the ground and tilt angle. Simulations can represent the effects of terrain occulting, shadowing, incidence angle depended scattering, range attenuation, antenna parameters (pattern, gain, beam width e.g.) and transmitter parameters (frequency, output power, pulse width, PRF e.g.) on radar returns for both sector and circular scans [C10844]

"Digital Audio Watermarking by Learning in Wavelet Domain"

Most of the watermark (WM) decoding schemes use correlation-based methods because of their simplicity. Generally, a decision threshold specified semi-automatically is used at the decoding site. The main problem of the correlation-based decoders is the existence of undesirable correlation between the embedded signal and the host signal that makes the decision threshold specification harder, especially in noisy channels. In this paper, WM decoding is modeled as a pattern recognition problem, thus eliminates the threshold specification problem by learning the embedded data in wavelet domain followed by a nonlinear classification. Furthermore, the encoding performance is improved by perceptual control of Watermark-to-Signal-Ratio (WSR) without disturbing imperceptibility. When the WSR is higher than -30 dB, the decoding and detection performances of the developed system are greater than 99% and 98%, respectively. System false alarm ratios remain less than 2% [C10845]

"Effect of Mutual Coupling on the Performance of Adaptive Arrays"

In this study, performance of the array signal processing algorithms which are used for interference mitigation in radar and communication systems is analyzed while regarding the electromagnetic properties of the antenna elements. In real world applications electromagnetic characteristics of the antenna array have very significant effect on the performance of the algorithms and sometimes may cause a complete fail of the process. In the paper, particularly, effects of the mutual coupling are presented. Performances of the Schelkunoff array synthesis method, least-squares (LS) method and the least mean square (LMS) algorithms for interference suppression in adaptive array with dipole elements are analyzed. Null depth, nulling bandwidth, signal to interference plus noise ratio (SINR) and the changes in the fundamental properties of the array pattern are observed for different

scenarios [C10846]

"Locating Subsurface Targets Using Minimal GPR Measurements"

This paper describes a novel approach which finds probable target areas in ground penetrating radars (GPR) with minimal number of measurements. A subsurface GPR target creates a hyperbolic signature in the space-time domain. Conventional algorithms use these signatures to image and detect subsurface targets. Our approach uses the time delay differences (TDD) in consecutive GPR A-Scan measurements to localize the target. For further reduction of measurement numbers regions of low target probability are determined to eliminate redundant measurements. Results from the experimental data from a model mine field show that the target positions can be found accurately using much fewer measurements than the conventional imaging algorithms [C10847]

"Near Field Parameter Estimation of Moving Sources with Recursive Expectation Maximization Algorithm"

In this paper, maximum likelihood (ML) estimator is proposed for the joint estimation of the direction of arrival (DOA) and range parameters of moving sources in the near-field of the antenna array. ML estimation algorithm is presented for deterministic signal model. Recursive form of the expectation maximization (REM) algorithm is suggested for the estimation of the near-field parameters because there is not closed form solutions for the maximum likelihood functions. Moreover, simulation results of the suggested algorithm are presented [C10848]

"A New Hybrid Approach to Radar Target Classification for the Estimation of Scattering Centers"

Radar images, range profiles and scattering centers are used as feature parameters in radar target classification applications. Scattering center parameters, when used as feature parameters, enable an efficient compression of feature space compared to classical target classification methods based on radar images and range profiles. A method used for the estimation of scattering centers via cancellation of side lobes is the CLEAN algorithm. In this work, model based Prony, MUSIC, ESPRIT and evolutionary based CLEAN methods are applied for the estimation of scattering centers. A hybrid method is proposed which improves the convergence of evolutionary based CLEAN. Scattering centers which are estimated by aforementioned methods are classified using correlation based matching score method, Bayes classifier and artificial neural networks. Classification is accomplished using simulated data of four different aircraft models created by the point target model at different frequency bands and aspect angles [C10849]

"Development of a MATLAB Based Target Tracking Simulation Environment"

A simulation environment for tracking of maneuvering targets in clutter is developed in MATLAB. The simulation environment allows to generate 2-dimensional surveillance radar measurements and to run various target tracking algorithms on these measurements. As a first simulation example, IMM-NNJPDA algorithm, which incorporates NNJPDA data association and IMM filter structure, is implemented and the performance of this algorithm is investigated in an example scenario. By this simulator, in the future, it is aimed that statistical test and evaluation of different radar sensors, scenarios, target tracking methods and data fusion architectures will be performed [C10850]

"Separation of Skewed Alpha-Stable Sources Using Minimum Dispersion Criterion"

In this work, we extend the method which separates symmetric alpha-stable sources using minimum dispersion criterion to the case of skewed alpha-stable mixtures. Thus, a more robust method based on fractional lower order statistics is developed which is capable of separating general alpha-stable sources [C10851]

"Data Extrapolation Based CLEAN Algorithm for One Dimensional Scattering Center Extraction"

A novel scattering center extraction algorithm based on data extrapolation and continuous parameter genetic algorithm (CGA)-based CLEAN is presented. The frequency domain data is extrapolated using AR modeling to obtain high resolved range profiles and then initial estimates of scattering centers obtained from the peaks of these profiles are used to increase the convergence rate of the CLEAN algorithm. Simulation results show that the proposed method requires less computation time compared to classical evolutionary programming based approaches and it has high resolution properties for limited frequency band data [C10852]

"SAR Image Edge Detection by Ratio-based Harris Method"

The presence of speckle, which modeled as a strong multiplicative noise, makes the edge detection of synthetic

aperture radar (SAR) images very difficult. The usual edge detectors using gradient yield poor results. By analyzing Harris' combined corner and edge detector, to solve the speckle-sensitivity and anisotropic response, an edge detection method used for SAR image is presented. Horizontal, vertical and diagonal ratios of averages of non-overlapped neighboring pixel values instead of gradients are used to calculate edge strength maps (ESM); then they are fused to obtain the final ESM; finally, a threshold is presented to obtain edge detection result. Analysis and experiment results illustrate that the proposed method can be used for edge detection in SAR image effectively [C10853]

"Processing Multichannel Radar Images by Modified Vector Sigma Filter FIR Edge Detection"

Some peculiarities of modified vector sigma filter are studied. In particular, its edge preservation ability is considered in case of processing multichannel remote sensing (RS) images. Such a problem is of high importance for many scene recognition and segmentation tasks. It is demonstrated through comparative quantitative and visual processing data that the proposed filter simultaneously provides efficient noise suppression and excellent edge preservation. Edge detection results that prove this fact are also depicted [C10854]

"Statistical Analysis of Sar Data in Different Vegetated Areas"

In this work, we deal with the problem of modeling SAR clutter data from different vegetated areas. We analyzed MSTAR dataset by means of histogram, moment analysis and covariance estimation. Some results are shown in this summary [C10855]

"An Interactive Software for Real-Time Simulation of Through-the-Wall Imaging Radar"

An interactive software written in Visual C# has been developed to provide real-time simulation capabilities for imaging behind the wall scenes. The software implements algorithms and techniques developed by the researchers at the Center for Advanced Communications in Villanova University, but is also amenable to house other imaging approaches. The software features a user friendly and flexible graphical interface that permits easy and interactive scene construction, from specification of the wall and array element locations to placement of objects at various locations behind the wall. All operations are performed using comprehensible dialog boxes and mouse drag-and-drop actions. For illustration, we present an example that demonstrates the usage of the real-time through-the-wall imaging radar simulator. The software serves as an educational tool for courses on radar imaging, introducing the students to the important emerging technology of through-the-wall imaging [C10856]

"Analysis of Time-Frequency Transient Components Using Phase Chirping Operator"

The instantaneous frequency law (IFL) is a very important item when the physical parameters of the corresponding signal have to be evaluated. Radar, sonar, mechanical diagnostic are just three domains where the signal's non-stationarity imposes the IFL estimation. There are several cases where the IFL is composed by fast variations. Digital phase modulations or signals emitted by electrical switches are typical examples of IFLs having fast transient parts. To deal with such kind of signals, we propose a new method based on the chirping of the phase transitions. Namely, the phase chirping operator (PCO) transforms a fast IFL variation in a chirp component. This chirp contains all the parameters about the initial variation: time, duration, covered bandwidth, etc. Results for some physical data will highlight the benefits of the PCO compared with wavelet transform and Wigner-Ville distribution [C10857]

"High Resolution – High Focused Squint-Mode Radar Imaging Using the Fractional Chirp Scaling Algorithm"

The fractional Fourier transform (FrFT), which is a generalized form of the well-known Fourier transform, has only recently started to appear in the field of signal processing. This has opened up the possibility of a new range of potentially promising and useful applications. In this paper we apply the new FrFT-based chirp scaling algorithm (CSA) to a high resolution-high focused synthetic aperture radar (SAR) imaging and compare its performance with the classical CSA based on the fast Fourier transform (FFT). Simulation results show that the FrFT-based CSA can offer significantly enhanced features compared to the classical FFT-based approach [C10858]

"Detection of Multiple Heartbeats Using Doppler Radar"

Doppler radar life sensing has shown promise in medical and security applications. The current paper considers the problem of determining the number of persons in a given area (e.g., a room) using the Doppler shift due to

heartbeat. The signal is weak and time-varying, and therefore poses a complicated signal processing problem. We develop a generalized likelihood ratio test (GLRT) based on a model of the heartbeat, and show that this can be used to distinguish between the presence of 2, 1, or 0 subjects, even with a single antenna. We further extend this to N antennas. The results show that one can expect to detect up to $2N-1$ subjects using this technique [C10859]

"Unsupervised Segmentation Of Non Stationary Images With Non Gaussian Correlated Noise Using Triplet Markov Fields And The Pearson System"

The hidden Markov field (HMF) model has been used in many model-based solutions for image segmentation, and generally gives satisfying results. However, when the class image is non stationary, the unsupervised segmentation results provided by HMF can be poor. In this paper, we propose a new model based on triplet Markov fields (TMF) and the Pearson system which enables one to deal with non stationary hidden fields and correlated, possibly non Gaussian noise. Moreover, the nature of marginal distributions of the noise can vary with the class. We specify a new general parameter estimation method and apply it to unsupervised Bayesian image segmentation [C10860]

"Calculation of the Intercept Geometries for Engagement"

One of the fundamental functions of the radar systems is weapon control. (The weapon terminology stands for any asset in the tactical environment like a fighter jet, bomber, etc) Recent aircrafts are equipped with their onboard radars. These radars have narrow viewing area and short range compared to the surveillance radar systems. Due to these shortcomings of the weapon radars or some malfunctions, weapons require guidance assistance from the surveillance radar systems. There are three weapon control schemes which are "close", "loose" and "broadcast" control. This paper discusses the intercept geometries which are associated with "close control" hence other control types are beyond the scope of this paper. Close control intercept geometries are calculated in a manner to guide the weapon to a specified location or a moving target. When a change in the target kinematics occurs the calculated geometry becomes invalid and therefore geometry calculations have to be refreshed at every radar update. Four attack options for the intercept geometries are realized: Cutoff, Pursuit, Stern and Stern Conversion. These attack options result in different types of geometries and the implementation of these geometries and error analysis of the implementation constitute the scope of this paper [C10861]

"Simulation Based Multisensor Data Fusion Tool"

In this paper, a generic and expandable rule-based fusion tool on a command control system is presented. The main objective of our fusion tool is to execute a generic, user-friendly information fusion process via a database using rules, which can be defined during run time [C10862]

"Modelling of IFF Capability of an Airborne Multi Function Phased Array Radars"

Applications of multi function phased array radars include but not limited to air surveillance, air traffic control and target tracking. Recent developments have made it possible to add IFF (identification friend or foe) capability to these radars. In this paper, simulation model of the IFF capability of an airborne multi function phased array radar is presented [C10863]

"Signal Processing in Passive Multistatic Tracking Radars"

A passive multistatic radar system that tracks airborne targets in cartesian coordinates by using sound/picture carrier etc. signals of VHF/UHF-band, commercial television (TV) signals as the illuminator is proposed. This system comprises four separately-located passive receiving stations that calculate the Doppler shifts on the carrier arising from target dynamics and a central tracking station that processes these data with an extended Kalman filter (EKF) to estimate the velocities and positions of the target. The fact that the system does not emit signals provides covertness and immunity against potential counter-measures; on the other hand the fact that the system is multistatic and that operates at VHF/UHF band provides effectiveness against targets that use stealth techniques. In this work, principles of the proposed system are given and a simulation in which a randomly maneuvering target is tracked with the extended Kalman filter is demonstrated [C10864]

"Multifunction Radar Resource Management: Simulation Approach"

In this work, a simulation approach is presented for resource management in multifunction radar (MFR). A task scheduling model for changing tactical scenarios is composed. In particular, we are concern with improving the search and track functions. An architectural design approach is proposed and a simplified scenario is given in the experimental results section [C10865]

"Synthetic Aperture Radar Imaging from Wide-Angle Data with Frequency-Band Omissions"

We consider the problem of wide-angle synthetic aperture radar (SAR) imaging from data with arbitrary frequency-band omissions. We propose an approach that involves composite image formation through combination of subaperture images, as well as point-enhanced, super-resolution image reconstruction. This framework provides a number of desirable features including preservation of anisotropic scatterers that do not persist over the full wide-angle aperture; robustness to bandwidth limitations and frequency-band omissions; as well as a characterization of the aspect dependence of scatterers. We demonstrate the effectiveness of the proposed approach through experiments based on electromagnetically simulated realistic data [C10866]

"Methods for Analysis of LPI Radar Signals"

LPI (low probability of intercept) radars occupy wide frequency bands and have very low peak power so they are difficult to be detected by hostile intercept receivers. Hostile radiometric receivers are not able to intercept and measure the parameters of LPI signals which lie in wide frequency bands. In this study, four different methods for the analysis of LPI signals; zero-crossing method, short time Fourier transform (STFT), Wigner-Ville distribution (WVD) and cyclostationary signal analysis method are investigated and their performances on LPI signals are presented by utilizing computer simulations [C10867]

"Direct RF sampling employing time-skewed analog to digital converters and complex finite impulse response filters"

This paper presents an approach to directly sample and baseband an RF signal without the use of mixers. The technique utilizes an array of time-skewed analog to digital converters (ADC) combined with complex finite impulse response (FIR) filters to provide digital I and Q samples of the complex envelop of the RF signal. Since the process is complex, the analog to digital conversion rate need only be commensurate with the signal bandwidth, and not the carrier frequency. This device is referred to as a complex analog to digital converter, or simply, CADC. The CADC is based on the use of FIR filters with complex coefficients. These can be used to filter and demodulate a sampled signal of arbitrary bandwidth to baseband-without the use of a demodulator or mixer. The CADC uses aliasing to effectively demodulate the signal of interest to baseband, which obviates the complex demodulators often used in sampled data systems. For high frequency applications, such as radar, this can eliminate the need for analog mixers often used to mix frequencies to an intermediate frequency (IF) prior to analog to digital conversion. Since the conversion rate need only be commensurate with the signal bandwidth, slower ADCs can be used with respect to other direct RF sampling methods. These slower ADCs tend to have more effective number of bits (ENOB) than those which operate at higher rates, resulting in the wider dynamic range often desired in radar applications. The CADC architecture is more immune to ADC matching errors such as amplitude, phase, and DC offset, which are often encountered with the more traditional time-interleaved ADC arrays. The CADC also reduces the impact of jitter and quantization noise because of its filtering characteristics. The filtering thus acts to increase the ENOB over that of each ADC. [C10868]

"An analysis between radar interferometry and sonar interferome-"

This paper is an attempt to compare two interferometric processings. The first one is applied to traditional space-borne radar (SAR) and the second on recent interferometric sonar data. Few comparisons between those techniques have already been made, despite the fact that they share many similar principles, only a. Thus, the key idea of this article is to present both techniques with assets, drawbacks and specific "tricks" used in data processing. The first part introduces briefly both sensors and compares signal and processing techniques used for both of them. The second part deals with interferometry, and more precisely with underwater and satellite interferometry. Then a noise-pollution analysis is performed on both techniques followed by bias removal methods for getting interferometric information. The conclusion summarizes the similarities between sonar & radar processing, pointing at the techniques that can be applied to both [C10869]

"Medeling of propagation of electromagnetic waves in forest media Application to detection and localization of targets"

In this paper, we study the propagation of electromagnetic waves in forest media in UHF and VHF frequency bands. We propose a full wave coherent method that allows computing the electric field everywhere in the medium and for any kind of transmitting antenna. Using the data given by the model, we develop two methods in order to detect and localize a metallic target in the medium. The first one is based a monostatic SAR imaging algorithm, the second one is based on a DORT method associated with MUSIC algorithm [C10870]

"Quality Measures for Lidar Signal Processing"

This paper presents a consistent derivation of quality measures for lidar signal processing used to obtain a representation of dynamic traffic scenes for driver-safety applications. These quality measures evaluate both the individual tracks and the description of the complete scene. This evaluation is crucial since subsequent processing steps, such as warnings or actions, rely on the results of the preceding signal processing. In our approach each processing step is formulated in mathematical terms and then is evaluated using a probabilistic approach. In a subsequent step the individual quality measures are incorporated into one quality measure evaluating the overall signal processing for the individual tracks. Finally, the description of the complete scene is evaluated on the basis of the individual tracks' quality measures. This approach has been implemented and tested on real lidar data and has proved to give a reliable measure of the signal processing quality [C10871]

"A Neural Network Approach for the Inversion of Multi-Scale Roughness Parameters and Soil Moisture"

The overall objective of this paper is to retrieve soil surfaces parameters namely, roughness and soil moisture related to the dielectric constant by inverting the radar backscattered signal from natural soil surfaces. Because the classical description of roughness using statistical parameters like the correlation length doesn't lead to satisfactory results to predict radar backscattering, we used a multi-scale roughness description using the wavelet transform and the Mallat algorithm. In this description, the surface is considered as a superposition of a finite number of one-dimensional Gaussian processes each one having a spatial scale. A second step in this study has consisted in adapting a direct model simulating radar backscattering namely the small perturbation model to this multi-scale surface description. We have investigated the impact of this description on radar backscattering through a sensitivity analysis of backscattering coefficient to the multi-scale roughness parameters. To perform the inversion of the small perturbation multi-scale scattering model (MLS SPM) we used a multi-layer neural network (NN) architecture trained by a backpropagation learning rule. The inversion leads to satisfactory results with a relative uncertainty of 8% [C10872]

"Rigid Body Based Location Technology for Ad Hoc Sensor Networks"

As an optimization problem, precision location requires sufficient constraints to warrant unique location estimation. The algorithm to determine the constraint sufficiency is the locatability algorithm. For the classic triangulation in two dimensions, locatability algorithm examines if a sensor node has at least 3 non-collinear reference node (RN) neighbors. This condition is often not met in most ad hoc sensor networks due to the low RN density. Progressive location was developed to turn a located sensor node into an induced RN which in turn is used to locate other sensor nodes. But even after applying progressive location, a lot of sensor nodes are still left un-locatable. A holistic approach, the rigid body (RB) based location technology, is proposed to group together sensors and RNs in a sensor network to form globally rigid bodies (GRBs) and cooperatively estimate sensor locations. The key differentiator of the technology is its locatability algorithm, a bottom-up procedure to identify GRBs in an anchor-free network and to determine the locatabilities of GRBs by grounding the network. The algorithm consists of four processes (node categorization, bilateration extension, trilateration extension, and tri-connectivity test) and locatability rules. It is shown that a bilateratively rigid sub-network is a strongly rigid graph and requires only the tri-connectivity to become globally rigid. Rules are provided for the locatability determination of rigid bodies and their associated sensor nodes. Simulation results show that the RB-based location algorithm locates drastically more sensor nodes than triangulation and progressive location algorithms especially when RNs are sparse [C10873]

"3D Map Building Based on Stereo Vision"

In this paper, we present a 3D map building method based on stereo vision for autonomous land vehicle (ALV). We achieve the 3D coordinates under the camera coordinate system (C-CS) from the disparity map. Then we develop the conversion between the C-CS and the ALV coordinate system (ALV-CS) to acquire the local 3D map which reflects the actual scene basically. And the method is highly real-time and meets the need of ALV navigation. Furthermore, combined with the binocular stereo vision system, the error of the method is analysed based on the 2D prediction error from camera calibration and the disparity error from stereo matching, and the error item that describes the depth error between the built data of the scene point and the actual one is computed. The experiment to compensate the built 3D map is done and the result shows that the item can improve the precision of 3D map effectively. Then combined with information from INS and GPS, a global 3D map that reflects the actual scene, is built based on local 3D map [C10874]

"Resource allocation policies for aggregated QoS enabled pipes in multi-domain IP environment"

Next generation Internet should offer support for end to end (E2E) multimedia services with quality of services

(QoS) guarantees. In IP multi-domain environment this is still an open issue. One method to solve the E2E QoS problem in scaleable manner is to establish multi-domain end to end aggregated (in the core part of the E2E chain) paths having controlled QoS characteristics. The resources for these pipes should be allocated and installed in each domain by the domain managers. The instant of actual allocation decision in one domain may be in advance or after getting responses from the downwards domains. This paper focuses on such specific aspects, in the framework developed in the research project ENTHRONE IST-507637. It studies several allocation methods, from point of view resource utilization degree of resources versus the amount of required signalling when considering a whole chain of domains. The proposed method is currently implemented in the research project mentioned above [C10875]

"Simulation of Automotive Radar Target Lists using a Novel Approach of Object Representation"

The development of radar signal processing algorithms for target tracking and higher-level automotive applications is mainly done based on real radar data. A data basis has to be acquired during cost-expensive and time-consuming test runs. For a comparably simple application like the adaptive cruise control (ACC), the variety of significant traffic situations can sufficiently be covered by test runs. But for more advanced applications like intersection assistance, the effort for the acquisition of a representative set of radar data will be unbearable. In this paper, we propose a way of simulating radar target lists in a realistic but computationally undemanding way, which will allow to significantly reduce the amount of real radar data needed [C10876]

"Dynamic Load Balancing for Multiple Processors"

This research is motivated by the needs of dwell scheduling over multiple transmitters/receivers in many real radar systems. We propose a linear-programming-based approach with efficient implementations to minimize the number of radar tasks being dropped from the system and to balance workloads over multiple transmitters/receivers. A priority-based task dropping policy and an incremental version of the task assignment algorithm are proposed for task dropping and on-line implementations. The capability of the proposed algorithm is evaluated by a series of experiments, for which we have encouraging results [C10877]

"Need for large local FPGA-accessible memories in the integration of bio-inspired applications into embedded systems"

Advanced Principles Group (APG) has developed a reconfigurable computing board (RCB) based on the Xilinx Virtex-II Pro FPGA family, potentially capable of 1.5-2.0 TeraOps of compute power, 100 Gbps I/O on front panel, 4 Gbps I/O on backplane, as well as containing more than 4 GBytes of on-board memory. Computationally complex applications such as software-defined radio, synthetic aperture radar, hyper-spectral imaging and cellular neural networks drive similar wide bandwidths and therefore require super-computing I/O and signal processing densities far exceeding the capabilities of current and future microprocessor-based system technology. We illustrate how such applications benefit from the large amount of local FPGA-accessible memory (4+ GBytes) provided on the RCB [C10878]

"An adaptive algorithm for fast identification of FIR systems"

In this paper, we develop a fast recursive algorithm with a view to finding the total least squares (TLS) solution for adaptive FIR filtering with input and output noises. We introduce an approximate inverse power iteration in combination with Galerkin method so that the TLS solution can be updated adaptively at a lower computational cost. We further reduce the computational complexity of the developed algorithm by making efficient computation of the fast gain vector. We then make a careful investigation into global convergence of the developed algorithm. Simulation results are provided that clearly illustrate appealing performances of the developed algorithm [C10879]

"Identification of the Meteorological Objects on Doppler-Polarimetric Radar Data by using Fuzzy Logic Based Algorithm"

This article deals with the process of identification of dangerous meteorological objects. Zones of aircraft icing-in-flight and atmosphere turbulence are among them. Hydrometeors, such as water droplets and ice crystals, scatter incident electromagnetic waves (EMW). In common case, Doppler-polarimetric variables of backscattered electro-magnetic field depend on the velocity, shape, size, orientation, and type of the scatterers. The problem of simulation of EMW scattering on hydrometeors is rather difficult because a lot of different parameters of scatterers and conditions of sounding should be taken into account. This research does not claim to comprehensive description of all possible solutions of this problem. The key point of this paper is placed on the possibility of polarimetric weather radar to determine the type of hydrometeors in case of homogeneous medium (scatterers of one type) and in case of mixture of different types of scatterers in an ensemble of hydrometeors.

The possibility to determine quantitatively the ratio of two types of hydrometeors is also a subject of consideration in this research. This item is especially important for providing flight safety by using both ground-based and airborne weather radars; it can be used particularly, for remote detection probable icing-in-flight zones to prevent icing-in-flight of modern aircrafts [C10880]

"Use of Neural Network for Turbulence and Precipitation Classification Procedure"

This paper describes a methodology of precipitation and turbulence classification based on radar echo signal features measured by polarimetric radar. A neural network classifier is used to distinguish between different precipitation and turbulence classes. The classification procedure takes a decision about the type of precipitation and turbulence intensity by simultaneous feature consideration. In this paper the turbulence classification using multi-parametric decision technique is described [C10881]

"Computational Model of the Doppler Spectrum of Radar Returns from Rain"

This paper presents the computational model of Doppler spectrum that considers the influence of the shape of turbulence spectrum onto the spectrum of echo-signal from rain at different intensity of turbulence and rain rate. The inertia of raindrops is taken into account. The developed approach allows calculating Doppler spectrum at different conditions. Validation with real data is done [C10882]

"Meteorological Object Characteristics Estimation with Neural Network"

An example of network application for Doppler echo-signal processing is shown. The structure of neural network for such kind of operation is studied. A classical method and neural method in the calculation of eddy dissipation rate are considered and a comparison of results is done [C10883]

"Initial demonstration of an X-band digital beamforming (DBF) receive array"

This paper presents the architecture and initial measured performance of an X-band digital beamforming (DBF) plug-and-play receive array. This processor was designed to steer four independent simultaneous beams over the entire X-band with 32 independent channels, an instantaneous bandwidth of 15 MHz, and a spur-free dynamic range of at least 65 dB. Designed using commercial-off-the-shelf (COTS) components, we achieved a vast decrease in size of the DBF processor. When compared to previous DBF systems, the system's ease in mobility and measurement accuracy greatly increases DBF's applicability towards smaller airborne platforms. Using AFRL-SNHA's in house facilities, we have begun to measure and test the plug-and-play processor's current capabilities. These measured capabilities include not only the ability to form multi-beam, uniformly illuminated broadside and scanned array patterns, but also its ability to reduce the array sidelobes, using tapered illuminations. Measurements to date have been taken using only 8 to 12 channels, but work is currently underway to utilize the processor's full capacity. However, these initial measurements and results demonstrate that this DBF processor exhibits exceptional array processing capabilities, while possessing an overall small system footprint [C10884]

"Enhanced ADS-B research"

Automatic dependent surveillance-broadcast (ADS-B) is emerging as an advanced aviation technology that provides situational awareness within the aircraft that was previously available only on the ground. Pilots and ground personnel have begun to benefit from this technology but further benefits from technological improvements can still be realized. These improvements include security, increased data capacity, and advanced applications (4D trajectory and data exchange). To this end research is currently being performed by Sensis Corporation in cooperation with NASA Glenn Research Center to provide enhancements to the ADS-B UAT (universal access transceiver) data link. The research goal is to encourage user acceptance by improving upon existing capability and usability along with providing a roadmap and demonstrations of future data link capability [C10885]

"SBR waveform and processing parameters as a function of array distortion"

Structural distortions in large antennas have impact on antenna gain, sidelobe level and adaptive interference rejection. Partial compensation for the distortion of space-based radar (SBR) phased-array antennas and array-fed reflectors can be achieved by adjusting the phase-shifter settings to compensate for the distortion, if it can be accurately measured. This approach is effective in regaining the antenna gain and sidelobe levels, but the adaptive rejection of interference and clutter is much more complex. This paper addresses the ground moving target indication (GMTI) performance for a large active electronically scanned array (AESA) at a medium-earth orbit (MEO) altitude of 10,000 km, and a maximum sinusoidal mechanical distortion of 10 cm modeled across the

horizontal aperture. To evaluate the impact of mechanical distortion on GMTI performance, the full-dimension space-time adaptive processing (STAP) matched filter (MF) and the reduced-dimension joint-domain localized (JDL) algorithms were evaluated using signal-to-interference-plus-noise ratio (SINR), SINR loss and minimum discernable velocity (MDV) as the GMTI performance metrics [C10886]

"Antenna design and beamforming for a conformal antenna array demonstrator"

The present paper gives an overview over a radar demonstrator currently under development and the design of the system's conformal antenna array front-end. Important system parameters and overall performance of the planned system are described and experimental results for reflection coefficients, mutual coupling and embedded antenna element far field patterns will be included as well as simulated pattern synthesis results for different operational modes. In addition, a circularly polarized antenna sub-array suitable for integration in double curved apertures has been developed. The structure combines multiple cavity-backed patch antennas on a circular substrate and is connected to the feed network via a single coaxial line. A conformal antenna array of spherical shape based on this technology is currently being built for beam forming experiments [C10887]

"Optimization of vertical handover decision procedure using an experimental MIPv6 testbed"

The paper presents an experimental geographical testbed used to analyze the handover performance of the mobile IPv6 (MIPv6) protocol. The analysis carried out using a current implementation of MIPv6 protocol has allowed us to identify that a relevant contribution to handover latency can be associated to the handover decision. In the standard implementation, this procedure is triggered by the layer 3 neighbor unreachability detection algorithm. To overcome this problem, we have developed and tested a kernel module devoted to the dynamic management of the network interfaces of a mobile node. The developed interface management module (IMM) works in cooperation with the mobile IPv6 implementation, extending its functionalities to better support interface selection and movement detection. The experimental performance analysis highlights the ability of the proposed IMM to reduce the vertical handover decision time [C10888]

"Resource allocation framework for distributed real-time end-to-end tasks"

Traditional resource allocation algorithms such as Q-RAM (Rajkumar et al., 1997) assume that importance (or weight) or utility values for distributed real-time tasks is a totally ordered set to measure the rewards for completing every task. Hence, resource allocation problem can be viewed as the problem of maximizing total utility values. However, in several real-time applications such as multi-function phased array radar (MFPAR) systems, totally ordered importance are not available. We develop a two-level resource allocation framework. The framework allows the schedulers for subsystems or processors in distributed realtime systems to autonomously schedule local sub-tasks and the system performance is enhanced without heavy global optimization overhead. In addition, the framework can trade the run-time overhead including time and memory space with the optimality of resource allocation. We evaluate our framework by extensive simulations for MFPAR systems. The experimental results show that the developed framework outperforms the traditional priority-based approach [C10889]

"Innovative technologies for the developments of W-band radars and communication payloads"

The present work, that has been performed in the frame of the ASI (Italian Space Agency) program WAVE (W-band analysis and verification), i.e. the identification of innovative technologies to be used for the design and development of on-board W-band radars or telecommunication payloads. The paper provides and comments on the major results achieved in this investigation. Based on the state of the art of the present technology the possibility of developing low level W band MMICs with many functions integrated on the same chip has been investigated in order to reduce drastically the number of interconnections, the number of measurements and the workmanship with respect to the equivalent hybrid subsystems, which means a drastic reduction in terms of dimensions, weight and costs. As for the power is concerned, an analysis of the performances of MMICs developed using state-of-the-art consolidated monolithic processes has been carried out together with the analysis of the potential performance of new "wide band-gap" semiconductors that start to play an important role in terms of power and efficiency. At W-band, WR-10 waveguide losses play a significant role in the management of the performance of transmitter and receiver chains and of antennas feeds. In order to reduce such losses different technologies have to be explored. One of those is quasi optics. Quasi-optics is the name given to the technique of manipulating mm-wave signals in free-space beams through the use of quasi-optical components such as lenses, mirrors, polarisers and so on. Quasi-optics (QO) has a number of advantages over other transmission techniques (such as waveguide and microstrip), including low loss propagation and wide bandwidth capacity [C10890]

"Hardware/software interface for high-performance space computing with FPGA coprocessors"

Complex real-time signal and image processing applications require low-latency and high-performance hardware to achieve optimal performance. Building such a high-performance platform for space deployment is hampered by hostile environmental conditions and power constraints. Custom space-based FPGA coprocessors help alleviate these constraints, but their use is typically restricted by the need for TMR or radiation-hardened components. This paper explores a framework that allows Earth and space scientists to use FPGA resources through an abstraction layer. A synthetic aperture radar application is used to demonstrate the power of the system architecture. The performance of the application is shown to achieve a speedup of 19 when compared to a software solution and is able to maintain comparable data reliability. Projected speedups, for the same case study executing on the proposed flight system architecture, are several times better and also discussed. This work supports the Dependable Multiprocessor project at Honeywell and the University of Florida, a mission for the Space Technology 8 (ST-8) satellite of NASA's New Millennium Program [C10891]

"TDOA Geolocation with the Unscented Kalman Filter"

We consider passive geolocation of a radio frequency emitter via time difference of arrival methods. In a previous work, we presented a method for geolocation by a fleet of unmanned aerial vehicles equipped with passive radar sensors, based on adaptive repositioning of the vehicles to minimize a cost function. In this paper we experiment with the unscented Kalman filter to determine whether or not it provides a better implementation of this approach. Simulation results indicate that the unscented filter provides marginally better performance, in terms of mean target location error, compared with our previous results, but requires proper initialization [C10892]

"A 3-D Real-Time Road Edge Detection System for Automated Smart Car Control"

The current studies on road edge detection are mainly focused on algorithms for finding and tracking road edges through optical images (Y. Wang et al., 1998) (R. Wang et al., 2002) (B. Ma et al., 1999). In this study, the researchers developed a new road/trail edge detection system which is based on frequency-modulated continuous-wave (FMCW) radars. This system is able to provide much more road information than optical images do. The key features of this system are as follows: 1) the system is based on FMCW radars, the radar technology works effectively during both daytime and nighttime, on any types of terrain, and in a variety of weather conditions; 2) the system is designed to detect a three-dimensional profile of the road instead of two-dimensional road images as conventional methods do. With the 3-D images of the road, it is much easier to identify the road edge and measure the distance from wheel to the edge; 3) the system has a great potential to be upgraded to a four-dimensional profile detection system. In addition to the three space dimensions, the distribution of the physical properties of the road material could be obtained and counted as another dimension to the road profile. The significance of the four-dimensional road profiles lies in its capability of identifying road edges even when the road is covered by a layer of snow, sand or other substances [C10893]

"FDTD Simulation of Substrate Environments"

Ground penetrating radar (GPR) waves in inhomogeneous medium are analyzed by numerical methods in this paper. The theory analysis provides physical interpretation of a calculation model for characteristics of subsurface layers. In this model, the thickness and permittivity of subsurface layers would be estimated by traveling time of reflection wave in GPR measurement. A 3-D finite-difference time-domain (FDTD) code is used to simulate electromagnetic fields in multi-layer ground. Numerical simulations of the responses of GPR are described. Responses of different offset radars are studied in this paper. The thickness of the planar layer is calculated by simulated results. The results calculated from FDTD simulations verify the accuracy of the model for estimating the parameters of ground by GPR [C10894]

"Evolution of Sensor Suites for Complex Environments"

We present a genetic algorithm (GA) based decision tool for the design and configuration of teams of unmanned ground sensors. The goal of the algorithm is to generate candidate solutions that meet cost and performance constraints. The GA evolves the membership, placement, and characteristics of a team of cooperating sensors. Previous work shows that this algorithm can generate successful teams in simple, obstacle free environments. This work examines the performance of our algorithm in environments that include obstacles [C10895]

"Design and implementation of double precision floating point division and square root on FPGAs"

This paper presents the sequential and pipelined designs of a double precision floating point divider and square root unit. The pipelining of these units is based on partial and full unrolling of the iterations in low-radix digit

recurrence algorithms. These units are synthesized to produce common-denominator implementations that can be mapped on any FPGA chip regardless of architectural differences between the chips. The implementations of these designs show that their performances are comparable to, and sometimes higher than, the performances of non-iterative designs based on high radix numbers. While the iterative divider and square root unit occupy less than 1% of an XC2V6000 FPGA chip, their pipelined counterparts can produce throughputs that reach the 100 MFLOPS mark by consuming a modest 8% of the chip area. The pipelining of these iterative designs target high throughput computations encountered in some space applications [C10896]

"Sensing the channel: sensor networks with shared sensing and communications"

A new class of abstract sensor networks is introduced and analyzed. The object of the sensing is the inter-node channel. Examples of systems which seek to sense the channel include: underwater sonar, radar and optics based atmospheric sensor networks. In these networks, the sensing and communication tasks share the bandwidth resource in addition to the sharing of power resources as has been conventionally studied in the sensor network framework. Bounds on distortion tradeoffs are developed for various protocols, such as source coding analogues of decode-and-forward and amplify-and-forward and simple topologies such as two-hop networks (three node system) [C10897]

"Towards radar-enabled sensor networks"

Ultra wideband radar-enabled wireless sensor networks have the potential to address key detection and classification requirements common to many surveillance and tracking applications. However, traditional radar signal processing techniques are mismatched with the limited computational and storage resources available on typical sensor nodes. The mismatch is exacerbated in noisy, cluttered environments or when the signals have corrupted spectra. To explore the compatibility of ultra wideband radar and mote-class sensor nodes, we designed and built a new platform called the radar mote. An early prototype of this platform was used to detect, classify, and track people and vehicles moving through an outdoor sensor network deployment. This paper describes the sensor's theory of operation, discusses the design and implementation of the radar mote, and presents sample signal waveforms of people, vehicles, noise, and clutter. We demonstrate that radar sensors can be successfully integrated with mote-class devices and imbue them with an extraordinarily useful sensing modality [C10898]

"Adaptive combined bispectrum-filtering signal processing in radar systems with low SNR"

The application of adaptive techniques for obtaining bispectrum estimates in additive Gaussian noise and random shifts of received signals is considered. An approach using joint adaptive robust forming of bispectrum estimates and processing of complex-valued signal Fourier spectrum estimates by discrete cosine transform-based filtering with local variance estimation within each block is proposed. The advantages of the proposed approach in comparison to the conventional signal waveform recovery from bispectrum are illustrated by computer simulations [C10899]

"The Application Research of Microwave Imaging in Nondestructive Testing of Concrete Wall"

The examination of concrete walls is an important schedule in civil engineering. For these opaque and uncontinuous object, microwave technique is an effective method to realize nondestructive testing (NDT). A series of data coming from different frequencies and positions can be used to reconstruct an image of the section of the concrete wall. The equipment for microwave NDT is a small-size radar, which is consisted of an oscillation source, four PPLs, a four-way power distributor, power amplifiers, a coupler, a power detector, a common antenna, a signal collecting system and some control circuits. The design scheme and the working principle were stated. The algorithm for image reconstruction was introduced. Several concrete models with steel bars in them were under testing. The results of two models were given with one and two steel bars respectively. The reconstructed images showed the existence of the steel bars with depths and positions clearly. Further more research and plenty information are needed to determine the sizes of the steel bars [C10900]

"Speckle Suppression for SAR Images Based on Adaptive Shrinkage in Contourlet Domain"

Synthetic aperture radar (SAR) image is usually contaminated by speckle noise due to random interference of electromagnetic waves. To effectively solve this problem, a novel speckle suppression algorithm for SAR image was proposed. The algorithm combines the multiscale geometric analysis tool: contourlet transform and an improved adaptive shrinkage denoising algorithm. The Monte-Carlo simulation is incorporated to estimate the statistical properties of contourlet coefficients. To improve the visual quality of despeckling, the cycle-spinning technique is also utilized. Experimental results show that compared with conventional wavelet despeckling algorithm, the proposed algorithm can achieve better speckle suppression results, and the significant information

of original image like textures and contour details is well maintained [C10901]

"A Novel ISAR Imaging Algorithm for Maneuvering Targets Based on Sparse Signal Representation"

A novel imaging algorithm is proposed for inverse synthetic aperture radar (ISAR). Sparse signal representation, with great flexibility in matching structure in the data, can be used for maneuvering targets imaging. However, for complex-valued radar signals, the popular basis pursuit and FOCUSS (focal underdetermined system solver) algorithms have big computation. An efficient iterative method is presented as a novel imaging algorithm, which was first proposed for regularized problems. Applying the new algorithm into simulating and real radar data can obtain ISAR images with good quality. It shows that the proposed method is an efficient and a promising ISAR imaging method for maneuvering targets [C10902]

"Sequential Monte Carlo Implementation for Infrared/Radar Maneuvering Target Tracking"

When the trace of the infrared small weak target is nonlinear and non-stationary which are always appear in fact, the state equation and measurement equation are nonlinear-nonGauss and it is hard to get the solution using traditional algorithm. Taking the high precision of both infrared angle measurement and radar resistant measurement into account, a new maneuvering target tracking algorithm fusing the measurement of infrared sensor and radar sensor is proposed. After the process of infrared/radar time registration and space registration, the measurement data after fusion is sent into the resampling particle filter to track the target. The true state value is tracked by the posterior mean estimate of the state. Finally a simulation example is given and compared with the example of single radar target tracking, which is showed that the fusion tracking is better than single radar target tracking [C10903]

"Filament Preserving Segmentation for SAR Sea Ice Imagery Using a New Statistical Model"

Modelling spatial context constraints using Markov random field (MRF) has been widely used in the segmentation of noisy images. Its applicability to SAR sea ice segmentation has also been demonstrated by Deng and Clausi (2005). However, most existing MRF models are not capable of preserving filaments, specifically leads and ridges for SAR sea ice, which are valuable for ship navigation applications and helpful for identifying certain ice types. A new statistical context model is proposed that can preserve such narrow elongated features while producing similar smooth segmentation results as those of existing MRF based approaches [C10904]

"Joint Estimation of the Central Direction of Arrival and Angular Spread for Distributed Source Based on Beamspace Propagator"

Beamspace propagator method is suggested to estimate the central direction of arrival and angular spread for distributed source jointly. Especially for coherently distributed source, when the deterministic angular signal density is uniform, the nominal steering vector is deduced to subject to Vandermonde matrix. The proposed method is a possible alternative to conventional propagator method to estimate the parameters for distributed source, which enhances estimate accuracy with lower computational complexity. Simulation results clearly demonstrate that the proposed method is not only effective, but also enjoys better SNR performance compared with conventional propagator method [C10905]

"Calibration Method for Mutual Coupling Between Elements Based on Parallel Genetic Algorithm"

For the arrays of high frequency ground wave radar, a method with a signal to estimate the mutual coupling coefficient of arrays was brought out, which was based on principle of signal subspace and utilizing the parallel genetic algorithm. After estimating the impedance matrix C precisely with an assistant source, mutual coupling can be counteracted effectively for any types of array. Computer simulation results show that the proposed method successfully counteracts mutual coupling and direction of arrival (DOA) of sources can be estimated precisely. Furthermore, as output voltage vector and objective function are obtained, this method can be adopted to solve the problems of channel mismatch and elements' position errors [C10906]

"On Electronic Equipment Fault Diagnosis Using Least Squares Wavelet Support Vector Machines"

A systematic approach for fault diagnosis of analog circuits based on least squares wavelet support vector machines and wavelet lifting transform is presented, and is used in the scout radar electronic equipment. Firstly, output voltage signals under faulty conditions are obtained from analog circuits test points and noise is removed from signals with wavelet lifting transform. Then wavelet coefficients of output voltage signals are gained by wavelet lifting decomposition, and faulty feature vectors are extracted from the coefficients. After training the

least squares wavelet support vector machines by faulty feature vectors, the least squares wavelet support vector machines model of the circuit fault diagnosis system is built. The simulation result shows the fault diagnosis method of the analog circuits with wavelet lifting transform and least squares wavelet support vector machines is effective [C10907]

"Hierarchical Reinforcement Learning Model for Military Simulations"

Majority of the actions in army are hierarchical and occur simultaneously with some other action. Mission of an echelon is sub-divided into sub-missions which are assigned to the lower echelon. These lower echelons pursue their missions simultaneously. To apply reinforcement learning to such highly concurrent actions' domain as military, we propose a concurrent options model for a set of temporally extended actions that may not terminate at the same time and trigger the next transition without any regard for the other sub-options. We provide formal representation of the model. [C10908]

"Weather Radar Estimates of Rainfall Adjusted to Rain Gauge Measurements Using Neural Networks"

Other than rain gauges which measure the rain rate R directly on the ground, the weather radar measures the reflectivity Z aloft and the rain rate has to be determined over a Z - R relationship. Besides the fact that the rain rate has to be calculated from the reflectivity many other sources of possible errors are inherent to the radar system. Worth mentioning are especially errors caused by the vertical profile of reflectivity (VPR). In this paper an approach is described to estimate ground rainfall using radar data based on a neural network technique. The results indicate that the relationship determined by the neural network model between VPR and rain rate measured on the ground, is also representative for sites nearby. [C10909]

"On the Hardware-Relevant Simulation of Regular Two-Dimensional CNN Processing Grids"

Massively parallel processing architectures mimicking biological structures and their underlying calculation principles have been put into practice by the members of the cellular neural network (CNN) community. But until now flexible, scalable and industrially qualified toolkits are not available to support the simulation and development of these architectures within one single environment. In this paper we report on a simulation-framework, which is conceptualized and adjusted to deal with the specific simulation requirements of purely digital CNN processing devices. In particular, the framework is able to (1) handle complete CNN architectures of industrial relevant size, (2) to represent double precision float-point numbers as well as hardware relevant fixed-point numbers and (3) offer simulation run-times a magnitude faster than standard digital hardware simulations. We conclude this paper by presenting selected simulation results manifesting the proposed capabilities of the simulation-framework. [C10910]

"Multisensor Data Fusion Using Neural Networks"

This paper presents a Hebbian learning based linear single-layer neural network based measurement fusion of multisensor data. The performance of the proposed unsupervised neural network algorithm is compared with traditional fusion methods based on Kalman filtering such as measurement fusion and state vector fusion. The experiments have been carried out using multisensor data obtained from different radars. The results demonstrate the viability of the proposed algorithm. [C10911]

"Analysis of Radar Type Recognition Based on Decision Fusion"

The identification of radar types plays an important role in electronic warfare and provides the foundation for high-level situation evaluation and threat estimation. Aiming at the complexity of modern wars, a scheme for radar radiating-source recognizing system is proposed. Because of the complexity, fraudulence and ambiguity of radar radiating-source signals, the fusion performance of different Dempster-Shafer reasoning arithmetic is analyzed. The simulation results indicate that absorptive method can deal well with the fusion of high conflicting and low belief data [C10912]

"Greedy forward selection algorithms to Sparse Gaussian Process Regression"

This paper considers the basis vector selection issue involved in forward selection algorithms to sparse Gaussian Process Regression (GPR). Firstly, we re-examine a previous basis vector selection criterion proposed by Smola and Bartlett [20], referred as loss-smola and give some new formulae to implement this criterion for the full-greedy strategy more efficiently in $O(n2k_{\max})$ time instead of the original $O(n2k_{\max}^2)$, where n is the number of training examples and k_{\max} is the maximally allowed number of selected basis vectors. Secondly, in order to make the algorithm linearly scaling in n , which is quite preferable for large datasets, we

present an approximate version loss-sun to loss-smola criterion. We compare the full greedy algorithms induced by the loss-sun and loss-smola criteria, respectively, on several medium-scale datasets. In contrast to loss-smola, the advantage associated with loss-sun criterion is that it could lead to an algorithm which scales as $O(n^2k_{\max})$ time and $O(nk_{\max})$ memory if coupled with the sub-greedy scheme. Our criterion is similar to a matching pursuit approach, referred as loss-keert proposed very recently by Keerthi and Chu but with different motivations. Numerical experiments on a number of large-scale datasets have demonstrated that our proposed method is always better than loss-keert in both generalization performance and running time. Finally, we discuss the drawbacks of the sub-greedy strategy and present two approximate full-greedy strategies, which can be applied to all three basis vector selection criteria discussed in this paper. [C10913]

"Snake in Phase Domain: A Method for Boundary Detection of Objects in Phase Images"

This paper presents a snake algorithm for boundary detection of objects in phase images. Since phase image is a modulo- 2π field, the proper gradient vector field (GVF) for snake dynamics should be taken from an unwrapped phase. This paper proposes a procedure to avoid such unwrapping by applying modulo- 2π gradient estimation. Performance assessment is conducted by comparing a boundary detection result of non-modulo- 2π GVF snake estimate with a modulo- 2π regularized GVF snake. It is shown that the proposed method converges to the expected boundary, while the non-regularized procedure does not. [C10914]

"Unsupervised Segmentation Using Gabor Wavelets and Statistical Features in LIDAR Data Analysis"

In this paper, we address issues in segmentation of remotely sensed LIDAR (light detection and ranging) data. The LIDAR data, which were captured by airborne laser scanner, contain 2.5 dimensional (2.5D) terrain surface height information, e.g. houses, vegetation, flat field, river, basin, etc. Our aim in this paper is to segment ground (flat field) from non-ground (houses and high vegetation) in hilly urban areas. By projecting the 2.5D data onto a surface, we obtain a texture map as a grey-level image. Based on the image, Gabor wavelet filters are applied to generate Gabor wavelet features. These features are then grouped into various windows. Among these windows, a combination of their first and second order of statistics is used as a measure to determine the surface properties. The test results have shown that ground areas can successfully be segmented from LIDAR data. Most buildings and high vegetation can be detected. In addition, Gabor wavelet transform can partially remove hill or slope effects in the original data by tuning Gabor parameters [C10915]

"Comparing Different Localization Approaches of the Radon Transform for Road Centerline Extraction from Classified Satellite Imagery"

Using a local Radon transform helps improve the performance of the Radon transform-based linear feature detection. In this paper, three different approaches to localize the Radon transform are implemented and compared in the context of road centerline extraction from classified satellite imagery [C10916]

"Joint Image Segmentation and Interpretation Using Iterative Semantic Region Growing on SAR Sea Ice Imagery"

Segmentation of images into disjoint regions and interpretation of the regions for semantic meanings are two central tasks in an image analysis system. Typically, the segmentation and interpretation are performed separately with the interpretation as a post processing of segmentation. In this paper, we use an iterative method that keeps refining the segmentation and producing semantic class labels at the same time. The segmentation algorithm is based on a region growing technique and the interpretation is a Markov random field (MRF) based classification. The two processes are integrated under the Bayesian framework, with both aiming at reducing a defined energy. The interactions between the two are bidirectional by letting the interpretation result have some degree of control on the region growing process. Various features can hence be efficiently combined, and accurate classifications are obtained for operational synthetic aperture radar (SAR) sea ice applications [C10917]

"Boosted Gabor Features Applied to Vehicle Detection"

Robust vehicle detection is a challenging task given vehicles with different types, and sizes, and at different distances. This paper proposes a boosted Gabor features (BGF) approach for vehicle detection. The two main conventional Gabor filter design approaches are a filter bank design approach with fixed parameters even for different applications and a learning approach. In contrast, the parameters of our boosted Gabor filters, learned from examples, differ from application to application. Moreover, our boosted approach optimizes the filter parameters for every image sub-window, and the boosted filters have a large response for sub-windows containing a part of a vehicle resulting in a greatly improved performance in vehicle detection. Our vehicle

detection has two basic phases in which we build a multi-resolution hypothesis-validation structure. In the vehicle hypothesis generation phase, hypothesis lists are generated for three ROIs with different resolutions using horizontal and vertical edges, and following that, a hypothesis list for the whole image is obtained by combining these three lists. In the subsequent hypothesis validation phase, we validate the vehicle hypothesis list by inputting the boosted Gabor feature vector into the support vector machine. In the context of vehicle detection, the resulting system yields detection rates comparable to the best previous systems while achieving a 20 frames per second real-time performance on a Pentium(R)4 CPU 2.4GHz [C10918]

"An efficient algorithm for blind separation of multiple independent sources"

In this paper an improved whitening scheme is first developed by estimating the signal subspace jointly from a set of diagonalization-structural matrices based on the proposed cyclic maximizer of an interesting cost function. Next, a biquadratic contrast function is proposed for extracting one single independent component from a slice matrix group of any order cumulant of the array signals in the presence of the spatially-temporally white noise. A fast fixed-point algorithm is constructed for searching a minimum point of the proposed contrast function. Then multiple independent components are obtained by using repeatedly the fixed point algorithm for extracting one single independent component, and the orthogonality among them is achieved by the well-known QR decomposition. The performance of the proposed algorithms is illustrated by simulation results and is compared with several representative blind source separation algorithms [C10919]

"Tracking broadband plane waves using 2D adaptive FIR fan filters"

A novel composite method is proposed to track a broadband plane wave (PW) based on its direction of arrival (DOA) using 2D adaptive FIR fan filters. This method exploits a closed form expression derived for the unit impulse response of a 2D fan filter so that only one variable of optimization is required. Further reductions in algorithmic complexity are achieved using a unit impulse thresholding technique [C10920]

"DTM Generation from LIDAR Data using Skewness Balancing"

Light detection and ranging (LIDAR) data for terrain and land surveying has contributed to many environmental, engineering and civil applications. However, the analysis of digital surface models (DSMs) from complex LIDAR data is still challenging. Commonly, the first task to investigate LIDAR data point clouds is to separate ground and object points as a preparatory step for further object classification. In this paper, the authors present a novel unsupervised segmentation algorithm-skewness balancing-to separate object and ground points efficiently from high resolution LIDAR point clouds by exploiting statistical moments. The results presented in this paper have shown its robustness and its potential for commercial applications [C10921]

"Using Boosting to Improve Oil Spill Detection in SAR Images"

Marine surveillance system which uses synthetic aperture radar (SAR) images to oil spill detection must minimize false alarms in order to improve its reliability. This paper presents an application that uses boosting method to minimize misclassification and yields better generalization. Different feature sets were applied to neural network classifiers and its performance compared do boosting methods. The experiments reached substantial improvement in the classification accuracy to discriminate oil spots from the look-alike ones [C10922]

"Tracking a Variable Number of Human Groups in Video Using Probability Hypothesis Density"

We apply a multi-target recursive Bayes filter, the probability hypothesis density (PHD) filter, to a visual tracking problem: tracking a variable number of human groups in video. First, we use background subtraction to detect human groups which appear as foreground blobs. The PHD filter is implemented using sequential Monte Carlo methods; and the centroids of the foreground blobs are used as the measurements to update the PHD filter. Our experimental results show that when human groups appear, merge, split, and disappear in the field of view of a camera, our method can track them correctly [C10923]

"Recognition of Building Roof Facets by Merging Aerial Images and 3D Lidar Data in a Hierarchical Segmentation Framework"

We investigate in this paper an original methodology for detecting roof facets through the fusion of aerial images and lidar data (3D point cloud). Based on a hierarchical segmentation of the image, we define a cost function that manages the merging order of regions. It depends on both radio-metric similarities of two neighbouring regions as well as on extracted information from lidar data. Considering that lidar data have been filtered into points belonging either to ground or non-ground classes, we define semantic and geometric rules in the binary merging process. Building roof facets are finally detected by selecting a level of generality for representing roof

building components. Some remarks are given concerning the reliability of the integration of lidar and image data. Reconstructed roof facets are finally shown onto complex buildings [C10924]

"Identifying Weather Systems from Numerical Weather Prediction Data"

Weather systems such as tropical cyclones, fronts, troughs and ridges affect our daily lives. Yet, they are often manually located and drawn on weather charts based on forecasters' experience. To identify them, multiple atmospheric elements need to be considered, and the results may vary among forecasters. In this paper, we contribute to the fields of pattern recognition and meteorological computing by designing a generic model of weather systems, along with a genetic algorithm-based framework for finding them from multidimensional numerical weather prediction data. It was found that our method not only can locate weather systems with 80% to 100% precision, but also discover features that could indicate the genesis or dissipation of such systems that could be ignored by forecasters [C10925]

"Using Extended EM to Segment Planar Structures in 3D"

The proposed algorithm segments planar structures out of data gained from 3D laser range scanners, typically used in robotics. The approach first fits planar patches to the dataset, using a new, extended expectation maximization (EM) algorithm. This algorithm solves the classical EM problems of insufficient initialization by iteratively determining the number and positions of patches in a split and merge framework. Determining the fitting quality of the gained patches, the approach then allows for segmentation of planar surfaces out of the 3D environment. The result is a set of 2D objects, which can be used as input for classical computer vision applications, in particular for object recognition. Our approach makes it possible to apply classical tools of 2D image processing to solve problems of 3D robot mapping, e.g. landmark recognition [C10926]

"Anti-personnel Mine Detection and Classification Using GPR Image"

The automated anti-personnel mine (APM) detection and classification is currently a broad issue. The detection success depends on the feature selection that we obtain from the sensors. Ground penetrating radar (GPR) is one of the established sensors for detecting buried APM. In this paper, we introduce a method which improves the accuracy of detecting APM by using GPR imaging. This method adopts a segmentation technique for feature extraction and neural network as a pattern classifier. A seeded region growing algorithm is applied as region based segmentation for pattern construction following the median filtering and threshold of the original GPR image. A feed forward neural network (FFNN) with backpropagation training is employed for classifying the patterns. The FFNN takes the patterns (APM signature) that are constructed from each salient region and generate the classification. This method significantly improves accuracy in the detection and classification of APM [C10927]

"Contour Encoding Based on Extraction of Key Points Using Wavelet Transform"

In many situations, it is convenient to represent pictorial data in the form of contours. It may become necessary to compress such contour data for efficient storage and transmission. We present here a technique for achieving very high levels of compression of 2D contours. The goal here is to represent each contour using a discrete set of representative points known as key points. A novel method of extracting the key points using wavelet transform is presented. The scheme exploits the properties of the high frequency coefficients to identify these points. Local peaks in the magnitude plot of high frequency coefficients are designated as key points and are identified using an efficient algorithm. The performance of the scheme is evaluated using multiple actual contours derived from weather radar reflectivity fields [C10928]

"A Method of Reducing Speckle Noise of SAR Images Based on Wavelets and Wedgelet HMT Models"

In terms of the statistical characteristic of SAR images, combining the multi-scale wavelets and wedgelet approximation with HMT models, a novel method of reducing speckle noise of SAR images is presented in this paper. Furthermore, analyze the mechanism and computation complexity of this technique. The validity and efficiency are shown by experiments [C10929]

"Detection of Unknown Signals by Convolution"

The detection of an unknown signal in noise is usually through energy measurement. But the energy detector is not optimal for most practical signals. The proposed convolution detector in this paper can outperform the energy detector, when the signal is a rectangular pulse, over a range of signal-to-noise ratios. Comparisons of the performances of the two detectors are by theoretical and experimental receiver operating characteristic curves

[C10930]

"Building a confidence interval for the number of signals in noise using likelihood ratio test statistics"

We propose a multi-step procedure for constructing a confidence interval for the number of signals present in noise. The proposed procedure uses likelihood ratio statistics and their simulated percentiles in a sequential manner to estimate the upper and lower limits for the confidence interval. A preference zone in the parameter space of the population eigenvalues is defined and used to separate signals from noise. We derive the least favorable configuration asymptotically under the preference zone and use it to determine the procedure parameters for the required confidence level. We applied our procedure to computer simulated radar data and the MCARM measured data set. [C10931]

"Doppler-compensated adaptive pulse compression"

Within the minimum mean-square error (MMSE) context the adaptive pulse compression (APC) algorithm has been shown to effectively suppress the range sidelobes resulting from large targets to the level of the noise thereby unmasking nearby small targets and yielding substantial sensitivity improvement over deterministic matched/mismatched filtering techniques. However, this sensitivity improvement is limited by filter mismatch whenever the radar returns from large target(s) undergo a substantial Doppler phase shift caused by significant radial motion relative to the radar platform. To correct for the Doppler-induced filter mismatch, the Doppler compensated APC (DC-APC) algorithm is presented whereby the respective Doppler shifts for large target returns are jointly estimated along with the illuminated range profile and subsequently incorporated into the APC adaptive receive filter formulation thus suppressing the Doppler-mismatch-induced range sidelobes and regaining a significant portion of the sensitivity improvement of APC. [C10932]

"Multistatic radar systems signal processing"

In this paper, a multistatic radar system with multiple receivers and one transmitter is analyzed. We address the rules for selecting the weights for fusing multiple receivers in order to meet pre-specified performance goals. A multistatic radar ambiguity function is used to relate different radar performance measures to system parameters such as radar geometry and radar waveforms. Simulations are used to demonstrate that different performance criteria can lead to different rules for combining the signals from multiple receivers. [C10933]

"Bistatic radar scattering from an ocean surface at L-band"

This paper presents a numerical analysis for bistatic scattering from the sea surface at L-band. The unifying scattering model small slope approximation (SSA) of the first order is applied to calculate normalized bistatic cross section (NBCS) of the ocean surface. The calculations were made by assuming the surface-height spectrum of Elfouhaily et al. The correlation function based on this spectrum is calculated. The negative region participation in surface scattering which is function of the incident angle, the wind speed and the exploring wavelength is discussed. A comparison between SSA and geometric optics models shows that the last one is generally not accurate at L-band especially at large angles of incidences. Numerical results examine the wind dependency over a wide range of incident angles along the specular direction and in the forward scattering configuration. In addition, the NBCS behavior in fully bistatic configuration is predicted. Numerical results are obtained as a function of wind speed, incident/scattering angles and polarization states. [C10934]

"A fast algorithm to compute band-limited interpolation from unevenly spaced sampled data using K-nearest neighbor search"

This paper presents an algorithm that performs one or two-dimensional interpolation under certain conditions. It is optimized for speed by means of taking advantage of some special cases, which occur in SAR signal processing. In SAR processing, one needs to interpolate data from non-uniformly sampled grid into a uniformly sampled one. Coordinates of non-uniform points are related to coordinates of uniform points via a known transformation. Further, it is assumed that the non-uniform sampling points are located on lines in parallel to one of the coordinates on a two-dimensional plane. [C10935]

"Linear prediction of range-dependent inverse covariance matrix"

In this paper, we study issues associated with applying linear prediction theory to the range-dependent inverse covariance matrix (PICM) in bistatic airborne radar systems. For bistatic ground moving target indication radar, the clutter Doppler frequency depends on range for all array geometries. This range dependency leads to problems in clutter suppression through STAP techniques. An analysis of a new technique, proposed to obtain

an estimate of the inverse covariance matrix using least squares estimation, is provided in this paper. Simulation results show a significant improvement in processor performance, as compared to conventional STAP methods. [C10936]

"Frequency diverse array radars"

This paper presents a generalized structure for a frequency diverse array radar. In its simplest form, the frequency diverse array applies a linear phase progression across the aperture. This linear phase progression induces an electronic beam scan, as in a conventional phased array. When an additional linear frequency shift is applied across the elements, a new term is generated which results in a scan angle that varies with range in the far-field. This provides more flexible beam scan options, as well as providing resistance to point interference such as multipath. More general implementations provide greater degrees of freedom for space-time-frequency-phase-polarization control, permitting novel concepts for simultaneous multi-mission operation, such as performing synthetic aperture radar and ground moving target indication at the same time. [C10937]

"A general class of stepped frequency trains"

For uniform frequency stepped pulse trains, there can be undesirable peaks of the autocorrelation function, known as "grating lobes". In this paper, we address this issue, using an approach, which allows us to suppress grating lobes below a desired threshold level in the case of appropriately chosen stepped frequency waveforms, i.e., sequences of narrowband pulses that span the desired bandwidth. We will introduce a multiparametric generalization of a stepped frequency train, and by exploiting a factorization of the autocorrelation function, will be able to effect a useful tradeoff between competing properties of the factors by careful choices of relevant parameters. We provide a detailed description of the method applied to a representative data set. [C10938]

"Impact of the ionosphere on an L-band space based radar"

We have quantified the impact that the ionosphere would have on a L-band interferometric synthetic aperture radar (SAR) mission using a combination of simulation, modeling, Global Positioning System (GPS) data collected during the last solar maximum, and existing spaceborne SAR data. Using the Jet Propulsion Laboratory's Global Ionospheric Maps (GIM) total electron content (TEC) estimates derived from the worldwide array of GPS stations, we determined that the sun synchronous orbit which would minimize TEC at the time of imaging has dawn and dusk equator crossings. Such an orbit also avoids the equatorial post-sunset irregularities. We used the GIM data to examine the day-to-day variability in the background ionosphere and to quantify the impact of the background ionosphere on single pass SAR performance. With the exception of Faraday rotation related effects on single polarization systems, degradation due to the background ionosphere can be avoided if a reasonable model for the ionosphere is used during processing. Our studies reveal that Faraday rotation angles rarely exceeded the 10° threshold that impacts biomass retrieval and that repeat pass interferometric SAR decorrelation due to variations in the background ionosphere causing variable Faraday rotations is a negligible effect. Even a dawn-dusk orbit will not avoid high latitude ionospheric irregularities. We evaluated the strength of the ionospheric irregularities using GPS scintillation data collected at Fairbanks, Alaska and modeled the impact of these irregularities on azimuth resolution, azimuth displacement, peak sidelobe ratio (PSLR), and integrated sidelobe ratio (ISLR). Our examination of ionospheric artifacts in InSAR data has revealed that the artifacts occur primarily in the polar cap data, not auroral zone data as was previously thought. [C10939]

"The potential of bistatic HF surface wave radar system for the surveillance of water-entry area along coastline"

A bistatic/monostatic HF surface wave radar (HFSWR) experiment was conducted using both the transmit and receive systems of the HFSWR at Cape Race, Newfoundland and the receive system of the HFSWR at Cape Bonavista, Newfoundland. While the HFSWR at Cape Race operated in the monostatic mode, the transmitter at Cape Race and the receiver at Cape Bonavista were synchronized via the Global Positioning System to operate in the bistatic mode. The results of the experiment show that the range of the clutter return from a specified layer in the ionosphere in the bistatic radar, and the range of the clutter return from the same layer in the monostatic radar follow, approximately, the relationship specified by the Pythagorean theorem, i.e., $R = \sqrt{h^2 + (L/2)^2}$, where h is the virtual height of the specified layer in the ionosphere, which is also the range of the clutter return in the monostatic radar case, and L is the separation between the transmitter and receiver in the bistatic configuration. Based on these observations, we calculated the coverage areas of bistatic HFSWR systems for water-entry areas along coastlines. The calculation shows that a bistatic HFSWR system has the potential to significantly improve the nighttime coverage area over a monostatic system, while, approximately, maintaining the same daytime coverage. [C10940]

"Swathbuckler-radar system and signal processing"

Swathbuckler is a multinational initiative to research, build and test an extremely wide swath synthetic aperture radar imaging system. Contributions to the project came from AFRL Rome New York USA (high performance computer (HPC) implementation and Joint Battlespace Infosphere (JBI)), DSTL Malvern UK (high speed data capture and distribution processor (HSDCDP)), and DRDC Ottawa Canada (experimental radar testbed, signal processing algorithm design and test aircraft). This paper describes the Canadian contribution to the Swathbuckler experiment. Particular emphasis is placed on the architecture of the experimental airborne radar and the high-level design of the motion compensation and signal processing algorithms. Companion papers provide a complete Swathbuckler overview, details on the HSDCDP, details on the HPC implementation and the utilization of the JBI, and finally results from the flight tests in Ottawa. [C10941]

"Modeling the impact of discrete clutter on airborne adaptive radar systems"

This paper will examine the impact of discrete clutter on airborne adaptive radar systems using a hi-fidelity radar cross section (RCS) model of buildings. A realistic model of the RCS for different building designs with respect to incidence angle and operating frequency has been developed that captures the phenomenology necessary to study the impact of discrete clutter on adaptive signal processing algorithms. A key aspect of the RCS model is that it captures the key phenomenology while maintaining computational efficiency so it can readily be used in existing high-fidelity clutter simulations. Through the use of experimental data, we present examples of how the strong radar returns from buildings impact the performance of space-time adaptive processing (STAP). Validation of the RCS model against experimental data indicates its potential role in knowledge-aided clutter mitigation techniques to improve STAP performance. [C10942]

"Barankin bound for range and Doppler estimation using orthogonal signal transmission"

In this paper, the Barankin bound for performance evaluation of target range and Doppler estimation by an active radar (or sonar) is derived. The Barankin bound is analyzed for two signal cases: pulse train with identical (coherent) signals between pulses, and pulse train with orthogonal coded signals. At high pulse repetition frequencies (PRF's), identical signal transmission results in high sidelobes in the ambiguity function, while orthogonal signal transmissions allows to reduce the sidelobes and the ambiguity level. The Barankin bound is shown to be an efficient tool for system analysis in the presence of ambiguities. It is shown that for the identical signals case, the threshold signal-to-noise ratio (SNR) predicted by the Barankin bound is higher than the orthogonal signals case. The results are accompanied by maximum likelihood (ML) simulations, which show that the Barankin bound predicts the threshold SNR with a good accuracy. It is shown that at high SNR's, the Barankin bound, the Cramer-Rao bound and the ML coincide. [C10943]

"A waveform strategy for detection of targets in multiplicative clutter"

Conventional radar signal processing techniques approximate multipath as a linear process. Unfortunately, such an approach results in poor detection performance and because the model for the interference does not accurately represent the physical scattering process. We instead propose a method that uses the flexibility of waveform design for a given aperture to linearize the physical scattering phenomenon. This allows us to successfully detect targets using a Wiener matched filter approach in high multipath conditions. [C10944]

"Improved high range resolution profiling of aircraft using stepped-frequency waveforms with an S-band phased array radar"

A signal processing scheme based upon stepped-frequency waveforms is presented which enables high range resolution (HRR) profiles of targets to be formed of potentially sub-meter resolution, and extent of several kilometers, using an S-band (~ 3 GHz) radar system. This 'Hybrid' method is a significant improvement upon conventional ('Classical') HRR techniques, which have severely limited range unambiguous range extents. Successful aircraft trials and static experiments have been conducted using the MESAR2 phased array multifunction radar. Phased array time delay effects resulting from the reception of off-boresight target reflections were overcome without the need for calibration at every azimuth angle. Key application advantages are the potential to form high resolution range profiles of multiple target raids in an air defense scenario and extended threat clouds in ballistic missile defense. [C10945]

"Near-optimal peak sidelobe binary codes"

This paper describes an integer programming method for generating low autocorrelation binary codes at arbitrary bit lengths. PSL values and merit factors (for bit lengths 71 through 100) of the sequences obtained with this

method were compared to the best literature-based minimal-PSL sequences. At 74 bits, a new minimal-PSL value was obtained. That result was combined with the best results reported in the literature to produce a minimal-PSL binary sequence table for bit lengths 71 through 100. [C10946]

"Adaptive interference pre-suppression $\Sigma\Delta$ -beamforming for $\Sigma\Delta$ -STAP"

For airborne radar, interference is sophisticated. The original $\Sigma\Delta$ -STAP assumes that there will be a separate pre-suppression for jammers. Previous pre-suppression approaches utilize sideband jammer-only data. If sideband data are not available, previous pre-suppression approaches can not be applied. Or if there exist mainlobe jammers, conventional $\Sigma\Delta$ -beamforming can not suppress such interference sufficiently low so that the original $\Sigma\Delta$ -STAP will suffer. In this paper, an adaptive $\Sigma\Delta$ -beamforming approach, i.e., adaptive interference pre-suppression $\Sigma\Delta$ -beamforming for $\Sigma\Delta$ -STAP, is proposed. This new method doesn't utilize sideband data. Via simulations it is shown that the new method can suppress either sidelobe interferers or mainlobe ones. Especially for mainlobe ones, the advantages of the new method are significant. [C10947]

"Nonlinear k-space mapping method for SAR Fourier imaging"

A method for nonlinear mapping of k-space samples to facilitate the two-dimensional irregular to regular resampling required by the polar format algorithm (PFA) is presented. Mapping the locations of the collected k-space samples to a uniform rectangular grid and desired locations covering the data region, the interpolation becomes separable in two-dimensions. Resulting PFA images require no further processing to be displayed in the global X, Y coordinates and use all the collected data. This method of resampling allows PFA image formation from bistatic synthetic aperture radar (SAR,) and also data collected from irregular flight paths. [C10948]

"Passive maneuvering target tracking using 3D constant-turn model"

Most previous literature in the maneuvering target tracking community focus on 2D models or 3D models where target maneuvers mostly in a horizontal plane, and usually an acceptable accuracy can be expected when these models are applied to 3D tracking of civilian aircraft. However, it is not the case when come to agile military aircraft which turns in the 3D space rather than just horizontally, so more accurate model has to be developed to obtain better estimation of the target's state and that is the emphasis upon which our work places. The main contribution in the paper is two twofold, namely the derivation of the details for 3D constant-turn maneuvering model and its application in passive target tracking. Due to the nonlinear measurement and large initial errors in our application background, classical extended Kalman filter (EKF) degrades its performance greatly and is prone to diverge, for this reason we developed the unscented Kalman filter (UKF) based IMM algorithm to improve the tracking precision. Simulation studies are performed on two illustrative examples and good tracking performance has been achieved with only single passive sensor, which indicates the proposed method is effective. [C10949]

"Low spurious signal homodyne digital receiver"

Digital superheterodyne receivers employing two or more frequency conversion stages have been successfully employed in radars and communication equipment for many years. More recently, less complex single frequency conversion receivers, termed "homodyne receivers," have been revived and employed in lower performance equipment. The most significant problem limiting the performance in single frequency conversion directly to baseband is that of spurious signals due to the non-linear effects in the components. This paper describes a simple means in which second-order spurious signals that are generated from out-of-band signals can be cancelled while maintaining the signal of interest. Given that these fairly low, yet significant, spurious signals are cancelled and the in-band signal of interest is not too large, this new homodyne receiver does not have the issues with images that are present in superheterodyne receivers and furthermore, it may be smaller, less expensive, less complex, and should draw less power than the superheterodyne receivers. This receiver concept, if proven to be successful, might be employed in digital array radars (DAR). In this DAR application, one's own echo signals would only be of modest power levels but the out-of-band interfering signals that can be present could be of very large power levels. Furthermore, there may be similar applications in communications. [C10950]

"A novel approach to shared-spectrum multistatic radar"

In recent years the electromagnetic spectrum has become increasingly crowded due to the demand for higher bandwidths by both the radar and communications communities. One proposed solution to this issue is shared-spectrum multistatic radar, analogous to code-division multiple access (CDMA) communications. The recently proposed multistatic adaptive pulse compression (MAPC) algorithm has been shown to successfully suppress both range sidelobes and interference from multiple radars operating in the same spectrum, thus enabling

shared-spectrum multistatic radar. In this paper, we present a method to increase the overall information capacity of the MAPC algorithm by performing joint adaptive pulse compression in conjunction with adaptive beamforming. The addition of an adaptive beamforming stage to the MAPC algorithm enables further mutual interference suppression and therefore better estimation performance such that the number of multistatic radars simultaneously operating in the same spectrum may be increased for the same mean-square estimation error. Analysis of the performance of the adaptive beamforming MAPC algorithm in the presence of Doppler mismatch is presented. [C10951]

"Optimum target detection using illuminators of opportunity"

Unlike classical bistatic radars, passive radars make use of illuminators of opportunity to detect targets and to estimate target parameters. One existing radio transmission suitable for passive radar operation is the global system for mobile communication (GSM). For non-cooperative bistatic configurations, one of the major difficulties is the estimation of the reference signal which is required to perform detection. This reference signal, a priori unknown, can be extracted from the signal received at the antenna array provided the direction of arrival of the direct path signal is known. Conventional matched-filter based Doppler filtering offers the possibility of placing the target and interferences in a domain where they can be separated based on Doppler shift. However, slow moving targets residing near mainbeam clutter in the range-Doppler diagram, remain difficult to detect. Internal clutter motion (ICM) exacerbates this issue by spreading the clutter signal power in Doppler frequency. In this paper, we first present a method to estimate autonomously the direction of the illuminating GSM base station from measurements obtained with a two-element antenna array. We passively detect the azimuth of the transmitter without a priori knowledge of the environment. Spatial processing is then employed to attenuate the direct path signal and mitigate its influence on the target detection process. We then propose two methods able to cope with clutter echoes with non zero-Doppler components. We first propose an extension of a CLEAN-like algorithm. We also propose to extend adaptive matched filters to noise-like signals. The adapted matched filter can be used to suppress strictly static clutter but also clutter affected by ICM. These methods are validated by using actual clutter measurements obtained from a passive radar using a GSM base station as illuminator of opportunity. [C10952]

"Correction of the effects induced by the continuous motion in airborne FMCW SAR"

The combination of frequency modulated continuous wave (FMCW) technology and synthetic aperture radar (SAR) leads to lightweight, cost-effective imaging sensors of high resolution. In FMCW SAR applications the conventional stop-and-go approximation used in pulse radar algorithms can be not valid anymore, therefore the motion within the sweep needs to be taken into account. Analytical development of the FMCW SAR signal model, starting from the deramped signal and without using the stop-and-go approximation, is presented in this paper. The model is then applied to spotlight and single transmitter/multiple receiver digital beam forming (DBF) operational mode, where the effect of the motion during the transmission and reception of the pulse, if not compensated for, can become seriously degrading for the SAR image quality. The derivation is then verified by processing real FMCW SAR data collected with the demonstrator system built at the Delft University of Technology. [C10953]

"Split-gate tracking accuracy for phase coded CW radar"

In this paper, a phase coded continuous wave (CW) radar system is analyzed. The motivation for the research was to accelerate tracking filter convergence. The main goal of the paper is to express the variance of the range errors as a function of signal to noise ratio and position in the split-gate region. Furthermore, the effect of different signal processing algorithms on the variance of the range errors is investigated. The effects of channel mismatch in the receiver and range gate spacing on the variance of the range errors are also included. Analytical equations that relate the variance of the range errors to signal to noise ratio (SNR) and position within the split gate region are derived using a Taylor series expansion. The analytical equations are consistent with a statistical analysis of a simulation of the radar system in MATLAB. The results of the work are the analytical equations for the variance of the range error as a function of SNR, range gate spacing, and channel mismatch for a split-gate tracker. [C10954]

"A novel approach for distributed maneuver detection"

Quickest and accurate maneuver detection is critical to modern tracking systems. In this paper, the target maneuver detection problem when using multiple sensors is investigated. The target dynamic model and measurement model may exhibit complex nonlinearity and non-Gaussianity. Therefore, particle filters are implemented at the local sensors to predict the target state. At each time step, local sensors transmit binary data to the fusion center, where decision fusion is performed to detect the potential occurrence of target maneuver.

Since the sensors observe the same dynamic process, their measurements, and thus the local decisions, are correlated, which has to be taken into account at the fusion center. By considering correlation and using the Bahadur-Lazarsfeld expansion in the fusion rule, we can achieve better system design (local decision rules and fusion rule) than that achieved by assuming independence between sensors. Experimental results show that the distributed maneuver detection system achieves much better performance than using only a single sensor; the correlated design outperforms the independent design, and is very close to the optimal performance, especially for high correlation scenarios. [C10955]

"Aspect dependent drivers for multi-perspective target classification"

In this paper, a 2-D classifier using radial basis function neural networks (RBFNNs) has been implemented combining two imageries collected by different locations to prove the classification rates enhancement given by aspect diversification. Principal components analysis (PCA) is applied to features extracted from a masked version of the SAR image using the sole target's backscattering and shadow information. The classification performance, examined in terms of receiver operator characteristic (ROC) curves is presented using MSTAR data for a population formed by six classes plus two unknown and two independent targets. The resulting performance shows a reduction of the probability of false alarm, related to an improvement of probability of declaration and correct classification in comparison with the traditional single aspect case. [C10956]

"A Bayesian network sensor manager for heterogeneous radar suites"

In this paper, Bayesian networks are presented as an approach to reduce the decision uncertainty associated with selecting sensor operating parameters of a heterogeneous radar fusion system. In a dynamic real-time radar scenario, the situation can vary rapidly, and sensors fail. Particular actions must be taken quickly. Bayesian networks are well suited for these scenarios. The simulation results show that Bayesian networks can be used to adjust the required performance goals upon which sensor operating parameters are selected. [C10957]

"Investigation of GPR configurations by ray-tracing methods"

Methods for locating and identifying buried assets are one focus of a large research project entitled 'mapping the underworld'. As of part of the project we are studying novel configurations for ground penetrating radar (GPR). There are two of important specifications for the GPR configurations: the bandwidth and the dynamic range. In this paper, the bandwidth and dynamic range of a GPR are investigated through simulations. Media that are typical of street environments were modeled is used in the simulations. A 2D ray-tracing model is used to simulate propagation in the ground to identify signal levels, bandwidths and dynamic ranges. A novel In-Pipe deployment and a conventional deployment scheme for GPR are examined using ray-tracing. Comparison of the results shows that the In-Pipe deployment scheme for the GPR has immediate advantages over the conventional one, in terms of having a wider available bandwidth and therefore resolution, and in having a lower dynamic range requirement. [C10958]

"Coherent multilateral radar processing for precise target geolocation"

This paper analyzes the target geolocation performance of coherent processing of target signals observed by several radar receivers in a multilateral configuration. Each radar sensor is designed with a sufficient bandwidth to support good target range resolution but without the benefit of a narrow radar antenna beam for useful cross range measurement of the target position. The analysis results demonstrate the ability of coherent multilateral radar signal processing to achieve accurate target geolocation via triangulation and to eliminate target ghosts in a dense, multiple target environment. [C10959]

"New aspects to knowledge-aided clutter analysis"

Digital signal processing allows improvements in site-specific clutter prediction. With digital terrain maps and a flight obstacle register, land clutter origin can be solved. An efficient, knowledge-aided approach to extracting homogeneous clutter from radar signal is presented. Once homogeneous clutter's statistic has been recognized, also mixture models can be constructed. The suggested aspects are illustrated through an air surveillance radar simulation. The enhancement attained in clutter analysis and thus in clutter models is the novelty of the presented aspects. [C10960]

"Recent advances in spaceborne precipitation radar measurement techniques and technology"

NASA is currently developing advanced instrument concepts and technologies for future spaceborne atmospheric radars, with an over-arching objective of making such instruments more capable in supporting future science needs and more cost effective. Two such examples are the second-generation precipitation radar (PR-2) and the

nexrad-in-space (NIS). PR-2 is a 14/35-GHz dual-frequency rain radar with a deployable 5-meter, wide-swath scanned membrane antenna, a dual-polarized/dual-frequency receiver, and a real-time digital signal processor. It is intended for low earth orbit (LEO) operations to provide greatly enhanced rainfall profile retrieval accuracy while consuming only a fraction of the mass of the current TRMM precipitation radar (PR). NIS is designed to be a 35-GHz geostationary earth orbiting (GEO) radar for providing hourly monitoring of the life cycle of hurricanes and tropical storms. It uses a 35-m, spherical, lightweight membrane antenna and Doppler processing to acquire 3-dimensional information on the intensity and vertical motion of hurricane rainfall. [C10961]

"Passive detection suppression of cyclostationary phase coded waveforms"

A disadvantage of using pulse compression coded waveforms in radar is that the transmitted signal has features that can be easily detected by enemy passive detection equipment. One of these detectable features is the carrier frequency. Presence of the carrier frequency in coded waveforms gives rise to cyclostationary properties that are exhibited in the form of spectral lines in a nonlinearly transformed signal. This paper focuses on suppression of cyclostationary properties present in a transformed Welty coded CW waveform with the nonlinear transformation being that of the quadratic type [C10962]

"Single-channel receiver limitations in Doppler radar measurements of periodic motion"

Periodic motion, such as that resulting from cardiopulmonary activity can be measured by direct-conversion microwave Doppler radar. In a direct-conversion receiver, motion is measured as phase modulation, and the baseline phase relationship between the received signal and local oscillator signal for a given position has a significant effect on the demodulation sensitivity, resulting in optimum and case extreme target positions. Presented here is a mathematical analysis of this target-position sensitivity verified with measurements using a custom compact Doppler radar transceiver with separate quadrature outputs. The results indicate that increased error in respiration and heart rate measurements can be expected for case positions due to significant changes in mathematical conditions as well as reduced sensitivity, and that these limitations can be accommodated using two receiver channels in quadrature. [C10963]

"Friis and iterative trilateration based WiFi devices tracking"

The spreading of the WiFi networks allows new applications. New problems bound to the mobility of the terminals arise. This article addresses the service continuity in mobility which requires terminal positioning. The solution proposed is iterative trilateration for which the distances are computed according to the signal strength. This solution is implemented in GeoMoVie, the mobility component in a multimedia content streaming platform. It is tested and validated with a heterogeneous indoor test bed. It is also advantageously compared with related work approaches. [C10964]

"Using target RCS to aid measurement-to-track association in multi-target tracking"

Closely-spaced targets are a common challenge in multiple target tracking problems involving radar. If the targets are too close together, they may not be resolved by the radar. Even if they are far enough apart to be resolved, their states may be sufficiently close to make measurement-to-track association difficult, leading to data association errors in the tracker and degraded track quality. In response to this problem, this paper investigates three methods of exploiting measurement signal-to-noise ratio (SNR) as part of the assignment problem. If the radar cross sections (RCS) of closely-spaced targets differ significantly, this amplitude term can play a significant role, allowing measurements to be correctly assigned to tracks [C10965]

"Feature matching and signal recognition using wavelet analysis"

This paper investigates the application of multi-resolution wavelet analysis to the problem of feature matching in the presence of additive white Gaussian noise. The proposed algorithm computes the normalized cross correlation between the signal and the feature, using filtered wavelet coefficients. Simulations are conducted comparing the method to the classical optimum receiver [C10966]

"Estimating the DOA mean and variance of off-boresight targets using monopulse radar"

In monopulse radars, the direction of arrival (DOA) is estimated by the in-phase part of the monopulse ratio. The monopulse ratio curve (MRC) is highly nonlinear and hence, when the DOA variance is mapped through the MRC to estimate the off-boresight angular displacement, the variance of the angle estimator is often too small. Conventionally, the off-boresight angle parameters (mean and variance) are calculated by assuming the curve to be linear at the DOA estimate. This paper analyses the conventional method and investigates new methods for more accurate mapping of the DOA mean and variance to estimate off-boresight angle parameters [C10967]

"Symbolic Noise, Signal Processing, and Signal Enhancement by the Use of Chaos"

In this paper, we discuss the symbolic and visual approach to combinations of noise plus noise. Just as in other application chaos is used to disguise noise, we suggest that there is a dual process where chaos may be used to amplify signals in noise. An example of this is presented and some of the implications are discussed [C10968]

"Local Linear Regression (LLR) for Pose Invariant Face Recognition"

The variation of facial appearance due to the viewpoint (/pose) degrades face recognition systems considerably, which is well known as one of the bottlenecks in face recognition. One of the possible solutions is generating virtual frontal view from any given non-frontal view to obtain a virtual gallery/probe face. By formulating this kind of solutions as a prediction problem, this paper proposes a simple but efficient novel local linear regression (LLR) method, which can generate the virtual frontal view from a given non-frontal face image. The proposed LLR inspires from the observation that the corresponding local facial regions of the frontal and non-frontal view pair satisfy linear assumption much better than the whole face region. This can be explained easily by the fact that a 3D face shape is composed of many local planar surfaces, which satisfy naturally linear model under imaging projection. In LLR, we simply partition the whole non-frontal face image into multiple local patches and apply linear regression to each patch for the prediction of its virtual frontal patch. Comparing with other methods, the experimental results on CMU PIE database show distinct advantage of the proposed method [C10969]

"Moving target indication with dual frequency millimeter wave SAR"

Ground moving target indication (GMTI) for synthetic aperture radar (SAR) provides information on non-static objects in a static ground scene. An efficient approach for GMTI is the use of multi-channel SAR systems for a space- and time-variant analysis of moving targets. This allows the indication, correction of position errors, and estimation of radial velocity components for moving targets in the SAR image. All three steps are possible because of the Doppler frequency shift in the radar signal caused by the radial target movement. Our work focuses on the millimeter wave (mmW) SAR system MEMPHIS with multi-channel amplitude-comparison monopulse data recording and the ability to use carrier frequencies of 35 and 94 GHz simultaneously, making it a dual frequency multi-channel SAR. Our discussions include mmW specific SAR GMTI considerations and an adaptive algorithm to collect information on moving targets with a mmW monopulse radar, and GMTI blind speed elimination and target velocity ambiguity resolving by dual frequency SAR. For an experiment with MEMPHIS, frequency spectra, processed SAR images with position corrected moving targets, and accurate target velocities and positions are presented to verify the developed algorithm. [C10970]

"Tree detection in LiDAR data"

In this paper, we present an approach to detecting trees in registered aerial image and range data obtained via LiDAR. The motivation for this problem comes from automated 3D city modeling, in which such data is used to generate the models. Representing the trees in these models is problematic because the data are usually too sparsely sampled in tree regions to create an accurate 3-D model of the trees. Furthermore, including the tree data points interferes with the polygonization step of the building roof top models. Therefore, it is advantageous to detect and remove points that represent trees in both LiDAR and aerial imagery. In this paper we propose a two-step method for tree detection consisting of segmentation followed by classification. The segmentation is done using a simple region growing algorithm using weighted features from aerial image and LiDAR, such as height, texture map, height variation, and normal vector estimates. The weights for the features are determined using a learning method on random walks. The classification is done using weighted support vector machines (SVM), allowing us to control the misclassification rate. The overall problem is formulated as a binary detection problem, and the results presented as receiver operating characteristic curves are shown to validate our approach [C10971]

"Coexistence of Transmitted-Reference UWB System and IEEE 802.11a WLAN"

Transmitted-reference (TR) ultra-wideband (UWB) systems can relax the difficult synchronization requirements and can provide a simple receiver architecture that gathers the energy from many resolvable multipath components. However, TR-UWB systems are susceptible to interference which comes from other wireless systems. In this paper, TR-UWB system performance is studied in the presence of strong IEEE 802.11a WLAN interference. In order to reduce both the effects of interference by and into UWB signals, we propose a new method in conjunction with a multi-carrier type transmission pulse. The results show performance improvement in the presence of strong IEEE 802.11a interference. The proposed method can be used for the coexistence of different wireless systems with UWB system [C10972]

"Mobile RFID — A Case from Volvo on Innovation in SCM"

Utilization of Radio Frequency Identification (RFID) is often presented as improving supply chain management even though there are still few in-depth studies that support the hype. In this work, the feasibility of a mobile RFID solution in the automotive business-to-business of Volvo has been studied. Currently, due to costs of fixed infrastructure installations, many RFID solutions can only be financially justified in a setup with high volumes and high value items. In this setup, an innovative mobile RFID solution, utilizing cellular networks with data package communication (GSM/GPRS), web technology and integration has been evaluated. This is done from the perspectives of operational reliability, usability and productivity. The empirical evidences come from more than 3.000 readings that together with qualitative research explore a unique context of mobility in which existing infrastructure is leveraged. The advantages and disadvantages of the solution are summarized into a business case feasibility. Recommendations include design constraints and development strategies. [C10973]

"Low power frequency dividers in SiGe:C BiCMOS technology"

This paper reports a 71 GHz static and a 103 GHz regenerative dynamic frequency divider fabricated in 0.25 μm SiGe:C HBT technology with f_T/f_{max} 200 GHz. The static divider including the buffer works with a 3.5 V single supply voltage and consumes 140 mW with 42 mW for the master-slave flip-flop (FF). The high speed/power ratio makes it attractive for high-frequency wireless communication systems. The dynamic frequency divider operates from 24 GHz to 103 GHz with 5.2 V voltage supply and consumes 195 mW including the buffer with 41 mW for the divider core, and it can be applied at higher frequencies in low power millimeter wave systems [C10974]

"60 GHz Si micromachined cavity resonator on MCM-D"

This paper describes a 60 GHz high-Q cavity resonator etched in silicon. This cavity is flip-chip bonded to an MCM-D HRSi substrate containing the planar feed structure. The quality factor of the resonator without feed as predicted by HFSS is 1506 at 60 GHz. Substrate mode excitation by the feed is suppressed by using a semi-shielded cavity underneath the coupling slot. Design data together with a fitted lumped element model are presented for the resonator with feed and show a simulated Q of 1220. [C10975]

"Push-to-Talk over Bluetooth"

Push-to-Talk over Cellular (PoC) is an emerging service enabling a walkie-talkie-like service over GPRS. An open standard for PoC has been specified by the Open Mobile Alliance (OMA) [1]. OMA PoC is based on an IP/UDP/RTP protocol stack and a client-server based architecture. Group management, floor control etc are administered by PoC servers. The system exploits the SIP signalling capabilities of the IP Multimedia Subsystem (IMS) [2]. The objective of this paper is to propose an outline for a Push-to-Talk (PTT) system that utilizes a Bluetooth scatternet and the Personal Area Networking (PAN) profile for data communications [3], [4]. The proposed system is thus fully independent of cellular networks. A reasonable range of several hundred meters can be obtained with multihop communications between Bluetooth class 1 devices, whose range is up to 100 m. The proposed outline for Push-to-Talk over Bluetooth (PoB) comprises e.g. methods for group formation, network formation, communication, and floor control. The network formation method, which can be utilized in other applications as well, is based on creating a scatternet among a predefined set of devices and on avoiding loops. This approach enables usage of a simple broadcasting based communication method, in which the devices bridging the piconets into a scatternet act as repeaters. [C10976]

"Incorporating Doppler Velocity Measurement for Track Initiation and Maintenance"

Performance of multiple target tracking algorithms in complex environments heavily relies on the success of track initiation and measurement-to-track association algorithms. Doppler velocity measurement is the major discriminant of clutter from the target of interest with relatively higher velocities. This work summarizes the analytical derivations and presents simulation results about track initiation and maintenance using Doppler velocity reports along with the 3D position measurements extracted by a phased array radar. [C10977]

"Improved Target Detection and Tracking in Littoral Environments Using a Self-organising Spatio-temporal CFAR"

This paper describes a self organising spatio-temporal radar CFAR system that uses multiple intelligent software agents to detect and adapt the processing to features in the environment. By combining both temporal and spatial data gathering sufficient samples can be collected to allow both the first and second order moments of the clutter distribution to be approximated for each cell. By gathering higher order statistics to a useful accuracy, more stable thresholds may be produced. [C10978]

"Performance Comparison of Tracking Algorithms for a Ground Based Radar"

In this paper, performance of several tracking algorithms are compared when employed in a ground based radar. The algorithms have been compared in terms of percentage track loss and RMS estimation errors where the manoeuvrability of the scenarios was varied from low to moderate. [C10979]

"Inter-leaved filter structure using IMM for handling measurement association uncertainty in high clutter density"

The interleaved IMM filter structure presented in the paper is an improvement over the conventional IMM filter especially in high clutter density scenarios. The algorithm uses interleaving of the measurements in two parallel IMM filters. The performance benefits are in terms of lesser number of miscorrelations and false tracks i.e extended track life in high clutter density. [C10980]

"The fundamentals of selected radar advances"

{no data available} [C10981]

"2006 IEEE Radar Conference (IEEE Cat. No.06CH37730C)"

{no data available} [C10982]

"Radar Systems Panel-Welcome"

{no data available} [C10983]

"The IEEE Seminar on Target Tracking: Algorithms and Applications"

The following topics are dealt with: distributed air target tracking; particle filtering; data association; Viterbi algorithm; Riccati equation; infrared image sequences; multiple object tracking and video sequence. [C10984]

"A real-time alignment algorithm based on Kalman filter"

Alignment problem is a prerequisite process for data fusion of the radar networking. Classical registration algorithms are always proposed for fixed radars, which can't solve the alignment problem of the mobile radars ignoring attitude and attitude errors. This problem is studied in this paper. Using Taylor series, the linear model between the measurements and the errors are derived, and then a new real-time alignment algorithm for mobile radars is proposed based on Kalman filter. Finally, the effectiveness of this algorithm is conformed by simulation [C10985]

"Real-valued self-orthogonal finite-length sequences with maximum absolute value less than 2"

A finite-length sequence with impulsive auto-correlation function is effective for detecting signal with high resolution in CDMA communications, radar, sonar and so on. A finite-length sequence with zero sidelobe autocorrelation function except at both shift-ends is an ideal pseudonoise sequence and is called the self-orthogonal finite-length sequence or Huffman sequence. This paper presents a set of real-valued self-orthogonal finite-length sequences with maximum absolute value < 2 . The set includes the reversed sequences and bit-reversed sequences and the member size of a set is nearly $1.3M$ for length M . The real-valued sequences can be converted to the integer sequences with less quantization error for a practical application [C10986]

"A stochastic approach to ultrasound despeckling"

A novel stochastically driven filtering method to despeckle B mode ultrasound images is presented. This method is motivated by viewing the pixel values as a stochastic process and removing outliers, where outliers are defined by local extrema. These outliers are removed by local averaging. This produces another image with new outliers (local extrema) and the process is iteratively repeated. With each iteration homogeneous regions become smoother while edges that defined these regions remain preserved. To evaluate the performance of our proposed method in satisfying these two opposing goals we develop a modified Fisher discriminant contrast metric. Larger values of this metric indicate better performance in reducing each intraregion or intraclass variance and increasing the difference of interregion or interclass means [C10987]

"DDS-driven PLL frequency synthesizer for X-band radar signal simulation"

A DDS-driven PLL frequency synthesizer architecture is given in this paper. The AD9854 DDS device is used to generate low frequency reference signal and to drive the PLL and VCO to generate RF signal. Experiments and measurement results showed that this frequency synthesizer had wider bandwidth and low phase noise level, and can be used to generate X-band continuous wave signal, FM chirp signal and frequency agile signal for radar signal simulation [C10988]

"Simultaneous estimation of mutual coupling matrix and DOAs for UCA and ULA"

A structured least square (LS) method for simultaneous estimation of the mutual coupling matrix (MCM) and directions of arrival (DOAs) of signal sources for uniform linear array (ULA) and uniform circular array (UCA) is presented. The DOAs and MCM can be simultaneously estimated by the proposed method when observations of at least two different DOAs are available. This method significantly simplifies the procedure of mutual coupling compensation and it can also be applied for the calibration of ULA and UCA. Simulation results demonstrate the efficiency and accuracy of the proposed method [C10989]

"A Fast Handover System Evaluation in an All-IPv6 Mobility Management-Wireless Broadband Access based Hotspot Network Environment"

The ongoing convergence of wireless networking and IP networking more and more requires solutions for transporting realtime application data to IP enabled mobile devices and mobile networks. Even though the basic Mobile IPv6 protocol suite performs sufficient in macro environments with non realtime traffic, seamless mobility requires some more enhanced protocol procedures in between the mobile node and the involved network entities. Limiting the effect of handovers has the potential to considerably improve handover performance in terms of latency, packet loss, signaling overhead, and scalability. This contribution is going to present an extensive simulation study on the performance of the Fast Handovers for Mobile IPv6 approach. The demonstrated simulation scenario comprises 9 access router and up to 70 Mobile Nodes that communicate in accordance with the popular IEEE 802.11 wireless LAN standard. [C10990]

"Improved angular resolution of beamspace MUSIC for finding directions of coherent sources"

Beamspace MUSIC (multiple signal classification) of forward-backward spatial smoothing are used to estimate the directions of coherent arrivals. Coherence are often encountered in sonar, radar, or mobile communications. Such combination can be degraded when the source signals become coherent or strongly correlated. In this paper, we improve angular resolution of beamspace MUSIC by using the forward-backward averaging of a combined signal eigenvectors. The sample covariance matrix computed from the forward-backward spatial smoothing is exploited for an eigen-decomposition. The decorrelation performance of the proposed method is compared to the several methods based on MUSIC and on beamspace MUSIC, in terms of directions of arrival (DOA) estimations, MSEs versus (1) correlation, (2) noise variance and (3) SNRs, probability of resolution to separate closely spaced DOAs [C10991]

"Optimal Polarized Waveform Design for Active Target Parameter Estimation Using Electromagnetic Vector Sensors"

We develop optimal design methods of polarimetric radar signals that improve the estimation accuracy of the target parameters. A weighted sum of the Cramer-Rao bound (CRB) of the parameters of interest is used as the cost function of the optimization. We employ an array of electromagnetic vector sensors to fully recover the polarization information from the target returns. Simulation examples illustrate the improved system performance [C10992]

"RANSAC-based Flight Parameter Estimation for Registration-based Range-dependence Compensation in Airborne Bistatic STAP Radar with Conformal Antenna Arrays"

We consider space-time adaptive processing (STAP) in a bistatic radar configuration and 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 STAP processor from achieving its optimum performance. The compensation of the range-dependence of the secondary data requires the knowledge of the clutter power spectrum locus. This paper proposes a new RANSAC-based method for estimating, in the case of CAAs operating in arbitrary bistatic configurations, the clutter power spectrum locus or, equivalently, the flight configuration parameters. Based on the knowledge of this locus, we can perform a range-dependence compensation of the snapshots to obtain an accurate estimate of the clutter covariance matrix. End-to-end performance analysis in terms of signal to inference-plus-noise ratio loss shows that the method yields promising performance [C10993]

"3rd European Radar Conference"

{no data available} [C10994]

"EuRAD 2006 Sessions"

{no data available} [C10995]

"Characterisation of a Multistatic Radar System"

In this paper we report on the initial characterisation and calibration of a multistatic radar system, which has been designed using 'commercial off the shelf components'. This initial test strategy will provide a useful gauge of how effectively the system can detect certain simple targets and thus pave the way for further work looking at developing multistatic radar systems [C10996]

"High Precision Self-Adaptive Radar Gauging under Clutter Environments"

In this paper, a robust self-adaptive radar signal processing method for high precision level measurement is presented. The algorithms include dynamic tracking of multiple reflections and self-adaptive interferometric phase processing. The method has been tested under practical field scenarios, which contain multi-path effects, clutter object interferences and near-field reflections. The radar used in the tests is a Enraf X-band level gauge with frequency range from 9.5 to 10.5 GHz. The result shows that the accuracy of plusmn0.3 mm is obtained from the radar gauge. Under heavy clutter influences of 8-dB signal-to-clutter ratio, the accuracy of plusmn1 mm has been attained in whole measuring range. Furthermore, the gauge has been tested against the worst-case scenario that is the combination of unforeseen interruptions of continuous measurement with multi-path and clutter effects. The test results show that under severe interruptions the method can still maintain its high radar performance in robustness, repeatability and precision [C10997]

"Eigenstructure-based Estimation of Directions of Arrival of Signalsm with Rectangular Sparse Array"

Sparse arrays are attractive for wide range applications such as radar, sonar, wireless communications. This paper addresses the problem of determining the directions-of-arrival (DOA's) of narrow-band emitter signals impinging on a rectangular sparse array. The array incorporates several identical widely separated subarrays. Unitary ESPRIT-based DOA estimator is obtained for this class of sparse sensor arrays. Simulation results are included to show the performance of proposed estimator [C10998]

"Non-linear Frequency Scaling Algorithm for FMCW SAR Data"

This paper presents a novel approach for processing data acquired with frequency modulated continuous wave (FMCW) dechirp-on-receive systems by using a non-linear frequency scaling algorithm. The range frequency non-linearity correction, the Doppler shift induced by the continuous motion and the range migration removal are performed at the same time in the wavenumber domain with a very efficient solution. The cross-range focusing is then achieved with conventional matched filtering. Real data have been acquired with the FMCW SAR demonstrator system built at the Delft University of Technology. Stripmap images processed with the proposed method are presented in order to show the validity of the non-linear frequency scaling algorithm [C10999]

"Proceedings of the 3rd European Radar Conference"

The following topics are dealt with: array processing; system signal processing; reflect arrays and active antennas; non-periodic and sparse array antennas; radar applications; multilateration, coding and beam forming; remote sensing; classification and imaging; ultra wideband radar; multifunctional and reconfigurable array; transceiver accuracy; ultra wideband technology [C11000]

"An Expectation Maximization Based Simultaneous Registration and Fusion Algorithm for Radar Networks"

In this paper, we present an expectation maximization (EM) based simultaneous registration and fusion algorithm for multiple radars network. This simultaneous registration and fusion approach has advantages over other track registration techniques such as augmented Kalman filtering approach. Systematic biases (including radar time bias, radar two angular biases, and radar range bias) are estimated using the EM algorithm. The EM algorithm can guarantee that the estimated systematic biases can converge to a stationary point of the maximum likelihood function. In order to track maneuvering targets, three kinematic models are used to have a more complete

description of the motion of a target: the constant velocity (CV), the constant acceleration (CA), and the coordinated turn (CT) models. The conditional expectations and covariances of the system states can be effectively computed by interactive multiple model (IMM) approach. The IMM method is a recursive hybrid filtering technique that provides a good balance between performance and complexity. We employ a fixed-interval smoother-based IMM approach to estimate the system states. The forward and backward Kalman filters are used to obtain a smooth estimate. The IMM approach is combined with the EM algorithm for simultaneous registration and fusion. The proposed algorithm consists of two steps: the first step is to adopt the fixed-interval smoother-based IMM method to calculate the conditional expectation of the log likelihood function using the current estimate of the systematic biases and the observations; the second step updates the parameter estimate by maximizing the log likelihood function [C11001]

"Estimation of Pulse Parameters by Convolution"

The time-of-arrival (TOA) estimation of pulse signals is widely used in radar, sonar and other sensor systems for geo-locating targets. This paper presents a new estimator for the TOA and width (W) of a pulse. Three auto-convolutions of a full and partial pulse determine the location of three convolution peaks. These peak locations are given by linear equations that contain as unknowns TOA and W. Solving these equations yields estimates of the pulse parameters. Simulation results show the performance of the estimator in noise and are compared with results obtained using an existing estimator [C11002]

"A Hybrid Approach to Modulation Recognition for Intentional Modulation on Pulse (IMOP) Applications"

In this paper, a hybrid approach to modulation recognition is proposed for classifying unmodulated CW, narrow-band FM, wide-band FM, triangular FM, BPSK, DSB-SC and AM as well as noise. The algorithm is based on the use of decision theoretic and pattern recognition techniques. The decision theoretic approach is used to separate noise from signals, constant-envelope from varying-envelope waveforms, unmodulated CW from waveforms with phase information, and the two varying-envelope waveforms from one another. The pattern recognition technique is used to distinguish the three FM and BPSK waveforms. Computer simulations are used to demonstrate the performance of the proposed algorithm [C11003]

"Decomposition of Time-varying Multicomponent Signals using Time-Frequency Based Method"

This paper proposes a new time-frequency based signal decomposition method. This approach is based upon the eigenvalue decomposition method, combined with the s-method that produces a sum of the Wigner distribution of individual signal components. The proposed decomposition method is theoretically derived. The efficiency and accuracy of the proposed decomposition method is demonstrated on experimental high-frequency surface-wave radar data sets. The method presented here is not restricted to this application, but it can also be applied in various other settings of non-stationary signal analysis and filtering, for example, moving target identification in synthetic aperture radar (SAR) and inverse synthetic aperture radar (ISAR) images, etc [C11004]

"Trends in Microwave/Millimeter-Wave Front-End Technology"

Unique, high-performance components are utilized between the air or fiber-optic media interface and baseband/digital signal processing functions. TriQuint and other suppliers have developed power amplifiers, filters, duplexers, switches, phase shifters, and frequency conversion components specifically for this niche in systems ranging from RF-frequency cellular handsets to millimeter-wave frequency point-to-point radio transceivers. Examples of the use of specialized front-end technologies are: combining surface acoustic wave devices with GaAs switches and power amplifiers in a handset modules, linear millimeter-wave power amplifiers for point-to-point radio links, millimeter wave switches using GaAs PIN diodes, and combining GaAs HBT, PHEMT, and VPIN technology in a 77-GHz Tx/Rx front-end for automotive radar. Finally, future GaN HEMT technology is showcased by discrete transistors setting new levels of power density [C11005]

"Study on short-range transmission of UWB signals"

This work focuses on transmission of UWB signals through a closely-spaced antenna pair. The spatial distribution of the electrical field strength in the vicinity of a single antenna is investigated. The power budget of a transmission through a near-field coupled antenna pair is analyzed. Different mutual positions and distances between the antennas have been investigated. It was found that the reactive antenna coupling might decrease power budget as much as 15 dB by an antenna separation of 5 mm [C11006]

"An Innovative and Low Complexity PAPR Reduction Technique for Multicarrier Systems"

Large peak to average power ratio (PAPR) is a common drawback of multicarrier signals. In wireless communication systems, dealing with high PAPR requires keeping an important margin from the power amplifier compression point. High power amplifier back-off leads to low power efficiency which is not suitable in many embedded systems. In this paper, a new iterative technique to reduce the PAPR of multicarrier signals is presented. The proposed technique called "one-tone one-peak" (OTOP) is based on the tone reservation principles. It has the advantage to be very easy to implement and to give an appreciable PAPR reduction while giving a full control over the reserved tones magnitude [C11007]

"Advanced airborne SAR imaging"

The airborne experimental multichannel SAR/GMTI system PAMIR (phased array multifunctional imaging radar) serves as a platform for the demonstration of new capabilities in surveillance and reconnaissance. The sensor is working in the X-band and features a bandwidth of 1.8 GHz, five parallel receive channels, and an active phased array antenna comprising up to 256 Vivaldi columns and T/R modules and a broadband true time delay beamforming network. The antenna is reconfigurable, e.g. to a multi-baseline aperture for interferometric modes or to an elongated aperture for GMTI purposes. This contribution presents methods and results of two advanced radar tasks, namely high resolution SAR imaging with sub-decimetre resolution and non-canonical SAR imaging in case of rapid azimuth scanning [C11008]

"New Approaches to Multilateration processing: analysis and field evaluation"

The "multilateration" (MLAT) system is a surveillance and identification element of the A-SMGCS using the SSR transponder (Mode S or even A/C) reply/squitter as signals received by fixed stations where the time-of-arrival (TOA) is measured. In a central processing unit, the target position is estimated by the TDOA technique (time difference of arrival), for which a station is assumed to be the reference one. The cooperation between Tor Vergata University and the Company SELEX-S.I. has originated a new generation MLAT system (whose original features are patented) tested in a small Italian airport (Tassinano, Tuscany) in 2004/05 and presently (early 2006) installed at Milano Malpensa (MXP) airport. The new features includes (a) time-of-arrival estimation, (b) MLAT algorithms, (c) recovery of clocks deviations; they have permitted advanced surveillance performance in terms of accuracy, timeliness and integrity [C11009]

"MIMO Radar, Techniques and Opportunities"

MIMO techniques have been well studied for communications applications where they offer benefits in multi-path fading environments. This terminology is now appearing in the radar literature, but in several forms causing some confusion. Much of the existing work has focused on multistatic radars with sufficient spatial separation to de-correlate target RCS fluctuations, and where the data from the radars are combined incoherently. Another form of MIMO radar, closer to the communications technique, is where multiple orthogonal signals from the individual transmitter elements of a phased array are coherently combined on reception to form multiple beams. This paper presents a simple understanding of this within-aperture MIMO technique. We show how a filled array of "phantom" elements can be formed from relatively few physical elements. We explain the phantom element concept and extend it to the synthesis of various antenna array configurations, covering one, two and three dimensional geometries. The paper describes a range of waveform and signal processing options and discusses the implications of these radar capabilities [C11010]

"Template Based Micro-Doppler Signature Classification"

The micro-Doppler signature of a target is a time varying frequency modulation imparted on the radar echo signal by moving components of the target. Battlefield radar output the baseband signal as audio and soldiers listening on headphones are able to identify the target from its micro-Doppler signature. Automation of this capability is desirable for improved reliability and reduction in classification time. For the first time dynamic time warping (DTW), a speech recognition technique, has been applied to the problem. Its performance has been compared with the common k-nearest neighbour (k-NN) classification method since both approaches utilise a template library [C11011]

"Projection Approach for Estimating Radar Signal Multivariate Probability Density"

In the paper a new approach for estimating the radar signal multivariate probability density is suggested. It is based on the use of a projection of a random process to the set of random variables, with the probability density defined as a product of two-dimensional densities. The estimates of two-dimensional probability densities are obtained with the help of filtering the two-dimensional characteristic function. So we are suggesting a nonparametric estimate of the characteristic function. On the basis of these estimates nonparametric algorithms of signal detection are constructed. Examples for remote sensing of atmosphere are suggested [C11012]

"Meteorological Object Characteristic Calculation Using Doppler Spectrum Analysis with Neural Network"

In this paper, neural network usage for processing Doppler spectra from rain sounding is considered. Comparison of data calculated with the network and by ordinary methods is fulfilled. The paper describes architecture of one of the most compatible network used in radar processing. Teaching method, which gives reliable and truthful information, is considered. Perspectives of neural network usage in creation meteorological expert system are demonstrated [C11013]

"Computational Model of Radar Signal Spectrum Reflected from Rain"

This paper presents the computational model of Doppler spectrum that considers the influence of the shape of turbulence spectrum onto the spectrum of echo-signal from rain at different intensity of turbulence and rain rate. The inertia of raindrops is taken into account. The developed approach allows to calculate Doppler spectrum at different conditions. Validation with real data is done [C11014]

"Doppler Tolerance of OFDM-coded Radar Signals"

This paper proposes a new concept of radar coding using OFDM signals. The Doppler tolerance of such a radar is expressed as a function of Doppler frequency and time delay. In order to set a limit to the compression loss due to Doppler, it is shown that the target speed that can be allowed for a single pulse should be limited [C11015]

"Fast and Accurate Method for PCL Radar Detection in Noisy Environment"

A new fast and very accurate method for target detection in PCL radars is presented. This algorithm in noisy environment with SNR up to -60 dB could provide the perfect and accurate detection. Presented initiative algorithm apply a special filter bank to the target signal and clean the additive noise of the environment from it and detect the multiple targets with different RCSs [C11016]

"Spatio-temporal processing with ground-based rotating radar systems"

This paper considers spatio-temporal filtering in ground-based rotating radar systems. After the drawbacks of the standard spatio-temporal processing in this context are underlined, an hybrid spatio-temporal scheme is proposed to overcome them. Finally, this introduced processing is compared to standard ones through Monte Carlo simulations [C11017]

"Rain Clutter Filtering from Radar Data with Slope Based Filter"

One type of volume clutters is rain clutter that is caused by rain droplets. Moving weather systems will have a nonzero Doppler response the rate at which the rain droplets approach to the radar system. The complete data radar collects contain the returns of both the target and the clutter. The signal processing block in a radar system uses filtering operations to extract the target information while suppressing the clutter. Typically the filters are designed based on Doppler frequency using a Fourier filter bank. In this paper, we study the slope based filtering algorithm, and present some results obtained using that filter. Our experiment is indicating two interesting results. Firstly, the slope based filtering algorithm filter rain clutter at least as well as the Fourier filter bank. Secondly, the slope based filter performed better than the Fourier filter bank in the case of the generated Gaussian white noise. The experiments were performed in MATLAB environment and the data was real radar rain clutter data from Finnish Air Force medium range air surveillance radar (low PRF). Fifty different rain and snow situations have been recorded into data [C11018]

"Chaotic signals in radar?"

Chaotic signals add to the design repertoire for radar. This paper discusses the properties of chaotic signals, their generation and use, including transmitter hardware and efficiency, with reference to results in communications research and recent theoretical and practical results in sonar, and development throughout the world for radar. Practical issues arising from the unique properties of chaotic systems are considered. Phase locking and target identification benefits are also suggested. Results of sonar experiments and trials to support prediction from simulation findings are given. It is concluded that chaotic signals have the potential to offer exciting additional capabilities [C11019]

"Performance Study of Quantized Linear Frequency Modulated signals and its application to CW"

radars"

Direct digital synthesizers (DDS) are frequently used to generate wideband CW-FM signals in precise high resolution radars. With respect to a perfect linear FM signal, the stepped version produced by DDS can produce undesirable artifacts after range compression. However selecting carefully the configuration parameters of DDS (clock frequency, number of steps, step size, etc.) it is possible to obtain a virtually free of artifacts operation if the compressed signal does not show noticeable degradation with respect to ideal operation. From a theoretical study a simple design guidelines are proposed for the DDS parameters selection. This study has been validated by simulations and experimentally. An experimental CW-FM full polarimetric interferometric ground-based SAR using a DDS as a chirp generator has been developed according to the design guidelines in the TSC labs. The empirical results and system impulsional response are in agreement with this study [C11020]

"Monostatic Radar Signatures of Significant Classes of Ground Targets, in the Time and Frequency-Domain"

The problem of characterizing the radar returns from complex man-made localized targets using airborne radar platforms has been and currently is a topic of tremendous interest. This paper presents results of modeling four generic types of ground targets, and analyzes the monostatic radar cross section (RCS) both in the frequency and the time domain. The recorded results reinforce the conclusion that in realistic situations return signals are complex enough to include higher order terms, other than the shifted in time and frequency replica of the transmitted signal. A mechanism is shown on how to estimate these higher order terms. The existence of these terms allows one to see how signals are structured in the time domain. This in turn may successfully lead in the development of suitable matched filters for the class of targets studied in this paper [C11021]

"Advances in Phased Array Technology"

This paper presents an overview of developments at IMST in the area of steerable antennas, also often referred to as phased arrays. Such type of antennas have become a key area since the last few years. Various activities in this area have been conducted in the past, and are currently ongoing. Phased array antennas are, in general, rather complex systems that have to incorporate special features in order to perform beam steering, and have achieved ever more popularity during the last years, mainly driven by mobile multimedia applications. The complexity of the antenna systems, developed at IMST, ranges from small arrays with switchable elements, and partially mechanically and electronically steerable arrays (hybrid systems) to fully electronically steerable arrays. Such systems can be equipped with phase and amplitude shifters for each element, or the design can be based on digital beam forming (DBF). At IMST a large number of R&D projects reflects the broad spectrum of activities with respect to design and development of phased arrays. For the last 6 years, various projects have been carried out which all differ in topic, application and frequency range (L-band to Ka-band). It is intended to give here an overview of the work performed, and a global technical description [C11022]

"Computation of Far-Field Impulse Response of an X-band Waveguide Slot Array using the Finite-Difference Time-Domain Method"

The waveform in the far field of an antenna array can be obtained using the convolution of the input signal and the antenna far-field impulse response. Since it is very difficult to measure an antenna far-field impulse response, a numerical approach, i.e., the finite-difference time-domain (FDTD) method, is used in this paper to calculate an antenna far field impulse response. It is well known that the FDTD method models electromagnetic problems in both spatial and temporal domains. In conjunction with the time domain near-to-far field transformation, the FDTD method can be used to compute an antenna far-field radiation waveform at any angular location. With the far-field waveform computed by the FDTD method, this paper presents the deconvolution procedure to obtain an antenna far-field impulse response. A 54-element waveguide slot array of X-band navigation radar is used as an example. Its far-field impulse response as a function of the radiation angle is computed using the FDTD method. The far-field waveforms of an FM pulse transmitted by the waveguide slot array are calculated using the convolution of the FM pulse and the array far-field impulse response. The instantaneous frequencies of these far-field waveforms at different radiation angles are examined in details. It clearly shows from analysis results that the instantaneous frequencies at the leading and trailing edges of the received pulse have been distorted. The amount of frequency shift is related to the antenna radiation pattern at different radiation angles [C11023]

"Data Fusion in Space Surveillance: Physics, Modeling, Tracking & Classification"

Data fusion for the surveillance of space objects is distinguished through the complicated physical environment. The dynamics depends on the phase of the object, like boost, coasting, stationary orbit, or reentry. Sequential Monte Carlo methods are addressed to the tracking and classification problem of space objects within those

phases [C11024]

"Data Fusion for Ground Moving Target Tracking"

The aim of ground surveillance is the large scale, continuous and near real time determination of a dynamical ground picture. This task comprises detection and tracking of moving single targets and convoys, mobile weapon systems, and military equipment. The sensors of choice are airborne GMTI-radar (GMTI: ground moving target indicator) and SAR (synthetic aperture radar). As ground target tracking often suffers from dense target situations, high clutter, and low visibility, the integration and fusion of external background information is essential for providing precise and continuous tracks. We present multi hypotheses techniques for tracking several targets in complex ground situations with clutter. Methods to incorporate topographic information, in particular digital road maps, are described and demonstrated [C11025]

"Advanced Sensor Models: Benefits for Target Tracking and Sensor Data Fusion"

Modern sensor systems are typically characterized by advanced signal processing techniques which have direct impact on the quantitative and qualitative properties of the sensor data produced. This makes a more advanced modeling of the statistical characteristics of the sensor output inevitable. Via constructing appropriate likelihood functions based on these models the performance of Bayesian tracking and sensor data fusion techniques can be much improved. The proposed paper discusses the benefits by selected examples from various applications [C11026]

"The 6th IEEE International Symposium on Signal Processing and Information Technology"

The following topics were dealt with: biomedical signal processing; biomedical image processing; video processing; signal processing techniques; wavelet transforms; DSP systems; and radar signal processing [C11027]

"Multi-resolution Edge Detection Based on Alpha-stable Model in SAR Images Using Translation-Invariance Contourlet Transform"

In this paper we present the enhanced translation-invariance contourlet transform based on alpha-stable model and its application in edge detection of synthetic aperture radar (SAR) images. The translation-invariance contourlet transform is built upon the translation-invariance wavelet decomposition and nonsubsampling directional filter banks (DFB). Due to the impulsive nature of multi-resolution coefficients achieved, by the contourlet transform, they can be accurately modeled by alpha-stable model. Based on alpha stable statistic model of multi-resolution coefficients, maximum a posteriori (MAP) estimator can enhance them. Relating and fusing enhanced coefficients at different resolutions can take account of noise suppression, the integrity of edges and the veracity of position so as to improve probability of detection reducing probability of false alarm. Experimental results show that the proposed algorithm achieves better performance than the statistical edge detector of SAR image [C11028]

"Feasibility of Extracting Sea Surface Current by HF-SAR"

To meet the requirements of extracting sea surface current information by a single station, we try to apply the synthetic aperture technique to HF surface wave radar and present the new concept of HF surface wave SAR (HF-SAR), and consider the feasibility of extracting sea surface current by HF-SAR in this paper. First the composition and implementation aspects are described, then the system model and velocity estimation algorithm are designed, and finally the simulation model to extract the surface current is implemented on a single resolution cell. Simulation results show that by properly choosing the size of a resolution cell in azimuth direction, estimating the Doppler centroid and Doppler rate from azimuth echoes, the velocity estimation of the surface current is derived, and the precision is enough to meet the requirements. It indicates that HF-SAR is theoretically feasible to be used in sea surface current extraction [C11029]

"Breast Tumor Microwave Simulator Based on a Radar Signal Model"

Breast cancer incidence in women has increased from one in twenty in 1960 to one in eight today. Although advances have improved the likelihood of early detection, current breast imaging modalities still have limitations. In recent years, microwave imaging has shown its potential as an alternative approach for breast cancer detection. The principle behind this approach is the detection of differences in electrical characteristics between normal and malignant breast tissues in the microwave frequency range. A novel simulation technique for radar breast microwave imagery is proposed in this paper. Dispersive effects in the propagation medium and different antenna radiation pattern sizes are included in the simulation model. The proposed method produced accurate

results when compared to real data collected from a phantom that mimics the average differences in dielectric properties from skin, breast, and malignant tissue [C11030]

"Cheap Joint Probabilistic Data Association Filters in an Interacting Multiple Model Design"

This contribution presents an approach to fuse multiple sensors in an interacting multiple model design. Visual features like shadow and symmetry, treated as independent stand-alone virtual sensors, are employed for detection and tracking of vehicles for driver assistance tasks. Cheap joint probabilistic data association is utilised in order to account for the large amount of clutter present in the measurements provided by these sensors. Special attention is devoted to the different noise characteristics of the measurements. The individual sensors are considered in a sequential manner, leading to a versatile fusion architecture that allows easy integration of further sensor modules [C11031]

"Multicomponent Chirp Demodulation using Discrete Fractional Fourier Analysis"

The multicomponent chirp model finds numerous applications in biomedical signal processing, radar problems, and in the modeling of biological waveforms such as bat and whale echolocation signals. The problem of demodulating these signals is straight-forward when the components are distinct, however, when the components overlap spectrally or when one of the components is stronger than the others existing multicomponent demodulation algorithms run into singularity problems and are unable to effect signal separation and demodulation. In this paper, we present a method of multicomponent chirp demodulation using the recently introduced multiangle-centered discrete fractional Fourier transform. We specifically demonstrate that the proposed algorithm is effective in the aforementioned difficult situations where other algorithms fail [C11032]

"Reduced Complexity Blind Estimation of Under-Determined Convolutional MIMO Systems"

We consider identification of an under-determined convolutional multiple-input multiple-output (MIMO) system driven by white, mutually independent unobservable inputs. In our recent work, we showed that an N i-input and N_o -output system can be estimated within trivial ambiguities based on PARAFAC decomposition of a tensor containing K -th order statistics of the system output, where $K \geq \max\{(2N_i-1)/(N_o-1), 3\}$. In this paper we show that by using a tensor pair we can guarantee identifiability while using statistics of order smaller than in the single tensor case. We also provide an iterative identification scheme. The proposed tensor-pair approach results in complexity reduction as it involves lower dimensionality tensors and lower order statistics [C11033]

"On Complementary Punctured Binary Sequence Pairs"

This paper proposes a completely new complementary sequence-complementary punctured binary sequence pair (CPBSP). We present the definitions of CPBSP and its transformation properties. To reduce the searching range and improve the searching efficiency of CPBSP, the limited conditions of CPBSP are discussed to decide the punctured locations within the sequence pair. Searching results of perfect CPBSP (PCPBSP) with length no more than 15 shows that high-energy efficiency can be achieved at PCPBSP length 5 and 9. Such high-energy efficiency PCPBSP is feasible for engineering applications as synchronization codes and multi-user codes [C11034]

"A Novel Through-Wall Imaging Method Using Ultra WideBand Pulse System"

Through-wall imaging is one of the applications of Ultra Wideband communication that attracts recent interests for its ability to penetrate the wall. However, the available references fail to provide a clear feasible imaging method. This paper proposes a novel virtual elliptic curve imaging method based on the UWB pulse system, which presents the detail imaging process and imaging results. The key factor of this method is to correctly obtain the propagation delay by the correlator, and it is achieved by the spread gain of the pseudo-noise sequences. The imaging results show the proposed method has very high imaging resolution. And the error analysis is investigated on account of misestimating wall parameters. Simulations illustrate the effects of the errors under different scenarios. [C11035]

"Orthorectification as Preliminary Step for the Fusion of Data from Active and Passive Sensor Systems"

One of the main future tasks in the field of reconnaissance and surveillance is the data fusion of heterogeneous systems. For this purpose sensor data of airborne and spaceborne systems, which acquire the data from the same scene, with different spatial and spectral coverage are used. The use of different sensors enables the exploitation and the extraction of information on a higher level, supporting a value adding to the reconnaissance chain, which is especially helpful for the interpretation in urban terrain. A combination of active (SAR, LIDAR)

and passive (VIS, IR) sensors is considered. Because of the different imaging properties of the sensor systems it is necessary to transform the datasets into a common coordinate system. For each imaging device a specific transformation equation system is applicable depending on the sensor parameters and supplementary metadata. In this proposal for the used devices the imaging transformation is presented, which allows a common exploitation of the sensor data for the same scenery. An orthorectification method especially for SAR images was developed and applied to airborne SAR data. The spatial accuracy of the transformed sensor data in the common coordinate system is assessed using cadastral data set [C11036]

"Heterogeneous Fusion of Video, LIDAR and ESP Data for Automotive ACC Vehicle Tracking"

This contribution introduces an approach to cross-calibrate automotive vision and ranging sensors. The resulting sensor alignment allows the incorporation of multiple sensor data into a common detection framework. Exemplarily, we show how a realtime vehicle detection system, intended for emergency breaking or ACC applications, benefits from the low level fusion of multibeam lidar and vision sensor measurements in discrimination performance and computational complexity. The following tracking stage estimates the position and velocities of targets to permit distance control, time to collision measurements and further situation analysis [C11037]

"On Bayesian Tracking of Extended Objects"

In tracking and sensor data fusion targets of interest are usually considered as point source objects; i.e. compared to the sensor resolution their extension is neglected. Due to the increasing resolution capabilities of modern sensors, however, this assumption is often no longer valid: different scattering centers of an object can cause distinct detections. Examples of extended targets are found in short-range applications (littoral surveillance, autonomous weapons, or robotics). As an extended target also a collectively moving, loosely structured group can be considered. This point of view is all the more appropriate, the smaller the mutual distances between the individual targets are. Due to the resulting data association and resolution conflicts any attempt of tracking the individual objects is no longer reasonable. With reference to simulated radar data produced by a partly resolvable aircraft formation a Bayesian solution to the resulting tracking problem is proposed. Ellipsoidal object extensions are modeled by random matrices and treated as additional state variables to be estimated or 'tracked'. We expect that the resulting tracking algorithms are relevant also for tracking large, collectively moving target swarms [C11038]

"Ultra Low Phase Noise Stratum-3 TCXO with High Output Power"

Modern wireless communication equipment, point-to-point and point-to-multipoint microwave digital radios, radar equipment, microwave sources require high stability, low power consumption, and very low phase noise frequency sources in UHF band. Existing TCXO solutions can achieve -150 dBc/Hz phase noise floor at the carrier frequency of 100 MHz. The goal of this work was to create a 500 MHz TCXO with Stratum-3 stability performance (0.28 ppm over temperature, 4.6 ppm over all conditions), which can reach -155 dBc/Hz noise floor, -120 dBc/Hz at 1 KHz offset from the carrier, while providing +7 dBm of output power. The goal was accomplished by integrating in a small SMD package high performance, low frequency, Stratum-3 digitally compensated reference TCXO, low noise off-the-shelf phase locked loop (PLL) IC, and ultra low noise 500 MHz VCXO. The key solutions for this development besides solid digitally compensated TCXO design were optimization of the PLL circuit, and design of a VCXO. The VCXO is based on a 3rd overtone 100 MHz AT-cut crystal resonator with relatively high Q, passive band-pass filter, tuned on the fifth harmonic of the 100 MHz VCXO, and a free-running L-C oscillator, which is injection locked to the above mentioned fifth harmonic of the VCXO. The resulting device performance met all the stated goals and even somewhat exceeded the phase noise expectations. The sub-harmonic suppression was better than 50 dBc [C11039]

"Scale Estimation for Kernel-Based Classification"

This paper considers kernel density estimation for unsupervised data classification. A new methodology is proposed for finding the kernel scale using Bayesian statistics. K- nearest neighbourhoods are sampled by considering K as a random variable. The variance of each if-nearest neighbourhood is calculated and its probability density is fitted with a Gamma distribution. The estimated Gamma distribution is used to calculate the kernel scale. The proposed methodology is applied in three different machine learning algorithms: scale space, mean shift and quantum clustering. Quantum clustering employs the Shrodinger partial differential equation and uses the analogy between particles with their electro-magnetic field and data samples with their corresponding probability density function (pdf). The classification relies on the mode detection and the consequent data assignment in the resulting pdf. The proposed algorithm is applied for the classification of modulated signals and of topography extracted from radar images of terrain. [C11040]

"Online Detection of the Nature of Complex-Valued Signals"

A novel method for on-line tracking of the changes in the nature of a complex-valued signal is proposed. This is achieved by analysing the time variation of the mixing parameter within a hybrid complex-valued nonlinear adaptive filter. The proposed hybrid filter consists of a combination of split- and fully-complex nonlinear gradient descent algorithms, whose outputs are mixed in a convex manner. A learning algorithm for this scheme is derived and the potential of such an approach for tracking of signal modality changes is highlighted. The potential of the proposed approach is supported by simulations on both a synthetic benchmark signal and on real-world radar data. [C11041]

"Wireless SAW based high-temperature measurement systems"

The paper exemplifies the development of a surface acoustic wave (SAW) temperature measurement system, showing the advantages of wireless data transmission and passive sensor operation. It includes results of research on lithium niobate, langasite and gallium-orthophosphate, three piezoelectrics used as substrate crystals for the SAW devices. Critical parameters, limits and prospects of the materials as well as technological issues concerning the metallization and the lifetime of reflective SAW delay lines are discussed. The packaging and assembly of high temperature (HT) stable transponders is explained. A slot antenna, a patch antenna and a dipole antenna, thus providing maximum flexibility for the sensor geometry, are investigated. A phase matching algorithm, enhancing the measurement resolution by two orders of magnitude compared to a conventional peak detection algorithm, is described. A fully integrated SAW temperature sensor system is presented, basing on a frequency modulated radar operating in the 2.45 GHz ISM band and designed for a world wide legal usage [C11042]

"Narrowband Interference Detection in UWB Systems"

In February 2002, the FCC (2002 a, b) issued a ruling that UWB could be used for data communications as well as radar and safety applications. UWB system is constrained to have a maximum power transmission of -41 dB and a bandwidth ranging from 3.1-10.6 GHz. UWB co-exists and does not interfere with existing narrowband or wideband communication systems in the same spectrum. However, due to low transmitting power, UWB is affected by the so-called narrowband interference. This paper presents a method to estimate and detect narrowband signals in radio impulse receiver with the intention of eliminating them. The method uses a power spectral density estimation technique called spectrogram to track down the narrowband signal. The spectrogram at specific frequency range of the active narrowband is larger than its overall average power. A threshold detector is built which reports detection at the frequency range where the narrowband is located. The design correctness has been validated by means of Monte-Carlo simulation using UWB IEEE channel models, time hopping-pulse position modulation technique and Rake receiver [C11043]

"Distributed Boundary Estimation using Sensor Networks"

We examine the problem of determining boundaries occurring in natural phenomena using sensor networks. Sensor nodes remotely collect data about various points on the boundary. From this data, we estimate the boundary along with the confidence intervals using a regression relationship among sensor locations and the distances to the boundary. The confidence intervals are guaranteed to be narrower than a specified maximum width. Our distributed boundary estimation strategy uses a hierarchical structure of clusters of sensor nodes and requires 20-50% less messages as compared to a centralized scheme. The computed intervals show desired coverage of the true boundary points. Further, motivated by the practical need to estimate the boundary with a minimum number of sensors, we develop an adaptive approach for turning sensors on and off. The number of ON sensors in this scheme is only about 15% more than what a practical Oracle needs, to evaluate the boundary and confidence intervals around it. Our algorithms are also evaluated using data from real sensors on a testbed [C11044]

"The Properties of Time and Phase Variances in the Presence of Power Law Noise for Various Systems"

This paper discusses the behavior of sample, standard, bandpass, and Allan variances of the time and phase error in the presence of negative power law or fbeta noise for a variety of systems. These systems include those in the digital, communications, signal processing, radar, ranging, and time transfer areas. A theory is presented which spectrally defines these variances by explicitly incorporating a system phase response function $H_s(f)$ into the spectral integral. For many of the above systems, $H_s(f)$ is shown to contain highpass as well as lowpass filtering properties, and these highpass properties, when present, are shown to enable both the sample and standard variances, as well as Allan variances, to be used in the presence of fbeta noise for $\beta > -4$. It is also

shown that the sample variance defined in this way can be used to justify the heuristic low and high frequency cut-offs that appear in the spectral definition of the bandpass variance (also known as the jitter). $H_s(f)$ is further shown to fall into four general classes for the purposes of characterizing variance behavior. These classes we call: digital sampling, delay, delay with averaging, and PLL. The final part of the paper consists of a detailed discussion of the properties of these variances in the presence of negative power law noise for the above systems, organized by class of $H_s(f)$ [C11045]

"Gradient and Fixed-Point Complex ICA Algorithms Based on Kurtosis Maximization"

We present two algorithms for independent component analysis of complex-valued signals based on the maximization of absolute value of kurtosis and establish their properties. Both the algorithm derivation and the analysis are carried out directly in the complex domain, without the use of complex-to-real mappings as the cost function satisfies Brandwood's analyticity condition. Simulation results are presented that show the advantages of the new algorithms, especially when the number of sources in the mixture increases. [C11046]

"Automatic Target Recognition Based on High-Resolution Range Profiles with Unknown Circular Range Shift"

In this paper, an automatic aircraft target recognition (ATR) framework is presented, which is based on the high resolution range profiles (HRRP) of aircraft targets. This work is divided into two major parts. First, we consider the generation of the HRRP, which includes the modeling and simulation of radar cross section (RCS), the design of step frequency waveform (SFW), and IFFT processing for HRRP synthesis. In practice, a possible circular shift of the received HRRP relative to the template HRRPs in target library may exist. In such a situation, we resort to the statistical classification technique to develop an ATR algorithm, which begins with using the Neyman Pearson criterion to determine whether a target is present or not, under a constant false alarm rate constraint. Then the circular correlation is used to estimate possible circular range shift, as well as the unknown phase shift and attenuation. Moreover, we adopt the Gram-Schmidt orthogonalization (GSO) procedure to construct a signal space, and then project the received HRRP onto the signal space. Finally, the target classification can be done in terms of maximum a posteriori (MAP) decision rule. Simulation results are also included to demonstrate the feasibility of this approach [C11047]

"Fast Adaptive Update Rate for Phased Array Radar Using IMM Target Tracking Algorithm"

The capability of a phased array radar to use an adaptive sampling policy by the agile beam positioning results in an adaptive selection of the sampling time interval which improves the tracking performance. This paper presents a simple fast algorithm to determine the next update time for track update in phased array radar. This algorithm is based on the interacting multiple models (IMM) algorithm which is appropriate for manoeuvring targets tracking. The IMM is used here to predict and estimate the target's possible states and to select the correct next update time. The idea is to assign to each model in the IMM algorithm an appropriate rate and to weight these rates by the models' probabilities to obtain the rate to use. The resulting algorithm is named the fast adaptive interacting multiple models (FAIMM algorithm). The performances of this algorithm are compared to that of the adaptive IMM algorithm that uses Van Keuk criterion to select the next update time and to that of the IMM algorithm that uses a constant update time [C11048]

"Robust Estimation of Radar Pulse Modulation"

In this paper the problem of estimating a common modulation from a group of intercepted radar pulses is addressed. A robust M-estimation technique is proposed. The M-estimation approach provides tolerance against preprocessing errors as well as to other model failures. The performance of the M-estimation technique is compared to a maximum likelihood estimation method through simulation experiments [C11049]

"An Alternative Target Density Function For Radar Imaging"

In this paper, an alternative target density function (TDF) is proposed to image the radar targets in a dense target environment. It is produced by wavelet theory considering a new range and angle plane different from the conventional methods. It is shown that wavelet theory can be used as approach to imaging by active sensors by transmitting a waveform which is a kernel for this transform such as a window function. Although the imaging is obtained via the phased array radars, the problem associated with beamforming in linear phased array radar system is bypassed in this new algorithm [C11050]

"Scale Mixture of Gaussians Modelling of Polarimetric SAR Data"

This paper discusses a multivariate, non-Gaussian parametric modelling technique to analyse polarimetric SAR

data. We investigate a simple class of multivariate non-Gaussian distributions, the 'scale mixture of Gaussians', and assess its "Goodness-of-fit" to the radar data. Four models are analysed and various characteristics of the models are interpreted, together with practical considerations with regard to parameter estimation. We observe that SAR data is often not Gaussian in distribution, being more highly peaked at zero and falling off more slowly than the Gaussian. It is shown that a single 'flexible' model is sufficient to capture the statistics of the SAR data, leading to a feature set of the modelled parameters. Image classification is then studied by means of the modelled data and compared with an existing land cover map [C11051]

"Delay Estimation Using Adjustable Fractional Delay All-Pass Filters"

This paper presents a novel time-delay estimator utilizing an fractional-delay all-pass filter and Newton's method. Solutions using a direct correlator and an average squared difference function are compared. Furthermore, an analysis of the effects of the batch length dependence is presented [C11052]

"Unsupervised Change-Detection from Multi-Channel SAR Data"

Synthetic aperture radar (SAR) data presents a great potential for environmental monitoring applications and natural disaster management thanks to their insensitivity to atmospheric and Sun-illumination conditions. However, the automatic generation of change maps from multichannel SAR images acquired on the same geographic area at different times is still an open issue in the remote-sensing literature. In the present paper an automatic unsupervised contextual change-detection method is proposed for two-date multichannel SAR images, by integrating a SAR-specific extension of the Fisher transform with the expectation-maximization (EM) algorithm or with some of its variants (the Landgrebe-Jackson EM and the stochastic EM algorithms), applied according to a Markov random field model for the image data. The method is validated by experiments on SIR-C/XSAR data [C11053]

"ULTRA: Wideband Ground Penetrating Radar"

The frequency range employed in ground penetrating radar (GPR) systems is generally limited to 2 GHz because media loss increases dramatically at higher frequencies. Nevertheless, a series of applications exists in the Cultural Heritage field where the development of high frequency systems would significantly benefit, in terms of resolution, from an increased operating band. This article presents ULTRA, a wideband GPR (800 MHz-4000 MHz) system, using a CW-SF technique developed for this type of surveying [C11054]

"On the parity populations of Welch-constructed Costas arrays"

We prove that, in the case of Welch-constructed Costas arrays, the number of dots whose coordinates are both even (ee), both odd (oo), even and odd (eo), and odd and even (oe) are all equal if the prime p used has the property that $p \bmod 4 = 1$; and that, if $p \bmod 4 = 3$, the relation between these 4 quantities can again be determined, and that it involves an unexpected appearance of class numbers. [C11055]

"On some properties of Costas arrays generated via finite fields"

We prove that Welch-constructed Costas arrays are in general not symmetric and that the Golomb-constructed ones are symmetric in two cases only, namely the Lempel one and a (rare) second one leading to the construction of dense Golomb rulers. Finally, we look into the (hard) problem of the number of fixed points of a Welch-constructed Costas array and formulate a conjecture. [C11056]

"A new optimal double periodical construction of one target two-dimensional arrays"

There are known infinite classes of construction for Costas sequences due to Welch, Lempel-Golomb. Also sonar sequence constructions due to Taylor, Games, and Moreno. We present here a new construction of a more general type which is double periodical. [C11057]

"On the Existence and Counting Problems of Costas Arrays and its Signature Application"

Costas arrays special permutation matrices have widespread applications in many fields such as radar signal design and cryptography. However, so far the two basic problems-the existence and counting problems remain unsolved. This paper discusses the number of n times n symmetric Costas arrays, and discloses the relationship between the number of Costas arrays and symmetric ones. Also we attempt to search for Costas arrays based on simulated annealing algorithm (SAA). System algebraic methods can construct lots of Costas arrays but not all. For a long time, people have just enumerated all costas arrays for orders less than 26 with exponential computational complexity. On the other hand, it's easy to check whether a permutation matrix is a Costas array

or not with polynomial computational complexity. Based on the point, we present a signature scheme in the paper. [C11058]

"Information Theoretic Radar Waveform Design for Multiple Targets"

In this paper we use information theoretic approach to design radar waveforms suitable for simultaneously estimating and tracking parameters of multiple targets. Our approach generalizes the information theoretic water-filling approach of Bell. The paper has three main contributions: a new information theoretic design criteria for single transmit waveform with a receiving array using a weighted linear sum of the mutual informations between targets' radar signatures and the corresponding received beams (given the transmitted waveforms), we provide a family of design criteria that weight the various targets according to priorities. Then we generalize the information theoretic design criteria for designing multiple waveforms under joint power constraint when beamforming is used both at transmitter and receiver. Finally we provide a highly efficient optimization algorithm for optimizing the transmitted waveforms both for single target and multiple targets. We show that the optimization problem in both cases can be decoupled into a parallel set of low dimensional search problems at each frequency, with dimension defined by the number of targets, instead of the number of frequency bands used. The power constraint is forced through the optimization of a single Lagrange multiplier for the dual problem. We end with comments on the generalization of the proposed technique for other design criteria, e.g., for the linearly weighted MMSE design criterion. [C11059]

"A Doppler statistic for zero autocorrelation waveforms"

There are several natural constructions of constant amplitude zero autocorrelation (off the DC-component) waveforms. We adopt a construction for waveforms of length K , where K is a non-square-free integer. This property of K is used in the derivation of a frequency shifting (Doppler) detection algorithm which we derive. There are number theoretic properties which account for the properties of this algorithm, as well as for analogous but different properties in the square-free case. A variety of relevant examples is given along with the technical rationale for the algorithm. [C11060]

"Generating Costas Arrays to Order 200"

Number-theoretic generators of Costas arrays and generalizations in the literature and some presented here produce 526,908 of the known 663,703 known Costas arrays for orders up to 200. For orders higher than seven, there are more Costas arrays than the generators produce. A spin generalization is observed to find new Costas arrays for orders up to about 50, but none of higher order. This, and early work on the occurrence of Costas arrays, indicates that most, or all, Costas arrays are known, or are generated by known generators and their generalizations. [C11061]

"A New Construction of Multiple Target Sonar and Extended Costas Arrays with Perfect Correlation"

Previously there were no multiple target perfect families of Costas and sonar arrays. In this paper using the Welch Costas array and some results from design theory we construct four perfect auto and cross-correlation families of sonar and of extended Costas arrays. [C11062]

"Augmenting spatial awareness with Haptic Radar"

We are developing a modular electronic device to allow users to perceive and respond simultaneously to multiple spatial information sources using haptic stimulus. Each module of this wearable "haptic radar" acts as an artificial hair capable of sensing obstacles, measuring their range and transducing this information as a vibro-tactile cue on the skin directly beneath the module. Our first prototype (a headband) provides the wearer with 360 degrees of spatial awareness thanks to invisible, insect-like antennas. During a proof-of-principle experiment, a significant proportion (87%, $p = 1.26 \cdot 10^{-5}$) of participants moved to avoid an unseen object approaching from behind without any previous training. Participants reported the system as more of a help, easy, and intuitive. Among the numerous potential applications of this interface are electronic travel aids and visual prosthetics for the blind, augmentation of spatial awareness in hazardous working environments, as well as enhanced obstacle awareness for motorcycle or car drivers (in this case the sensors may cover the surface of the car). [C11063]

"Synchronization Technology of Bistatic Radar System"

A complete method of synchronization technology of bistatic radar using global position system (GPS) is presented. The time benchmark signal 1PPS was elaborately modified in order to increase the time synchronization precision. A very high time synchronization precision was achieved. Using the modified 1PPS to

discipline the local VCXO, the reference frequency signal both achieve a high long term stability (LTS) and short term stability (STS) property. The experimental results show that the time synchronization precision of our synchronization system can be improved from plusmn100 ns to plusmn25 ns. Well, the STS reach 2times10⁻¹¹/s and the phase noise is improved 20 dB comparing with the results [C11064]

"A New Eigensapce-based Beamformer with Sidelobe Control"

In this paper, a new eigenspace-based beamforming method is proposed. In this method, in order to reduce the sidelobe level of the beam pattern, the array weight of the conventional eigenspace-based beamformer is modified by adding a noise subspace weight which is obtained by using the penalty function method. And the computation of the noise subspace weight using penalty function method is shown to be equivalent to a constrained LS problem. An efficient adaptive algorithm for the array weight is developed based on fast subspace tracking technique. Simulation results verify the effectiveness of our method [C11065]

"Experience Map Creation by Virtual WLAN Location Estimation"

We propose a non-cumbersome automatic location estimation method based on an easily accessible infrastructure: the 802.11 LAN. The method consists of two phases: a map-preparation phase for virtual locations of access point (VLAP) and a target client location estimation phase using these VLAPs. Using the GPS location data of nomadic probe clients as a ground truth and its captured radio signal strengths from already deployed 802.11 access points, we can estimate VLAPs in urban areas. It may be shifted from the real location but could be more reliable since it reflects real radio characteristics. We then estimate the target client location based on the estimated VLAP map in the second phase. Five estimation methods were compared and we obtained a reasonable 23.8 meter mean accuracy using the RSSI and Density- Weighted Centroid method. [C11066]

"Frequency Coded Waveforms for Adaptive Waveform Radar"

We consider the use of frequency coded sequences for adaptive waveform radar. In particular, we investigate the joint use of stepped frequency chirps, Costas sequences, and pushing sequences to form an effective signal set for adaptive waveform radar. [C11067]

"Delay Estimation for Two Objects by Using Blind Beamforming on a Randomly Distributed Sensor Array"

In this paper we propose a new method to determine the time difference of arrivals (TDOAs) for two objects. Using the estimation of TDOAs and the known algorithms such as least square (LS) or constrained least square (CLS), we can determine the locations of the two objects simultaneously. The main contribution is to determine the eigen vectors that are close to the received signals, based on the minimum error criteria. Two eigen vectors are selected by this method, where each is used to estimate TDOAs for corresponding source. Simulation results indicate that this method yields accurate performance, with most, if not all, of the estimated TDOA values are identical to the original ones, for different source locations. [C11068]

"Waveform Design for MIMO Radar Based on Mutual Information and Minimum Mean-Square Error Estimation"

This paper addresses the problem of optimum radar waveform design for both radars employing a single transmit and receive antenna and the recently proposed multiple-input multiple-output (MIMO) radar. A random target impulse response is used to model the scattering characteristics of the target, and both point and extended radar targets are considered. Assuming the constraint on waveform power, two radar waveform design problems have been investigated. The first one is to design waveforms that maximize the conditional mutual information (MI) between the random target impulse response and the reflected waveforms given the knowledge of the transmitted waveforms. The second one is to find transmitted waveforms that minimize the minimum mean-square error (MMSE) in estimating the target impulse response. Our analysis indicates that under the same total power constraint, these two criteria lead to the same solution for a matrix which specifies the essential part of the optimum waveform design. The solution employs water-filling to allocate the limited power appropriately. We also present an asymptotic formulation which requires less knowledge of the statistical model of the target. [C11069]

"Receiving Signal Processing of MIMO Radar Based On Transmitting Diversity"

Multiple input multiple output (MIMO) radar is a new emerging radar technique developed recently. The principle of MIMO radar based on transmitting diversity is described and the method of receiving signal processing also is presented. Simulation results show that the proposed receiving signal processing method can simultaneously

form multiple receive beams and surveillance multiple targets. It also can improve Doppler resolution [C11070]

"Digital 2D imaging techniques for SRR"

For safety relevant applications various types of sensors are currently brought onto the market. Short range radar (SRR) sensors offer new perspectives delivering information about the traffic scenario around the vehicle. Currently different sensor concepts for 2D imaging are being discussed. The application of coherent phase analysis for angular processing seems to be a very powerful approach. In this paper the applicability of two such like techniques-digital beam-forming and Music2D-for SRR systems is investigated. These instructions give you basic guidelines for preparing papers for conference proceedings [C11071]

"A Practical FMCW Radar Signal Processing Method and Its System Implementation"

Frequency modulated continuous wave (FMCW) radar system measures objects and acquires information by changing the sending signal frequency along with the time and by measuring the receiving signal's frequency with respect to the sending signals. This paper introduces a practical FMCW radar signal processing method and system. This system is mainly used for eliminating noise interference from the sampled signal, checking out the objective signal, and sending the data as the processing results to a computer through the PCI Interfaces. The results are finally processed by the computer and displayed on its screen. This paper analyzes the signal processing algorithm, and applies it to the system implementation. This processing system uses the universal DSP chip as the core device, thus making it easier to use and transplant. This system can be applied to many fields (mini near-distance radar, aircraft carried radar, etc) as long as the front antenna and transceiver system are well organized. It can also be applied to the vehicle carried radar for distance-measuring [C11072]

"Parameter Optimization for Bistatic PCL Radar"

In this paper the accuracy of measurement with respect to some parameters like baseline variance and DOA estimation and bistatic RCS is considered. The radar designer can find the appropriate parameters to having the minimum error in target localization and maximum coverage range [C11073]

"Real-Time data and confidence declaration algorithm for MSSR Reply"

This paper presents a kind of method which can extract reply of mono-pulse secondary surveillance radar (MSSR) effectively at high density reply and introduce the real-time algorithm of confidence analyzing on the reply code. This arithmetic can not only extract code and confidence of the pulse reply code a time, but also fulfil the OVERLAP and de-FTUTI processing. The reply differentiation and confidence estimation can be correctly confirmed when there is multi-target reply-blend, providing available report form of the target trace [C11074]

"Anti-Jamming Process for Reply Extraction of MSSR"

This paper is about MSSR reply decoding and confidence bits. A novelty method is presented in this paper which can extract the reply code efficiently on highly high density reply occasion. The results of theoretical analysis and practical system-test have showed that this method can get very high detection probability and very low falsehood probability even in the environment of high density inquiring and complex jamming of FRUIT [C11075]

"Fast and High Resolution Statistical Based Algorithm for PCL Radar Detection in Noisy Environment"

This paper presents a new statistical based clean algorithm for multiple target detection in noisy environments. For this purpose the variance and average of the ambiguity function as the output of matched filter will be computed. This information used for separating the real targets from the false ones, in noisy environment and heavy clutter up to -13 dB [C11076]

"Application of Support Vector Machines to Pulse Repetition Interval Modulation Recognition"

The preprocessing of the pulse repetition interval (PRI) train is essential to the PRI modulation recognition of radar emitter signals when intelligent recognition methods are adopted. In this paper, a feature extraction method is proposed to deal with the PRI train to decrease the dimension of classifier inputs and to improve the robustness of recognition. Also, neural networks and support vector machines are adopted to design classifiers to identify the PRI types automatically. Experimental results show that the proposed method achieves lower error recognition rate and stronger capability of noise-suppression than the method proposed by Noone [C11077]

"Waveform Libraries for Radar Tracking Applications: Maneuvering Targets"

In this paper we extend the idea of adaptive waveform selection for radar target tracking to interacting multiple model (IMM) trackers to permit the modelling of maneuvering targets by allowing multiple possible dynamical models. We develop a one step ahead solution to the problem of waveform selection, which is designed to decrease dynamic model uncertainty for the target of interest. It is based on maximization of the expected information obtained about the dynamical model of the target from the next measurement. We also discuss the design of waveform libraries for target tracking applications. [C11078]

"Waveform-Agile Sensing for Tracking Multiple Targets in Clutter"

In this paper, we consider the problem of scheduling the waveform transmitted by waveform-agile radar sensors to track multiple targets in clutter. A number of generalized frequency modulated chirps with trapezoidal envelope form the library of waveforms available to the sensors, which obtain measurements using a nonlinear observation model. A joint probabilistic data association filter is used to track the target, and the waveform selection is made so as to minimize the predicted mean square tracking error. We provide simulation results to show that the scheduling improves the tracking performance of multiple targets even in the presence of clutter. [C11079]

"Space-Time-Waveform Adaptive Processing for Frequency Diverse Distributed Radar Apertures"

This paper reviews recent developments in the field of adaptive processing for frequency diverse, distributed, radar apertures. The large baseline of such a distributed radar results in angular resolution that is orders of magnitude better than the resolution of a single large radar. This capability comes at the cost of grating lobes (multistatics with evenly spaced apertures) or high sidelobes (multistatics with randomly spaced apertures). This paper presents some of the issues specific to such a radar and develops the notion of frequency diversity and presents the outlines of a data model that addresses the specific nature of frequency diverse distributed apertures. [C11080]

"Waveform Design and Diversity in Radar Sensor Networks: Theoretical Analysis and Application to Automatic Target Recognition"

In this paper, we perform some theoretical studies on constant frequency (CF) pulse waveform design and diversity in radar sensor networks (RSN): (1) the conditions for waveform co-existence, (2) interferences among waveforms in RSN, (3) waveform diversity combining in RSN. As an application example, we apply the waveform design and diversity to automatic target recognition (ATR) in RSN and propose maximum-likelihood (ML)-ATR algorithms for nonfluctuating target as well as fluctuating target. Simulation results show that our waveform diversity-based ML-ATR algorithm performs much better than single-waveform ML-ATR algorithm for nonfluctuating targets or fluctuating targets. Conclusions are drawn based on our analysis and simulations [C11081]

"A Digital Correcting Algorithm of Quadrature Double Channels Unbalance"

The whole system distortion is inevitable in I and Q channels of analog circuit because of the existing of amplitude and phase unbalance, the performance of receiving system become worse. Begins with the mathematical deduction, the paper presents an I and Q channels digital correcting algorithm, which is applicable to any kinds of symmetrical windows. This method implements simply and has high correcting accuracy. Finally, simulation results verify the validity of the method [C11082]

"An UWB Super-Resolution Method of Motive Target"

The high frequency UWB radar echo of a static target can be modeled as ARMA and approached by state-space technique. But this method is only valid when the target is static. Further, the motive target model of UWB radar is presented. This model is composed of a static model and a polynomial phase caused by the motion of target, and based this character a cyclostationary method can be used to estimate the motion parameters of the target. After the motive target model compensated by the estimated parameters, the eigenvalues can be extracted by the first method. The result of simulations shows the proposed method can correctly obtain the super-resolution of the motive target [C11083]

"Pseudo-Random Code Phase Modulation and LFM Combined Pulse Trains Ranging System"

A new combined signal-pseudo-random binary-phase code phase modulation and LFM combined pulse trains

signal is proposed, and the frequency spectrum function, the ambiguity function and the range correlation function are deduced. The working principle of combined ranging system is illustrated in detail and the formula of signals in each stage is deduced and the Doppler signal and its effect on the correlation output of combined ranging system is analyzed. Finally, the resolution, ambiguity characteristics and the range cut-off characteristic are studied. Research shows that the new combined ranging system is feasible and has advantageous performance [C11084]

"Jointly Tracking Dispersive Channels and Carrier Frequency-Offset in MIMO-OFDM Systems"

Multiple-input multiple-output with orthogonal frequency division multiplexing (MIMO-OFDM) is one of the promising schemes for future wireless communication systems. However, the carrier frequency-offset (CFO) and dispersive channels are great challenges in practice. In this paper, a new method is proposed to jointly track channel and CFO parameters in MIMO-OFDM for mobile user. The initial values of channels and CFO are first estimated jointly based on maximum likelihood (ML) criterion using one pilot symbol and then the CFO and time-varying channels are tracked by exploiting the finite alphabet (FA) property of the transmitted symbols. Simulation results show that the proposed method has well tracking performance in typical urban channel model [C11085]

"Range Finding by Using NRD Guide Pulse Radar Front-End at 60 GHz"

An NRD guide pulse radar front-end was fabricated for level sensor applications at 60 GHz. Main emphases were placed on circuit configuration and digital signal processing of multi-reflection for short range detection. Typically, an oscillation power is divided by a junction circuit and is introduced into two parts. One is for transmitter, and the other is for LO wave to construct hetero-dyne detection in receiver and the frequency of the former is up-converted so as to be different from the frequency of the LO wave, and thus, an amplifier is installed in the transmitting side due to low power of the up-converted millimeter-wave. In this paper, we proposed a new circuit configuration, which consists of a Gunn oscillator with two output ports to eliminate a junction circuit, a direct pulse-modulator to obtain a high level transmitting power without an expensive millimeter-wave amplifier, and a filter-based down-converter with an up-converter as a local oscillator. Multi-reflection between the radar front-end and target was removed by introducing an FPGA-based digital signal processing including high-speed counting, memorizing, and averaging. Good range finding was performed because the error was less than 1 % for the distance from 2 m to 40 m [C11086]

"Short range detector of static or mobile targets in the ISM band 2.45 GHz"

This paper presents a RF design for a short range (10-50 cm) detector of static or mobile targets and a simple new method of signal processing. A brief study of classical detection systems is firstly presented. Then the new radar architecture and the principle of detection are experimentally validated in the ISM band 2.4-2.48 GHz [C11087]

"Comparison of the 2D and 3D Netted Radar Ambiguity Function"

In this paper, netted radar performance is evaluated in terms of the ambiguity function. A three dimensional netted radar ambiguity model has been formulated. This takes into account the third dimension of height, which was not included in previous work. A software tool has been developed to assess the netted radar ambiguity and resolution properties. Simulation results show that the degradation of range and Doppler resolution shown in the two dimensional netted radar scenario is reduced in the three dimensional case [C11088]

"Signal and Interference Analysis: Proposed Analogue Signal Suppression Techniques for PCL Radar"

The aim of this paper is to show the severity of the signal and interference environment in which PCL radar systems often have to operate. This study was conducted at UCL in central London. It involved the spectral recording of numerous emitters of opportunity, which were subsequently used to evaluate PCL operating conditions for the particular illuminator in question. An analogue signal suppression circuit for the cancellation of direct (transmitted) signal leakage in the PCL surveillance channel/s will also be reported [C11089]

"Pulse-to-Pulse Stability Characteristics of Robust Design Centered High Performances/Low Cost T/R Module"

In radar applications any pulse-to-pulse amplitude and phase change in the transmitted/received signal can affect the radar performances in terms of cancellation and MTI (moving target indicator). The present paper will focus on the characterization of a high performances/low cost T/R Module and related components: in particular

PM and AM pulse-to-pulse measured stability better of 75 dBc will be shown [C11090]

"Phase Mode Excitation in Beamforming Arrays"

A complete theoretical model describing phase mode excitation of discrete and continuous uniform circular arrays is provided. Practical examples of beamspace radiation pattern synthesis are demonstrated using probe stimuli to control the complex amplitudes of individual modes [C11091]

"Innovative Dual Band Reconfigurable Beam Forming Network for Conformal Arrays"

An innovative dual band reconfigurable beam forming network for conformal arrays is introduced, based on a dual band power divider with independent power ratio in both WLAN frequency ranges. Each divider employs two dual band quadrature hybrids connected through two dual band phase shifters. Measured results show good performance in terms of return loss, isolation and power ratio accuracy, confirming the feasibility of the proposed architecture [C11092]

"Fast Signal Processing Algorithms for Noise Radars"

The paper presents new systems of orthogonal basic functions for fast signal processing algorithms, which can be used in different types of radars. The functional systems suggested allow us to use fast Fourier transform for calculating the convolution and the correlation function. The results were tested with the help of Monte-Carlo simulation as well as the physical radar model [C11093]

"A lightweight, ultra wideband polarimetric W-band radar with high resolution for environmental applications"

A lightweight, ultra wideband (UWB), polarimetric millimetre wave 94 GHz radar with high resolution is described for environmental and other short range applications. UWB and random signal W-band radar technologies are combined with polarimetric and super-resolution processing techniques to provide a compact remote sensing capability that is man-portable. An all-weather capability is provided for accurate and high resolution measurement of the physical size, relative distance, bearing, altitude, direction, velocity and classification of stationary and moving objects at ranges of less than 10 km. Attributed information relating to the sensed environment such as local surface features, water depth, terrain topology and object classification is derived from remote millimetre wave radar measurements including polarization [C11094]

"Signal Processing in Multisite UWB Radar Devices for Searching Survivors in Rubble"

The use of ultra wideband multisite radar devices (UWB MSRDs) with two antennas separated by about 1...1.5 m for searching survivors in rubble is very prospective. Optimised signal processing in such UWB MSRD is considered, which has to solve two principal problems: 1) detection of very weak signals reflected from a moving human chest due to breathing against strong clutter background, and 2) location of survivors with accuracy required for effective rescue works. Large signal attenuation and unknown additional delay of signals propagating through rubble are taken into account [C11095]

"UWB Array-Based Radar for Landmine Detection"

In this paper, the development of an UWB array-based time-domain radar sensor is described. The radar sensor is designed to be used within a vehicle-mounted multi-sensor system for humanitarian demining. The main novelty of the radar lies in the modular approach, design of the antenna system and waveform of the transmit antenna feeding pulse. The radar has focusing capability via near-field beamforming in cross-scan direction and migration in along-scan direction [C11096]

"2-Dimensional Measuring Method Using a Wide-area Surveillance Sensor with Leaky Coaxial Cables"

We have developed a wide-area surveillance sensor with a pair of leaky coaxial cables (LCX). It detects targets in the surveillance area by scattering signals generated by targets whose positions are measured using propagation delay time. Such a sensor has been studied previously; however, several problems remain. The primary issue is two-dimensional sensing which in practice is desired to improve the accuracy of the boundary line of the surveillance area. In this paper, we present a fundamental beam-forming technique for LCXs and a method for measuring 2-dimensional target position using a multi-frequency measurement technique [C11097]

"Detection of the Markov Signals in a Mixture with the Markov Correlated Clutters using Autoregressive Models"

New adaptive algorithms of detection of correlated signals on background of correlated clutter are proposed. Algorithms are based on autoregressive Markovian model of random process. Statistical hypothesis about parameters of autoregressive model of narrow band random process are checked. Viability and efficiency of new algorithms proves to be true by using statistical modeling as well as by processing real signals of weather radar [C11098]

"Imaging Simulation of Spacecraft by Ground Based High-Resolution ISAR"

A novel method based on de-chirping technique for compressing stepped-frequency chirp signal (SFCS) was firstly introduced, and then applied to imaging simulation for a spacecraft by a ground based ISAR using SFCS. The echo signal model for an orbiting spacecraft (the Chinese Shenzhou Spacecraft) was analyzed by deriving the equivalent translational and rotational movement. Result showed that the spacecraft was clearly imaged with resolution as high as about 0.20 m [C11099]

"Limited Multi-Static Calibration Technique without a Phantom for the Detection of Breast Cancer"

Breast cancer is a serious disease that affects many women each year. The current benchmark in detection is the mammogram but recent efforts have been made in alternative detection methods, the most promising is microwave detection. The method focused on works by illuminating the breast with a pulse and detecting any reflected signals, making it similar to ground penetrating radar. A key problem though is the reflection of the pulse from the skins surface and direct signals between adjacent antennas. Calibration to remove these commonly uses a breast phantom however there is wide variability in tissue properties making a universal phantom unrealistic. Using a mismatched phantom results in performance degradation. This paper introduces a new method to calibrate a system using only received signals through a preset antenna layout and averaging scheme, which overcomes the conventional method problem and improves the system performance [C11100]

"Analysis of Bistatic SAR Frequency Synchronization"

In this paper, a bistatic SAR echo's mathematical expression with frequency errors is given, and the frequency error was analysed. Two types of frequency synchronization errors were considered. We analysed the different effects about imaging of bistatic SAR in the condition that the echo with different frequency errors. The analytical result is proved by simulation, it can be the reference for bistatic SAR system design [C11101]

"Separation of Micro-Doppler Signal Using an Extended Hough Transform"

In this paper, we present a separation method of micro-Doppler signal based on the Hough transform which is widely used in the image processing. Mechanical vibration or rotation of structures in a target may induce frequency modulation on returned signals and generate side-bands about the center frequency of the target's body, which is know as the micro-Doppler phenomenon. Then the body image will be contaminated due to the interference from the rotating parts. Using an extended Hough transform, the spectrums of the rotating parts of the target can be eliminated from the spectrogram of the target. A computer simulation is given to illustrate the effectiveness of the proposed method [C11102]

"State Estimation and Fault Diagnosis for Nonlinear Analog Circuits"

This paper demonstrates a new approach of fault diagnosis for the nonlinear analog circuits, which is based on the computation of maximum Lyapunov exponent of chaotic time series. We use this method to estimate the operating states of strong nonlinear analog circuits, and make a discussion on selecting a proper pair of embedding dimension and time delay for phase space reconstruction. This new fault diagnosis method is validated by an instance: the output signal of a harmonic oscillator with variable periods in radar is taken as the testing object, the surrogate method is used to generate the fault data, and the maximum Lyapunov exponent is calculated by means of the small data-set approach. The simulation testing results indicate that this method can efficiently find out the abnormal changes in nonlinear analog circuits [C11103]

"Gradient Vector Flow Snake for Airborne Pulsed Doppler Radar Clutter Tracking"

For an airborne lookdown pulsed Doppler (PD) radar, clutter power often changes dynamically about 80 dB with wide clutter distribution in range and Doppler as the platform moves. Therefore, the clutter tracking techniques are required to guide the selection of const false alarm rate (CFAR) schemes. The aim of this work is exploring the possibility of tracking clutters using image segmentation algorithms and employing gradient vector flow snake

(GVF-snake) for clutter tracking. Characteristics of the PD radar clutter and behaviors of the GVF-snake are covered after brief introduction, followed by demonstrations and analyses on tracking results. After the studies on tracking from different types of clutters, including simulated and real ones acquired from airborne radar, conclusions on the GVF-snake tracking algorithm are given [C11104]

"Influence of PRF Shakiness on Bistatic SAR Imaging"

In this paper, the influence of pulse repetition frequency (PRF) shakiness on bistatic synthetic aperture radar (SAR) imaging is presented. The PRF shakiness error is analyzed from a physical point of view and a mathematical model for this error is introduced. The simulation results match the physical and theoretical analysis well. It is shown that the PRF shakiness error deteriorates the performance of bistatic SAR imaging on azimuth, for it corrupts the phase coherence between echo signals. Particularly, the peak side lobe ratio (PSLR) and integrated side lobe ratio (ISLR) increase with the presence of the error [C11105]

"A Time-frequency Atom Approach to Radar Emitter Signal Feature Extraction"

In this paper, a novel approach to extract the features of radar emitter signals in the high density, complex and variable signal modulation environment is presented. Based on the over-complete time-frequency atom dictionary, the signals are decomposed into a linear expansion of atoms by the method of matching pursuit (MP). Then, improved quantum genetic algorithm is applied to effectively reduce the time-complexity at each search step of MP, and thus some optimal time-frequency atoms describing features of signals are obtained, which can provide some new feature parameters for the deinterleaving and recognition of the radar emitter signals subsequently. Experiment result proved the validity and feasibility of the approach and that the extracted atoms had the features of certain extent noise-suppression ability [C11106]

"Fractal Stochastic Signal Processing Based on the Affine Spectral Correlation Method"

This paper proposed a new time-scale representation-"the wavelet spectral correlation function (WSCF)", and analyzed the property and the relation between SCF and WSCF. Based on the analysis of WSCF of fractal stochastic noise and WGN and the SCF of WGN, the property of fractal stochastic noise in the WSC domain is studied. Considering the actual sea clutter, a fractal noise AM-FM model was proposed, furthermore, its relation in frequency spectrum with the narrowband WGN AM-FM jamming is analyzed, and the WSCF of the sea clutter was analyzed, which presents the advantage of the WSCF in the processing of the sea clutter. The signal recognition of pseudo random code pulse trains was simulated, including the width and repeating period of the sub pulse, which showed the value of theory and application of WSCF in the signal recognition and estimation [C11107]

"Health Monitor Analysis System: Successful Instrumented Design and Unexpected Benefits"

The U.S. Air Force needs to extend the life of their AN/GPN-22 and AN/TPN-25 precision approach radar (PAR) systems. Obsolescence issues plaguing many PAR transmitter components, along with the need for specialist diagnostic teams, prompted a redesign effort of the transmitter sub-system. The current PAR family design provides limited analog Built-in-Testing and manual test points for diagnostic measurements. Our transmitter redesign effort includes the health monitor analysis system (HMAS), a microprocessor based transmitter management subsystem (TMS) that provides health monitoring. The TMS automates maintenance health diagnostics, prognostics and transmitter alignments. All transmitter system Line Replacement Units (LRU) are fully instrumented: inputs, outputs, and critical internal parameters. The TMS contains a Diagnostic Engine that will fault isolate to an individual LRU. Extensive instrumentation provides high confidence of data measurements. All instrumented parameters are logged to a database for empirical prognostic analysis. In order to reduce the specialist training needed for the diagnostic teams, the TMS contains a user friendly graphical user interface (GUI). A transmitter traveling wave tube (TWT) prognostic engine autonomously performs a Miram Curve [1] analysis to determine optimal tube filament parameters to extend tube life and computes tube life estimates. Except for catastrophic failures, this will allow for tube replacement during scheduled maintenance, minimizing system downtime. A Prognostic Engine by-product is TWT potential life extension due to optimal tube temperature management. Other potential applications for the TMS framework include any instrumented electronic system where health monitoring is desired. The TWT Prognostic Engine is directly transferable to other vacuum-electron device based radar and communication systems. [C11108]

"UWB Channel Measurements and Results for Office and Industrial Environments"

This paper presents the results of ultra wide band (UWB) channel measurements carried out at the campus of Delft University of Technology. The measurements were conducted in an indoor office and industrial environment using a time domain setup which allows measurements from 3.1 to 10.6 GHz. Results on large scale path-loss

exponent, shadowing, small scale fading and rms delay spread (RDS) for indoor office and industrial area propagation are presented [C11109]

"Motion Estimation from Map Quality with Millimeter Wave Radar"

Simultaneous localization and mapping (SLAM) builds maps of a priori unknown environments. Whilst this key mobile robotic competency continues to receive substantial attention, less attention has been paid to assessing the quality of the resulting maps. This paper proposes a way to quantify the intrinsic quality of point-cloud maps built from a stream of range bearing measurements. It does so by considering both the temporal and spatial distribution of the points within the map. One of the causes of unsatisfactory maps is the execution of unmodelled or poorly sensed vehicle manoeuvres. In this paper we show that by maximizing the quality of the map as a function of a motion parameterization, the vehicle motion can be recovered while correcting the map at the same time. In contrast to typical scan matching techniques, we do not rely on segmentation of the measurement stream into two separate "scans"; Instead we treat the measurement sequence as a continuous signal. We illustrate the efficacy of this approach by processing range data from a 77 GHz millimeter wave radar that completes 2 rotations per second. We show that despite this acquisition speed being commensurate with vehicle rotation rates, we are able to extract the underlying vehicle motion and yield crisp, well aligned point clouds [C11110]

"Low-Rate Chaotic UWB Transceiver System Based on IEEE 802.15.4a"

The chaotic UWB communication system based on IEEE 802.15.4a is proposed for wireless headset applications. A compact architecture can be implemented by using a chaotic UWB signal and a non-coherent detection scheme. The chaotic UWB generator is designed with the BW of 3.1 to 5.1 GHz, and a baseband process is realized on an FPGA including an adaptive decision and a channel code for non-source coded data stream. The system performance is evaluated by transmitting MP3 audio/voice and measuring PERs at 32 byte length of a PSDU for the system sensitivity and the interferer compatibility. The proposed system can be an excellent candidate for short-range connectivity services, as well as an inexpensive system with good capability for narrow-band interferences [C11111]

"Simulated Imaging Performance of UWB SAR Based on OFDM"

This paper concerns initial simulation study of an imaging radar system employing frequency division multiplexing as means of generating radar pulses. General architecture of OFDM communication system with realistic parameters was adopted and then modified to be used for synthetic aperture radar modeling. Arbitrary target function consisting of several point scatterers was used to test system's ability to produce imagery. At the conclusion of the study it was found that UWB OFDM imaging radar does, indeed, present certain benefits, such as dynamic spectrum allocation, anti-jamming potential through pulse diversity, possibility for dual use as a communication system-while also having a potential to produce high-resolution target images on par with other pulse-based UWB radars [C11112]

"Near Field Imaging for Breast Cancer Detection by UWB Minimum Variance Beamforming"

In this paper, we propose a near field imaging method for breast cancer detection by using coherent-signal-subspace-based wideband minimum variance beamforming. Transmitting the pulse and recording the backscattered signal at 13 antenna positions results in a 13-element array data. The received array data with artifact removal preprocessing is presented as near field model. By extending the coherent subspace method in the far field array processing problem to this near field problem, we develop the near field wideband coherent-signal-subspace-based minimum variance beamforming to construct the image of the breast with tumor embedded. This new method is applied to the computed finite-difference time-domain (FDTD) data to implement the simulation, and the results show that the tumor is clearly identified and localized [C11113]

"A Low-Cost UWB Radar System for Sensing Applications"

A new low-cost pulse based ultra-wideband radar system working up to 6.4 GHz has been developed. The main focus was on the use of cheap off the shelf components. Pulse generation in the transmitter was solved with a simple transistor circuitry. The down conversion in the receiver is realized with a sampling phase detector combined with a direct digital synthesizer. To control the radar system and for transmitting the digitized data to the PC a USB-controller is used [C11114]

"UWB Radar RF Front-End to Mitigate Impacts on EESS and Radio Astronomy"

A novel UWB short-range radar (SRR) which effectively mitigates its impacts on radio services using the

restricted band such as radio astronomy or Earth Exploring Satellite Service is introduced. The essential components, a burst oscillator generating no carrier leak, and antennas with notch-filtering function are presented in detail. Other key MMICs, such as a high-speed square-law detector, variable gain LNA, a sample-hold circuit, etc. are also described with the performances of the SRR [C11115]

"The Peak Sidelobe Level of Families of Binary Sequences"

A numerical investigation is presented for the peak sidelobe level (PSL) of Legendre sequences and maximal length shift register sequences (m-sequences). The PSL gives an alternative to the merit factor for measuring the collective smallness of the aperiodic autocorrelations of a binary sequence. The growth of the PSL of these infinite families of binary sequences is tested against the desired growth rate $O(\sqrt{n \ln n})$ for sequence length n . The claim that the PSL of m-sequences grows like $O(\sqrt{n})$, which appears frequently in the radar literature, is concluded to be unproven and not currently supported by data. Notable similarities are uncovered between the PSL and merit factor behaviour under cyclic rotations of the sequences [C11116]

"Advanced Optical Processor for Arbitrary Waveform Radar Imaging"

Essex has developed a prototype hybrid optical/digital processor for range-Doppler image formation using wideband arbitrary waveforms. The processor is called the advanced optical processor (AOP) and is a hybrid acousto-optic/digital processor that generates high dynamic range, range-Doppler images from wideband radar returns in real time. The AOP was first tested at a U.S. Government facility in November 2005. The AOP is currently scheduled to be tested with a range radar in April 2006. The laboratory testing included three waveform types and verification of all the necessary trigger control signals. The range radar testing will include collection and processing of the same three waveform signals to demonstrate arbitrary waveform capability. The AOP supports high resolution processing necessary for target discrimination and kill assessment by enabling the use of true arbitrary wideband waveforms. The selected architecture combines the advantages of both optical signal processing for the front-end receiver and high-speed digital signal processing for the real-time processing. Its size is a 6U form-factor and fits within the 6U electronic chassis [C11117]

"Signal Waveform's Optimal Under Restriction Design for Active Sensing"

We consider signal waveform's optimal under restriction design (SWORD) for active sensing. In the presence of colored interference and noise with known statistical properties, waveform optimization for active sensors such as radar can significantly increase the signal-to-interference-plus-noise ratio needed for much improved target detection. However, the so-obtained optimal waveforms can result in significant modulus variation, poor range resolution, and/or high peak sidelobe levels. To mitigate these problems, we can constrain the waveform optimization problem by restricting the sought-after waveform to be similar to a desired waveform, which is known to have, for example, constant modulus as well as reasonable range resolution and peak sidelobe level. One example of the desired waveform is the widely used linear frequency modulated waveform or chirp. We will provide a detailed solution to the constrained optimization problem and explain how it is related with the existing waveform optimization methods [C11118]

"Link Between the Joint Diagonalisation of Symmetrical Cubes and PARAFAC: An Application to Secondary Surveillance Radar"

The Manchester decoding algorithm (MDA) presented in N. Petrochilos and A.J. van der Veen (2004) succeeds in separating secondary surveillance radar (SSR) replies impinging on an array. The final step of the MDA consist of jointly diagonalizing a collection of several symmetric cubes by a sub-optimal technique. In this article, we demonstrate that it is in fact a PARAFAC problem with an almost symmetric solution. Furthermore, comparisons with other algorithms are carried out, with the help of computer simulations [C11119]

"Distributed Coherent Aperture Measurements for Next Generation BMD Radar"

This paper describes the distributed coherent aperture work being carried out at MIT Lincoln Laboratory in support of the next generation radar (NGR) program under the direction of the Radar Systems Technology (RST) group within the Missile Defense Agency/Advanced Systems (MDA/AS) Directorate. The NGR concept achieves transportability and high-radar sensitivity by coherently combining multiple distributed radar apertures in a building block manner. The operational concept uses orthogonal noise-like waveforms and multiple-input multiple-output (MIMO) techniques for cohere-on-receive operation and for adaptively estimating the transmit coherence parameters. In cohere-on-transmit mode, like waveforms are used and the relative phase and transmit time of each transmit pulse is adaptively adjusted so that the transmitted pulses arrive at the target in-phase and at the same time. In cohere-on-receive mode, an N2signal-to-noise ratio (SNR) gain is achieved over a single aperture when the orthogonal waveforms are combined coherently. In cohere-on-transmit mode, full

coherence is achieved on both transmit and receive for an N2SNR gain over a single radar. The NGR concept and recent highly-successful distributed aperture measurement campaigns are described. These measurements were carried out at the white sands missile range (WSMR) using the Lincoln Laboratory Wideband MIMO Distributed Aperture Test System in July 2005 and at the Air Force Research Laboratory (AFRL) Ipswich Antenna Range Facility in August 2004. Wideband coherence on transmit and receive was demonstrated at X-band in real time against live targets. A performance analysis, including comparison to the Cramer-Rao bounds, is given for the coherence parameter estimators during the presentation. Future plans are briefly discussed, including experiments with more radar channels and plans to demonstrate additional benefits of using MIMO techniques with distributed apertures and through spatial-- diversity [C11120]

"Information Theoretic Criterion for Waveform Selection"

A novel criterion for waveform selection in adaptive radar and other sensing applications is presented that is based on the information theoretic concept of mutual information. In addition, its application to the area of waveform diversity for synthetic aperture radar (SAR) systems is examined. Mutual information is a measure of the information (in the sense of Shannon) in a random variable or vector about another random variable or vector. It is shown herein that such a framework provides the basis for a conceptually simple and powerful criterion for context-dependent evaluation of candidate waveforms, as well as context-dependent design of waveforms. Furthermore, in the special case of zero-mean Gaussian-distributed clutter, interference, and noise, the criterion attains an analytically simple form—a scalar function of the singular values of a specific cross-covariance matrix. The criterion can be used in distinct optimization contexts (minimization or maximization) as a function of the problem to be addressed. In addition, the criterion inherently includes the statistical information of the sensed parameters. More specifically, in the context of a SAR system the criterion includes the covariance matrix of the set of illuminated ground scatterers. The formulation and simulation-based results are presented in the context of a first-order radar system model for simplicity, but the approach can be extended in a straightforward manner to cover more complex models. Results presented show that the criterion is an effective means for waveform selection in an adaptive SAR system [C11121]

"Novel Nonlinear Functions used for Optimal Detection in Gaussian Mixture Noise based on Maximum Entropy Densities"

Non-Gaussian noise poses a challenge to conventional detector techniques. In such a case it is possible to design a nonlinear detector that performs better than the optimal linear detectors. Locally optimal detector is one that has good performance when the signal is weak and the probability density function (PDF) of noise is known precisely. This paper deals with a new nonlinear detector for binary signal detection in Gaussian mixture noise. This detector is optimal without any constraints on signal strength, and it is convenient for non-Gaussian even symmetric PDF's. Furthermore, it does not require the knowledge of the exact noise PDF. We use maximum likelihood (ML) and maximum entropy, that are two optimal criteria, in obtaining this new detector. The proposed detector consists of new nonlinear functions followed by an accumulator and threshold comparator. These new nonlinear functions are polynomials consisting of odd power terms. Simulation results confirm the superiority of the new detector with respect to the previously proposed methods [C11122]

"Probabilistically-constrained Estimation of Random Parameters with Unknown Distribution"

The problem of estimating random unknown signal parameters in a noisy linear model is considered. It is assumed that the covariance matrices of the unknown signal parameter and noise vectors are known and that the noise is Gaussian, while the distribution of the random signal parameter vector is unknown. Instead of the traditional minimum mean squared error (MMSE) approach, where the average is taken over both the random signal parameters and noise realizations, we propose a linear estimator that minimizes the MSE which is averaged over the noise only. To make our design pragmatic, the minimization is performed for signal parameter realizations whose probability is sufficiently large, while "discarding" low-probability realizations. It is shown that the obtained linear estimator can be viewed as a generalization of the classical Wiener filter [C11123]

"Moving Target Localization for Indoor Imaging using Dual Frequency CW Radars"

In this paper, we propose a simple method, to determine the unambiguous range of a moving target, using dual frequency continuous wave (CW) radars. The carrier frequencies, and hence the wavelength, determine the maximum unambiguous range of the target. The technique is capable of determining range for an indoor moving target. It uses phase comparison of the Doppler signals to estimate the range, where as the target velocity is directly obtained from the Doppler shift. Simulation results are presented in the presence of noise to validate the technique. Experimental results are also provided showing the effectiveness of the proposed method for indoor range estimation. Specifically, we have performed two experiments, the first experiment is in an indoor laboratory

setting with absorbers to mitigate multipath. In the second experiment, the target was behind a one foot thick concrete wall, in an indoor setting without absorbers. For both experiments, we were able to successfully detect the target and estimate its range [C11124]

"Projection Techniques for Separation of Multiple Secondary Surveillance Radar Sources in a Real Environment"

secondary surveillance radar (SSR) based on multilateration principle and omni-directional antennae are operational today. We proposed new algorithms to separate a mixture of overlapping SSR replies on a M-elements antenna in previous works, other solutions were also proposed in the literature. Unfortunately, all have either some shortcomings, or an expensive computational cost, or no simple practical implementation. Therefore, there is a need for reliable, simple, effective algorithms to separate multiple SSR signals. Real recorded signals in a live environment are used to demonstrate the effectiveness of the proposed techniques [C11125]

"Beam Raster Scanning for 2D Flyover SAR"

Synthetic aperture radar (SAR) imaging technology has continued to evolve over the last few decades and the future holds promise. Beam raster scanning for 2D flyover SAR is yet another milestone in the evolutionary path of SAR imaging. This SAR imaging technique may have application in areas like passive unmanned aerial vehicle SAR. This paper builds on the 2D aperture synthesis concepts based upon rigorous analytical results presented by the authors earlier and elucidates the characteristics of sombrero point spread function and reconstruction in comparison to sine point spread function and reconstruction. This paper also explains the concept of 2D target area data collection scheme called flyover beam raster scanning [C11126]

"Airborne Very Long Baseline Interferometry and Geolocation"

A method is presented of performing geolocation of fixed emitters from a single, airborne platform using a two-element, very long baseline interferometer (VLBI) from 10 to 100 feet in length. The interferometer baseline is precisely tracked through a differential GPS system using auxiliary antennas placed in close proximity to the VLBI pair. A lever arm correction is applied to arrive at the VLBI baseline from the GPS measurements. A batch least squares processing algorithm is presented that operates on the interferometric phase measurements directly and resolves the associated ambiguities through global search strategies. A method of eliminating receiver phase bias by performing a difference operation is shown. Simulation results and Cramer-Rao lower bounds are also presented [C11127]

"A Generalized Formulation for Adaptive Pulse Compression of Multistatic Radar"

For the return signal at a radar receiver comprised of radar returns from K illuminating radars operating in the same spectrum in near proximity, the multistatic adaptive pulse compression (MAPC) algorithm has been shown to effectively separate and subsequently pulse compress the multiple signals such that range sidelobes and cross-correlation sidelobes are minimized in the mean square-error (MSE) sense. This previous formulation implicitly assumed that the K radars possess very good control of sidelobe emissions. However, sidelobe control on transmit results in mainbeam spreading and loss, which is often unacceptable. In this paper, a generalized framework is developed which accounts for all of the inherent signals that are incident at a given radar receiver. In general, these signals collectively originate from the respective transmit mainbeams and sidelobes of the K illuminating radars and are then reflected into the receive mainbeam and sidelobes of the given radar receiver [C11128]

"Polarization-Based High Resolution Radar Scatterer Classification"

We consider the use of polarization diversity for the detection, tracking and classification of scattering centers in high range resolution radar (HRR) data. Specifically, we propose a novel exploitation of polarization ratios to label moving scattering features into various geometrical classes including edges, tips or smooth reflectors. We demonstrate scattering-center labeling for both parametric and non-parametric classification algorithms. Experimental results on simulated HRR data are provided and indicate that polarimetric information can be exploited for geometrical typing of scatterers [C11129]

"Analyses of Autofocusing Schemes for Indoor Imaging with Unknown Walls"

The quality and reliability of through-the-wall radar imagery is governed, among other things, by the knowledge of the wall characteristics. Ambiguity in wall characteristics has a two-fold effect. It smears and blurs the image, and also shifts the imaged target positions. In this paper, we consider the smearing effect and present an autofocusing technique, based on higher order statistics, which corrects for errors under unknown walls. This is

achieved by tuning the wall variables until the sharpest image is obtained. Simulation results show that the proposed technique provides high-quality focused images with target locations in close proximity to the true target positions [C11130]

"A New Radar Detector in Unknown Signal and Clutter Environment"

In this paper, we introduce a new detector in the absence of any statistical knowledge of the fluctuating signal; perhaps a weak signal, and clutter. We use a few sampled fractional moments (FM) to construct the maximum entropy (MAXENT) probability density function (PDF) estimation. These moments; i.e., their fractional orders, are obtained from the observed sample variates. Using the fractional moments instead of the integer moments the estimated PDF is quite close to the true PDF. The test statistics is a fractional polynomial of very low order of the received samples. We consider the following target fluctuating models, swerling, lognormal, and Rician. We also consider the clutter to follow low and heavy tail models; i.e. Rayleigh, and lognormal [C11131]

"Large Phased Array Radar using Networked Small Parabolic Reflectors"

Multifunction phased array systems with radar, telecom, and imaging applications have already been established for flat plate phased arrays of dipoles, or waveguides. In this paper the design trades and candidate options for combining the radar and telecom functions of the deep space network (DSN) into a single large transmit array of small parabolic reflectors will be discussed. In particular the effect of combining the radar and telecom functions on the sizes of individual antenna apertures and the corresponding spacing between the antenna elements of the array will be analyzed. A heterogeneous architecture for the DSN large transmit array is proposed to meet the radar and telecom requirements while considering the budget, scheduling, and strategic planning constraints [C11132]

"A performance comparison of two time diversity systems using OS-CFAR detection for partially correlated chi-square targets and multiple target situations"

In radar systems, detection performance is always related to target models and background environments. In time diversity systems, the probability of detection is shown to be sensitive to the degree of correlation among the target echoes. In this paper, we derive exact expressions for the probabilities of false alarm and detection of a pulse-to-pulse partially correlated target with 2K degrees of freedom for the Order Statistics Constant False Alarm Rate (OS-CFAR) detector. The analysis is carried out for the "non conventional time diversity system" (NCTDS) and multiple target situations. The obtained results are compared with the "conventional time diversity system" (CTDS). [C11133]

"Forward-Looking Planar Array 3D-STAP using Space Time Illumination Patterns (STIP)"

Close-in sensing is needed for urban warfare operations, where ground moving target indication (GMTI) could be provided via forward or rear-facing multi-function array radars mounted on small highly-maneuverable airborne platforms. However, airborne radar arrays oriented any direction other than side-looking cause an elevation dependent angle-Doppler relationship in the clutter returns. This non-stationarity is acute in close-in sensing geometries where elevation diversity exists over the scene of interest. However, planar arrays have an inherent advantage over linear arrays due to their ability to observe clutter statistics as a function of elevation. This paper demonstrates the utility of elevation diversity by synthesizing a single 3D-STAP filter that exhibits an elevation dependent azimuth-Doppler response which is tailored to null the clutter "bowl" which characterizes the forward-looking clutter spectrum. Such a capability is particularly exploitable on transmit, where all elevation angles are simultaneously illuminated. To demonstrate potential benefits, this paper proposes the use of recently developed space time illumination patterns (STIP) from a planar AESA to invoke elevation diverse space-time illumination in a forward-looking clutter scenario. It is shown that 3D-STIP (azimuth-elevation-Doppler) facilitates elevation specific space-time beamforming which removes the clutter energy from a given Doppler frequency across all ranges, potentially simplifying processing on receive. Simulations using synthesized training data and clairvoyant covariance knowledge are conducted to demonstrate proof-of-concept [C11134]

"Three Variants of an Outlier Removal Algorithm for Radar STAP"

For space-time adaptive processing (STAP), we present three variants of an outlier removal algorithm, the self-censoring reiterative fast maximum likelihood (SCRFML). Specifically, these three SCRFML variants are implemented for three STAP methods, i.e., normalized adaptive matched filter (NAMF), normalized parametric adaptive matched filter (NPAMF), and low-rank normalized adaptive matched filter (LRNAMF). We demonstrated that the SCRFML algorithm can systematically reduce the number of dominant eigenvalues after successive regularization have been applied to the sample/parametric covariance matrix estimate. Then, we show that the model order for NPAMF can be determined from the simulation of cutoff signal-to-noise ratio versus sample

support. After the application of outlier removal variants, we compare the detection performance and computational costs of these STAP methods [C11135]

"Neuro-Fuzzy Model for Multi-Channel Underwater Imaging"

Multispectral imaging system usually consist 2-15 different color channels, hyperspectral system-100-200 channels. The image processing in each channel includes the complicated calculations and the final results have quite a large error. As is well known that there are large number of input parameters and some their uncertainty in the case of airborne and underwater LIDAR systems modeling. The using of statistical and determined models give the result having quite a large error of optical information processing and the given calculations take a lot of time to compute. The fundamentally different mathematical algorithms-the neural networks and the fuzzy logic is offered to use. It is realized with specially developed algorithms for multi-channel image processing. The new neuro-fuzzy model of foam coverage for four color channels has been developed to determine the interval of the minimal reflections and to obtain the images of non-foam covered areas [C11136]

"Rate Distortion Bounds on Passive Sonar Performance"

Information theory provides a novel perspective on passive sonar performance analysis. This approach begins by partitioning the search space and then considers the problem of assigning an unknown source to the correct partition based on pressure observations from a hydrophone array. Prior work described necessary conditions for achieving arbitrarily small probability of error (P_e) as a tradeoff between SNR and the range precision of the partitions. The current work presents a method to extend these results using the rate distortion function to find necessary conditions for any P_e , not just arbitrarily small ones. The Gaussian channel bound sets an upper limit on the information rate received at the array. Through the rate distortion function, this upper limit on information rate implies a lower bound on P_e for a given partition. Furthermore, the current work describes a tradeoff among range precision, P_e and SNR. Examples of this tradeoff are given for a typical 2-dimensional (range and depth) shallow water environment [C11137]

"Information Theoretic Measures for Through-the-Wall Surveillance"

Two information theoretic measures, entropy and divergence, are considered for detecting possible scene variations in the emerging through-the-wall radar imaging and surveillance applications. Investigation of these measures shows that they are likely candidates to provide automated reliable notifications of single and multiple changes in the scene. This capability is a key and welcome feature for practical and effective through-the-wall surveillance systems. Using experimental data, we show that the entropy measure is useful for discriminating between populated and unpopulated settings, whereas the divergence measure should be applied by the system operator for monitoring changes in the scene [C11138]

"Ultra Wideband Multibeam Optical Coherent Transient Radar"

In this paper, we present an electro-optic radar receiver for wide bandwidth, high time-bandwidth-product radar returns that simultaneously performs parallel beamforming across arrays with thousands of antenna elements. This analog technique allows for correlation times of approximately 10 ns across 30 GHz of bandwidth without the use of extremely fast digitizing circuits or digital processors. To perform this technique, we upconvert the return waveforms from the antenna array onto an array of optical fibers by using an array of electro-optic modulators. From here, we can use a single lens as a Fourier optical beamformer. The frequency scaled beams are formed into a optical coherent transient (OCT) crystal along with an optically upconverted copy of the transmitted waveform. The OCT crystal correlates the return with the reference signal across all squinted beams. A chirped readout laser probes the spectrum of the correlation at each frequency bin across all beams while a synchronized zoom lens compensates for the frequency scaled location of the beams. The resulting beam spectra is Fourier transformed across time to generate the correlation peaks of the return signal. Pulse-to-pulse correlation peaks can be achieved using spatial multiplexing within the crystal or temporal multiplexing of the readout of the signal. We motivate such a system by calculating the digital processor requirements of a similar system, followed by a detailed description of the architecture [C11139]

"Analysis of Prior-Subspace Estimation Schemes"

In the context of the direction-of-arrival (DOA) estimation problem, we can sometimes assume that we have a priori knowledge of a subset of the DOA for several sources. In that situation, some works have proposed to tacking into account of this knowledge to improve the localization of the unknown sources. The key idea is based on an orthogonal deflation of the signal subspace. In a companion paper, we have derived and analyzed the CRB associated to this model and we have shown that the prior-knowledge of a subset of the DOA is beneficial only for coherent or highly correlated sources associated to closely-spaced DOA. In particular, for

uncorrelated sources with closely-spaced DOA, the orthogonal deflation cannot help the estimation of the unknown DOA. Finally, we suggest that a possible solution could be to use oblique projectors. In this paper, we follow this line and we propose two algorithms based on the MinNorm principle [C11140]

"Concurrent Detection and Tracking using Multiple, Flying, Sensors"

We develop a probabilistic technique for performing multiple target detection and tracking based on data from multiple, flying, sensors. Multiple sensors can facilitate detecting and discriminating low signal-to-clutter targets by allowing correlation between different sensor types and/or different aspect angles. However, the data association problem can cause the computational complexity of standard trackers to become prohibitively high when combining too much data—a problem which will be exacerbated when including data from multiple sensors. Dynamic logic (DL) is a probabilistic technique for performing data association, based upon maximum likelihood parameter estimation of mixture models, which does not suffer from a computational explosion with increasing amounts of data. Previously, a DL-based tracker was developed for the relatively simple case incorporating data from a stationary sensor platform. In this paper we expand the framework to incorporate multiple, moving, sensor platforms, which requires a revision in the parameter estimation equations. The framework is general enough to be valid for different sensor types, for example radar or electro-optical. Sample results from synthetic data are presented [C11141]

"Statistical Identifiability of Multidimensional Frequency Estimation with Finite Snapshots"

Recently much progress has been made to improve the identifiability of frequency estimation from one snapshot of multidimensional frequency data mixture. However, in the case of multiple snapshots (or multiple trials of experiments), there are few identifiability results available. With multiple data snapshots, most existing algebraic approaches estimate frequencies from the sample covariance matrix. In this work we provide an upper bound on the maximum number of multidimensional frequencies that can be estimated for a given data size with finite snapshots. We show how the identifiability bound increases as the number of snapshots increases. An eigenvector-based algorithm is also obtained for N-D frequency estimation. Simulation results show the proposed algorithm offers competitive performance when compared with existing algebraic algorithms but with reduced complexity [C11142]

"Preprocessing for Adaptive Spatial Filtering in Ground-Based Rotating Radar Systems"

An effective scheme for spatio-temporal processing with ground-based rotating radars consists in making adaptive spatial filtering, with frequent updates, followed by temporal processing. In presence of jamming and clutter, spatial processing first filters jammers, whereas temporal processing then filters clutter. However, starting by making a spatial adaptive processing requires to dispose of jamming + noise alone reference. But as clutter has not been filtered yet, it may be present in estimation data with stronger power than that of jammers. Therefore, the estimation of the jammer correlation matrix will be degraded resulting in a fall of performances of spatial processing. In this paper, it is first proposed to use a preprocessing before spatial filtering. The objective of this preprocessing is to reduce clutter power in the estimation samples used to compute adaptive spatial filters and thus improve the efficiency of jamming filtering. Then, a performance study of this preprocessing in terms of clutter power reduction is made, aiming at quantifying both the influence of antenna rotation and clutter decorrelation [C11143]

"Range-dependence Issues in Multistatic STAP-based Radar"

Multistatic radar systems offer the potential to overcome some of the limitations of the monostatic or bistatic systems. In particular, the ability to build larger apertures allows to increase spatial accuracy. Space-time adaptive processing (STAP) is a method of choice in the context of slow-moving target detection. However, the statistics of signals from multistatic radars are typically range-dependent. This range-dependence leads to major difficulties in estimating the interference plus noise covariance matrix required to perform STAP. In this paper, we present a method able to compensate for the range-dependence of the signal statistics and we show that this method achieves near-optimal performance [C11144]

"An Approach to Active Sensor Imaging"

In this paper, an alternative target density function (TDF) is proposed to image the radar targets in a dense target environment. It is obtained by considering a novel range and scanning angle plane different from the conventional methods. An alternative method is briefly proposed for smoothing the target density function by taking advantage of Walsh functions. Although the imaging is obtained via the phased array radars, the problem associated with beamforming in linear phased array radar system is bypassed in this new algorithm [C11145]

"Incorporating Pulse-to-Pulse Motion Effects into Side-Looking Array Radar Models"

A technique is presented for incorporating pulse-to-pulse (inter-pulse) motion effects into side-looking array radar data models yielding a motion-sensitive space-time snapshot. Low flying, highly-maneuverable unmanned aerial vehicles (UAV) represent a potential worst case application scenario given their roll, yaw, and pitch rates are primarily limited by structural integrity. High degrees of maneuverability during the coherent processing interval (CPI) allow clutter and target returns to change significantly. The technique presented uses M coordinate transformations to describe platform attitude variations throughout the CPI. Ward's model then is extended to incorporate maneuver-induced changes in spatial frequency and Doppler. The new motion-sensitive space-time snapshot is used to characterize space time adaptive processing (STAP) performance without motion-compensation applied. Results clearly show motion-induced clutter-null broadening with measurable degradation of STAP algorithm minimal discernable velocity [C11146]

"A Novel Non-Linear Approximation to the Huygens-Fresnel Diffraction Patterns for Reconstructing Digital Holographic SAR Images"

Based on the nonlinear approximation of Huygens-Fresnel diffraction patterns, the SAR images of a target can be made up from a knowledge of a hologram for all frequencies and all aspects angles to provide a complete description of the target. In this paper we reconstruct the image of hologram employing the multiresolution Fresnelet transform to approximate the Huygens-Fresnel diffraction patterns in an off-axis geometry from the simulated test pattern (3bar). Fresnel transform is a wavelet-like transform, very close to Gabor functions (M. Unser et al., 1992) and well localized with respect to the holographic process. This method allows us to generate and reconstruct hologram on a digital computer, and apply multiresolution wavelet base analysis and special filtering on it. Since images are nonstationary process, we use fractional Brownian motion (fBm) method to describe texture in SAR images. It is known as a suitable model to classify a vast number of natural phenomena and shapes, such as the range of rivers, terrain surfaces, mountains ripples of water, coastlines and etc. The novelty of this technique lies in the use of Fresnel transform in reconstruction of holographic SAR images and fBm model for classifying them [C11147]

"Single-Snapshot Beamformer Performance using Large Arrays with Faulty Sensors"

Large sensor arrays are prone to element failures which can seriously degrade their performance. In the event of sensor failures, conventional non-adaptive re-design of array weights for the resulting non-uniform or even sparse array often leads to undesirable mainlobe-versus-sidelobe level trade-offs. Alternatively, adaptive array processing techniques can be employed but for large arrays it can be compromised by lack of snapshot support in dynamic environments. Recently, an approach called beam-space adaptive channel compensation (BACC) was introduced based on the idea of reconstructing the filled array data from the receive beams in which the sidelobe leakage of strong interferers from adjacent beams is minimized. In this paper, BACC and various alternatives are evaluated using actual radar data with both injected and real scatterers. Results of four methods, BACC, MV adaptive beamforming using an augmented Toeplitz covariance matrix (Toeplitz-MV), principal solution beamforming, and conventional beamforming in the presence of faulty sensors are compared in terms of ROC performance, probability of detection versus SINR, and the unmasking of targets in estimated range-Doppler spectra [C11148]

"Human and Object Detection in Smoke-filled Space using Millimeter-wave radar based Measurement System"

In recent years, crisis management's response to terrorist attacks and natural disasters, as well as accelerating rescue operations have become an important issue. In rescue operations of fire disaster, one of the biggest problems is that the firefighter's view is obstructed by dense smoke. We considered the most important task for firefighters is to understand the inside situation of the dense smoke space. Therefore, we aim to develop a system visualizing the situation of the space. First, we scanned target space by using millimeter-wave radar combined with a gyro sensor. Then, due to detect humans and objects, we construct a 3D map from signal-reflection datasets using 3D image processing techniques. In this paper, we introduce our system and report the results of the measurement experiment in the real smoke space situation. [C11149]

"A Fully Integrated SoC for GSM/GPRS in 0.13/spl mu/m CMOS"

A single-chip radio for quad-band GSM/GPRS applications integrates the RF, analog/mixed-signal blocks, DSP, application processor, RAM/ROM, and audio. It is implemented in a 0.13μm CMOS process. The RX achieves -112.5dBm/-110.5dBm sensitivity and the TX meets all the spectral mask requirements while using a 1.5V supply [C11150]

"Performance Tradeoffs among Beamforming Approaches"

In this paper, three main criteria for the adaptive beamformer design are discussed: maximal signal-to-interference-plus-noise ratio (MSINR), minimal mean-squared error (MMSE), and minimal least-square error (MLSE). Although in the case of exactly known power and steering vector of the signal-of-interest (SOI), there are beamformers that can simultaneously meet the MMSE and MSINR criteria, this is no longer true when the exact knowledge of the steering vector is unavailable. To account for steering vector errors, a meaningful approach is to model the actual steering vector as random. In this paper, it is shown that in the latter case, the MMSE and MSINR criteria can not be simultaneously attained. We study the achievable region in the MSE-SINR plane and propose a new adaptive beamformer that can attain a frontier of operating points on the boundary of this region and, therefore, provide an optimal performance tradeoff among the MSINR and MMSE criteria. It is also shown that in the random steering vector case, the MLSE and MSINR criteria are simultaneously achievable and a new adaptive beamformer is proposed that satisfies both these criteria

[C11151]

"Programmable Processor Design for Givens Rotations based Applications"

A wide range of applications involve matrix decompositions which can be computed using givens rotations. A programmable processor for givens rotations offers more flexibility than highly tailored systolic array hardware implementations. The programmable processor design presented in this paper employs an approximate rotations method to compute givens rotations. Instantiations of this programmable processor can then be arranged/configured (i.e. in arrays of varying size and dimension) according to the requirements of the target application. Another advantage of this approach is that the processor can be programmed to compute different algorithms (e.g. QR decomposition, singular-value decomposition or a combination of both) [C11152]

"2006 IEEE SAM-2006 IEEE Sensor Array and Multichannel Signal Processing Workshop Proceedings"

The following topics were dealt with: beamforming; direction-of-arrival estimation; tracking; multi-sensors application; multi-channel processing; sensor array processing; MIMO processing; space-time coding; synthetic aperture space-time processing; imaging; space-time processing for radar; sensor networking; sensor management; sonar; and microphone array processing [C11153]

"Extreme Beam Broadening using Phase Only Pattern Synthesis"

This paper describes methods for broadening the beam of a phased array antenna using phase-only element weights. This type of broadening can be valuable for improving the search occupancy and/or reducing the search frame time for large phased arrays, when transmit beam broadening is combined with multiple simultaneous receive beams. Phase-only broadening is required for typical solid-state (active phased) arrays because control of the transmit amplitude at each element is not practical. A notable result is that there is a relationship between the amount of beam broadening and the efficiency (directivity) of the resulting beam. In particular it is shown that broadening less than $\sim 2.5:1$ results in reduced beam efficiency for both linear and circular arrays, while a broadening of greater than $\sim 2.5:1$ results in improved beam efficiency, and that, therefore, certain broadening configurations will be preferable to the radar designer (e.g. $4:1$ in one plane rather than $2:1$ in two planes, due to a large difference in efficiency). The algorithms used to achieve the broadening patterns presented here are based on a combination of homotopy from known optimality with a stochastic gradient descent approach using a carefully constructed one parameter family of penalty functions [C11154]

"Electrical funnel: A broadband signal combining method"

A non-uniform 2D propagation medium is compatible with modern IC processes and is used to produce a 4-to-1 broadband power combiner called an electrical funnel. The combiner is used in a wideband power amplifier in a $0.13\mu\text{m}$ SiGe BiCMOS process and yields 125mW peak output power at 85GHz with a 24GHz 3dB bandwidth [C11155]

"Gridding Multivariate Positive Data for Real Time Visualization"

Common visualization methods require an underlying grid. For visualization of scattered data samples it is required to approximate the data at the same grid using some interpolation technique. It is common that the data samples are positive and representing the quantities for which negative value is meaningless. For example mass, volume and density are meaningless when negative. Modified quadratic Shepard method is a commonly used method for gridding purposes. However it does not preserve positivity for inherently positive data sets. This

paper discusses the problem of gridding inherently positive data sets for real time visualization applications using modified quadratic Shepard's method. Key requirement for an algorithm to be used for real time application is its predictable timing behavior. We present an efficient and deterministic alternative quadratic Shepard method as a solution to the problem of visualization of multivariate positive data in real time [C11156]

"Parametric Adaptive Signal Detection for Hyperspectral Imaging"

In this paper, we introduce a class of training-efficient adaptive signal detectors that exploit a parametric model taking into account the non-stationarity of HSI data in the spectral dimension. A maximum likelihood (ML) estimator is presented for estimation of the parameters associated with the proposed parametric model. Several important issues are discussed, including model order selection, training screening, and time-series based whitening and detection, which are intrinsic parts of the proposed parametric adaptive detectors. Experimental results using real HSI data reveal that the proposed parametric detectors are more training-efficient and outperform conventional covariance-matrix based detectors when the training size is limited [C11157]

"Target Model Effects on MIMO Radar Performance"

A simple comparison between "spatial MIMO" (multiple input-multiple output), "frequency MIMO", and coherent netted radar systems shows that better performance can be achieved by the incoherent processing approaches. This assumes that the MIMO techniques acquire independent samples and there is no a priori information available to the netted radar enabling the incoming signals to be phase-aligned (P.F. Sammartino et al., 2006). Here we consider a more detailed model for target backscatter in order to gain a deeper sight into the true potential of these radar signal processing techniques. The overall aim of this work is to understand the performances available when real targets are under surveillance and to understand which conditions make MIMO perform best or, at least, better than a netted radar system. The target models introduced here are a step towards this aim [C11158]

"Impact of an ARQ Scheme in the MAC/LLC Layer on Upper-layer Packet Transmissions over a Markovian Channel"

In this paper, we capture the impact of an ARQ scheme in the MAC/LLC layer with a forward error-correcting code on upper-layer packet transmissions over a Markovian channel by examining the performance of a single service data unit which may be either a TCP segment or a UDP packet. We assume that the ACK/NACK delay of ARQ blocks belong to a single service data unit is less than the transmission period of each ARQ block. The performance measures of a single service data unit transmission are derived in terms of the transmission success and failure probabilities given a retransmission time-out value, retransmission timeout probability and the moments of transmission delay. Further, the queueing performance of a service data unit transmitter is also presented by varying average received signal-to-noise ratio, mobile velocity, number of ARQ blocks needed to transmit a single service data unit, number of retransmissions for each ARQ block and error-correcting capability applied to an ARQ block. From numerical examples, renegotiation between a serving base station and a mobile station is needed, when the mobile station is far from the serving base station in order that a service data unit is fragmented into a larger number of ARQ blocks in order to apply high error-correcting capability for each one [C11159]

"A Novel Joint De-Interleaving/Recognition System of Radar Pulse Sequence"

First, the paper shows a novel sorting method based on delaminating coupling and support vector clustering (SVC). Secondly, it presents a notion of type-entropy. And recognition technology of type-entropy is introduced into signal sorting system so that a novel radar sequence signal sorting system is to be presented. The experiment result shows that the system can sort efficiently radar signals in the complex pulses environment [C11160]

"Architecture of a Context-Aware Vertical Handover Decision Model and Its Performance Analysis for GPRS-WiFi Handover"

The common desire to be connected "anytime, anywhere, anyway, and to anything" leads to explosive growth of mobile computing and speedy emergence of new wireless technologies, applications, and devices in recent years. In this array of heterogeneous systems, intelligent handover (HO) decision, beyond traditional ones that are based on only signal strength, is needed so that terminals can select the best option available from diverse networks and services as per user requirements. In the process, it would enable user applications to switch automatically between active interfaces that best suit them based on application requirements and interface capabilities, and to use multiple radio interfaces simultaneously. To fulfill the above requirements, this paper

describes the architecture of a context-aware vertical HO decision model suitable for multimode mobile devices in heterogeneous networks and evaluates its performance for vertical HO between GPRS and WiFi. [C11161]

"Interworking between GPRS AND ISP for Wireless Internet Service of Mobile ISP Subscriber"

In this paper we illustrate how visited mobile ISP subscriber can access home ISP via GGSN (gateway GPRS support node) on GPRS (general packet radio service) network. We also introduce messages between GGSN and ISP for wireless Internet access of visited ISP subscriber, and a specific DHCP relay which can provide dynamic IP to visited ISP subscriber, and signaling for IP management using RADIUS authentication and account server for wireless Internet service. The contribution of this paper is to suggest interworking solution between ISP and GPRS network for seamless Internet service [C11162]

"Barankin Bounds for Target Localization by MIMO Radars"

Multiple-input multiple-output (MIMO) radar/sonar systems transmit signals coded in time and space domains and have several advantages upon conventional systems. In this paper, the Barankin bound on target localization errors is used for analysis of the threshold signal-to-noise ratio (SNR) of MIMO radar/sonar systems. It is shown that the threshold SNR of MIMO systems with spatially orthogonal transmit signals, is significantly lower than with coherent transmit signals. Orthogonal signal transmission results in lower threshold SNR, because of the lower sidelobes in the likelihood function. The lower sidelobes are achieved, since MIMO configuration allows to process the signal in both transmit and receive modes. Simulation results show that the threshold SNR obtained by orthogonal signal transmission is lower by more than 10 dB compared to coherent signal transmission [C11163]

"Adaptive Techniques for MIMO Radar"

By transmitting independent waveforms via different antennas, the echoes due to targets at different locations are linearly independent of each other, which allows the direct application of many adaptive techniques to achieve high resolution and excellent interference rejection capability. In the absence of array calibration errors, we discuss the application of several adaptive algorithms including Capon, APES and CAPES. When array errors are present, we apply the robust Capon beamformer (RCB) and doubly constrained robust Capon beamformer (DCRCB) approaches to the MIMO radar system to achieve accurate parameter estimation and superior interference and jamming suppression performance [C11164]

"MIMO Radar Space-Time Adaptive Processing for Multipath Clutter Mitigation"

This paper describes a multiple-input-multiple-output (MIMO) generalization of space-time adaptive processing (STAP) to mitigate radar clutter subject to multipath propagation between transmit and receive arrays. Multipath clutter can occur when surface returns are multiply scattered, causing significant Doppler frequency and wavenumber spreads. In the worst case, multipath propagation may cause Doppler spread clutter to return via the receiver mainlobe. In such situations, conventional STAP cannot mitigate Doppler spread mainlobe clutter without also suppressing the target. MIMO radar techniques using orthogonal waveforms have been proposed for increasing radar coverage rate often at the expense of employing significantly larger radar time-bandwidth products. In this paper, we consider a MIMO approach wherein conventional radar waveforms are phase-coded to be orthogonal after Doppler processing at the receiver, i.e. in "slow-time". Slow-time MIMO has the advantages of being bandwidth efficient and easily implemented without the need to modify the receiver before range pulse-compression. In this paper, the mathematical formulation of MIMO STAP is developed for both direct-path and multipath clutter scenarios. At each slant range, the MIMO STAP processor operates on a receive sensor, transmitted pulses, and slow-time phase code channel data cube. Coherent combination of the decoded slow-time channels at the receiver permits effective control of the transmit array pattern by receive post-processing as a function of slant range. Simulation results demonstrate SNR gains when a transmit null is steered in the outbound direction towards the multiply scattered clutter [C11165]

"An Optimal Baseline Design and Performance Analysis in Distributed Spaceborne SAR System"

This paper discusses the capability of distributed spaceborne SAR, and presents a novel honeycomb configuration of satellite constellations with 6 micro-satellites. And a further analysis of five functional models about this configuration is done. The reliability determination test shows dependability in different working status of this 6-satellite system. Basing on the performance of this constellation, the optional baseline design was given. Furthermore, the relationship between multi-baseline and the range resolution, the accuracy of height measurement, the velocity accuracy, etc, are discussed. Then some simulations were accomplished to analysis the effects of the height measurement error, the accuracy of velocity and the flat land effect. It demonstrated that 6 micro satellites SAR system with the optimal baseline performs perfectly [C11166]

"A Comparison of Back-Projection and Range Migration Algorithms for Ultra-Wideband SAR Imaging"

Ultra-wideband waveform and large integration angle benefit the synthetic aperture radar (SAR) with very high range and azimuth resolutions. However, at the same time, more new complexities and challenges are brought to the conventional SAR imaging algorithms. The back-projection algorithm and range migration algorithm are two newly developed algorithms that can be used in ultra-wideband SAR imaging. The back-projection algorithm originates from the medical imaging reconstruction technique called computer-aided tomography whereas the range migration algorithm is derived from seismic migration techniques. In the application to SAR imaging, the performance comparison is made in this paper based on theoretical analysis, simulation and experimental data. The analysis and processing results show that both algorithms are suitable for ultra-wideband SAR imaging and the theoretical resolution performances can be achieved. In addition, some practical issues of implementation and performance difference about these two algorithms are addressed as well [C11167]

"Evaluation and Tuning of a SAR Detector using Sparse-Array Spotlight Mode Simulations"

We describe a method of tuning a simple detection process of stationary targets in SAR images. The tuning metric accounts for the squared-error performance of prescient estimators of target location and reflectivity. The efficiencies of these prescient estimators are compared to their Cramer Rao bounds (CRBs). The off-line tuning is performed by collecting statistics of scatterer estimation in SAR images created using sparse-array spotlight mode simulations [C11168]

"A Synthetic Acoustic Volumetric Array"

This paper presents a novel synthetic aperture method, which can be used to reduce the average sidelobe level of a random spherical volumetric array. The technique exploits a general property of random arrays in which the average sidelobe level is inversely proportional to the number of elements present [C11169]

"Radar Waveform Design using Minimum Mean-Square Error and Mutual Information"

This paper addresses the problem of radar waveform design for target identification and classification. Both the ordinary radar with a single transmitter and receiver and the recently proposed multiple-input multiple-output (MIMO) radar are considered. A random target impulse response is used to model the scattering characteristics of the extended (nonpoint) target, and two radar waveform design problems with constraints on waveform power have been investigated. The first one is to design waveforms that maximize the conditional mutual information (MI) between the random target impulse response and the reflected waveforms given the knowledge of transmitted waveforms. The second one is to find transmitted waveforms that minimize the mean-square error (MSE) in estimating the target impulse response. Our analysis indicates that under the same total power constraint, these two criteria lead to the same solution for a matrix which specifies the essential part of the optimum waveform design. The solution employs water-filling to allocate the limited power appropriately. We also present an asymptotic formulation which requires less knowledge of the statistical model of the target [C11170]

"Discriminating Between Stationary and Time-Varying Autoregressive (TVAR) Models in Array Processing"

For a set of T independent N -variate Gaussian training samples ($T < N$), we derive a test for discriminating between stationary autoregressive models of order m , $AR(m)$, and time-varying autoregressive models of order m , $TVAR(m)$ [C11171]

"Multiple Window Based Ultrawideband Microwave Imaging for Early-Stage Breast Cancer Detection"

In this paper we propose a multiple window (MW) method for ultrawideband microwave-based breast cancer detection in low signal-to-clutter ratio tissue environments. Multiple space-time beamformers or windows are employed to obtain approximately statistically independent images of backscattered power which are then averaged. Areas of large backscattered power suggest the presence of tumors because of the relatively large dielectric properties contrast between normal and malignant tissue. We develop a criterion for designing the multiple beamformers and illustrate the performance of the MW method with simulated data from a 2-D realistic numerical breast model. We demonstrate that the MW method yields higher signal-to-clutter ratios than the penalized least-squares based beamformer for various tumor locations [C11172]

"Iterative Detection of Linear Objects in GPR and Seismic Images"

An iterative technique for detecting linear features in 2D images based on the Radon transform is developed. The algorithm is suitable for processing ground penetrating radar (GPR) and seismic images to find underground pipes and tunnels. Detection is performed in the Radon transform space. The length and width of the linear object area are estimated and the corresponding portion of the image is removed at each iteration. The algorithm has the advantage of detecting very weak linear objects, which are barely detected by existing detection algorithms, in Radon transform space. The proposed algorithm is tested on both simulated and experimental data measured from a laboratory scale model area. Results show successful detection of strong and weak linear objects [C11173]

"Adaptive Matched Direction Detector"

We consider the problem of detecting a partially unknown signal, in the presence of unknown noise, using multiple snapshots in the primary data. To account for uncertainties about signal's signature, we assume that the steering vector lies on an unknown line in a known linear subspace. Additionally, we consider a partially homogeneous environment, for which the covariance matrix of the primary and the secondary data have the same structure, but possibly different levels. We study the invariances of the detection problem and derive the maximal invariant. A two-step generalized likelihood ratio test (GLRT) is formulated and compared with a 2-step GLRT which assumes that the steering vector is known [C11174]

"Optimal Adaptive Array and Angle Tracking for Multiple Targets-A Re-examination of Optimal Array Processing"

The optimal array for detecting the signal from a desired direction but contaminated by receiver noise and strong interference from different sources with unknown arriving-angles is re-examined. The well-known optimal array is obtained by inverting the covariance matrix of interference and noise to maximize the signal to interference and noise ratio (SINR). In practice, the covariance matrix is unknown and has to be estimated by a sample covariance matrix. The optimal array is thus estimated by inverting the sample covariance matrix. This procedure has been employed in optimal array research without challenge. However, it is shown in this paper that the estimated optimal array fails to yield the highest SINR in the case of unknown arriving-angles. Instead the highest SINR can be achieved by optimally estimating the arriving-angles of interference followed by a constrained matched filter, which maximizes the signal to noise ratio subject to canceling the interference from the estimated arriving-angles. In order to reduce the computational burden, an angle-tracking system for multiple targets is adopted to achieve the optimal estimation of arriving-angles. The resulting system of angle-tracking adaptive array offers the highest SINR at a computational burden only on the order of N^2 multiplications within a radar range-cell $\Delta\tau$, rather than N^3 multiplications in the well-known but questionable estimated optimal array. Here N is the number of sensors in the array and M the number of interference sources. Typically, $N = 1,000$ in a planar radar array, $M = 2-10$ and $\Delta\tau = 1 \mu s$. Numerical simulations confirm the theoretical results [C11175]

"A New Near-Field Source Localization Algorithm without Pairing Parameters"

In this paper, we propose a new near-field source localization algorithm without any spectral peak searching or parameter pairing. Firstly, based on fourth-order cumulant of the outputs of a uniform linear array (ULA), we derive a multiple invariance-sensor array processing (MI-SAP)-type data model using the formed cumulant matrices. Secondly, the DOA, range, and frequency parameters are estimated from the matrices got via trilinear decomposition of three-way array. Finally, simulation results are presented to validate the performance of the proposed method [C11176]

"Improved 2-D Root MUSIC for Non-Circular Signals"

This paper proposes an improved two-dimensional (2-D) root MUSIC algorithm for non-circular sources. The proposed method has many advantages over conventional root MUSIC algorithms. First, it requires no pair matching between the azimuth and elevation angle estimation, whereas conventional 2-D root MUSIC algorithms require an exhaustive pair-matching search. Second, the proposed algorithm shows no estimation failure when the elevation angles are between 70 and 90 degrees, whereas the conventional 2-D root MUSIC algorithms fail. Third, the proposed algorithm can estimate the direction of arrival angles (DOAs) of coherent sources, whereas the conventional 2-D root MUSIC algorithms cannot. Fourth, the algorithm does not require any forward/backward spatial smoothing, whereas the conventional 2-D MUSIC algorithms do. Hence, the proposed algorithm can reduce the computational load significantly and can be applied to faster real-time radar/sonar and commercial wireless systems. In addition to these advantages, the simulation results show that the proposed algorithm outperforms the conventional root MUSIC algorithms by a 7 dB gain in signal-to-noise ratio (SNR) to

achieve the same root mean square error (RMSE) performance [C11177]

"Biologically Inspired Methods for Array Signal Processing"

This paper focuses on the various array signal processing methods that have been inspired by biological models. It discusses the long-standing algorithmic challenges and combinatorial complexity as well as the knowledge instinct and dynamic logic of these biologically-inspired methods. It also provides examples of these methods used in GMTI tracking, slow-moving targets in SAR and UAV swarm navigation and fusion [C11178]

"Integrating Inter-Vehicle Communication with Roadside Wireless Access Points to Provide a Lower-Cost Message Broadcasting Service on Highways"

Intelligent transportation systems (ITS) is an important research topic. One important function of ITS is to broadcast emergent traffic information to vehicles so that they can avoid a dangerous or congested zone in time. This paper investigates the use of inter-vehicle communication to assist roadside wireless access points to provide a lower-cost message broadcasting service on highways [C11179]

"Simple Multiuser Detectors for DS-UWB Systems"

UWB is an emerging technology inviting major advances in wireless communication, networking, radar and positioning systems. In this paper, we present novel algorithms for the multiuser detection based on minimum mean square error (MMSE) for a DS-UWB multiuser communication system. The algorithms exploit the inherent multipath diversity and also mitigate the effects of both inter symbol interference (ISI) and multiuser interference (MUI). Simulation results show that the given algorithms perform better than the other known detectors in literature. We also provide closed form expression for the BER results of the above scheme [C11180]

"Performance Analysis of Non-Cosited Evolved 2G and 3G Multi-Access Systems"

An efficient combination of radio access technologies, integrated in a multi-access network, will be a key enabler in future provisioning of mobile data services. This paper addresses a scenario where an incumbent mobile network operator, with an existing 2G and 3G infrastructure, has deployed a dense WCDMA/HSPA macro-cell network in an urban area. With this high capacity network deployed, upgrading previous 2G and 3G systems with EDGE and HSPA respectively may seem obsolete. However, even though these systems may not support the intended data rates alone, they could, thanks to favorable propagation characteristics and the additional spectrum available, be useful as complements. Simulation results indicate that upgrading GPRS base stations with EDGE, or a sparse WCDMA macro cell layer with HSPA, mainly would benefit uplink transmission. For this case, the data rate that can be guaranteed with 95% area availability (coverage) can be increased with approximately 40-100%. In the downlink, though, the dense WCDMA/HSPA system alone supports user data rates of 500 kbps for all relevant user densities. Thus, upgrading legacy infrastructure would be obsolete [C11181]

"Real-Time WLAN Monitoring in a 4G Multiplatform Environment"

Real-time monitoring in 4G networks is of prime importance for network operators of present and future generation. Nowadays operators utilize stored historical data from their data warehouses to improve networks and services, at the same time the number of mobile subscribers rapidly increases and additionally, the new data-technologies for wireless access add extra traffic to the already overloaded networks, often causing serious problems to their performance. A real-time monitoring tool is necessary to operators in order to guarantee high quality of service. In this paper a novel 4G multiplatform real-time monitoring system is presented and analyzed, giving emphasis to WLAN part. The main idea of this system is to collect reports from numerous network elements in such way that the system is compatible and operational in any kind of network of any manufacturer and operator. Additionally the system architecture discussed in this paper is capable of accommodating and supporting 4G networks effectively [C11182]

"The Phase Statistical Characteristics for the Signal Reflected from Fluctuating Reflector at the Retransmission Method"

The differences in phase distribution for microwave signal reflected from fluctuating reflector at retransmission and radar-tracking methods are determined. The data emphasizing the growth of effective values of phase fluctuations at retransmission method comparing with radar-tracking one are obtained [C11183]

"An optimal sampling of linear FM signal for efficient aperiodic correlations"

In digital communication and radar pulse signal processing, sequences with low autocorrelation levels are highly desirable. It has become a common practice to perform signal processing in discrete structures instead of continuous domains. The discrete structure of the phase code signal implies a possible potential to manipulate sidelobe patterns as desired, which promises wide dynamic range responses for various applications. This paper shows that a particular sampling rate for linear FM signals may lead to a significant reduction of peak sidelobe level (PSL) at the pulse compression output [C11184]

"GPRS Based System for Atmospheric Pollution Monitoring and Warning"

This paper presents the synthesis of a SCADA (supervisory control and data acquisition) system, named Pollution Guard, designed to collect and process atmospheric pollution data measured in several strategic points of a region. Pollution Guard makes use of the GPRS (general packet radio service) data communication infrastructure from a mobile communication provider that covers a very large area, practically the air pollution data being collected from every place in the country. In comparison to other similar systems, the new functionalities provided by Pollution Guard are the SMS (short messaging system) and e-mail alerts generated when the level of toxic substances exceeds some given values, chosen with regard to respiratory illness [C11185]

"Performance of Admission Control Strategies for Dual Transfer Mode in EGPRS Networks"

Dual transfer mode (DTM) has been defined by 3GPP for EGPRS networks. It provides simultaneous usage of GSM and GPRS services without requiring a full fledged GPRS class A terminal. DTM relies on the usage of half rate coders that make it possible to share a timeslot between a voice call and a data session. The data session can be extended to more time slots if necessary. This work examines an optimal policy adapted for resource allocation in a cell providing DTM capability. At the end of one part of a DTM call, the policy decides whether the released half slot should be reallocated to an existing data session or not. In earlier work, this optimal policy was proven to be a threshold strategy. The optimal policy is compared with the two policies where the same decision is taken regardless of the state of the system. Its performance is evaluated with respect to system load and configuration parameters [C11186]

"A Study of Hailstone Detection System Based on Radar Echo Reflectivity Image"

Hailstone is one of the main meteorological disasters and it is very difficult to be forecasted effectively. A system of automatic recognition hail cloud is built base on the reflectivity image in this paper. The system deals the inputting image with the cut-down, filter, dilation and erosion process, and then the cloud is extracted from the image. A new concept called reflectivity density, which is used to distinguish hail cloud from rainstorm cloud, is defined. When recognized hailstone cloud the system will find the hailstone landing position by using Hough transform to detect hook echo or detecting the pixel with a reflectivity over 60 dBZ. This system is built on the Windows platform, and the experimental results validate the availability of the algorithm [C11187]

"Analysis of LIDAR Data Fused with Co-Registered Bands"

In the past decade, Light Detection And Ranging (LIDAR) has been recognised by both the commercial and public sector as a reliable and accurate source for land surveying. Object classification in LIDAR data tends towards data fusion by employing additional simultaneously recorded bands. In this paper, a rule-based approach is presented for improving classification accuracy obtained in a supervised Maximum Likelihood classification. Simultaneously recorded co-registered bands are used such as high resolution LIDAR first, last echo and intensity data, aerial and near infra-red photos. Issues regarding feature and class selection and differentiated accuracy assessment are addressed. Furthermore, the individual influence of each band on the classification is investigated. The results show that incorporating additional knowledge and considering contextual relationships among classes is beneficial for improving classification accuracy in fused LIDAR datasets. [C11188]

"An Overview of Systolic Array Concepts and Applications for Linear Algebra and Signal Processing"

Modern communication, control, avionic, and radar systems require the use of computationally intensive algebraic operations for real-time high throughput filtering, estimation, tracking, direction-of-arrival, and localization purposes. In this overview paper, we first review some basic systolic array (SA) concept, then SA algorithms for digital filtering, recursive least-squares, QR decomposition, Kalman filtering, eigenvalue and singular value decompositions will be discussed. [C11189]

"Bearings only target tracking with signal time delay using the IRPUKF algorithm"

An intelligent range parameterized unscented Kalman filter algorithm (IRPUKF) is proposed to track the target using the bearings-only measurement. The algorithm deals with the time delay in signal propagation by the parameter adjustment on-line method. Compared with the conventional algorithm, it solves the signal time delay problem and improves the estimation precision with acceptable cost [C11190]

"A Statistical Analysis of the Effect of Capacity Limitation and Retry for Hierarchical Wireless Hybrid Networks"

We investigate a hierarchical wireless hybrid network, implementing two different network paradigms: ad hoc and infrastructure-based systems, where mobile gateways, equipped with both cellular and infrastructure-less air interfaces, allow integration of the two separate paradigms. The paper reports results achieved through a mathematical analysis of the topology of wireless links, providing the distribution of the number of lowest-level nodes attached to the highest level. Nodes have a maximum capacity, and seek service at the upper level through a retry mechanism where the nodes are addressed according to a ranked list based on the level of received power. The mathematical analysis provides a means to allow access control, depending on the maximum number of radio resource units available at each node and the maximum number of retries at each level. Wireless nodes at different levels are uniformly distributed over the bi-dimensional plane with different densities; path loss and shadowing are included with different propagation parameters, different air interfaces are used, and different hard capacities characterise the nodes at the different levels. With respect to other papers recently presented by the authors to other conferences, this work focuses on the role of the node capacity limitations and the maximum number of retries [C11191]

"Comparison of Available Bandwidth Estimation Techniques in Packet-Switched Mobile Networks"

The relative contribution of the transport network towards the per-user capacity in mobile telecommunication systems is becoming very important due to the ever increasing air-interface data rates. Thus, resource management procedures such as admission, load and handover control can make use of information regarding the available bandwidth in the transport network, as it could end up being the bottleneck rather than the air interface. This paper provides a comparative study of three well known available bandwidth estimation techniques, i.e. TOPP, SLoPS and pathChirp, taking into account the statistical conditions of the available bandwidth and assessing the variability of their estimations. Simulation-based studies on a mobile transport network show that pathChirp outperforms TOPP and SLoPS, both in terms of accuracy and efficiency [C11192]

"A Seamless Service Continuity Scheme for Enhanced Network Performance in UMTS/WLAN Networks"

The proliferation of wireless access technologies, mostly wireless LANs, along with the ubiquitous coverage of cellular networks, has spurred many researchers to consider schemes for integrated network provision. In overlaying network environments, flexible resource management and service continuity during handover play a crucial role in the quality-of-service seen by the user. This paper describes an integrated UMTS/WLAN architecture that manages to establish every connection in a mobile terminal through the most appropriate access network, based on both network policies and user preferences. Moreover, connections are handed over independently between UMTS and WLAN, aiming at seamless service continuity. A detailed simulation model is used to measure the performance of the proposed architecture against existing schemes [C11193]

"Joint DOA, Range and Polarization Estimation of Near-Field Sources using Second Order Statistics"

In this paper, the joint estimation of direction-of-arrival (DOA), range and polarization of near field sources is investigated. The uniform linear array (ULA) consists of orthogonal dipole-pairs, which measure the x-axis and y-axis components of the electric field of the polarized signals. Without spectral peak searching, the proposed algorithm gives a closed-form solution. Because using only second order statistics, this method reduces the calculating burden. Some numerical simulations illustrate the effectiveness of the proposed algorithm [C11194]

"Folding Deinterleaving Algorithm for Multiple Mixed Pulse Trains with Pulse Repetition Intervals"

In this paper, a new deinterleaving algorithm for separating pulse signals from a multiple superposed pulse train is presented. We also introduce the current research in radar signal recognition, and point out that the synchronization method used in computing pulse repetition interval has some disadvantages, such as the "double period" phenomenon. It is shown, by a case study and analysis, that the new algorithm is much more efficient for high density pulse signal environment compared with that in synchronized method [C11195]

"Multiple-Parameter De-Interleaving System in ESM Data Processing Scheme"

First, the paper shows a novel sorting method based on cascade coupling and support vector clustering (SVC). Secondly, recognition technology of type-entropy is introduced into signal sorting system so that a novel radar sequence signal sorting system is to be presented. The experiment result shows that the system can sort efficiently radar signals in the complex pulses environment [C11196]

"A Novel Filtering Algorithm for SAR Image Based on Self Adaptive Correction of Penalty Coefficient"

Speckle noise is much serious in SAR (synthetic aperture radar) image. It will seriously affect the information extraction of terra and object and the application of SAR image. A novel filtering algorithm for speckle noise in SAR image is presented here. This algorithm is based on an iterative filter that based on a membrane model Markov random field approximation optimized by a synchronous local iterative method (TSPR). With this algorithm, the affect of the energy function by neighbors' spatial relation is taken into account. By self adaptive correcting the penalty coefficient in iteration process better filtering effect can be acquired. According to the comparing experiments about faded image by speckle noise of various intensities, with the algorithm presented here we can get restored image with higher signal noise ratio (SNR) than TSPR [C11197]

"Doubly Periodic Arrays and a New Construction of Multiple Target Sonar and Extended Costas Arrays with Perfect Correlation"

There are only a few multiple target families of Costas and sonar arrays with perfect correlation property. In this paper using the Welch Costas array and some results from design theory we construct perfect auto and cross-correlation families of sonar and extended Costas arrays [C11198]

"Weighted Norms of Ambiguity Functions and Wigner Distributions"

In this article new bounds on weighted p-norms of ambiguity functions and Wigner functions are derived. Such norms occur frequently in several areas of physics and engineering. In pulse optimization for Weyl-Heisenberg signaling in wide-sense stationary uncorrelated scattering channels for example it is a key step to find the optimal waveforms for a given scattering statistics which is a problem also well known in radar and sonar waveform optimizations. The same situation arises in quantum information processing and optical communication when optimizing pure quantum states for communicating in bosonic quantum channels, i.e. find optimal channel input states maximizing the pure state channel fidelity. Due to the non-convex nature of this problem the optimum and the maximizers itself are in general difficult find, numerically and analytically. Therefore upper bounds on the achievable performance are important which will be provided by this contribution. Based on a result due to E. Lieb, the main theorem status a new upper bound which is independent of the waveforms and becomes tight only for Gaussian weights and waveforms. A discussion of this particular important case, which tighten recent results on Gaussian quantum fidelity and coherent states, will be given. Another bound is presented for the case where scattering is determined only by some arbitrary region in phase space [C11199]

"Binary self-dual extremal codes of length 92"

In this note a construction of an extremal binary self-dual code of length 92, possessing an automorphism of order 15, is presented. Thirteen new codes are found. All of them have weight enumerators of the third type and no example of such codes has been known up till now [C11200]

"A Novel Emitter Recognition Approach to Incomplete Information System"

Incomplete information system is commonly encountered to emitter recognition problem in practical reconnaissance environment. The main reason is that reports with emitter parameter values are unknown. In order to solve emitter recognition problems in incomplete information system, rough set theory is introduced. A new emitter recognition method to incomplete information system based on rough set theory is presented in this paper. This recognition method does not change emitters' original information, and it reduces knowledge and finds decision rules directly from incomplete decision table. Example of recognizing the radar emitter is selected to demonstrate this new method. Experimental results show that this new recognition method is effective [C11201]

"Design and Realization of Delay Mapping Receiver Based on GPS for Sea Surface Wind Measurement"

The delay mapping receiver (DMR) is for receiving and processing the reflected GPS signal to get the

information of wind of sea surface by recording the reflected GPS signal and matching it to the theoretical model. The hardware structure, software design and difference from normal GPS receiver are introduced in this paper. The test results at near sea of Tianjin of China are provided, which prove the design of DMR is successful and the collected data are useful for the sea surface wind measurement [C11202]

"To the 60-year anniversary Professor Smolskiy Sergey Mikhailovich"

{no data available} [C11203]

"Polarizationary-Spectral Objects Selection on the SEA Surface Background"

The possibility for increasing efficiency of surface objects selection using polarizationary spectral features of scattered signals on orthogonal polarizations is shown [C11204]

"Time-Delay Estimation for Complex LFM Signal Based on Cyclic Cross-Correlation Amplitude"

In this paper, the time-delay estimator of complex LFM is discussed and constructed based on the cyclic cross-correlation amplitude. Then, the mean and variance of estimating error are deduced and the estimator performance is analyzed in detail. Finally, the performance of the estimator is given through computer simulation, which is in agreement with the analytic results [C11205]

"A Novel Method for Resolving Problem of Tolerance in Radar Signal Sorting"

Firstly, the problem of tolerance of radar signal sorting is analyzed in modern electronic warfare that faces even more complex and dense pulses environments. It has become a vital factor to reduce the efficiency of sorting of the conventional multi-parameters signal sorting system. Secondly, a novel radar signal sorting method is to be presented based on support vector clustering (SVC) and cascade coupling according to the idea of statistics learning theory. It prevented tolerance from affecting radar signal sorting. The simulation experiment shows that this method is efficient on high dense pulses and complex signals environments [C11206]

"Modeling of Guidance Signal of Anti-radiation Missile in the Case of Multiple Sources"

Anti-radiation missile (ARM) is a kind of powerful weapon with the functions of detecting, interference and destroying, which can attack and destroy enemy's radar and electronic facilities. Along with the development of science and technology, ARM technique obtained new breakthrough, resulting in the more serious threat to the radars on modern battlefield. How to counter ARM has already caused all countries' attention. Now various methods to counter ARM has been proposed, such as, warning of the ARM' attack, adopting low probability intercept radar, decoying the ARM with baiting sources, destroy the ARM with luring missile. Among them, decoy ARM with baiting sources is an efficient way. The technique had been used on the United States' "Patriot" to counter ARM. In this paper, a model of synthesis electromagnetic field under the action of multiple sources has been deduced. Under the spherical coordinate system of ground radar station, equiphase surface gradient vector equations have been established. Based on the relation of rectangular coordinate system and spherical coordinate system and the relation of the body coordinate system and ground radar coordinate system, the guidance signal model of ARM has been formed [C11207]

"A New Doppler Parameters Estimation Algorithm for SAR Processing"

This paper presents a modified algorithm for the estimation of linear frequency modulated signal of synthetic aperture radar (SAR) raw data, which is based on phase unwrapping and polynomial fitting. On the mathematical model of SAR raw data, the paper analyzes the Doppler parameters estimation of the key problem to generate high quality SAR images, considering the raw signal is embedded in additive noise. The results of simulation show that the new method is reasonable and can make blind processing SAR raw data, and improve images quality [C11208]

"A Force Field Method Based Multi-Robot Collaboration"

A force field (F2) based multi-robot collaboration method is presented in this paper. In this method, a virtual force field is generated for every moving robot and continuously changing based on the robot status including its traveling speed, dimension, priority, location and environment, etc. The interactions among robots' force fields and obstacles provide a natural way for collision avoidance and collaboration while robots are on their way to goals. In this paper, the definition of reaction force direction is modified to reduce robot orientation oscillations which occur when a robot approaches obstacles or other robots. Then the influence of task priority on motion planning and the problem of deadlock in multi-robot cases are discussed. Simulations in a real indoor

environment were carried out and demonstrated the feasibility and effectiveness of this method [C11209]

"Legendre and gabor moments for vehicle recognition in forward collision warning"

Collision warning remains an active research field due to the increasing complexities of on-road traffic worldwide. Vision-based warning systems are of particular interest because of the extensive information contained in images. This paper proposes the combination of Legendre moments and Gabor features for monocular vision-based vehicle recognition. We focus on vehicle recognition within a region of interest (ROI) in an image by assuming that the ROI has been detected by a radar sensor. Two classifiers including a support vector machine (SVM) and a neural network have been investigated to verify the effectiveness of the features. We have tested the proposed approaches on real-world video sequences acquired under various weather conditions for a wide range of vehicles and non-vehicles at up to 70 meters. The proposed combination of Legendre moments and Gabor features has yielded a correct classification rate of 99.1% and a false alarm rate of 1.9%. We have compared the proposed features with the over-complete Haar wavelets in the literature [C11210]

"A cooperative radar system for collision avoidance and communications between vehicles"

In order to improve reliability, security on roads or exploitation of automatic guided transports, many sensors are being developed to equip vehicles. Research has been carried out at INRETS and IEMN on low cost microwave collision avoidance sensors for metro guided transports and for road vehicles. For this goal, an original radar system has been designed in our laboratories. It is based on cooperative collision avoidance radar which uses a transponder inside targets. The proposed system is made of a couple of microwave transmitting and receiving equipment fixed on each vehicle, one ahead and the other behind. In order to avoid interferences between the transmitted and the received signals, two duplex frequencies of 2.2 and 2.4 GHz are used respectively for downlink and for uplink. The system is based on pseudo-random sequences combined with a correlation receiver and has a broadband of about 50-100 MHz. This bandwidth has been exploited to establish a high data flow communication between sensors. The aim of this paper is to describe the mock-up realized and technical solutions developed using spreading spectrum techniques to allow multi-user access and to combine the two desired main functionalities, localization and communication, inside a unique cooperative radar system. The system performances have been evaluated in terms of BER using simulations and main results will be presented [C11211]

"Ball lightning: new physics, new energy source, or just entertainment?"

Summary form only given. Ball lightning is a natural phenomenon characterized by a glowing ball of light that forms outside in the open air and inside closed rooms, aircraft, and submarines; floats along at about 1 m/s (even against the prevailing wind) or flies along side aircraft at hundreds of m/s; lasts 1 to 1000 seconds; passes through glass and metal with or without leaving a hole; does no great harm to people on contact or kills them promptly. Ball lightning can reportedly produce impressive artifacts; e.g. excavating ~200 tons of water saturated earth in less than 20 minutes. Since the effects of ball lightning vary considerably, the underlying physics may be very different for different events. Although laboratory experiments have produced a glowing ball of light that lasts for as long as there is a source of electrical power and then decays within a half second, the underlying physics of naturally occurring ball lightning-including its source of energy-is not known. This presentation focuses on cases that leave measurable effects with no apparent connection to a power source. Some effects are consistent with large induced currents. If these effects are caused by a radiating in the TEM mode, then the RF signatures should be observable by satellite and ground based sensors. Observations of long-lived RF bursts are indeed observed with satellite based systems. The following alternate explanations have been examined and found lacking: plasma instabilities, communication signals, radar signals, meteors, and malfunctioning electronics. These observations have not been tied to ball lightning observations. In addition, many and perhaps all of these emissions originated above the ionosphere-based on the lack of frequency chirping of lower frequency components passing through the ionosphere. If these RF bursts are caused by whatever causes ball lightning, then the phenomenon is not limited to the atmosphere and may be more fundamental than atmospheric discharge--es. The next step is to search for RF signals from ball lightning with a network of ground based sensors. More generally, reported observations are compared to existing theories and a path forward to investigating this elusive phenomenon is proposed [C11212]

"Preliminary investigation of breast tumor detection using the E-Pulse technique"

In this paper, the E-Pulse technique has been successfully applied on breast tumor detection. Numerical examples on a breast model with dispersive dielectric properties demonstrated that the E-Pulse technique can be applied to the problem. Introduction of the skin layer into the breast model and the inhomogeneous properties of the breast tissue would be the subject of further investigations [C11213]

"Antenna array processing for radar applications using support vector machines"

Support vector machines are a good candidate for the solution of antenna array processing problems such as beamforming and the angle of arrival estimation, because these algorithms provide superior performance in generalization ability and computational complexity. In this work we introduce three new approaches for antenna array beamforming based on support vector machines. The first one is based on the use of the linear support vector regressor. The second algorithm uses a nonlinear multiregressor to find the parameters of a linear beamformer and the third is an implementation of a nonlinear beamformer using a nonlinear support vector machine. Comparisons with conventional beamforming strategies and simulation results are provided to demonstrate the advantages of the support vector machine approach [C11214]

"Blind source separation for extraction of target scattering centers"

This paper focuses on using blind source separation of complex signals to extract scattering centers of radar targets that can then be used for target identification. The concept introduced in this paper assumes that the signal returned (or scattered) from a target is linear or convolutive mixture of several scattering centers along the body of an unknown aircraft. This information can then be used in a pattern recognition scheme for the purpose of identifying the non-cooperative unknown target. The results presented prove the concept using synthetic radar data. Work is ongoing to apply this concept to real radar data as received through an array of sensors (antennas) [C11215]

"Performance analysis of meter band radar height-finding approach for low-angle tracking"

In this paper, a new meter band radar superresolution height-finding approach under clutter environments is presented in the presence of multipath, which cascades moving target indication (MTI) method and forward spatial smooth MUSIC (FSS-MUSIC) algorithm, the MTI/FSS-MUSIC approach for short. The numerical simulation analysis of the presented approach is performed and the root-mean-square-error (RMSE) of target height estimation is given. It is demonstrated that clutter suppression method i.e., MTI cascaded superresolution height-finding approach is available for VHF array radar low-angle tracking applications [C11216]

"Generation of high-power chaos-a proposed scenario"

Summary form only given. In the course of the last decade, interest in the generation of high power chaos has grown substantially. This development was largely enhanced by the range of possible applications which among others include coding, ultra-wide-band (UWB) spread spectrum communication systems as well as detection and radar. Also a new field of research has opened up with the realisation that the interaction between E-M radiation and live tissue should be investigated more closely, either using high power microwave pulses, low power chaos for dosimetry purposes and THz radiation for diagnosis of some malignant growth. So far various methods have been tried in search for suitable sources of high-power chaos. For example 30 ns high-power pulses have been obtained by feeding an amplatron with anharmonic signals. Similarly chaotic oscillations have been generated by hard driving a relativistic BWO, initial simulation results being obtained using MAGIC2D. Others used a smooth anode magnetron to achieve somewhat similar results; also the effect of a time-delayed feedback in both klystrons and TWTs on generating chaos has been investigated. In our own research group we investigated the generation of chaos using plasma filled diodes. As a result of all the above research effort we have decided that a more systematic approach to the generation of high-power chaos would not be out of place. In our contribution we propose to discuss what we consider to be the essential requirements for the generation of high-power chaos. High power, of whatever kind, can only be achieved using high voltages and currents; this immediately brings us into the realm of relativistic kinematics, since in practice we would be operating in the region of 500 kV and above. It would appear that the magnetic field invariably plays a crucial role in the interaction process. We are going to show, using the simplest possible means, why it should be so, especially as far as the energy volume density in--the interaction space is concerned. We have shown already that chaos can be generated in a plasma-filled diode even without the presence of a magnetic field; therefore an addition of plasma is likely to facilitate the development of chaos via the usual cascade of bifurcations. These are the three points which we propose to discuss more fully as part of our presentation [C11217]

"Cognitive Radar Networks"

This paper describes the use of cognitive radar networks for the reliable surveillance of an environment where the likelihood of the presence of uncooperative targets is high. Despite the limited effectiveness of amplitude as a radar discriminant, through the clever use of detection through tracking, the detection performance of the noncoherent radar is enhanced. Further improvement in overall performance can be attained through the adaptive illumination of the environment, made possible by linking the receiver to the transmitter via a feedback

channel, which, in turn, makes the tracking adaptive, and sensor fusion performed in the central base station [C11218]

"Recent Breakthroughs in Phased Arrays and Radar"

This paper describes some of the recent breakthroughs in phased arrays and radar, including the sea-based X-band (SBX) radar, the 35 GHz active phased array, and the low cost MEMS phased array. It also discusses recent developments in GaN and SiC, digital beam forming, and tubes [C11219]

"Developments in Modern Synthetic Aperture Radar"

This paper traces the developments in modern synthetic aperture radar (SAR), including the ultra-high resolution SAR, bistatic SAR, and synthetic aperture sonar. It also includes a discussion of the historical origins of SAR and what the future holds for the technology [C11220]

"Structured Covariance Estimation: Theory, Application, and Recent Results"

The maximum-likelihood approach to structured covariance estimation and spectrum estimation has wide applicability in time series analysis, spectroscopy, adaptive beamforming and detection, remote sensing, radio astronomy, and radar imaging. Standard structured covariance EM algorithm with full model matrices is computationally demanding. Computational requirements drastically reduced when model matrices are sparse. Sparse structure may be achieved through appropriately chosen data preprocessing. We are investigating application in problem of airborne radar imaging from multiple viewpoints, previously computationally unrealistic [C11221]

"Dissipation of microwaves propagating through atmospheric pressure glow discharge plasma"

Summary form only given. The atmospheric pressure glow discharge (APGD) is a cold collisional, non-equilibrium plasma that explores wide applicability of plasma for modifying aerodynamic properties specially the drag reduction and also for radar cross-section (RCS) reduction by microwave invisibility. The experimental study has been carried out to develop some information for microwave dissipation in the plasma to cease the radar function. The cold plasma produced at atmospheric pressure can absorb the microwave power because of its complex dielectric constant and diffuse density profile. The attenuation of microwaves in the plasma depends on the discharge operating parameters to create sufficient plasma density and thickness, incident wave frequency and electron-neutral collision frequency for momentum transfer etc. The uniform glow discharge was ignited between parallel-plate dielectric covered electrodes as well as on a planar surface in helium gas at atmospheric pressure. The first experiment was performed with the measurements in parallel-plate electrode geometry. The electron plasma density has been measured using optical emission spectroscopy with helium line intensity ratio method that was verified by electron density obtained by microwave attenuation measurements. Hence, the measurement of microwave attenuation was also used as a diagnostic method to estimate the electron plasma density. The microwave signal was launched to the plasma by a Gunn oscillator (X-band) and transmitted signal was detected by high sensitivity microwave detector. The attenuation in transmitted signal was measured for various operating parameters. The measured attenuation was in good agreement with the theoretical prediction for defined plasma parameters. Further experiments are in progress to measure the microwave attenuation in planar surface discharge at various plasma and wave parameters. The details of the experimental setup and results of these studies will be presented [C11222]

"3-d simulations for radar cross-section reduction using plasma absorbers"

Summary form only given. Radar cross section (RCS) is the measure of a target's ability to reflect radar signals in the direction of the radar receiver. A collisional unmagnetized plasma, surrounding the target, acts as a good absorber of electromagnetic waves over a wide frequency range, reducing its RCS. This has given rise to world wide interest in plasma stealth technology. We have performed 3-D finite difference time domain (FDTD) simulations for calculating electro-magnetic wave scattering and absorption due to plasma-shielded objects. We have earlier validated our 3-D calculations against experimental results for wave scattering from a plasma-shielded metallic plate. Those simulations yielded a reasonable match with experimental measurements. That study also showed that bending of waves inside plasma due to density gradients plays as important a role as absorption. Those results have major implications for plasma stealth applications, which have heretofore assumed that plasma absorption is the main mechanism. We have also compared two techniques for studying the bending/refraction of electromagnetic energy flow through a plasma with spatial density gradients. These are the accurate FDTD method and the much faster, albeit more approximate, ray-tracing method. Our earlier work focused on the near-field region. The RCS refers to far-field measurements. In this paper, we present actual far-field (RCS) results for objects with generic shapes, such as flat plates, cylinders and spheres, both with and

without plasma shielding. In this paper, we also report on the dependence of bistatic RCS on plasma parameters, such as the peak electron density, the spatial profile of density and the collision frequency. Finally, we provide a physical interpretation for the results. Such an interpretation is only possible using the detailed spatio-temporal evolution of electromagnetic fields that is provided by the FDTD method. To our knowledge, this is the first detailed three dimensional calculation of plasma-based RCS reduction for real-life objects [C11223]

"Learning Algorithm for Real-Time Vehicle Tracking"

This article presents a learning algorithm for real-time object tracking in video sequences which uses an improvement of a feature selection method known from object detection. But in contrast to trackers based on object detection methods, our approach explicitly selects the features which are best suited to track an object, which are different from the best features for object detection. The used features are constructed from pairs of image patches and related to Haar features. Besides the automatic selection of features according to their discriminative (tracking) power, the advantage of this approach is that the resulting tracker is very fast, allowing it to run in addition to a detector to robustify the object position estimation and to compensate for dropouts of the detector. A comparison of the proposed tracking algorithm with other tracking methods is presented which shows the accuracy of the proposed algorithm [C11224]

"Transmitter Noise Cancellation in Monostatic FMCW Radar"

Digital leakage cancellation realizes noise cancellation at RF frequency, in addition to suppress leakage signal in FMCW monostatic radar. Noise cancellation mechanism is analyzed with autocorrelation function of noise. The measurement results in Ka band radar test are provided and show the effectiveness [C11225]

"Robustness of Arrays with Different Waveforms"

This paper examines the robustness of the basic waveform of UWB antenna arrays and Gaussian modulated sinusoidal pulse against failure of element. Simulation for circular arrays shows that pattern of Gaussian pulse is more robust and does not change for failure of elements and there is some condition that radiation of Gaussian pulse in sidelobes is zero. For Gaussian and GMS (T), the direction of maximum radiation never changes. According to tables, circular array for both GMS has better energy radiation percent than Gaussian but for linear array only GMS (T) is better. The results of the previous analysis show that significant improvement in the performance of antenna arrays patterns is possible if one is willing to abandon simple narrow-band sinusoidal signals and instead work with time gated ultra-short pulses and wavelets. The GMS is better than Gaussian in angular resolution in both modes T and 2T and it is suitable for radar applications. GMS pulse in case of element failure generates sidelobes but amplitudes of these sidelobes are smaller than Gaussian's radiation [C11226]

"Research on simplified array manifold based on ideal subarray patterns"

Spatial spectrum methods at the subarray level break through the limitations of the presented methods at element level and have an important application in phased array radar. The methods at subarray level based on exact array manifold need to calibrate the whole array. In order to reduce calibration cost and expense, constructing a simplified array manifold is a key problem. In this paper, we post-process the digital subarray output by introducing a weighting network and find out the simplified array manifold based on "ideal" subarray patterns. Compared with the method based on direct simplified array manifold, this method can control the available direction finding range flexibly and suppress uninteresting sidelobe sources better. Theory analysis and simulation results demonstrate the validity of the proposed method [C11227]

"Effects of Systematic FMCW Radar Sweep Nonlinearity on Bias and Variance of Target Range Estimation"

In linear frequency modulated continuous wave (FMCW) radar systems, the quality of target range estimation is directly associated to the linearity of the transmitted frequency sweep. In this paper we introduce a novel technique for analyzing the effects of systematic sweep nonlinearities on bias and variance of target range estimates, applicable to the commonly used Fourier transform based evaluation methods. A prototype FMCW radar system, capable of generating nonlinear frequency sweeps, is presented and used to verify the theoretical results on real measurement data [C11228]

"A Direct Path Interference Cancellation Approach to Passive Radar Based on FM Radio transmitter"

Target detection by non-cooperative illuminator is a research hotspot in electronic warfare field, with four

countering' potential advantages. One of the major problems in bistatic radars with continuous waves is the direct path interference (DPI). The conventional solution to this problem is to use an adaptive antenna by steering null towards the interference. Unfortunately the null depth obtained by this technology is not enough for surveillance radar. First of all DPI based on FM broadcast transmitter in passive radar is analyzed in this paper. Secondly, a DPI cancellation approach based on adaptive fractional delay estimation (AFDE) is in detail introduced how to deal with this problem. Finally, a passive radar experimental system based on FM broadcast transmitter is discussed. Simulation results by applying real collected data show the provided method is effective [C11229]

"An X-Band CMOS Multifunction-Chip FMCW Radar"

A fully integrated, miniaturized, low-power frequency-modulated continuous wave (FMCW) multifunction chip realized by typical 1P6M 0.18 μm deep n-well CMOS technology is presented for the first time. The multifunction chip consists of VCO, buffer amplifier, 3-dB power divider, isolators, driving amplifiers, mixer, low-noise amplifier, attenuator, etc., necessary for carrying out the X-band RF signal processing of the FMCW signals interfaced to dual antenna arrays. The chip real estate measures 2.4 mm by 1.3 mm. The entire FMCW chip design is based on the synthetic complementary-conducting-strips (CCS) quasi-TEM transmission line. The transmitter output is 3.5 dBm for frequencies between 9.5-11.0 GHz and maximum tuning bandwidth is nearly 150 MHz. The receiver channel has conversion gain of 6 dB. The calculated range is in good agreement with the measurement data [C11230]

"A Closed-Loop Pulsed Power Control Circuit for UWB 24 GHz Automotive Radar Transmitter"

This paper presents a closed-loop power control circuit for a UWB pulse radar transmitter. It provides over 10 dB of dynamic power control on a 24 GHz pulsed signal with pulse width of 1.59 nS and duty cycle of 0.5%. The circuit consists of an on-board directional coupler, a three-stage power detector and an error amplifier. All the circuits are integrated on the same chip with the transmitter in a SiGe HBT process. Temperature compensation schemes are applied to improve the circuits temperature stability. The circuit consumes 2.7 mA current and occupies only 360 times 480 μm^2 [C11231]

"A fast optimization method of two-dimensional antenna array for adaptive beamforming"

This paper presents a fast array optimization technique of two-dimensional antenna array for adaptive beamforming. Using a potential function, the optimization technique was applied to a case where the number of antennas = 12. This technique generated a non-triangular symmetric alignment that has a maximum sidelobe response of less than half that of triangular [C11232]

"Determining the Height of Buried Objects Comparing a 1d Transmission Line Method and a 3d GPR Field Simulation"

Within this contribution two different simulation techniques, namely, a 1d transmission line method and a numerical 3d field simulation of a ground penetrating radar including the antenna structure, the soil and the buried object are compared with respect to the achievable accuracy when the height of different buried objects is to be determined [C11233]

"An improved 2-D phased array spatial spectrum estimation method at subarray level"

Most of the presented spatial spectrum estimation methods are based on element outputs. This paper studies the spatial spectrum estimation methods at subarray level which can be applied in multi-function phased array radars and gives the model of these methods. To improve the performance of the method based on the direct simplified array manifold, we post-process the digital subarray outputs by bringing in weighting network and construct simplified array manifold based on the Gaussian patterns. With the improved method we can control the available direction finding region flexibly and suppress sidelobe sources better. Theory analysis and simulation results express the validity of the method [C11234]

"Performance Comparison Between Statistical-Based and Direct Data Domain STAPs"

In this paper the performances of two space-time adaptive processing (STAP), namely statistical-based methods and the direct data domain least squares (D3LS) method, are compared. The number of secondary or training data needed in the processing is a major concern in many applications. In the situation that the radar platform moves relatively fast, the smallest number of secondary data is preferred. While the statistical-based methods require training data in estimating the interference covariance matrix, the D3LS does not. The D3LS utilizes the interference information in a space-time snapshot under test itself in canceling this interference. The goal of this

paper is to evaluate the performance of these two approaches by comparing the accuracy of the signal amplitude estimation when the number of training data is varied [C11235]

"Simultaneously estimating azimuth and elevation angles along with the wavelength of the incoming signals by using matrix pencil method"

In this paper we describe a method for simultaneously estimating the direction of arrival (DOA) of the signal along with its unknown frequency. In a typical DOA estimation problem it is often assumed that all the signals are arriving at the antenna array at the same frequency, which assumed to be known. The antenna elements in the array are then placed half wavelength apart at the frequency of operation. However, in practice seldom all the signals arrive at the antenna array at a single pre-specified frequency, but at different frequencies. The question then is what to do when there are signals at multiple frequencies, which are unknown. This paper presents an extension of the matrix pencil method to simultaneously estimate the DOA along with the operating frequency of each of the signals. This novel approach involves approximating the voltages that are induced in a three-dimensional antenna array, by a sum of complex exponentials by jointly estimating the direction of arrival (both azimuth and elevation angles) along with the carrier frequencies of multiple far-field sources impinging on the array by using the 3-dimensional matrix pencil method. The variances of the estimates computed by the matrix pencil method are quite close to the Cramer-Rao bound. Finally, we illustrate how to carry out the broadband DOA estimation procedure using realistic antenna elements located in a conformal array. Some numerical examples are presented to illustrate the applicability of this methodology in the presence of noise. The Cramer-Rao bound for the estimators are also provided to illustrate the accuracy and the computational efficiency of this new methodology [C11236]

"Study on ADBF Methods at Subarray Level"

This paper studies adaptive digital beamforming (ADBF) at the subarray level. We present the signal model, generalize the optimum weights at element level to ones at subarray level directly, get the general form of the conventional weights at subarray level and discuss it based on different criteria. Moreover, by introducing the mismatched vector we improve the optimum weights at subarray level. The improved methods can work not only in the presence of jammers but also in the absence of jammers. The desired quiescent patterns can be obtained without SLL (sidelobe level) losses in the absence of jammers and also the SLL improves remarkably in presence of jammers. Simulation results indicate the validity of the introduced methods [C11237]

"A Simple Adaptive Beamforming Method in the Presence of Coherent Interferences"

A new simple adaptive beamforming method is proposed for the coherent environment in this paper. With the new method, the eigenvector, corresponding to the combination of the desired signal and the coherent interferences, is estimated. Then, the components of the desired signal and the coherent interferences in the covariance matrix are subtracted in the eigen-sense. Finally, adaptive beamforming is performed on the pre-processed covariance matrix. By this means, signal cancellation can be avoided. The proposed method needn't estimate the DOAs of the coherent interferences, and has a lower computational complexity. Simulations demonstrate its validity [C11238]

"Joint Estimation of Doppler Parameters for SAR with Large Range Migration"

By exploiting the statistical property of synthetic aperture radar (SAR) range-Doppler domain signal, a novel approach is proposed in this paper to solve the dilemma whether it is better to first estimate Doppler parameter or to determine range migration (RM) trajectory. The approach is performed in the range compressed range-Doppler domain. Its basic idea is to search for the ambiguity number moptand platform velocity voptwhich minimize the contrast of the sequence made up of the signal intensity distributed over the RM trajectory determined by them. The better auto-focus performance can be obtained from the data aligned according to the RM trajectory determined by them. The better auto-focus performance can be obtained from the data aligned according to the RM trajectory determined by moptand voptand furthermore, the correct PRF-ambiguity number can also be computed, accordingly [C11239]

"A Novel Non-interactive Verifiable Secret Sharing Scheme"

In this paper, we present a novel non-interactive verifiable secret sharing scheme constructed by Shamir's secret sharing scheme for secure multi-party communication protocol in distributed networks. In our scheme, only the Dealer is allowed to send message and there is no communication among players. The Dealer only publishes one commitment for verification, and the number of the commitment will not increase along with the augment of the threshold of secret sharing scheme. At the same time, the efficiency of verification for each share doesn't fall as the augment of the threshold. The security of the verifiable secret sharing scheme is based on the

intractability of computing discrete logarithm. [C11240]

"Dynamic Filtering and Mining Triggers in Mesoscale Meteorology Forecasting"

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"Significance of LiDAR Return Signal Intensities in Coastal Zone Mapping Applications"

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"The Influence of Lidar Acquisition Settings on Canopy Penetration and Laser Pulse Return Characteristics"

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"Real-Time Processing Algorithm for Wide Swath Radar Interferometry of Ocean Surface"

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"Multi-variate Bayesian Classification of Soil Drainage using Feature-level Fusion of Topographic and Hydrologic Data"

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"Clutter Suppression Techniques for River Surface Current Measurements"

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"Use of Tandem-X in a Squinted Split Antenna Mode Configuration to Retrieve 2-D Current and Ocean Wave Information"

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"Comparison of MODIS Atmospheric Water Vapor Retrieval, Meteorological Models Tropospheric Delay Estimation with the Results Derived from GPS"

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"Ground-based Radar Interferometry for Terrain Mapping"

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"Forest Parameter Estimation Using JERS-1 Repeat-pass Interferometry: Stem Volume Retrieval in Siberia and Sweden"

This paper presents results from estimation of stem volume in boreal forest using backscatter and interferometric coherence from the L-band SAR on the Japanese Earth Resources Satellite (JERS-1). Five test areas in Siberia and one in Sweden have been included in the study. Data from 14 JERS-1 44-day pairs from Siberia and 12 pairs covering the Swedish test area have been evaluated. The best multitemporal combinations of the measurements give relative RMSE values ranging from 33% to 48%. When considering one of the two observables only, the lowest retrieval errors are obtained under frozen conditions when inverting the coherence and under unfrozen conditions when inverting the backscatter. [\[C11268\]](#)

"Tropical-Forest Density Profiles from Multibaseline Interferometric SAR"

Vertical profiles of forest density potentially are robust indicators of forest biomass, fire susceptibility and ecosystem function. Tropical forests, which are among the most dense and complicated targets for remote sensing, contain about 45% of the world's biomass. Remote sensing of tropical forest structure is therefore an important component to global biomass and carbon monitoring. As in radio astronomy, which uses multibaseline radio interferometry to measure the structure of celestial objects, so multibaseline interferometric SAR (InSAR) can be used to estimate the vertical structure of forests. Vegetation density profiles, along with radar backscattering characteristics and attenuation, determine the radar brightness profile "seen" by InSAR. This paper will describe an experiment at La Selva Biological Station in Costa Rica (~3m rainfall/year) in which we flew 18 effective fixed baselines over tropical forests at C-band (0.056 m wavelength) and L-band (0.25 m). Preliminary inversions for radar brightness profiles will be compared to extensive lidar profiles measured in the same area. They will also be compared to field-measured profiles. [C11269]

"SAR Interferometric Approaches for the Analysis of Structural Forest Parameters: State of the Art and Perspectives for Brazilian Studies"

This paper presents three practical examples of airborne InSAR data application to improve the knowledge of forest structures. Two experiments were done in the Amazon tropical forest to study the spatial distribution of VLTs in the primary forest using LM filtering and a series of Markov processes and others, to map and model the estimation of biomass variations in primary and secondary forests. The third experiment refers to the relation of SAR data and the volumetric configuration of Eucalyptus sp. stands. The advances on the analysis of PolInSAR data are very helpful to increase, in the near future, the regional inventorying of land cover changes in the Brazilian territory. [C11270]

"Hurricane Winds Measured with Synthetic Aperture Radars"

Since 1999 several synthetic aperture radar (SAR) images of hurricanes have been acquired by the Canadian satellite RADARSAT-1 as well as the European satellite ENVISAT. Several of these SAR images have captured hurricanes of category 4 and 5. These SAR images provide a unique opportunity to investigate the utility of SAR data for estimation of hurricane winds as well as for the improvement of hurricane forecasting. Using the SAR wind retrieval algorithm WiSAR, we have obtained good accuracies (root mean square error of 18' circ and 1.5 ms-1) for low to moderate wind speed conditions. The algorithm enables one to retrieve wind fields with a resolution of up to 300 m over a swath width of up to 500 km. WiSAR is an algorithm, which has shown to give good results under low and moderate wind conditions. The algorithm extracts wind directions from wind induced streaks imaged by the SAR at scales above 200 m. Wind speeds are extracted from the SAR measured normalized radar cross section (NRCS) utilizing the C-band model CMOD5, which describes the dependency of the NRCS on wind. It will be shown that the algorithm enables to measure wind directions as well as wind speeds of over 50 m s-1. The SAR-retrieved wind fields are compared to results of a high resolution numerical hurricane model. [C11271]

"Tropical Cyclone Parameters Derived from Synthetic Aperture Radar (SAR) Images"

Ocean waves play an important role in the dynamics of extreme events like hurricanes or typhoons by conditioning the air/sea fluxes of momentum, heat and moisture. In this study a data set of ENVISAT ASAR Scan SAR images (400 times 400 km coverage) are used to observe the structure of tropical cyclones and typhoons at the sea surface. The following features of hurricanes were determined: wavelength and direction of boundary layer rolls for information of mixed boundary layer depth, radius of maximum wind speed, sea state in terms of wavelength, and direction. These image parameters are related to parametric models of hurricanes and validated by aircraft measurements from the National Hurricane Center (NHC). The work aims at the improvement of prediction of the cyclone track, intensity and sea state at these high wind speed conditions. The paper focuses on two illustrative case studies from August 2005, e.g., images of Hurricane Katrina acquired over the Gulf of Mexico and of Typhoon Talim acquired over the NW Pacific. [C11272]

"L-band Polarimetric Interferometry in Boreal Forest Parameter Estimation, a Case Study"

In this study we concentrate on the application and validation of forest height estimation by polarimetric SAR interferometry for boreal forest. The study material was collected during the FinnSAR campaign, carried out in Finland in fall 2003. The main instruments of the campaign were E-SAR airborne radar (L- and X-band) and HUTSCAT helicopter-borne profiling scatterometer (X- and C-band). The validated forest height estimation algorithm is based on random volume over ground (RVoG) model inversion by using POLInSAR data. We compare POLInSAR-derived forest height with results from profiling HUTSCAT scatterometer measurements and

with ground measurements and discuss the results. Our results show that the forest height values, estimated by means of two different instruments, are in good agreement. [C11273]

"Relation between the Attenuation Coefficients and Interferometric Phase Center Heights Behaviors from P-band to L-band"

The objective of this paper is to examine the link between the attenuation coefficients and the interferometric phase center heights, for several frequencies from P-band to L-band, and to study in what extent it depends on the canopy architecture and description. This study relies on the use of a coherent and full polarimetric scattering model, which simulates the backscattered fields by a forested area. In a first part, we study the frequential behavior of the interferometric phase center heights and in the second part, we focus on the attenuation coefficients. The behaviors of these two quantities are compared and in a third part, we propose to empirically derive a relation between these two quantities and the mean forest height. Finally, we investigate if a change of the incidence angle has an impact on the determination of this relation. [C11274]

"Development of Techniques to Retrieve Snow Covered Area (SCA) in Boreal Forests from Spaceborne Microwave Observations"

The feasibility of SAR data for the operational mapping of the fraction of Snow Covered Area (SCA) is investigated by applying Radarsat observations together with the modeling of error propagation. Additionally, the performance of SAR retrievals is compared with optical satellite data-based (MODIS) SCA estimates. The results indicate performance characteristics comparable with those of optical data retrievals even when wide swath Radarsat ScanSAR Wide A data are applied. The developed Radarsat data processing system is also implemented for the operative use to aid hydrological forecasting at the Finnish Environment Institute (SYKE). [C11275]

"An Approach for Multisensor Harmonization in Snow Cover Area Mapping"

In this study, we have developed an approach for fusion of optical and SAR data for snow cover fraction (SCF) retrieval that avoids the typical blending effects when combining independently retrieved geophysical data from different sensors. Instead of undertaking the sensor fusion at the geophysical parameter level, the fusion is done at the electromagnetic signal level. A state model, based on hidden Markov model theory, has been developed for the simultaneous signal from the optical and the SAR sensors. The model goes through a given set of states through the snowmelt season where transition probability distribution functions of time have been determined for each state transition. A coupling between corresponding models for optical and SAR observations has been developed in order to make a more reliable model of the sensor co-variation. [C11276]

"Monitoring Snow Cover Characteristics with Multifrequency Active and Passive Microwave Sensors"

The importance of microwave sensors in monitoring snow parameters is well recognized. However, several problems are still open regarding the reliability of remote sensing for operational use. In 2002-2005 a series of ERS SAR and ENVISAT ASAR images were collected on the Italian Alps to monitor the temporal evolution of snow cover. In the same time a long sequence of multi-frequency radiometric data was collected with ground based sensors. The measurements confirmed the potential of microwave active and passive sensors in monitoring the extent of wet snow cover and in estimating the liquid water content of wet snow and the snow water equivalent of refrozen snow. [C11277]

"Forest Height Estimation in Tropical Rain Forest using Pol-InSAR Techniques"

Tropical rain forest environments are highly complex and heterogeneous in terms of species composition and structure and is often difficult to access. Radar remote sensing is for large tropical regions the only available information source for monitoring. Pol-InSAR is a novel developed radar remote sensing technique sensible to the vertical structure of forest that allows the estimation and mapping of forest height. In this paper we demonstrate forest height inversion at two frequencies-L band and P band-by means of Pol-InSAR using INDREX-II data and addresses the problem of temporal decorrelation. [C11278]

"Digital Height Modeling (DHM) of Tropical Forests using Multi-frequency InSAR Methodology"

The objective of this study was to verify how digital elevation models (DEM) built by P-band repeat pass synthetic aperture radar (SAR) interferometry (InSAR) and X band InSAR can be used for estimating a digital height model (DHM) of forested environments and assess its quality. P band signal penetrates towards the forest floor which potentially generates a ground level DEM. X band radar reflects on the top of the vegetation cover,

so X band InSAR produces a digital surface model (DSM). The DSM-DEM difference is a map of the vegetation cover height, the DHM. The estimated DHM can be used for forest volume estimation over large areas and used for improving SAR image interpretation either in P or X band. In September 2000, the National Institute for Space Research of Brazil (INPE) and the Brazilian Army Cartographic Service Division (DSG) conducted a mission over the Tapajo acutes National Forest, Para acute State, Brazil when X and P band InSAR data was obtained. Extensive ground data collection, forest inventory, land cover identification and differential GPS altitude measurements was done over the area to permit proper results assessment. It was concluded that the estimated DHM has a good relationship with the vegetation cover height, ($r^2 \sim 0.96$) estimated from forest parameters measured on the ground survey. [C11279]

"Snow Water Equivalence Retrieval Using X and Ku band Dual-Polarization Radar"

In this study, we evaluated the feasibility of using the dual frequency (X-band 9.6 GHz and Ku-band 17 GHz) and dual polarization (W and VH) radar to estimate snow water equivalence through numerical simulations. [C11280]

"Progress in Determination of Wind Vectors from SAR Images"

During the past decade, the ability to determine detailed information of ocean surface wind from Synthetic Aperture Radar (SAR) has been generally accepted. It is expected that SAR will provide all-day and all-weather wind parameters with high spatial resolution and high accuracy, which would provide valuable data to marine weather forecasters and SAR model designers. However, the methodology for retrieving wind fields from SAR is far from complete. Present procedures require that a prior wind direction must be available in order to get wind speed information from SAR images. Errors in wind direction can result in significant biases in the SAR-retrieved wind speed. The prior wind direction can be acquired from measurements of other instruments (scatterometer, buoys etc.), from meteorological model outputs, or from wind-induced slicks if evident in the SAR images. The latter method may be limited by the image; many SAR images don't have any obvious wind-induced slicks. He et al. [2005] developed a new gradient method model (GM), which can retrieve wind directions from SAR images without trying to infer slicks. However, thus far, this method can only be used in relatively uniform wind field situations. In this paper, two modifications to the GM method have been developed by introducing an optimal analysis method. Wind speed and direction (with ambiguity) can be retrieved directly. In this method, sigma0 from two overlapped sub-blocks of the SAR image are used to retrieve wind parameters, which would violate the original GM method, because it cannot be used in highly varied winds, such as hurricanes. The chief advantage of this method is that wind speed can be retrieved without additional reference wind directional information. The wind direction ambiguity can be removed by background geophysical information of the SAR image or by in-situ measurements. Two cases are considered to illustrate this new method. One is a simulated image with relatively uniform wind field, and the other is a Radarsat-1 image which captures the eye of hurricane Isabel before it made landfall in North Carolina in 2003 as a category 2 storm. In both cases, the retrieved wind result is shown to compare well with Quikscat measurements and in-situ data. However, error exists for highly-varied wind field, especially for the retrieved wind direction. Future investigation will focus on this limitation, and also conduct further comparisons. [C11281]

"Soil and Vegetation Moisture Variability Analyzed Through Combination of SAR and Optical Images and Theoretical Models"

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"Impact of Filtering Soil Roughness Low Frequencies on the Radar Backscattering Coefficient Simulated by the IEM Model"

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"High Resolution Change Estimation of Soil Moisture by Combination of TMI Brightness Temperature and PR Surface Cross Section"

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"Monitoring Urban Changes in Rome, Italy by Multi-Temporal ERS-SAR Images"

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"Retrospective Change Detection based upon a Multi-season, Sparse Temporal Sequence of

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"Spatial Characterization of Soil Moisture Using SAR Data"

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"Observations of an ARSR System in Canton, MI with the L-band Interference Suppressing Radiometer"

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"Integration of MERIS and ASAR Data for LAI Estimation of Wheat Fields"

The objective of this work is to assess the accuracy of LAI maps retrieved from ENVISAT MERIS data over wheat fields. The method consists of comparing, at catchment scale, the LAI maps retrieved from MERIS data to those retrieved from ASAR AP data. The latter were preliminary validated, at field scale, by means of in situ data. The experimental site is an agricultural area, mainly devoted to wheat cultivation, located in the Basilicata region, close to Matera city (Italy). On this area ENVISAT MERIS, ASAR AP and ground data were intensively acquired during the 2004 growing season. Results indicate that errors affecting wheat LAI estimations derived from optical and radar data are comparable. [\[C11290\]](#)

"Severe Weather Applications over the Oceans using ERS SAR Wavemode Data"

Due to the relatively small amount of in situ data available for the open oceans, particularly during extreme events, under such conditions remote sensing techniques take an important role in the retrieval of geophysical information. Up to now the only remote sensing system capable of providing information on two dimensional sea state on a global and continuous scale and under all weather conditions is the Synthetic Aperture Radar (SAR). In the scope of the project Wave Atlas, ESA provided a two years wave-mode dataset of ERS-2 SAR raw data, mainly collected during 1999 and 2000, which was reprocessed to single-look- complex imageries at DLR using the BSAR processor. In this study the data were used for a statistical evaluation resulting in global ocean maps of different basic image parameters and oceanic parameters like wind speed, significant wave height, mean period and their respective regional and temporal variability during the seasons of the year using the empirical algorithms CWIND1.0 and CWAVE1.0. Global statistics are given for the time frame of 1998 to 2000 and examples of severe storms are analysed in detail. In future, the reprocessing of wavemode data is planned to be extended to the full lifetime of ERS-1 and ERS-2, which is at least 1991-2006. As wave mode data are also available from the ENVISAT mission, there is the possibility for future expansion. [\[C11291\]](#)

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"The Results of Spatio-Temporally Combined, Microwave Active-Passive Measurements of Snow, Bear and Vegetated Soil at 37GHz"

In this paper preliminary results of simultaneous and spatially coincident, polarimetric measurements of snow, bear and vegetated soil microwave reflective (radar backscattering coefficient) and proper radio thermal emission (brightness temperature) characteristics at 37GHz are presented. [\[C11349\]](#)

"A New Unified Approach to Channel Imbalance and Cross-Talk Calibration of Polarimetric Data"

A new unified approach to channel imbalance and cross-talk calibration of polarimetric data is described. This approach is applied during the SAR image formation, employing the multilook SAR processing technique and the covariance matrix of observed data. This method makes no assumptions about the reciprocity of the distortion model and noise system, and about the presence of dominating target with azimuthal symmetry. The standard linear and nonreciprocal distortion model for the received signal is assumed for each polarimetric image obtained from three looks without overlapping. This leads to a set of equations that relate the observed covariance matrix and the distortion system parameters. The non-linear solution of the calibration parameters is solved by iterative approach based on numerical methods. Fully polarimetric SAR L-band data, acquired by CENSIPAM Airborne R99-SAR on the Tapajos Forest (Brazilian Amazon), was used to evaluate the method as well the polarization signature response of some trihedral corner reflectors deployed in the area. [\[C11350\]](#)

"Two Novel Polarimetric Indices and Their Application on the Target Enhancement in POLSAR Images"

In this paper we introduce two new parameters for polarimetric SAR (POLSAR) images. For this purpose, the eigenvalues and corresponding eigenvectors of the coherence matrix is calculated. It can be assumed that there are different land cover features, and they are represented by different or slightly different coherence matrix so that eigenvalues and corresponding eigenvectors. However, the condition number and perturbation in the solution of the coherence matrix are calculated for each pixel in the POLSAR image. The results indicate that different scatterer properties so that the scattering mechanisms could be represented with these parameters. [\[C11351\]](#)

"An Unsupervised Classification for Fully Polarimetric SAR Data Using IHSL Transform and the FCM Agrithm"

In this paper, the IHSL transform and the fuzzy C-means (FCM) segmentation algorithm are combined together to perform the unsupervised classification for fully polarimetric SAR data. We apply the IHSL colour transform to H/alpha/SPAN space to obtain a new space (RGB colour space) which has a uniform distinguishability among inner parameters and contains the whole polarimetric information in H/alpha/SPAN. Then the fuzzy C-means algorithm is applied to this RGB space to finish the classification procedure. The main advantages of this method are that the parameters in the color space have similar interclass distinguishability, thus it can achieve a high performance in the pixel based segmentation algorithm, and since we can treat the parameters in the same way,

the segmentation procedure can be simplified. The experiments show that it can provide an improved classification result compared with the method which uses the H/alpha/SPAN space directly during the segmentation procedure. [C11352]

"Effects of Wind on Internal Waves Synthetic Aperture Radar Images"

A theory of internal wave synthetic aperture radar (SAR) imaging has been improved by applying Korteweg-de Vries (KdV) equation, Bragg back scatter model, and replacing surface wave action equation with high frequency ocean wave spectrum balance equation. An analytical expression for an ocean internal wave SAR image will be obtained. Based on the new theory, the effects of wind on internal waves SAR images are studied with theoretical and scale analysis. The results indicate that the effects of wind are comparable with the hydrodynamic parameters, and the signature of internal waves can be imaged on the SAR only when oceanic state is low. The results agree well with some observations. [C11353]

"Bistatic Radar Cross Section Measurements of Ocean Scattered GPS Signals from Low Earth Orbit"

Signals from the Global Positioning System are constantly being scattered off the entire Earth's surface. These signals can be detected from airplanes, surface platforms and in Low Earth orbit and are known to contain information on the oceans. Recently, a new opportunity to study GPS reflections in space has been realized with the launch in October 2003 of the United Kingdom's Disaster Monitoring Constellation (UK-DMC) satellite. The UK-DMC carries a dedicated GPS reflections receiver and a custom designed downward facing antenna. Using this GPS experiment it is possible to process surface scattered signals and estimate the ocean wind and waves. This paper will present a method for calculating a bistatic radar cross section (BRCS) for ocean scattered GPS signals. This method will then be applied over a range of signals detected by the UK-DMC experiment. For purposes of comparison, numerous data collections have been collocated with National Data Buoy Center (NDBC) buoys. These buoys provide an independent measurement of the ocean wind, waves and often a wave frequency spectrum from which the surface mean square slopes, an indication of ocean roughness, can be determined. BRCS values have been estimated over a range of ocean conditions (from less than 2 m/s winds to greater than 14 m/s winds) and vary generally as expected when compared to buoy measurements of the ocean wind and waves. An empirical relationship between the estimated BRCS and the ocean wind speeds and surface roughness will be presented for a limited set of data gathered by the UK-DMC experiment. [C11354]

"A Marine-Radar Wind Sensor"

A method, called WiRAR, is developed to measure the wind vector using a marine X-band radar as sensor. WiRAR extracts local wind directions from wind induced streaks, which are visible in radar images at scales above 50 m. It is shown that the streaks are very well aligned with the mean surface wind directions. Wind speeds are derived with WiRAR from the normalized radar cross section (NRCS), by parametrization of its dependency on the wind vector, which was performed by training of a Neural Network. The dependency of the NRCS on sea state and atmospheric parameters, such as air-sea temperatures and humidity, were studied with respect to further improvement of WiRAR. Therefore, sea state parameters are extracted from radar-image sequences by derivation of the Signal-to-Noise Ratio (SNR) and wave phase speed at the spectral peak cp. The SNR is directly related to the significant wave height H_s . Recently, the research platform FINO-I has been set-up in the German Bight. This platform provides various environmental data, such as wind measurements at different heights of up to 100 m for studying the atmospheric boundary layer, as well as air-sea temperatures, humidity, and other meteorological and oceanographical parameters. WiRAR is applied to radar-image sequences acquired by a marine X-band radar aboard FINO-I. The derived wind vectors are compared to wind measurements at the platform. The comparison of wind directions resulted in a correlation coefficient of 0.99 with a standard deviation of 12.8deg and for wind speeds with a correlation coefficient of 0.99 with a standard deviation of 0.41 ms⁻¹, respectively. In contrast to traditional offshore wind sensors, the retrieval of the wind vector from the backscatter of the ocean surface makes the system independent of the sensors motion and installation height and reduces the effects due to platform induced blockage and turbulence effects. [C11355]

"A New Method for DEM Generation using a Single POLSAR Flight Pass"

In this paper, we proposed a new method for DEM generation from a single POLSAR flight pass. As usual, orientation angles induced by azimuth slope can be estimated from POLSAR data. However, for DEM generation, Another condition is need to attain the orthogonal terrain slopes. Thus, shape from shading techniques, which is mostly used by the robot vision community and generate slopes in the range direction, could then be combined with polarimetry. After terrain slopes have been computed, these slopes data are then used to solve a Poisson equation to estimate the elevation surface. [C11356]

"The Associated Modeling and Precision Analysis of Spatial States and the Inter-Satellite Baseline of Formation Flying Satellites"

The inter-satellite baseline plays a vital role in the formation flying satellites missions. Based on the relation between the spatial states and the inter-satellite baseline, this paper erects a model to associate these two kinds of parameters. The error propagation relations are deduced in detail, which are described by the precision influence factors and error propagation matrices. Simulations are also carried out to show the baseline determination precision in some certain scenarios. [C11357]

"Formation Flying InSAR Configuration Error Simulation and Compensation"

Configuration error for airborne formation flying InSAR was studied. The aircraft interval changes are the most important error. Interval decreasing is taken as an example. Phase changes with baseline changes were derived in formula. The simulation result of plane interval changes is given out. A pentahedron on flat ground is set to show influence of the configuration error. Correct phase compensation is the key technology to get accurate interferogram. So azimuth slope eliminating was adopted. Two control points were arranged in observing area to compensate the phase error introduced by configuration error. This algorithm can improve the DEM precision for whole area. The pentahedron terrain is employed to verify compensation algorithm. The simulation terrain and compensation results prove that the algorithm is effective and efficient. [C11358]

"Coherence Improvement of Cross-Interferometric Pair by a Block Azimuth Filtering"

ERS-ENVISAT cross-interferometry with a small height ambiguity is useful to measure the topography in the regions of low slope. Azimuth common-band filtering is a key pre-processing for the cross-interferometry. An adaptive block azimuth filtering was designed and applied to the ERS-ENVISAT tandem pair. As range bin increases, the Doppler centroid of the ERS increases while that of the ENVISAT decreases. It results in systematic increment of the Doppler centroid differences as range bin increases. The coherence of 0.7 in the near range reduced to 0.2 in the far ranges. The block azimuth filter estimates Doppler centroids of at each block, and adjusts band width of the filter. The coherence degradation caused by range-dependent Doppler centroid can be compensated by this method. The coherence is better than conventional azimuth filtering about 0.1 in far range. The resulting interferogram shows improved coherences between 0.8 to 0.4 in near and far range, respectively. However there is still gap of coherence in near and far ranges, it is resulted from inherent problem of less overlapped bandwidth at far range. Although the total improvement was not significant, it is valuable for selection of permanent scatterers in the far range. Test results are discussed in this paper. [C11359]

"S-Band, Polarimetric, Combined, Short Range Action Scatterometer-Radiometer for Platform and Vessel Application"

In this paper S-band (~3 GHz), polarimetric, combined, short pulse scatterometer-radiometer is described, for simultaneous and spatially coincident measurements of sea surface, snow, bear and vegetated soil microwave reflective, and emissive characteristics, and for backscattered radar signal frequency distribution statistical parameters estimation. The system may be successfully used for near sea surface wind and sea surface wave fields' parameters precise and unambiguous retrieval, as well as for land and sea surface signatures and targets detection and identification their origin. [C11360]

"Building Extraction Using C Band Pol-SAR Image"

This paper introduces a method for building location information extraction using airborne C-band polarimetric SAR data. The method is based on the analysis of building feature. The method decomposes the scattering covariance matrix into three simple mechanism, i.e., odd-bounce; even-bounce; cross-bounce. Taking into account that the typical strong T-shaped echoes from quite large buildings are visible, a method is introduced to extract the location of the buildings. [C11361]

"Phase Unwrapping with Phase-Singularity Spreading"

We propose a novel phase unwrapping method where we spread the singularity in phase map with fractional phase compensators. We find that the obtained digital elevation maps have higher quality than those obtained in conventional network programming method. In addition, the calculation cost is very small. We present the basic idea and the processing procedure. [C11362]

"Estimation of Friction Velocity Using Tower Based Marine Radars"

The friction velocity is estimated from image sequences of a marine Radar, which operates at grazing incidence

with X-band at horizontal polarization in transmit and receive. Therefore, radar image sequences are analyzed in space and time. The direction of the friction velocity is extracted from streak like features visible in the image resulting from the temporal integrated radar image sequence. The orientation of these streaks are determined by derivation of local gradients of the radar images. The magnitude of the friction velocity is derived from the measured normalized radar cross section by a geophysical model function (GMF), which is parameterized by training of a Neural Network. For further improvement of the GMF the radar retrieved signal to noise ratio, which is strongly related to the significant wave height, is taken into account. The methodology is validated at FINO-I, a research platform in the North Sea, where various meteorological and oceanographical parameters are measured on an operational basis. The radar retrieved friction velocities are compared to in-situ wind directions as well as to the friction velocities estimated from in situ measurements using the TOGA COARE formulation. The comparison resulted in a standard deviation of 13deg for wind direction and 0.41 ms⁻¹ for the magnitude of the friction velocity. In contrast to traditional measurements the retrieval of friction velocity from marine radars is free of platform induced effects, e.g., turbulence, and can be used from moving platforms. [C11363]

"Segura River Aquifer (SE Spain) Obtained by Means of Advanced DInSAR"

The hydrological quality of an aquifer system is evaluated by means of two parameters: its capabilities to transmit water (transmissivity, T) and to store water (storage coefficient, S). In this work, a method based on temporal data of the surface subsidence is employed to calculate storage coefficients (S) and transmissivities (T) of the Vega Media of the Segura river aquifer-system. Subsidence data are obtained by means of differential SAR interferometry. The retrieved values of S for all available wells vary from 3.2 times 10⁻⁵ to 1.9 times 10⁻³ m/m. For the only well where water flow is available, a T value of 0.302 m²/day is estimated. First results show a reasonable agreement between data calculated with this technique and other acquired by means of in situ measurements. [C11364]

"Consideration of the Correlation between Beta-angle and Lineament Patterns by Using Polarimetric SAR Images"

This paper describes the relationship between a polarimetric parameter, the beta-angle, and the lineament features based on the eigenvalues and eigenvectors of the coherency matrix of the polarimetric SAR (POLSAR) data. First, coherency matrix was calculated from the Pauli vector of the POLSAR image set. Then, eigenvalues and corresponding eigenvectors of the coherency matrix were calculated. Subsequently, beta-angle, derived from the eigenvalue and the corresponding eigenvectors. However, the beta-angle has the potential to represent the orientation of the scatterer about the radar line of sight. In addition, alpha-angle has been obtained using the same eigenvector above. We validate them using fully polarimetric L-band SAR data. The relationship between these two angles is also discussed, and a two-dimensional feature space is constructed (beta-alpha space). We then show initial results of applying the beta-alpha space to the Japanese airborne polarimetric and interferometric SAR (Pi-SAR) to extract features of lineaments as one of the geological features of the land surface. The results demonstrate that the effectiveness of the proposed extraction algorithm. [C11365]

"Road Extraction from High-Resolution SAR Image on Urban Area"

Because of active and side-look imaging and speckles in the SAR image, the road edge is blur and it is difficult to determinate the road edge. Therefore, extraction of the road from high-resolution SAR image can't use the methods that were used to the optical image. In this paper, we research how to extract the information of zonal road and how to get the vector road from the high-resolution SAR image. Usually, urban road is regular. In remote sensing image, the road has many characters, such as functional character, spectral character, geometric character and texture character so on. These characters consist of the knowledge of road extraction. After accurately expressing the character knowledge with mathematical equations, we can extract the road information more accurately. Therefore, we must construct road model after analyzing the road characters in the high-resolution SAR image. Based on the above analysis, we may accurately extract road from SAR image. By our experiment, the result proves that our method is a good idea. [C11366]

"InSAR Monitoring of Post-Landslide Activity"

In this study we used differential InSAR techniques to monitor current post slide activity at several landslides along transportation and energy corridors. The landslide materials vary from rock debris, glacial till to permafrost alluvium. Our results show that motion is triggered by spring melt and heavy rainfall events. In the northern Mackenzie Valley pipeline corridor seasonal landslide activity is related to permafrost melt during warm summer months. [C11367]

"Sea Ice Type and Open Water Discrimination for Operational Ice Monitoring with RADARSAT-2"

Envisat ASAR alternating polarization (AP) modes are evaluated to determine the potential utility of multi-polarization data for operational sea ice monitoring in preparation for RADARSAT-2. [C11368]

"InSAR Derived Deformation Patterns Related to the Aigion Earthquake (Greece)"

The detectability of the deformation pattern produced by the June 15, 1995 Aigion earthquake with DInSAR techniques is ensured by its magnitude ($M_w=6.3$), shallow depth and dip-slip mechanism. In this paper, stacking procedures are applied to a series of ERS interferograms in order to filter out from the differential phase field the atmospheric signal, and an a posteriori test is used to check the statistical properties of the atmospheric signal both in time and space. Based on the DInSAR-derived deformation pattern, a new fault model is proposed that takes into account the crustal layering of the western part of the Gulf of Corinth. [C11369]

"A Simulation for Synthetic Aperture Radar with Digital Beam-Forming in Elevation"

In conventional SAR system high azimuth resolution and wide swath width are parameters that can not be improved simultaneously. A High-Resolution Wide-Swath (HRWS) Synthetic Aperture Radar (SAR) system was design to reconcile those two contradictory requirements. In the paper presented is a simulation of the HRWS SAR system including some of possible system failures and nonidealities of system components. The goal of the simulation is the evaluation of the influence of distortions and failures and prediction of the systems performance in elevation. [C11370]

"TerraSAR-X for Oceanography"

TerraSAR-X is a german X-band radar satellite to be launched in 2006. The system will provide synthetic aperture radar (SAR) data with high spatial resolution for both commercial and scientific use. The spacecraft will be equipped with a phased array X-band SAR, which can operate in different polarisations and has furthermore beam steering capabilities. In addition the system has a split antenna mode, which is able to provide along track interferometric information. The instrument is designed for multiple imaging modes like Stripmap, Spotlight and ScanSAR. Due to its polarimetric and interferometric capabilities as well as the high spatial resolution of up to 1 m, the TerraSAR-X sensor is a very interesting tool for oceanography. The presentation will give an overview of several applications, which are of both scientific and commercial interest like current and ocean wave measurements, monitoring of morphodynamical processes or high resolution wind field retrieval. The potential as well as limitations of the instrument are summarized and compared with existing sensors. Necessary steps to translate existing C-band SAR inversion algorithms for wind and wave measurements to X-band are discussed. A strategy is outlined to achieve this by a combination of theoretical investigations and the use of existing experimental data acquired by both airborne and groundbased X-band radar. [C11371]

"Studies of Ocean Surface Profile Retrieval from Simulated LGA Radar Data"

Retrieval of one dimensional ocean surface profile information is studied through the use of S and X band radar backscattering data at low grazing incidence. The required backscatter data is obtained through the use of numerical electromagnetic scattering codes. The simulations compute backscatter at multiple frequencies in each time step, so that range-resolved radar cross sections are obtained after an FFT operation. Profile retrievals are obtained through a simple "tilted Bragg" assumption, which allows local incidence angles on the surface to be directly determined from RCS data. These local incidence angles are then translated into surface slopes, and further integrated to construct the estimated profile. Initial results from this process are reported in this paper; further studies are in progress to quantify the overall accuracy achieved as a function of various surface and sensor parameters. [C11372]

"Oil Spill Surveillance and Tracking with Combined use of SAR and Modis Imagery: A Case Study"

The use of satellite remote sensing for oil spills detection has been attempted, traditionally, with synthetic aperture radar (SAR) sensors. These sensors are the most suitable instruments to the detection of slicks, since they damp strongly short waves measured by SAR and oil spills appear as a dark patch on the SAR image. However, SAR systems do not offer the required temporal acquisition rate of the same area, to guarantee the possibility to monitoring large oil spill movement on the sea. We propose the use the Modis (Moderate Resolution Imaging Spectroradiometer) images acquired in sun glint conditions to reveal smoothed regions such as those affected by oil pollution. In this work we present a case study, in the Mediterranean Sea near the French coast, in which we have applied this methodology to a large oil spill detected on a SAR image of the 8th July 2002. Using two Modis acquisition in the same day, one by Modis/TERRA 20 minutes later the ERS2-SAR acquisition and the other by Modis/AQUA 80 minutes later the first Modis acquisition, we show that it is possible to surveil the oil spill in its movement towards north-west. Wind speeds and directions at 10 m above the sea surface were retrieved using the semi-empirical backscatter model CMOD4 on the SAR image, and utilized to

track the movement of oil spill. Surface wind vectors predicted by the meteorological ECMWF model were exploited as guess input to SAR wind inversion procedure. The comparison between Modis images and the predicted position of the oil spill show an adequate agreement. [C11373]

"A New Set of the Parameters for the Terrain Surface Classification in Polarimetric SAR Image Based on Deorientation of Polarimetric Scattering Vector"

Deorientation theory of polarimetric scattering targets is developed, which transforms the scattering vector of spatially oriented targets into a certain status with minimization of cross polarization. A new set of the parameters u, v, w, Ψ is defined to describe and classify different terrain surfaces. Based on the vector radiative transfer (VRT) model of non-spherical particles above a rough surface, numerical simulations illustrate the parameters u, v, w, Ψ and the entropy H . These parameters are applied to the unsupervised classification in polarimetric images. The terrain surfaces of polarimetric SIR-C and airborne SAR images are classified and orientation-analyzed. [C11374]

"An Overview of Hampton University's 48-Inch Lidar System"

In 2004 Hampton University was the benefactor, via governmental surplus, of a world-class lidar system that is built around a 48-inch diameter-receiving telescope. LIDAR, is an acronym for light detection and ranging, which is the optical analog of microwave radar. The telescope for the LIDAR system has been positioned in HU's Observatory so that data can be taken at the zenith, viewing the sky through the movable dome roof. The proposed research develops a new capable LIDAR at HU for investigating novel laser remote sensing techniques and devices to strengthen our remote sensing program. This paper outlines HU's 48-inch lidar system, and the expected measurements it makes. Once the 48-inch LIDAR system is fully operational at HU it is to be a part of the Cloud-Aerosol LIDAR and Infrared Pathfinder Satellite Observation (CALIPSO) Quid Pro Quo Validation program. The program is important in validating the calibration and algorithms for the CALIPSO data. Data was taken while CALIPSO overpasses, and comparisons made. [C11375]

"A Multiple-Band Algorithm for Separating Land Surface Emissivity and Temperature from ASTER Imagery"

We intend to propose a multiple-band algorithm which can simultaneously retrieve land surface temperature and emissivity from ASTER data. We build four radiance transfer equations for ASTER band 11, 12, 13, 14, which involve six unknown parameters (average atmosphere temperature, land surface temperature and four bands emissivity). We also analyze the emissivity characteristics of common objects about 160 kinds provided by JPL spectral database between thermal band 11, 12, 13, 14 and find that there is approximate linear relationship between them. For common 80 kinds of errors, the average emissivities error of band 11 and 14 are all under 0.01, the max emissivity error is under 0.0097 for band 11 and 14. So we can obtain six equations and six unknown parameters. In order to improve the accuracy, we can make some classification before retrieving land surface temperature. We can use three methods to resolve the equations. The first is that we make classification for image and get different equation, then resolve the equation. The second is Least-squares. The third is that, we can simulate database according to the characteristics of objects and utilize the neural network to resolve equations. The analysis indicates that the neural network can improve the practical and accuracy of algorithm. [C11376]

"Mobile Aerosol Lidar for Earth Observation Atmospheric Correction"

A new atmospheric correction method of earth observation images based on the combination of satellite data and lidar data is proposed in this paper. A mobile scanning Mie lidar was developed to detect the aerosols' spatial and temporal distribution for the purpose above. To obtain more accurate data, future development plan of a multi-wavelength, multi-channel Raman lidar is discussed. Earth observation images processed by the radiative transfer model and this new method are presented. Also issues to approach the final goal of this new atmospheric correction method are discussed. [C11377]

"Improving Satellite Moderate Resolution Instrument Geolocation Accuracy in Rough Terrain"

When Earth-locating (geolocating) modern moderate resolution instrument data, such as from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Terra and Aqua satellites, corrections for Earth terrain effects are applied to enable accurate retrieval of global geophysical parameters. The current approach to terrain correction calculates the pierce point of the center of each observation with a digital terrain model. With the recent Shuttle Radar Terrain Mapping Mission (SRTM) terrain model data, which has a higher spatial resolution and better accuracy than previous global terrain models, there

is an opportunity to improve geolocation accuracy in rough terrain by using more advanced techniques to compute geolocations that are more representative of the centroid of each observation. The authors evaluate whether calculating geolocation using an observation weighting approach is significantly better than calculating the pierce point geolocation and if so under what conditions. The relative additional computational cost of an approximate technique is weighed against the possible increase in geolocation accuracy. [C11378]

"Extraction of Stream Channels in High-Resolution Digital Terrain Images Using Morphology"

Our paper proposes an approach for the extraction of stream channels from airborne laser swath mapping (ALSM) data. Recent advances in technology have led to high-resolution topographic data acquisition by means of ALSM yielding digital elevation model (DEM) datasets with horizontal resolutions of 1m and a vertical accuracy of 0.15 m. We apply morphological operations on an ALSM DEM to detect stream channels. The results are compared with an existing terrain analysis tool known as TauDEM. Tools like TauDEM use morphology over large-scale areas but they often fail in detecting stream networks over small-scale areas. The proposed method uses small-scale morphology to provide complementary results for streamline locations over a small catchment area. [C11379]

"2D Inverse Scaling Bistatic Processing and the focused Image Quality Measurements"

This paper presents a bistatic focusing solution for the general case, when transmitter and receiver trajectories move along non parallel trajectories with different velocities. Processing in the general case turns out to be additionally truly azimuth time variant. This problem is solved by implementing a novel 2D inverse scaled FFT algorithm. In the second part of the paper the focused bistatic SAR image bistatic processing quality will be evaluated by measuring the geometric registration, amplitude and resolution, ISLR and PSNR of simulated point targets. [C11380]

"FPGA-based Implementation of a Polarimetric Radiometer with Digital Beamforming"

In [1] a general overview of the PAU system is provided. This work describes in more detail the implementation of the polarimetric and pseudo-correlation radiometer (PAU-RAD) that measures the four Stokes parameters. [C11381]

"Reduction of the Reconstruction Bias in Synthetic Aperture Imaging Radiometry"

Synthetic Aperture Imaging Radiometers (SAIR) are powerful instruments for high-resolution observation of planetary surfaces at low microwave frequencies. This article is concerned with the reconstruction of radiometric brightness temperature maps from SAIR interferometric measurements. Even in the absence of modeling errors and radiometric noise, a systematic error, or bias, has been observed in the reconstructed maps. The origin of this bias is analyzed and an efficient solution is proposed for reducing it. Particular emphasis is laid on numerical simulations carried out for the SMOS space mission, a project led by the European Space Agency and devoted to the remote sensing of Soil Moisture and Ocean Salinity from a low orbit platform. [C11382]

"Exploiting Physical and Topographic Information within a Fuzzy Scheme to Map Flooded Area by SAR"

An inundation event occurred in Italy on November 1994 has been analysed in order to assess the capability to map the flooded areas by radar (SAR) images in support to civil protection interventions. ERS images collected before and after the inundation have shown the presence of different scattering mechanisms occurring in the flooded areas and originating either an increase or a decrease of the backscattering coefficient, depending on the land covers type. This analysis has allowed us to develop a flood discrimination procedure based on a fuzzy approach able to integrate all the possible sources of available data (SAR images, land cover and a DEM) and prior information (cover dependent backscattering behaviour). A comparison with a ground survey providing the maximum flood extension has given encouraging results. [C11383]

"Automated Content Extraction from SAR Data"

Segmentation algorithms are often used in many image processing applications like compression, restoration, content extraction, and classification. In particular as for content extraction works carried out in the past decade have demonstrated that multi-frequency fully polarimetric SAR observations are particularly interesting, thanks to physical properties of the backscattered signal at various frequencies and polarizations. To achieve a good classification, the main difficulty is that SAR images are often embedded in heavy speckle. Segmentation of multi/hyperspectral (optical) imagery is obtained by means of algorithms based on image models, which exploit the spatial dependencies of land-covers. Unfortunately, speckle noise hides such spatial dependencies in

observed SAR data. With the aim of investigating on a content extraction algorithm capable of discriminating cover classes present in the observed SAR image, heterogeneity features are used here to emphasize spatial dependencies in the data. Thus, observed pixel values are mapped into features, that take "similar" values on "similar" textures. This allows for using the same procedure of the optical case. Obviously, homogeneity/heterogeneity feature and segmentation quality are fundamental for classification accuracy. Here, the problem is tackled through the joint use of information theoretic SAR features and of a segmentation algorithm based on Markov Random Fields (MRFs). [C11384]

"A Lidar Collaboratory Data Management System"

A data management system has been developed for the Connecticut State University (CSU) Lidar Collaboratory to facilitate user authentication, scheduling of remote lidar instrumentation control sessions, storage and retrieval of lidar datasets and generation of new data products. In addition to providing for efficient archival and retrieval of lidar data products, a major design goal of the data management system is to support collaborative, multidisciplinary, atmospheric sciences research projects. In this paper, we describe the framework of the CSU Lidar Collaboratory data management system and how the system interacts with the data acquisition and data analysis software. [C11385]

"Performance Evaluation of Amplitude-Phase Algorithm for SAR Raw Data Compression"

This paper defines series of important performance evaluation parameters to evaluate amplitude-phase (AP) algorithm comparing 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 based on ERS-2 data show that AP 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. [C11386]

"Comparison of Surface Scattering Models for Gaussian and Exponential Surfaces"

In this paper, predictions from the small-slope approximation (SSA), the advanced integral equation model (AIEM), and the reduced third-order local curvature approximation (RLCA3) theories of rough surface scattering are compared with each other and with predictions obtained from numerical simulations for dielectric surfaces with Gaussian and exponential correlation functions. A discussion of the results obtained is provided, along with plans for continued investigations. [C11387]

"InSAR Co-registration Accuracy Assessment Based on Misregistration Value"

Based on estimated offset between the corresponding points in the master and the slave image by spectral diversity algorithm, a new indicator misregistration value is proposed to assess registration accuracy. After error analysis is carried out, the new indicator is compared with conventional indicators. Its advantage is the feasibility to assess the registration accuracy in both directions. According to the three indicators, comparison results of several co-registration algorithms are obtained. Airborne X-band interferometric data are used to validate the new indicator. [C11388]

"Remote Sensing Image Ground Segment Interoperability: PLEIADES-HR Case Study"

Pleiades-HR is a high-resolution optical Earth observation system developed by CNES, for civilian and military users. The launch of the first Pleiades satellite is scheduled in 2008, the second, 18 months later. The Pleiades-HR program is the French part of the French-Italian ORFEO program which also comprises COSMO-SkyMed, an Italian high-resolution radar system. The Pleiades-HR products will be distributed by SpotImage and will complete the existing SPOT product line. In such a multi-sensors and multi-users context, CNES has decided to design the new Pleiades-HR ground segment pointing the stress on systems interoperability in order to ease the data access from the end user point of view. After a synthetic presentation of the Pleiades HR ground segment and image products, this paper focuses on PLEIADES HR image product definition and cataloguing services, two major points for the image ground segment interoperability. Among all possible solutions, the image product and catalog services have been defined taking into account the PLEIADES-HR system characteristics, its performance requirements and the international standards (ISO-TC211, OGC, image standards, JPEG2000 ...) use and evolution capabilities. The results presented in the paper are also part of a European initiative of ground segment harmonisation studied in the frame of the HMA project with other European Space Agencies. [C11389]

"A First Experiment of 3D Imaging with a Ground based Parasitic SAR"

The present paper provides the first example of 3D imaging using the ground based parasitic SAR instrument developed in the past years at Politecnico di Milano. [C11390]

"Combined Ground Penetrating Radar and Seismic System for Detecting Tunnels"

An experimental system to collect co-located ground penetrating radar (GPR) and seismic data was developed to investigate possibilities of using the sensors individually or in a cooperative manner to detect shallow tunnels. These sensors were chosen because they sense very different physical properties. The seismic sensor is sensitive to the differences between the mechanical properties of a tunnel and the soil while the GPR is sensitive to the dielectric properties. Raw and processed data from both sensors are presented. [C11391]

"An Adaptive Filtering Approach to Distributed Space-borne SAR Imaging"

An adaptive filtering approach to distributed space-borne SAR imaging is proposed in this paper. The signal model and principle of adaptive filtering imaging are presented at first. Then two categories of adaptive filters are evaluated. The performance analysis and comparison of those two filters indicates that the computation load is lower than with a Wiener filter and imaging quality is better than with a matched filter. Finally the numerical simulation results are presented to illustrate the results. [C11392]

"Research on Bistatic SAR Imaging"

For reasons of stealth and other operational advantages, more attention has recently been focused on bistatic SAR. Bistatic SAR uses separated transmitter and receiver flying on different platforms, and has the ability of the exploitation of additional information contained in the bistatic reflectivity of targets. Besides of technical problems-like the synchronization of the oscillators-the processing of bistatic raw data imaging is not well studied theoretically all the same, which is a major area in bistatic SAR. This paper firstly describes the special case of equal velocity vectors and parallel flight paths of transmitter and receiver, and then makes detailed and mathematical study on the approximate bistatic-to-monostatic application (BTMA). Based on the BTMA, the bistatic imaging can be processed with a Standard SAR Processor. [C11393]

"A Novel Height Reconstruction Approach Based on MLE Using Multi-frequency InSAR Data"

SAR interferometry allows height reconstruction of the earth surface. A method based on the use of multi-frequency interferograms and Maximum Likelihood Estimation (MLE) has recently been proposed. However without a priori knowledge of the terrain, the result of the reconstruction is unsatisfied in practical cases. In this paper, we present a novel method to reconstruct highly sloped and discontinuous terrain height profiles using multi-frequency interferograms. It is based on MLE using multi-frequency interferograms joint statistic property, combining with some conventional signal frequency phase unwrapping algorithm. The method can not only improve efficiency of the MLE, but also ensure reliability of the estimation. [C11394]

"A Generalized Space-Time Formulation for Robust Persistent Scatterer Interferometry"

Differential synthetic aperture radar (SAR) interferometry allows measuring slow terrain movements. The extraction of this information is a complex task. Important advances were introduced by the persistent scatterer approach, with the ideas of minimizing the amplitude and phase dispersions in long series of SAR acquisitions. This approach exploits mainly the temporal properties of the signals. On the contrary, other approaches, more similar to classical differential interferometry, exploit first the spatial and then the temporal properties of the data. In this work, we present a generalized formulation of the persistent scatterer interferometry problem that contains the two approaches mentioned above as limiting cases. In the general case, the spatial and temporal properties of the data are exploited jointly, which helps recovering the correct solution even with a limited number of images. Tests performed on real ERS data show that the proposed approach is promising. [C11395]

"Determination of Glacier Velocities on King George Island (Antarctica) by DInSAR"

The Antarctic Peninsula is a region highly sensitive to climate change. For ice dynamic modelling and climatic impact studies several parameters have to be known. Radar interferometry is a feasible method in such remote areas to derive velocity fields. For King George Island, the available ERS-1/2 tandem pairs with reasonable baselines have been processed. Due to temporal decorrelation only 2 out of 19 pairs showed almost everywhere high coherence and an additional 6 have partial moderate coherence. A SAR DEM was constructed by double differencing interferometry. Ascending and descending scenes were combined to derive a velocity field for the main part of the Island. External elevation data were additionally incorporated in the processing. Glacier velocities range between 0 m and about 120 m per year. Validation with DGPS measurements from several field campaigns shows good agreement with the interferometric derived velocities. Inaccuracies exist for the edges of

the ice cap as here decorrelation effects hampered the generation of an InSAR DEM and no external data were available. [C11396]

"Optimization of bistatic Radar Configurations for Vegetation Monitoring"

Bistatic radars have been recently proposed as an alternative to conventional monostatic radars since they can provide additional information in many fields of remote sensing applications. However, up to now, no bistatic radar campaigns, nor laboratory experiments, having vegetation as the target have been set up. This paper presents theoretical simulations of the bistatic scattering coefficient of crop and forest canopies. The electromagnetic model developed at Tor Vergata has been used to analyse scattering as a function of the observation angle, both in azimuth and elevation, and it will be shown that biomass monitoring can be optimized at out-of-incidence scattering planes. [C11397]

"A Solution for Bistatic Motion Compensation"

Bistatic synthetic aperture radar (SAR) missions have become attractive in the last years, because of their higher degree of freedom in choosing transmitter and (passive) receiver motion trajectories. In order to take advantage of this increased imaging flexibility, adequate processing algorithms have to be developed, implemented and verified with experimental data. Currently some promising approaches have been published in this area. A further step in improving the focusing results within a bistatic SAR constellation where transmitter and receiver are mounted on different platforms essentially comprises the bistatic motion compensation (MC). We present a geometrical MC approach which requires high accurate position and velocity information of transmitter and receiver. [C11398]

"A Theoretical Study of the Sensitivity of Spaceborne Bistatic Microwave Systems to Geophysical Parameters of Land Surfaces"

A research activity aiming to assess the potential of bistatic measurements of scattered radiation from the land surface is presented. The purpose is to identify the best configuration of a passive system measuring the signal originated by sources of opportunity, like GNSS or radars aboard a satellite. The preliminary result of the study consists of the validation of the electromagnetic model simulating bistatic scattering from bare soil, including the coherent component. A very preliminary sensitivity analysis to soil moisture is also presented. [C11399]

"A Fourth-Order Imaging Algorithm for Spaceborne Bistatic SAR"

Eldhuset's research, the fourth-order Extended Exact Transfer Function (EETF4), indicates that the range history of a high spatial resolution spaceborne SAR can be modeled by a fourth-order Taylor expansion in azimuth time. In this paper, this point of view is introduced in bistatic SAR, and the transfer functions in the 2-D frequency and the range-Doppler domains are derived. Using this method, an efficient bistatic focusing solution based on squinted mode chirp scaling (CS) algorithm which accommodates both tandem and TI case is developed. Quantitative analysis and simulations are also provided. [C11400]

"On Position and Attitude Determination Requirements for future Bistatic SAR Experiments"

In future bistatic SAR experiments¹ the overlapping of transmitter and receiver antenna footprints is, due to the different trajectories and velocities of the involved platforms, an issue. In this paper we focus on the planned hybrid experiment with an aircraft and TerraSAR-X as carrier platforms. The effect of unknown rotations about the body-axes on the tie point of the antenna pointing vector in Earth's local tangent plane is described. Simulation results based on possible aircraft and satellite parameters are presented and discussed. Based on the suggested geometric modeling and results, positioning and attitude determination requirements can be easily derived for different constellations. [C11401]

"Modular SAR Simulator for Bi- and Multistatic Constellations"

Bi- and multistatic SAR missions are becoming increasingly important for the SAR data acquisition. Established methods for processing monostatic SAR signals and for mission planning have to be adapted to the bi- and multistatic case. To support this evolution, a suitable flexible and powerful simulation tool is essential, which is able to handle such complex scenarios and to provide corresponding simulation data. This paper presents a new simulator architecture. In particular, the modular approach to implement and to simulate this kind of bi- and multistatic SAR scenarios is discussed and an example is given. [C11402]

"Evaluation and Optimisation of Configurations of a Hybrid Bistatic SAR Experiment Between

TerraSAR-X and PAMIR"

The development of new technologies and algorithms in the field of bistatic SAR will lead to new instruments of remote sensing in various domains. One of the next important steps will be the realisation of challenging bistatic SAR experiments to prove, evaluate, and develop this new technique. In this context, we will conduct hybrid bistatic SAR experiments using the SAR satellite TerraSAR-X and the airborne SAR sensor PAMIR. This paper presents first considerations with respect to the optimisation of possible geometries between the spaceborne and the airborne SAR sensor. [C11403]

"DEM Reconstruction Accuracy in Multi-Channel SAR Interferometry"

Interferometric SAR (InSAR) systems allow the estimation of the height profile of the Earth surface. Maximum Likelihood (ML) and Maximum A Posteriori (MAP) statistical techniques have shown to be effective for such problem if multiple interferograms, obtained with different baselines and/or with different frequencies, are used (multi-channel InSAR). In this paper, we evaluate the reconstruction performance of the considered ML and MAP statistical height estimation methods in terms of the Cramer-Rao Lower Bounds (CRLB) of the estimated height values. [C11404]

"Interferometric Triherence for Ground Movements Monitoring"

Minor movements-of the order of 10 cm-of earth surface often precede landslides. Interferometric techniques have a potential of detecting such movements before a landslide occurs. An interferometric quantity-called triherence-was adopted for mapping of points where the interferometric phase is stable over at least one triplet consisting of three consecutive SAR scenes in suitable interferometric conditions. The results from JERS and ASAR triplets of the two study sites suggest that the triherence measure enables to pick up some points in the landscape where the phase behaviour of SAR pixels is stable. Most of the stable points were identified in urban areas but many of them can also be found in natural areas. The initial hypothesis, that in case of sparse vegetation or sparse forest cover, some highly coherent scatterers might be found, seems to be pertinent even if it still needs to be thoroughly checked on the ground. [C11405]

"Monitoring the Cryosphere using Radarsat-1 and SSM/I Data: an Overview of CRYSYS Related Accomplishments at INRS-ETE"

The cryosphere consists of ocean ice, glaciers, lake and river ice, snow cover, seasonally frozen ground and permafrost. During a decade (1995-2005), the CRYSYS project supported a network of researchers from universities and government laboratories involved in the monitoring of the Canadian cryosphere using remote sensing data and climatic models. Through this decade, INRS-ETE has been using remote sensing to develop tools for snow monitoring, seasonal frost mapping, and river ice characterization in Canada. This paper summarizes INRS-ETE main scientific accomplishments. [C11406]

"Advances on DInSAR with ERS and ENVISAT Data using the Coherent Pixels Technique (CPT)"

In this paper, improvements on the Coherent Pixels Technique (CPT) for deformation phenomena monitoring are presented. Advances are made in the different steps of the algorithm (from data selection to their processing) improving quality of the results and computational time. Deformation results of different studied areas are presented revealing the power of DInSAR techniques for risk management and for the understanding of much geological process. [C11407]

"Estimation of the Deformation Temporal Evolution Using Airborne Differential SAR Interferometry"

This paper presents airborne DInSAR results using a stack of 14 images, which were acquired by the Experimental SAR (E-SAR) system of the German Aerospace Center (DLR) during a time span of only three hours and fifteen minutes. An advanced differential technique is used to retrieve the error in the digital elevation model (DEM) and the temporal evolution of the deformation for every coherent pixel in the image. Furthermore, some modifications in the differential processing chain are included to deal with the existence of the so-called residual motion errors, which play a similar role as atmospheric artifacts in the spaceborne case. The detected deformation of a corner reflector and of some agricultural fields allows to validate the proposed techniques to measure deformation phenomena with an airborne platform. [C11408]

"Surface Displacement Monitoring on Reclaimed Land Using PSInSAR Technique"

Large portion of western coast of Korean peninsular has been reclaimed. Because the reclaimed land stands on weak foundation, the subsidence monitoring is required for civil protection. Newly developed PSInSAR technique

is applied to monitor surface deformation on reclaimed land in Incheon Port. There was long lasting subsidence on test area up to 30 mm/year. APS and DEM error are also analyzed for the confirmation of the result.

[C11409]

"An Empirical Approach for the Retrieval of Ocean Wave Parameters from Synthetic Aperture Radar Data"

Spaceborne Synthetic Aperture radar (SAR) is still the only instrument providing continuous two-dimensional (2-D) ocean wave measurements on a global basis. For more than a decade the European satellites ERS-1 and ERS-2 have acquired SAR data over the open ocean operating in wave mode. The ERS acquisitions are currently continued by the ENVISAT ASAR wave mode. It is well known that the derivation of ocean wave parameters from SAR data is not straightforward and different approaches have been proposed. In this study we present a new technique, which is based on an empirical SAR imaging model. The method has the calibrated SAR image as the only input. A data set of 6000 globally distributed ERS-2 wave mode image spectra and collocated ocean wave spectra computed with the numerical model WAM are used to fit a linear model, which relates the SAR spectrum to integral wave parameters like, e.g., the significant wave height. This model is then used for ocean wave parameter retrieval. The radar cross section and the azimuthal cut-off wavelength estimated from the wave mode images are used as additional input variables. The method takes into account the coupling of the different parameters and is based on a least-square minimisation approach. The resulting coupled linear system of equations is solved using a singular value decomposition technique. Disjunct subsets of the collocated data set are used for fitting the model and retrieving ocean wave parameters. Scatterplots and global maps with the derived parameters are presented. It is shown that the standard deviation of the retrieved significant waveheight with respect to the WAM waveheight is in the order of 0.62 m. Other wave parameters, which are of practical relevance like mean wave periods are investigated as well. [C11410]

"Observation of the Soya Warm Current Combining HF Ocean Radar with Coastal Tide Gauges and Satellite Altimetry"

Three HF ocean radar stations were installed at the Soya/La Perouse Strait in the Sea of Okhotsk in order to monitor the Soya Warm Current. The frequency of the HF radar is 13.9 MHz, and the range and azimuth resolutions are 3 km and 5deg, respectively. The radar covers a range of approximately 70 km from the coast. It is shown that the HF radars clearly capture seasonal and short-term variations of the Soya Warm Current. The velocity of the Soya Warm Current reaches its maximum, approximately 1 m s⁻¹, in summer, and weakens in winter. The velocity core is located 20 to 30 km from the coast, and its width is approximately 50 km. The surface transport by the Soya Warm Current shows a significant correlation with the sea level difference along the strait, as derived from coastal tide gauge records. The cross-current sea level difference, which is estimated from the sea level anomalies observed by the Jason-1 altimeter and a coastal tide gauge, also exhibits variation in concert with the surface transport and along-current sea level difference. [C11411]

"Observing Eddy Features in the Ocean Surface Wind Field by Assimilating HF Radar and Anemometer Measurements in a Wind Model"

Strong evidence for 10-40 km scale eddies in the surface wind field over Monterey Bay, California has been presented by Archer, Ludwig et al. using shore and buoy anemometers and satellite images. These cyclonic eddies are frequently present in the evening and early morning and are responsible for fog in the Santa Cruz area. We have previously demonstrated the ability of multifrequency HF radar (4.8 to 21.8 MHz) to map the ocean wind field. Observations over a year time span indicate standard errors of prediction of 1.7 m/s for wind speed and 25deg for direction with biases of 0.1 m/s and 0.3deg respectively. Here we report observation of a 10-20 km cyclonic eddy at the north end Monterey Bay. By combining HF radar wind vector estimates with shore based anemometer data in the WOCSS surface wind field model we are able to form a detailed (5 km resolution) image of an eddy over Monterey Bay and to follow its development and decay. This particular eddy contrasts with previous eddy observations in terms of season and meteorological setting. [C11412]

"Coastal Current Observation in the Area of Abrupt Topographic Change with DBF Ocean Radar"

A DBF ocean radar can detect the surface current pattern every 15 minutes. The tidal current and the residual current were investigated through the continuous observation of the DBF (digital beam forming) radar in the middle-west area of Ariake Bay in autumn 2005. For the validation of the surface current data by the DBF ocean radar the ship-board ADCP measurements were also conducted at spring tide. As the result of the comparison of both surface current data, the correlation coefficient and the standard error of the current speed are 0.89 and 7.23cm/s, and those of the current direction are 0.92 and 35.89 degree. The harmonic analysis of the long-term data by the DBF ocean radar clarifies the spatial pattern of the principal tides and the residual currents. The

residual currents in 15days flow south to southeastward caused mainly by the tidal residual currents due to the topographic asymmetry. [C11413]

"Spectral Behavior of the Ocean Surface Backscatter and the Atmospheric Boundary Layer at C- and Ku-band under High wind and Rain Conditions"

During the NOAA/NESDIS 2005 Hurricane Season (HS2005) and the 2006 Winter Experiment, the University of Massachusetts (UMass) installed two instruments on the NOAA N42RF WP-3D research aircraft: the Imaging Wind and Rain Airborne Profiler (IWRAP) and the Simultaneous Frequency Microwave Radiometer (SFMR). IWRAP is a dual-band (C- and Ku), dual-polarized pencil- beam airborne radar that profiles the volume backscatter and Doppler velocity from rain and that also measures the ocean backscatter response. It simultaneously profiles along four separate incidence angles while conically scanning at 60 RPM. SFMR is a C-band nadir viewing radiometer that measures the emission from the ocean surface and intervening atmosphere simultaneously at six frequencies. It is designed to obtain the surface wind speed and the column average rain rate. Both instruments have previously been flown during the 2002, 2003 and 2004 hurricane seasons. For the HS2005, the IWRAP system was modified to implement a raw data acquisition system. The importance of the raw data system arises when trying to profile the atmosphere all the way down to the surface with a non- nadir looking radar system. With this particular geometry, problems arise mainly from the fact that both rain and ocean provide a return echo coincident in time through the antenna's main lobe. This paper shows how this limitation has been removed and presents initial results demonstrating its new capabilities to derive the atmospheric boundary layer (ABL) wind field within the inner core of hurricanes to much lower altitudes than the ones the original system was capable of, and to analyze the spectral response of the ocean backscatter and the rain under different wind and rain conditions. [C11414]

"Use of Dual Polarization Radar Measurements to Understand the Azimuth Behavior of the Sea Surface Backscattered Signal"

We present an analysis of the azimuth anisotropy of the ocean radar backscatter from C-Band observations in VV and HH polarizations from the airborne radar STORM during the VALPARESO experiment. Comparisons with existing semi- empirical models show that none of them are in agreement with the anisotropy of the radar signal, and the trend with wind speed is too weak compared to the observations. This is attributed to a shortcoming in the description of the short surface waves anisotropy. By considering an additional mechanism for nonlinear wave interactions, we show that the short wave anisotropy is modified and can explain the anisotropy of the radar signal. [C11415]

"High Resolution Sea Surface Current Maps Produced by Scanning with Ground Based Doppler Radar"

Pulsed coherent X-band radar has been operated from shore and from board a ship to scan the sea surface velocities by separating the influences from wind and underlying currents. Test sites lie at tidal inlets of the German Bight that is part of the North Sea. Under the use of Precise Differential Global Positioning Systems (PDGPS) geo-coded radar current maps were produced. [C11416]

"Testing and Validation of the CASA DCAS System"

We present a system emulator that provides a versatile environment for testing and validating a distributed system for sensing of the lower atmosphere during its development lifecycle. The emulator, along with its comprehensive RAPIDS toolbox, provide the necessary infrastructure to experiment with different parameters of the system to ensure that the system specifications are being met, while also providing the scope of experimenting with newer configurations and futuristic designs. Extensive monitoring of the system possible through RAPIDS, allows to expose bugs and performance bottlenecks. The remote experimentation feature of the system allows several users to drive/monitor the system without requiring physical access to the emulator. [C11417]

"The TanDEM-X Mission Concept"

TanDEM-X (TerraSAR-X add-on for Digital Elevation Measurement) is an innovative radar interferometry mission to generate a global, consistent and highly accurate digital elevation model (DEM) and to provide a configurable SAR interferometry platform for demonstrating new SAR techniques and applications. This paper summarizes the mission concept starting from the user requirements, the HELIX orbit and TanDEM-X operational modes to the expected height performance. Examples of new SAR techniques are presented. [C11418]

"Bistatic Image Processing for a Hybrid SAR Experiment Between TerraSAR-X and PAMIR"

Future bi- and multistatic SAR systems could support the scientific community and the commercial market with an additional and powerful tool for imaging and exploration of interesting areas on earth. With the diversity of geometries between transmitter and receivers one can achieve for instance improvements in scene classification, extractions of particular features, and cost reduction. New experiments are necessary to investigate the advantages as well as the problems of bi- and multistatic SAR systems. This paper describes the bistatic use of the spaceborne SAR system TerraSAR-X for future space- borne/airborne SAR exploration. TerraSAR-X will illuminate a particular scene while the receiver, the airborne SAR system PAMIR, will collect the reflected signals on board of an aircraft. [C11419]

"A First Study on the use of TerraSAR-X for Meteorological Purposes"

In this paper we present the predicted performance of the TerraSAR-X for meteorological purposes. Principally, the study focuses on the possibility of measuring rain over ocean and forest. Regarding the acquisition geometry, we investigate the rain volume and voxel resolution, the signal-to-noise ratio and the signal-to-clutter ratio. The clutter interference has been evaluated for intra- and inter-pulse ground returns. Measurement of rain for nadir-looking geometry looks promising over forest and ocean under almost all conditions. However, for side-looking geometry, rain detection could be only possible at very high rain rates. [C11420]

"Polarimetric Passive Microwave Signatures and RFI Suppression During the Soil Moisture Experiment/ Polarimetry Land Experiment in 2005"

The Soil Moisture Experiments in 2005 (SMEX05) and Polarimetry Land experiments (POLEX) were conducted jointly by the US Naval Research Laboratory, the USDA ARS Hydrology and Remote Sensing Laboratory and other cooperators in Ames, Iowa between 13 June and 3 July 2005. Leveraging upon proven methodology and existing facilities and experience from the preceding SMEX02 experiment, SMEX05/POLEX was designed to address algorithm development and validation issues related to current and future soil moisture sensor systems, including enhancement of the Aqua AMSR-E and WindSat soil moisture validation. It also encompasses three unique elements in its scientific objectives: (1) Exploration of unique polarimetric information from satellite sensors such as WindSat and CMIS for soil moisture with supporting NRL aircraft instrumentation. (2) Exploration of diurnal effects associated with soil, vegetation and atmosphere at the 6 am/6 pm observing times of WindSat, CMIS, Hydros, and SMOS. (3) Statistics and mitigation of RFI for CMIS risk reduction. In this paper, we present an overview of the experiment and some preliminary data analysis. [C11421]

"The Application of AMSR-E Soil Moisture for Improved Global Agricultural Assessment and Forecasting"

Soil moisture is estimated by the U. S. Department of Agriculture (USDA) Production Estimates and Crop Assessment Division (PECAD) by utilizing a modified two-layer Palmer water balance model derived from temperature and precipitation observations. It is envisaged that these soil moisture estimates can be improved by integrating passive microwave data which has greater temporal frequency and covers larger spatial domains than available in the past. By integrating direct observations from the EOS Advanced Microwave Scanning Radiometer (AMSR-E) into the current PECAD soil moisture model, more accurate soil moisture and correspondingly crop yield estimates may be possible. This paper presents a methodology for soil moisture data assimilation using a simple bias correction and 1D Ensemble Kalman Filter data assimilation algorithm. An outline of the technical approach is presented. [C11422]

"Use of Airborne LIDAR for the Assessment of Landscape Structure in the Pine Forests of Everglades National Park"

Remote sensing technologies have provided valuable data for landscape modeling, vegetation mapping and comprehensive studies of ecosystems. Airborne laser mapping or LIDAR (Light Detection and Ranging) can directly measure the three dimensional structure of plant canopies, as well as, provide accurate digital terrain models (DTM). While temperate and boreal pine forests have been studied using these methods, very limited work has been done in subtropical pine forests. In this study, airborne LIDAR was used to characterize the three dimensional structure of the forest on Long Pine Key at Everglades National Park. Analysis of the vertical distribution of airborne LIDAR data points has shown that distinctive patterns can be described which are characteristic of the vegetation communities and transition zones for pine forests, hammocks and marshes. This information is a valuable resource for forest managers by providing landscape structural data over large areas. [C11423]

"Coastal Ocean Surface Current Retrievals from Sequences of TerraSAR-X Images"

Coastal surface currents have been computed for years from sequential infrared and more recently ocean color imagery using the Maximum Cross Correlation (MCC) technique. Preliminary results suggest that this MCC method may be applied to sequential Synthetic Aperture Radar (SAR) imagery yielding surface currents with a much higher spatial resolution which are independent of the presence of cloud cover which makes it impossible to use infrared or ocean color imagery. A requirement for the application of the MCC to SAR imagery is the presence of surface slicks, which are often related to ocean color patterns. Test applications are made to ENVISAT ASAR images. [C11424]

"Retrieval of Surface-layer Refractivity using the CSU-CHILL Radar"

The surface-layer refractivity, i.e., the refractive index of air near the earth's surface, can be retrieved from radar using a technique developed by Frederic Fabry, et al. In warm weather, the equation for the index of refraction humidity dominates over temperature and pressure, which has a significant impact on the phase of propagating electromagnetic waves from a radar. Thus, the refractive index can be measured by observing the phase change between any two stationary ground targets along a radial from the radar at roughly the same ground level. This index, in turn, can be used to estimate the water vapor near the surface. With this data, the evolution of the near-surface boundary layer moisture field leading up to convective storm initiation and storm evolution can be detected to enhance quantitative precipitation forecasts. Stationary ground targets are those that return strong radar echoes and do not produce rapid phase changes under slowly varying humidity levels, unlike vegetation, for example, that adds a significant random component to the measured phase as it moves in the wind. The calibration stage, which determines the stationary targets and reference phase, is a critical step, currently requiring manual selection of scans, ideally under conditions of uniform humidity in the radar coverage space. This procedure was recently performed using the dual-polarized CSU-CHILL S-band radar to estimate the refractivity. Prior to this experiment, only single polarization had been used for this estimation. [C11425]

"Improved Rain Attenuation Correction Algorithms for Radar Reflectivity and Differential Reflectivity with Adaptation to Drop Shape Model Variation"

One important goal of the Collaborated Adaptive Sensing of the Atmosphere (CASA) Engineering Research Center is to observe and monitor hazardous weather events in the low troposphere (below 1 km) by deploying networks of small, low-cost radars with small antennas. The first generation of CASA radar networks with dual-polarization capabilities is being deployed in Oklahoma. To achieve good sensitivity with small antenna size, high frequencies (X-Band) are selected. It is well known that signals transmitted at such high frequencies suffer attenuation due to rain along the propagation path. This article describes improved rain attenuation correction algorithms which correct radar reflectivity (Z_h) and differential reflectivity (Z_{dr}) through measured differential propagation phase (Phidp). [C11426]

"Use of Disdrometer Data for X-Band Polarimetric Radar Simulation and Tropical Rain Characterization"

Natural variations in raindrop size distribution (DSD) were studied for simulated X band radar response from October 2004 to July 2005 (normal no-storm conditions) and during September 15th to 16th, 2004 when the tropical storm Jeanne passed over the island of Puerto Rico. Three types of estimators of rain rates were examined: A classical estimator $R(ZH)$ and two polarimetric radar estimators $R(KDP)$ and $R(ZH, ZDR)$. According to simulation results, the normalized errors (NEs) with respect data disdrometer of $R(ZH)$, $R(KDP)$ and $R(ZH, ZDR)$ for all DSD samples in October 2004 to July 2005 data are 40.85%, 14.73%, and 15.83% respectively, while for the tropical storm Jeanne they are 23.39%, 9.35% and 14.53%. The results show that the estimator $R(ZH)$ is the most sensitive to variations in DSD. Calibrated R-Z relations were developed for X-band for two conditions: storm/no-storm. Data from NASA TRMM satellite and rain gauges, the rain rate per hour was used for pinpointing areas of heaviest rain and for validation. [C11427]

"The TerraSAR-X Orthorectification Service and Its Benefit for Land Use Applications"

The German Aerospace Center (DLR) currently develops the TerraSAR-X Payload Ground Segment. On request level 1b products will be distributed to the user. Two of the four basic products available are generated by the geocoding system. This system supports ellipsoid and terrain correction in order to provide orthorectified images. A new product called Enhanced Ellipsoid Corrected (EEC) will be offered that considers Digital Elevation Models (DEMs) of a moderately coarser resolution than the resolution of the TerraSAR-X modes. SRTM/X-band DEMs with approximately 25 m resolution will be the backbone for this operational and fully automated service. For high precision terrain correction first results of an experimental processor are presented using a high resolution

DEM, tie- pointing and image adjustment. [C11428]

"TerraSAR-X Products and Product Performance Update"

TerraSAR-X is a German satellite to be launched towards end of the year 2006. The SAR instrument built by EADS/Astrium has a multipolarized active phased array antenna and is programmable in wide ranges. This allows to operate imaging modes such as e.g. stripmap, spotlight, ScanSAR and dual-polarization modes. By further dividing the antenna in halves with different position or different polarization, experimental modes for ground moving target detection (GMT) or Quad-Polarization are possible. As a consequence of the various sensor capabilities the tree of SAR products offered by the DLR Ground Segment contains many different variants of polarization, resolution and scene size. Even more product variants are caused by different processing parameters selectable by the user. Some product performance parameters, such as the radiometric accuracy as a function of geometric resolution or the image resolution as a function of incidence angle depend on both, sensor settings (PRF, pulse duration) and on processing parameters (bandwidth, weighting, multi-looking). The processing parameters for the products have been designed by DLR in a way so that valuable products with maximum information content are offered to the user. In order to generate the specified products, the TerraSAR Multi Mode SAR Processor TMSP has been designed by DLR. This processor will be operated at the DLR payload ground segment in Neustrelitz for commercial and scientific customers. The processor will also be operated at additional direct access partner stations of Infoterra GmbH, who will serve private and public customers. [C11429]

"Status of the TerraSAR-X Mission"

TerraSAR-X is a new German radar satellite scheduled to be launched in October 2006 with a lifetime of 5 years. It carries a high frequency X-band SAR sensor that can be operated in three different modes and polarizations. The Spotlight-, Stripmap- and ScanSAR-modes provide high resolution images for detailed analysis as well as wide swath data whenever a larger coverage is required. Imaging will be possible in single, dual and quad-polarization. TerraSAR-X will be an operational SAR-system for scientific and commercial applications. The Pre-launch AO was the first opportunity to apply for data for research purposes. Between June 13 and October 4 2005 172 Pis submitted 205 proposals representing more then 350 research groups. [C11430]

"Aquarius Mission Technical Overview"

Aquarius is an L-band microwave instrument being developed to map the surface salinity field of the oceans from space. It is part of the Aquarius/SAC-D mission, a partnership between the USA (NASA) and Argentina (CONAE) with launch scheduled for early in 2009. The primary science objective of this mission is to monitor the seasonal and interannual variation of the large scale features of the surface salinity field in the open ocean with a spatial resolution of 150 km and a retrieval accuracy of 0.2 psu globally on a monthly basis. [C11431]

"Scattering and Propagation of Polarimetric Radar Signals in Storms and Clouds"

The introduction of differential reflectivity (Z_{dr}) and propagation differential phase ($Phidp$) was originally intended for improving radar estimates of rainfall rate. These parameters together with the effective reflectivity factor (Z_h) proved to be very useful for other applications as well. They have been shown to produce significant improvements over conventional single polarization radars in discriminating liquid and ice phase hydrometeors and, with the aid of several other polarimetric parameters (linear depolarization ratio and co-polar correlation coefficient), for classifying different hydrometeor types. Radar techniques developed for these purposes are being used in research applications and will soon become operational tools. The classification of ice phase hydrometeors and the quantitative estimation of their bulk parameters (e.g., median size, ice mass content, etc.) are necessary for better understanding storms and clouds. As methodologies are developed for extracting more information about hydrometeors using polarimetric radars, it becomes increasingly important to model the hydrometeors more accurately. Their shape, size, fall behavior, and composition must be represented with sufficient detail, capturing the dominant features that influence the measured radar parameters. This paper reviews developments in hydrometeor modeling for dual-polarization radar remote sensing applications. The use of these modeling results in various applications such as rainfall rate estimation and hydrometeor classification are illustrated with the aid of experimental measurements. The first application of the "self-consistency" principle is discussed using dual-frequency polarimetric radar parameters (S-band Z_{hnd} Z_{drw} with X-band Z_{hnd} specific attenuation A_h). [C11432]

"Development of a C-band Polarimetric and Pulse Compression Radar in Okinawa, Japan"

National Institute of Information and Communication Technology (NICT, formally CRI) has developed a new C-band (5340 MHz) multi-parameter Doppler radar system with a bistatic Doppler radar network to establish the

next-generation technology of rain observation for meteorological and hydrological applications such as weather forecasts and run-off analysis in predicting floods. This new radar is named COBRA (CRI Okinawa Bistatic polarimetric RADar). The weather targets of this system are typhoons, Baiu-frontal rainfall, meso-scale precipitation in subtropical zones, and clear air turbulence. Two transmitter (klystron) units are used for the polarization observation. The transmission polarization for each pulse is selected from six possible polarizations. Additionally, NICT has developed equipment for weather radar that modulates the transmitting signal and demodulates the received signal (i.e., a pulse compression function). This equipment has been added to the existing COBRA system, forming a new system referred to as COBRA+. The COBRA+ system uses two traveling-wave tube amplifier (TWTA) transmitter units. [C11433]

"Using Shuttle Radar Topography Mission Elevation Data to Map Mangrove Forest Height in the Caribbean"

In this paper we describe a methodology to map mangrove forests in 3D in the Caribbean region. We used shuttle radar topography mission (SRTM) elevation, lidar and field data to estimate mangrove mean tree height at the landscape scale. This paper emphasizes two regions which are undergoing ecosystem restoration activities: The Everglades National Park, USA and Cienaga Grande de Santa Marta, Colombia. In these regions we used, respectively, airborne and spaceborne (ICESat (ice, cloud, and land elevation satellite)) lidar data to calibrate SRTM data and estimate mean tree height. Our results show the method is accurate if mangrove forest canopy vertical structure is well characterized. [C11434]

"Mapping of Snow Water Equivalent and Snow Coverage from Combined EO and in situ Data for Climatic Studies and Hydrological Forecasting Models"

Information on physical snow cover characteristics, such as snow water equivalent (SWE) and the areal coverage fraction of snow covered area (SCA), can be obtained from space-borne remote sensing data. The feasible instruments include optical spectrometers and microwave radars (SCA mapping), and microwave radiometers (SWE mapping). As data assimilation techniques are applied, the EO data-derived information can improve the performance of river discharge forecasting models and the knowledge on snow climatology. The results discussed here indicate that the assimilation of EO data-based SCA estimates to hydrological modeling significantly improves the accuracy of operational river discharge forecasts. The results also indicate that the employment of space-borne microwave radiometer data using the data assimilation technique improves the SWE or snow depth mapping accuracy when compared with the use of values interpolated from synoptic observations. [C11435]

"The Aquarius Scatterometer: An Active System for Measuring Surface Roughness for Sea-Surface Brightness Temperature Correction"

The Aquarius scatterometer is a total-power L-band radar system for estimating ocean surface roughness. Its measurements will enable the removal of wind effects from the Aquarius radiometer ocean-surface brightness temperature measurements being used to retrieve ocean salinity. The Aquarius scatterometer is a relatively simple, low-spatial resolution power-detecting radar, without ranging capability. But to meet its science requirement, it must be very stable, with repeatability on the order of 0.1 dB over several days, and calibrated accuracy to this level over several months. Data from this instrument over land as well as ocean areas will be available for a variety of geophysical applications. [C11436]

"Dual-polarization Developments at CNR: Past and Present Research"

This paper reviews the research activities carried out by the radar meteorology group that was established at the Institute of Atmospheric Physics of the National Research Council of Italy. The group started in the late 1970s, and, after the publication of a keystone paper on the use of linear polarization by Seliga and Bringi (1976), its primary focus has been on polarimetric radar techniques and their meteorological applications. The research efforts, realized through close cooperation first with Pennsylvania State University and later with Colorado State University, have produced positive results that have contributed to a spread in the knowledge of dual-polarization techniques and in learning important information about microphysical processes in clouds and precipitation. This paper highlights some of these research achievements. [C11437]

"Relation Between Coherence, Forest Biomass, and L-band σ_0 "

Relation between coherence, forest biomass, and L-band σ_0 were examined by using the L-band data taken by Japanese Polarimetric and Interferometric Airborne SAR (PiSAR). Several PiSAR observations were performed over a well-managed national forest, in which four kinds of conifers were dominantly planted. A

coherence map over the forest area was made from two flight data, whose observation interval was about 30 minutes. The coherence in this site are ranging from 0.5 to 0.8. High coherence values of 0.7 ~ 0.8 were appeared at the young stands. On the other hands, some stands with high biomass also show high coherence value. Since the coherence values are weakly correlated with σ_{HH} and σ_{HV} at the stands with high biomass, the high coherence value and the high σ_{HH} value are considered to be the same origin. The regression curve between the coherence and a stem volume derived in this analysis shows higher coherence value than the other two JERS-1 (L-band) 44-day pair data and one ERS 1/2 C-band 1-day pair data. This may be due to the shorter repeat-cycle of the PiSAR pair data and difference of the scattering elements. [C11438]

"Design and implementation of PALSAR Ground Data System at ERSDAC"

The Phased Array type L-band Synthetic Aperture Radar (PALSAR) is one of the imaging sensors onboard the Advanced Land Observing Satellite (ALOS) launched on January 24, 2006. The antenna of PALSAR is beam steerable to realize a variety of off-nadir angles. There are multi-polarimetric (dual and quad) observation modes and single polarimetric modes. It has also ScanSAR modes to observe a wide swath (250 km-350 km). PALSAR Ground Data System (GDS) has been developed at ERSDAC since 1999. In the system, raw data provided from JAXA are processed to SAR images as final products which are archived and distributed to the worldwide users. The SAR data processor of PALSAR GDS is designed to achieve optimal data quality as well as maximum performance to meet the requirements from various users. [C11439]

"Wetland Characterization using Polarimetric RADARSAT-2 Capability"

Wetlands play a key role in regional and global environments and are critically linked to many major issues such as climate change, water quality, the hydrological and carbon cycles, and wildlife habitat and biodiversity. Mapping wetlands and monitoring their change in a systematic and repeatable manner for the Canadian Wetland Inventory (CWI), led by the Canadian Wildlife Service of Environment Canada (EC), are important in order to manage and protect significant wetland areas in Canada. The use of RADARSAT-1 Synthetic Aperture Radar (SAR) data has been shown to be important for wetland water extent characterization. However, the limited capability of RADARSAT-1's single-polarization C-band SAR in vegetation type discrimination makes the use of clear-sky- dependent visible near-infrared (VNIR) satellite data necessary for wetland mapping. In this paper, the unique polarimetric capability of RADARSAT-2 is investigated for wetland classification. The roll invariant incoherent target decomposition, the TSVM-ICTD [11], is used for optimum characterization of wetland target scattering. It is shown that like RADARS AT-1 HH polarization, the magnitude of the complex symmetric scattering is not effective for vegetation type discrimination. The phase of the symmetric scattering type has to be used for a more complete characterization of wetland vegetation species. This new phase scattering parameter introduced in [11] has been shown to be very promising for wetland classification using Convair-580 polarimetric SAR data. [C11440]

"The Development of the Chilbolton Radar 1977 to 1988"

The development of the Chilbolton Radar as a fast switched linear dual-polarization radar is given for the period 1977 to 1988. Reasons are given for the direction of the development, the solution of technical problems in the context of the technology of the time and the significance of international collaboration that gave impetus to the work. [C11441]

"Chill Radar Dual Polarization"

The CHILL radar was originally designed as dual polarization radar. It was put into operation in late 1971. The original concept was a dual frequency X-band and S-band system. In 1972, the idea of using it as polarization radar was suggested by Drs. Tom Seliga and Viswanathan Bringi. After several years, the X-band radar was discarded and the system became a dual polarization radar instead. This discussion outlines the changes that were preformed on the system to make it a good polarization system. The radar was dual polarization capable from the beginning with a switch which changed the polarization of the transmit signal. A short list of the changes that were made in the radar and there success and problems are presented. The changes started with an electrical operated switch (original design) which took a second to switch but no special processing; a modified processor and the same switch changing to a 4 second cycle; a ferrite switch with 2 microseconds switching time and changing the processor to one with more channels; two channel separate transmitter and receiver; new antenna; and finally a second new antenna. Most of these upgrades also involved signal processing updates. [C11442]

"Yamase-derived Gap Winds Off the Western Hokkaido Coasts and Their Effects on Sea Surface Temperature Fields"

Suttu, which is located in the western Hokkaido, is known to be the 4th strongest windy place in Japan, where topographical gaps efficiently develop strong winds. These gap winds over the ocean and their effects on sea surface temperature (SST) fields are investigated by scatterometer- and synthetic aperture radar (SAR)-observed wind fields and the Advanced Very High Resolution Radiometer (AVHRR)-derived SST data. The SAR wind field observed by a wide-swath ScanSAR mode reveals a series of wind jet/wake patterns, which correspond to upstream land topography. The strong jets extend offshore over 100 km. It is found by several SAR-derived wind fields that these gap winds develop under the condition of upstream easterly winds. The easterly winds are common in spring and summer, which are known as the Yamase phenomena in northern Japan. Low/high SST patterns, which correspond to the jet/wake, are frequently observed off the western Hokkaido coasts in summertime. We create a composite image of the SST spatial anomalies for windy days, based on insitu wind measurements in Suttu. The composite image shows well-defined local SST cooling/warming stripes along general wind jet/wake regions. These are probably induced by the difference of the diurnal warming amplitude. [C11443]

"Polar Decomposition and Polarimetric SAR Analysis: A Quaternion Approach"

We assess here the use of polar decomposition in SAR polarimetry, based on the quaternion formalism. Quaternions are helpful to obtain compact and original expressions of polar decomposition parameters, with straightforward extensions in bi-static polarimetry. Once the formalism of quaternions has been presented, both coherent and incoherent polarimetry approaches are discussed in this joint framework of polar decomposition and quaternions. Preliminary tests and comparisons with Cloude-Pottier parameters are conducted on ONERA/Ramses SAR data takes. [C11444]

"Digital Beamforming for HRWS-SAR Imaging: System Design, Performance and Optimization Strategies"

Multi-aperture synthetic aperture radar (SAR) systems in combination with an appropriate coherent processing of the individual aperture signals enable high resolution wide swath (HRWS) SAR imaging [1]-[8]. An innovative reconstruction algorithm for such a digital beamforming on receive was presented in [9]-[12] that allows for HRWS even in case of a non-uniformly sampled data array in azimuth. This paper will compare this algorithm to different azimuth processing strategies regarding their performance in dependency of the overall sampling. Further, optimization strategies are discussed to maximize the system's performance by pattern tapering on transmit and "Pre-Beamshaping on Receive" networks that allow for pattern tapering on receive and adaptively adjust the virtual sample positions. [C11445]

"Bistatic Space Borne / Airborne Experiment: Geometrical Modeling and Simulation"

In this paper, the geometrical setup of an airborne/spaceborne SAR experiment is described. This experiment is planned in cooperation of ZESS (University of Siegen) and FGAN (Forschungsgemeinschaft für angewandte Naturwissenschaften) [1]. While TerraSAR-X will be used as SAR illuminator, the reflected pulses will be received by FGAN's X-band system PAMIR. Due to the high difference between the velocities of the platforms, both systems must perform antenna steering to achieve an appropriate scene length in azimuth. [C11446]

"Bistatic Exploration using Spaceborne and Airborne SAR Sensors: A Close Collaboration Between FGAN, ZESS, and FOMAAS"

Following the goals of our cooperation treaty between FGAN and ZESS (University Siegen), we work closely together on the complex research field of bistatic exploration. Single tasks of the overall topic are for instance experimental missions, processing, image formation, position- and attitude estimation, synchronisation, simulation, parameter estimation, and visualization. This paper presents an overview about the common projects of FGAN, ZESS, and FOMAAS. [C11447]

"Development of 9.25MHz Ocean Radar for Measuring Ocean Waves"

The National Institute of Information and Communications Technology (NiCT) is developing a 9.25-MHz ocean radar for measuring sea surface currents and ocean waves offshore. This study clarifies the accuracy and validity of observing ocean waves with a 9.25-MHz ocean radar. The precision of the receiving signals of the 9.25-MHz ocean radar is evaluated by observing ocean waves with a wave gage mounted on a buoy. The results of observing ocean waves with a 9.25-MHz ocean radar are compared with the results of observing them with a wave gage. This comparison showed that the directional wave spectrum can be estimated from the receiving signals when the noise level is low during the day. [C11448]

"No Math: Bistatic SAR Processing Using Numerically Computed Transfer Functions"

Standard SAR processing algorithms use analytically derived transfer functions in the 2-D frequency and the range- Doppler domains. These rely on the assumption of hyperbolic range histories of monostatic SARs on straight flight paths. A moderate deviation from these conditions can often be handled satisfactorily by a range-variant velocity parameter. However, bistatic SARs with considerable separation between transmitter and receiver can no longer be approximated accurately enough by hyperbolic range histories. In [1] we have presented an alternative approach, NuSAR. We suggested using numerically computed transfer functions for bistatic SAR processing. We presented the idea and gave hints on how to compute the three transfer functions required for SAR processing. In this paper we present bistatic simulation results with the NuSAR algorithm. It is shown, that NuSAR works well even in extreme bistatic configurations, as long as we restricted ourselves to quasi-stationarity, i.e. where the velocity vectors of receiver and transmitter are similar enough that we may assume the point response function to be sufficiently azimuth-invariant within a single azimuth processing block. [C11449]

"First ENVISAT and ERS-2 Parasitic Bistatic Fixed Receiver SAR Images Processed with the Subaperture Range-Doppler Algorithm"

Past and current SAR missions, such as SIR-C, ERS- 1/2, ENVISAT, SRTM, E-SAR, etc. had in common that the signal transmitter and the receiver were located at the same moving platform. New missions are being planned [1] based on the bistatic concept, where transmitter and receiver subsystems are located at different locations and thus may follow different trajectories. But before these missions become a reality, there are several experiments to be considered. One of them is the Parasitic Bistatic Fixed Receiver case, a novel and challenging configuration regarding hardware development and SAR processing techniques. This configuration will improve our experience in the bistatic field with cost effective measurements. In this paper, we will present the first images of the ongoing satellite bistatic campaign in our department. The images have been acquired with the specific hardware SABRINA (SAR bistatic fixed receiver for interferometric applications, fully developed at UPC) and processed with the Subaperture Range- Doppler Algorithm which will be explained in detail. We have been using ESA's ENVISAT and ERS-2 C-band SAR satellites as opportunity transmitters and we have located the hardware prototype receiver at the roof of our department looking to the illuminated scene, a hill in front of the Campus. The mean bistatic angle is about 75deg, the capture window is only two seconds long and experiments have a period of 35 days due to the satellite revisiting time. [C11450]

"Research on Unification of Spatial Reference of Multi-source Data in 3S Integration"

Spatial reference unification is the foundation of "3S" integration project and is also complicated. This paper proposes and designs scheme for coordinate unification according to constitute of multi-source data and system requirements in digital tobacco "3S" monitoring project, then solves the two problem: WGS84 datum transformation with local datum and SAR image calibration with other spatial data in research area. The result proves that the scheme satisfies the precision requirement of this project which makes good preparation for the following monitoring work. [C11451]

"Spatially Variant Restoration for Polarimetric Synthetic Aperture Radar Imagery"

A. spatially variant speckle filter is proposed for multi-look polarimetric synthetic aperture radar (POLSAR) imagery. The central idea is that the filtering is applied only to homogeneous areas based on the scattering properties, while for detected edges, lines and point-like textural features, the original complex covariance matrix of these features is restored in order to preserve the actual features. The capabilities of the proposed filter were examined using nine-look NASA/JPL POLSAR C-band data. Based on the obtained results, the proposed filter showed a promising performance in speckle removal and radiometric preservation. Moreover, the point-like textural features as well as structural features (i.e. edges and lines) were well-retained in the filtered outputs. [C11452]

"Comparison of PolSAR Speckle Filtering Techniques"

The objective of this paper is to compare the most widely used and the most recent speckle polarimetric synthetic aperture radar (PolSAR) filters. Two new conceptual approaches in PolSAR filtering are evaluated on simulated PolSAR images. The criteria of comparison includes indicator of speckle reduction capability, edge sharpness and preservation of scattering properties. Results indicate better performances with the partial differential equation (PDE) -based filters. [C11453]

"Classification of Polarimetric SAR Data Using Spectral Graph Partitioning"

A new approach for classification of Polarimetric Synthetic Aperture Radar (POLSAR) data is proposed using segmentation that is formulated as a graph partitioning problem. This work is motivated by the fact that human experts are very good at visual interpretation and segmentation of POLSAR data, which is often challenging for automated analysis techniques. Spectral graph partitioning, a framework that has recently emerged in computer vision for solving grouping problems with perceptually plausible results, is used with modifications necessary to accommodate POLSAR data. Using the similarity of edge-aligned patch histograms and spatial proximity, classification performance that is superior to the Wishart classifier is achieved. This approach also provides a way to combine region-based and contour-based segmentation techniques, as it can accommodate different representations of polarimetric data as well as other data sources (e.g., optical imagery). [C11454]

"Data Fusion: Cumulative Effects of Discrete Fusion on Target Detection Probability"

This paper describes the culmination of a four-year research, application, and development program towards finding and quantifying a methodology for sensor and data fusion of remotely sensed targets. It builds on previous research reported in IGARSS'02 [1] and IGARSS'04 [2]. Here, we examine the effectiveness of the data fusion methodology, specifically, the impact of iterative data collection on the effective probability of detection of targets. Through statistical (Bayesian) combination of sensor iterations, low confidence sensors (those with moderate probability of detection and moderately low probability of false alarms) can provide high detection performance. This can be extended to multiple data source types. The goal is to make use of higher coverage data products which have only moderate detection performance in the detection and tracking of targets. This is made possible through a combination of discrete target data, along with the analysis of parameters from the respective remote sensing technologies. This process requires the existence of a reasonable maneuvering model or sufficient processing resources. [C11455]

"Evaluation of Convair-580 and Simulated Radarsat-2 Polarimetric SAR for Forest Change Detection"

Radarsat-2 is a significant advancement in technological capability over Radarsat-1 in terms of better spatial resolution and polarimetric parameters. To determine the effectiveness of C-band polarimetry of Radarsat-2 data for applications of forest typing, structure recognition and disturbance detection, C-band polarimetric data from Environment Canada's Convair-580 were acquired. We also obtained simulated Radarsat-2 data, a degraded version of the Convair-580 data. Polarimetric techniques, such as polarimetric filtering and decompositions, were performed on these data sets. The underlying backscatter phenomena were examined and the results were compared. Historical fire disturbance patterns were detected clearly with the Convair-580 data by using the Entropy- alpha decomposition technique. Moreover, the combination of the surface scattering and volume scattering decompositions showed results in obtaining clearcut information in forested areas. By using the simulated Radarsat-2 data, we gained an insight into what could be expected from real Radarsat-2 quad-pol products. Even though the simulated Radarsat-2 data had more noise than Convair-580 data, the fire scars in the same area were still detectable. [C11456]

"A Radar Sensing Algorithm by Gabor Theory"

In this paper, an alternative target density function (TDF) is proposed for narrowband radar model. This is achieved by estimating a new target density function by Gabor theory. It is shown how Gabor transform can be used to obtaining wideband target density function by transmitting a waveform which is a kernel for this transform. The windowing characteristics of this theory is plausible to reaching an accurate result. The presented wideband target density function is developed in a various manner different from the conventional methods. [C11457]

"TD2D and TDEPAR Time Domain SAR Image Processors State of Art, Performance Evaluation and Comparisons"

First Page of the Article [C11458]

"Comparison of three methods for estimating movement parameters"

The paper is concerned with the estimation of the movement parameters (velocity, acceleration, jerk, and so on) of a target illuminated by an L-FMCW radar. The signal model is introduced and three relevant estimation methods are briefly described. These methods are then compared in simulations and by the use of recorded radar signals. [C11459]

"Covert Operation of Surveillance Noise Radar"

paper is devoted to solving the functional problem of the ground-based surveillance pulse noise radar for covert operation in the presence of operative electronic support measures system (ESMS). The radiation covertness is provided by selecting space-time frequency parameters of noise sounding signals and the corresponding structures of noise radar returned-signal processing, and by the definite radiation strategy for sounding local scan zones, the stage of target servicing and adaptive control of radio electronic ESMS countermeasures means. [C11460]

"Inverse Filtering for Noise Radar Processing"

This paper proposes pulsed noise-like or noise waveforms to be able to perform pulse compression with inverse filtering operations to get high resolution, low sidelobes and possibly super resolution. The processing is based on the earlier developed methods to reduce sidelobes and to equalize the response from each processed pulse. This impacts the clutter filtering and allows better clutter suppression. The proposed method can also handle pulse to pulse agility with different pulse lengths and different pulse repetition intervals. [C11461]

"Coherent X-ray Radar"

Simple sources of coherent X-ray radiation are not available yet. That is why methods of conventional radar can not be used for design of a coherent radar or reflectometer in X-ray of electromagnetic spectra. In the paper theoretical design of a coherent X-ray radar is suggested for the first time based upon principles Noise Radar Technology. Two possible schemes for implementation of coherent X-ray radar are suggested. Some results of theoretical consideration are briefly discussed. [C11462]

"Performance Analysis of a Novel Adaptive SLB/CFAR System"

In many radar applications, strong signals may enter through the antenna sidelobes and be interpreted as main beam signal. This results in false detection and angle errors [1]. A new adaptive sidelobe blanking (SLB) combined with a constant false alarm rate processor (CFAR) is proposed to prevent acquisition of strong target in the antenna sidelobes and also to reject pulsed interference originating in the sidelobes with maintaining constant the false alarm rate. We assume that the target is a Swerling I target fluctuation model. Closed form of probabilities of detection, false alarm, blanking and false blanking are determined and the performance of the system SLB/CFAR is analysed. [C11463]

"Analysis and Real Time Implementation of a Clutter Map CFAR Detector with Noncoherent Integration"

In this paper, we analysis a CMAP-CFAR (Clutter Map Constant False Alarm Rate) detector with noncoherent integration. The predetector statistics of the complex envelope are assumed Gaussian. A Swerling II target fluctuation model is considered and the incoming pulses are assumed independent. Closed form expressions of the probability of detection and the probability of false alarm are determined. On another hand, we propose a real time implementation of CMAP-CFAR detector with post integration using Texas Instrument DSP TMS320C4x. [C11464]

"High resolution DOA automotive radar with four receiving antennae"

Current research activities in the automotive industry focus on the improvement of the perception capabilities of radar sensors. A radar sensor with four receiving antennae and its LFMSK transmit signal are introduced. To determine the DOA (Direction Of Arrival, azimuth angle) of the targets in the range of the radar sensor spatial samples of the antennae are chosen and processed using the high resolution frequency estimation technique MUSIC (MUltiple Signal Classification). Results of simulations and practical measurements are presented and compared. [C11465]

"The Use of Frequency-Randomised Waveforms with Intelligent Processing for UAV SAR Imaging"

A stepped-frequency continuous wave (SF-CW) synthetic aperture radar (SAR), with frequency-agile waveforms and real-time intelligent signal processing algorithms, is proposed for operation from a lightweight UAV platform. An SF-CW radar offers some distinct advantages over a pulsed radar. It measures the frequency response of the scene across a set of discrete frequencies over the bandwidth of interest, at each element position along the synthetic aperture. This means the individual frequency measurements are low power, but which are then integrated to simulate a much higher-power pulsed system. This is a cost effective way of providing radars with a low probability of interception (LPI), operating across wide frequency bands to obtain high image resolutions. In contrast, pulsed radars require large peak powers. Low power operation, and associated simple SF-CW circuitry, provides significant savings in the mass and size of the SAR sensor. To alleviate any bandwidth restrictions

imposed by the spatial sampling requirements along the aperture, an approach is outlined using frequency randomised waveforms which allows the bandwidth to be greatly under-sampled before the appearance of significant sampling artefacts. This also provides benefits to the LPI performance of the radar. For a fixed transmit power, omission of frequencies naturally produces a decrease in target signal. However, an intelligent frequency selection scheme is proposed to alleviate signal drop-off, such that signals can be maintained 3dB above the level that might otherwise be expected. [C11466]

"Acoustic Random Noise Radar Using Ultra Wide Band Waveforms"

Ultra wideband noise radar gives high range resolution and the range ambiguity is suppressed as a result of the non-periodic waveform. Random noise waveforms could also be applied in acoustic radar (Sodar/Sonar). Both wave generation and signal processing can then be performed on a PC. As a result, some signal processing algorithms used in random noise radar/sodar can be tested simpler using sound waves. This paper presents basic relationships and algorithms for signal processing in random noise radar/sodar, and the noise floor generated by the randomness of the transmitted signal is defined. A PC-controlled acoustic radar with ultra wide band random noise waveform (1-8 kHz) was implemented to test some of the algorithms described. Measurements were carried out on both moving objects and stationary scenes. Moving target indication using stretched time processing (Doppler) and change detection algorithms were tested as well. Recording from a bridge shows the potential use of the technique for water level indication as an example. [C11467]

"Tracking of multiple ground moving targets with adaptive monopulse radar-part II: the tracker"

For analysing dynamic scenarios with multiple ground moving vehicles, airborne GMTI radar is a well-suited sensor due to its wide area, all-weather, day/night, and real time capabilities (GMTI: ground moving target indication). The production of GMTI tracks from GMTI data is essential for producing a "recognised ground picture" as well as for analysing traffic flows. This contribution is the second out of two twin papers on ground target tracking. In part I the properties of the radar sensor used and a scenario with two crossing vehicles are discussed. In part II we describe aspects of the tracking algorithm used and present selected numerical results related to an improved sensor modelling aspects. [C11468]

"Correlation of High Range Resolution Radar Signals of Aircraft with Modelled Data Stored in a Data Base"

Performing a Non-cooperative Identification function (NCI) depends mainly on the database with which measured radar data can be compared. This paper is concerned with one dimensional high range resolution signals of airborne targets and the possibility of creating matching templates from modelled data for storage in a template library. Both the measured data and the modelled data are processed to obtain range profile plots as functions of the target aspect angle. The measured and simulated plots are compared for different targets. Further, both data sets are tested in such a way that cuts through the plots are taken as templates for profiles under a certain aspect angle $az=y$. These cuts are correlated with the original measured range profiles. Identification statistics are obtained from the correlation with the modelled data and with the measurement based data. [C11469]

"A modified M/N logic for track initiation of low observable targets using amplitude information"

This paper deals with the optimization of the track initiation procedure for fast moving low observable targets. The standard approach consisting in applying a first detection threshold to each scan followed by an M/N logic, requires very low threshold values to guarantee an acceptable detection probability, which results in turn in a high probability to initiate false tracks. We derive a new technique to initiate tracks of low observable targets by exploiting the full amplitude information as well as the monopulse ratio information and evaluate its performance. The new technique outperforms the M/N decision logic, while keeping comparable a simplicity and low computational cost. [C11470]

"Joint Adaptive Detection-Estimation Algorithm for Maneuvering Target Tracking"

An adaptive maneuvering target tracking algorithm based on dynamic system model which incorporates both random and deterministic character of maneuver is presented. Such a model enables to work out relatively simple recursive adaptive input estimation (IE) algorithm with analytic threshold level calculation. The simulation results of the algorithm implementation are presented. The comparative analysis has revealed better performance characteristics of the proposed algorithm in comparison with the interactive multiple model (IMM) approach. [C11471]

"Optimum Reception of Incoherent Noises Signals"

The questions of optimum detection of random non-stationary signals with finite energy on a background normal white noise at non-coherent accumulation are considered. Except for unknown to duration, to time of arrival, middle frequency and width of spectrum of noise signal his structure is unknown also. It is shown that for the detection of such signals it is expedient to use their two-parametric presentation. The results of research of influencing of base of two-parametric presentation on detection characteristics are represented in the lecture. It is shown that only on condition of matched of base of two-parametric transformation with the structure of secretive noise signal it is possible to attain potential detection characteristics at non-coherent accumulation.

[C11472]

"Power Amplifier Linearization and Efficiency Improvement Techniques for Commercial and Military Applications"

This paper presents some recent developments in the area of power amplifier (PA) linearization and efficiency improvement techniques. Advanced digital pre-distortion (DPD) architectures implemented with digital signal processing (DSP) are discussed. Various results of improvements in intermodulation distortion (IMD) when applied to high power RF amplifiers are presented. Crest factor reduction (CFR) has been shown to substantially increase the power output, and hence the efficiency of PAs operating with high peak-to-average waveforms. The combination of DPD and CFR is shown to improve both efficiency and linearity to levels previously unachievable with analog technologies alone for commercial wireless applications. Independent of these signal processing techniques, polar transmitter circuit architectures have been proposed to improve PA efficiency. A combination of a polar transmitter architecture operating in combination with DPD and CFR is proposed in this paper to address more demanding military wireless communications applications. [C11473]

"Design and Real Time Implementation of a Novel Combined CA-CFAR/SLB System on TMS320C67x Processor"

In this paper, we present a novel approach for real time implementation of a combined Cell Averaging-Constant False Alarm Rate (CA-CFAR) detector and SideLobe Blanking (SLB) system. The proposed approach has been implemented using the Texas Instruments TMS320C6711 Digital Signal Processor (DSP). We propose also an optimized procedure for CFAR based threshold estimation using a Generalized Automatic Sliding Window technique (GASW) which efficiently uses data to reduce the memory access number and exploits pre-computed values to set the new threshold for adjacent cell. DSP implementation results are presented and discussed.

[C11474]

"Design and Sensitivity Analysis of Highly Compact Comparator for Ku-Band Monopulse Radar"

This paper gives the design of a highly compact comparator at a Ku-band frequency and presents analysis results of the comparator for the fabrication inaccuracies. First an unconventional magic-t using a nonstandard waveguide is designed at 15.50 GHz. To reduce the volume occupied by the magic-t, its E-arm (or difference port) is kept parallel to the plane of two inputs of the magic-t instead of perpendicular to them as is done in a convention magic-t. The sum and the difference ports of the above folded magic-t are then matched using inductive windows at 15.50 GHz. Keeping the required location of the outputs of the comparator in mind, four of these matched folded magic-ts are suitably interconnected to design a highly compact comparator. The effects of the fabrication errors in the waveguide and matching elements dimensions on the centre frequency, magnitude and phase response of the comparator are also analyzed and presented. [C11475]

"Investigation of the Effect of Array Geometry on the Performance of Free-Space Optical Interconnects"

The effect of transmitter and receiver array configurations on the stray-light and diffraction-caused crosstalk in free-space optical interconnects was investigated. The optical system simulation software (Code V) is used to simulate both the stray-light and diffraction-caused crosstalk. Experimentally measured, spectrally-resolved, near-field images of VCSEL higher order modes were used as extended sources in our simulation model. In addition, we have included the electrical and optical noise in our analysis to give more accurate overall performance of the FSOI system. Our results show that by changing the square lattice geometry to a hexagonal configuration, we obtain an overall signal-to-noise ratio improvement of 3 dB. Furthermore, system density is increased by up to 4 channels/mm². [C11476]

"High-Resolution Radars for Environmental Studies"

Recent advances in the design and realization of high-resolution radars for environmental studies are discussed.

Two types of such instruments are considered: Doppler, millimeter-wave meteorological radars and an airborne SAR system, which have been developed at the Institute of Radio Astronomy of the National Academy of Sciences of Ukraine. The meteorological radars have been designed for long-term, unattainable operation at remote locates. The SAR system benefits essentially from a novel algorithm, which enables the estimation of the antenna beam orientation angles directly from the radar returns. The SAR with this technique introduced can be operated from small aircrafts without using of a complicated navigation system. The set-up of these instruments, the technical solutions, and the signal processing techniques introduced are discussed. The results obtained during measurement campaigns are presented as well. [C11477]

"How Infrasonic Imaging, HF-Surface radar & HF-OTHR and GPS Technology can favorably be implemented for detecting the On-set of Tsunamis and the real-time imaging of its spreading"

Worldwide, medium to short term tsunami prediction is becoming ever more essential for safeguarding man due to an un-abating population increase within low-lying coastal regions of all of the affected oceans. But hitherto there have been no verifiable methods of reliable tsunami prediction developed -except for a few isolated examples of placing arrays of costly short-lived sensors along the ocean bottom requiring monthly re-calibration efforts. This dilemma is a result of not yet having identified the proper approaches to tsunami prediction. The question on whether there do exist reliable prediction methods was answered long ago by fauna living within the coastal littoral zone that is affected by tsunamis. Especially during the last devastating "Boxing Day 050426 Tsunami" caused by the Sumatra-Andaman "Super-Earthquake" of $M = 9.3$ with epicenter near Simeulue Island, there were many verifiable episodes on how fish escaped the affected coastal region in time; the elephants, water-buffalos and other non-domesticated animals rushed for higher ground locations well in time before the tsunami crest and subsequent swells approached, and so on. These observations provide proof that some electromagnetic or, more likely, infrasonic local warning signatures are received by these creatures relatively long before the approaching tsunami strikes. We presume that the signatures could be infrasonic waves traveling at high speeds as under-water surface waves that could be detected by marine fauna as well as coastal animals and birds. Tsunamis have existed for millions of years and fauna of the affected coastal region has developed instinctive warning mechanisms that we need to explore. Another promising natural sensor may utilize electromagnetic precursor signatures that yet need to be fully discovered. Both, the role electromagnetic phenomena and the role infrasonic signatures will be scrutinized. The results of successful post-event model reconstructions of viable electromagnetic and infrasonic precursor signatures will be presented. [C11478]

"COTS Hardware for Software Radar"

The paper describes the concept and implementation of a semi-specific hardware configuration that allows to implement radar processing algorithms with ease and flexibility, thanks to supporting measures built into the operating system software. [C11479]

"Advanced signal processing improves search radar"

Modern fast signal processing can improve search radar performance significantly. Fast sampling will allow wide bandwidths, higher range resolution, an enhanced digital pulse compression ratio and dynamic range, less clutter and better ECCM. This paper reminds and analyzes what has become possible [1]. [C11480]

"Sensitivity Analysis of Configuration in Bistatic Radars"

There are inherent errors in target location and velocity measurement caused by bistatic geometry in addition to the errors that are caused in monostatic radars. In this paper, the accuracy of measurement with respect to some parameters like baseline variance and DOA estimation is considered and bistatic parameters sensitivity with respect together is formulated. [C11481]

"Influence of Power Spectral Density Distortions of Noise Radar Signal on its Ambiguity Function"

In this paper we discuss various distortions of energy spectrum of an ergodic random signal and their influence on the main parameters of estimation of autocorrelation function with the aim of searching of signal optimum characteristics, which would allow to minimize losses in resolution and detection abilities at a maximum diminution of a minor-lobe level of ambiguity function. Besides, in the present paper we have considered influence of parameters of noise sounding signals processing with prescribed power spectrum shape on the shape of the correlator response and accuracy of correlation function estimation. [C11482]

"The Joint Radar Targets Detecting and Communication System"

The combined radar system architecture for joint radar target detection and communication is considered. In this

system we use complex quasi-continuous waveform of the big time-bandwidth product and duration with the combined modulation. This waveform is used in interrupted continuous wave radar technique. With reference to mariner radar [1] for a radar-location and communication it is offered complex coherent radar waveform with phase and linear frequency modulation. Problems of waveform synthesis, performance characteristic of the combined system are discussed. [C11483]

"Application of STAP For Detection of Target In The Presence of Ground Clutter"

For Airborne radars it is necessary to suppress the levels of the interferers well below the weak desired signal. The problem is complicated due to the motion of the radar platform as the ground clutter received by airborne radar is spread out in range, angle and over Doppler. Space-Time adaptive processing (STAP) is a technique, which helps to detect small signal of interest in such a noisy environment. This paper considers a generic clutter model. The simulations clearly bring out the 2-D nature of ground clutter and give an insight into the noisy environment in which the target is detected. [C11484]

"Fast-time STAP Performance in pre and post Range Processing Adaption as applied to Multichannel SAR"

Hot-clutter cancellation using fast-time space time adaptive processing (STAP) can occur either pre or post range processing (RP) and to date, there has not been a direct comparison on which method offers the best results. This paper provides an analytic comparison which is verified with simulation and aims to provide insight into the location of the adaptive filter which would provide the best hot-clutter suppression. The covariance models are tested with signal models used in a multichannel synthetic aperture radar (SAR). [C11485]

"Concept of the Coherent Autofocus Map-Drift Technique"

The paper presents concept of the coherent autofocus map-drift technique. The main goal of this work is to obtain high accuracy and sensitivity for autofocus technique in strip-mode SAR. Presented technique is based at the well-known noncoherent map-drift algorithm and it also takes advantages of multi-look registration to estimate unknown platform velocity component. At the proposed coherent map-drift technique, opposite to the classical map-drift, the cross-correlation is not carrying out at the image intensity from multi-look processing, but at the complex multi-look image data. [C11486]

"Real-Time Unfocused SAR Processor For Airborne Maritime Patrol Radar"

The modern airborne patrol radar benefits from having a real-time SAR capability. The high-resolution coast-line imaging, and vessel identification in maritime patrol radars can be done effectively in SAR mode. Telecommunication Research Institute in cooperation with Warsaw University of Technology started in 2003 project of an onboard SAR imaging processor for maritime airborne patrol radar. Such a processor has been introduced into a new version of Polish airborne radar and has been successfully tested by Polish Navy and Polish Coast Guard. [C11487]

"Trade-Off between Motion Measurement Accuracy and Autofocus Capabilities in Airborne SAR Motion Compensation"

When processing airborne SAR data, motion compensation is an unavoidable step. Accurate motion compensation requires the knowledge of the exact position of the platform at each pulse. This paper studies the trade-off between two approaches. The first approach is to get the most accurate position estimation as possible to be able to perform the motion compensation with correct input data. The second approach is to accept a less accurate position estimation and to analyze in which way an autofocus algorithm is able to compensate position measurement errors. [C11488]

"Spatial-Temporal Differential Analysis for GMTD with Airborne Radars, Part 2: First Experimental Results"

We consider an application of the spatial-temporal differential analysis (STDA) technique to the ground-moving target detection (GMTD) using airborne radars with multiple receive channels. STDA is a new approach, suitable to processing multiple radar signals which utilizes spatial and temporal scintillations in the instantaneous signal power. To test the practical potential of STDA, we used multi-channel airborne radar measurements (MCARM) database, which was developed to test and improve space-time adaptive processing (STAP). In particular, we processed the MCARM file rd050575, obtained from flight 5, cycle d, and acquisition 575. The goal was to detect the Sabreliner airplane flying towards the radar-carrying airplane BAC 1-11 in the presence of urban, land, and sea clutter. Second-order structure functions for multiple radar signals were used for the processing. This

simplified STDA technique applied in the time domain only provides a good performance by detecting the Sabreliner with a false alarm rate below 10' in the same range bin where it was previously detected using several STAP variants. [C11489]

"Spatial-Temporal Differential Analysis for GMTD with Airborne Radars, Part 1: Theoretical Background"

We introduce a conceptually new approach to processing multiple synchronized radar signals. The method is referred to as the spatial-temporal differential analysis (STDA). STDA operates with spatial and temporal increments of the instantaneous signal power received from multiple channels. To improve the radar detection and tracking capabilities, STDA takes advantage of the signal scintillations, which are regarded as a harmful phenomenon by conventional signal analysis techniques. We present and discuss a simplified technique for ground-moving target detection (GMTD) using airborne radars with multiple receive channels. The technique is based on structure functions in a time domain, which are statistical moments of the increments. We demonstrate that STDA in the time domain "senses" different characteristics of the scatterers than conventional spectra-based techniques do. This new concept enables detection of weak moving targets in heavily cluttered environment. [C11490]

"Different homogeneity detectors for improving Space-Time Adaptive Radar performance in heterogeneous clutter"

Secondary data selection for estimation of the clutter covariance matrix in space-time adaptive processing (STAP) is normally obtained from cells (range rings) in close proximity of the cell under test. The aim of this paper is the analysis of performance improvement of space-time adaptive radars when secondary data selection is obtained by discriminating between quasi-homogeneous areas on the ground which generate clutter with different statistics (i.e. clutter edges including littoral, farmland-wooded hills or rural-urban interfaces). The algorithm presented in this paper, referred to as the different homogeneity detector (DHD), has been tested with simulated data obtained by using a general clutter model and a uniform linear array. [C11491]

"Radar Measurements Utilizing FFT Spectrum Approach"

Radar pulse measurements are a critical part of radar, EW (Electronic Warfare) and ELINT systems. Radar pulse measurements have historically presented many challenges for the design engineer, production test manager and field technician. The transient nature of the radar pulse combined with modern pulse compression schemes often demand elaborate test setups. With the advent of faster technology the ability to use a FFT based measurement approach greatly simplifies these measurements. Today we will review the measurement challenges and the approach used by a FFT based tool. [C11492]

"Modeling and development of software-configurable range radar"

A multi-purpose software-configurable range radar which deploys composite frequency modulation continuous wave (FMCW) and spread spectrum (SS) measurement techniques is proposed and described in this work. The FMCW radar technique is used to find the range of the target whereas the spread spectrum signal is transmitted to measure distance and velocity in the scenario of strong interference. The adaptive algorithm applies to the software configurable radar. An S-band prototype system is demonstrated and described. Our measurements have validated the software-configurable radar system. [C11493]

"Frequency-encoding technique for active MMW imaging"

A novel method of millimetre wave active imaging at video frame rate is proposed that does not require a sensor array, using the transmitter to encode the scene as a function of frequency. Image reconstruction is performed digitally, so a large potential reduction in system complexity may be realised. We show how resolution can be improved by coherent processing, and demonstrate the technique by a simple experiment. Finally the requirements for design of the transmitter aperture are considered. [C11494]

"A four-element reflecto-nulling antenna array"

In this paper, a novel approach is developed for achieving a reflecto-nulling antenna array which can make the null of re-transmitted radiation pattern at the reflection angle of the incident wave without using digital signal processing techniques. The array is designed by properly utilizing 90deg hybrids. For a 90deg hybrid, if the input port and isolated port are connected to the receiving antenna and transmitting antenna, it can be shown as the direct port and coupled port are terminated with two out-of-phase reflection coefficients Γ and $-\Gamma$, the re-transmitted radiation pattern will have a null at the specular direction $-\theta$ when the incident angle is

thetasi. The formulas and measurement results of a four-element reflecto-nulling antenna array are presented with the measurement arrangement. [C11495]

"A micromachined wide-band suspended-line coupler at 24GHz for vehicle radar applications"

Directional couplers have extensive applications in microwave circuits such as beamforming networks. Recently there has been growing scientific and commercial interest in microwave components for anti-crash and pre-crash systems in cars centered at 24 GHz. In this paper a novel suspended transmission-line 3 dB coupler at 24 GHz is presented. This circuit has been micromachined on a glass-quartz substrate and BCB layers have been used to suspend the transmission lines of the coupler. In this paper simulated and experimental results are presented and the fabrication method described. [C11496]

"An experimental GSM based passive radar"

This paper presents a low-cost experimental GSM based passive radar and testing of ground vehicle detection. It describes the system design, signal processing, and field measurement for detecting various ground vehicles. Using this novel passive radar, numerous field experiments for various ground moving targets are extensively explored. Interesting field experiment results were presented to demonstrate the GSM based passive radar ability to detect and track the Doppler frequency of different types of ground moving targets. [C11497]

"Digital signal processing of multi-reflection for short range detection using NRD guide pulse radar front-end at 60 GHz"

A pulse radar front-end using an NRD-guide technology was fabricated for a millimeter wave level sensor, and then range finding was performed by using it. Multi-reflection however occurred between a target and a planar antenna due to a pencil beam radiation of our developing planar antenna, so that a precise distance could not be calculated for short range detection. In this paper, an FPGA-based signal processor was devised in order to eliminate such multi-reflection. Continuous sampling method was employed to reduce experimental errors, which were investigated from the viewpoint of difference of a period between a modulated pulse train and a continuous sampling clock. The error of range finding was successfully measured to be less than 12 cm for the distance range from 2 m to 20 m under the multi-reflection environment. It was improved compared with that of a signal processor without the continuous sampling method. [C11498]

"Nonparametric Algorithm for Radar Detection of Moving Target"

New nonparametric algorithm of radar signal disorder detection has been considered. The algorithm is based on spectral estimation of a few signal samples of some close windows and nonparametric rank test application to compare them. The algorithm can be used for radar signal detection specifically in the tasks of turbulence detection in clouds and precipitation as well as for moving target detection. The efficiency of new algorithm is analyzed. [C11499]

"HF-OTH Skywave Radar: A Method for Peak Power Evaluation"

This paper addresses the problem of peak power evaluation in HF OTH skywave radar. A wide number of factors affect the performance of such systems, specifically ionospheric propagation and absorption losses, as well as external radio noise interferences. A normalized version of the signal to noise ratio (SNRN) has been introduced in order to evaluate the power requirements over a wide range of environmental conditions. Finally, this paper attempts to provide a method for evaluating the peak power values required in OTH radar systems and also some useful project criteria. [C11500]

"Wide-Aperture 2-D HF skywave radar beamforming with unknown phase offset between sub-arrays"

Sensor systems using a distributed aperture with separately calibrated sub-arrays or elements with different angle-dependent complex response require either elaborate calibration or operation with a beamforming algorithm which compensates for the lack of full aperture calibration. An approach using a variant of adaptive subspace detection algorithms which inherently compensate for unknown scalar offsets between sub-arrays is investigated. [C11501]

"Fast and High-Resolution PCL Radar Detection in Noisy Environment"

Multiple target detection in conventional PCL (Passive Coherent Location) radar systems by means of Ambiguity Function Processing and without any powerful algorithm is impossible. Presented Gradual Clean Algorithm

(GCA) is a new and simple method, which could provide the perfect detection in noisy environment and heavy clutter condition up to $\text{SNR} = -15$ dB and $\text{SCR} = -100$ dB (clutter is assumed as a distributed target with large RCS). Determining the number of real targets and keeping the false alarm probability approximately constant are the presented algorithm capabilities. [C11502]

"Noise modulated multistatic surveillance radar concept"

Noise modulated surveillance radars have many desirable properties. However, practical problems with signal processing and system design have inhibited noise modulated radars to become common. Fast improving signal processing will probably change this in future. We have studied what kind of noise modulated radar might be realistic in 15 years. Advantages are good LPI, good ECCM, good ARM avoidance, good selectivity and simple mechanical construction [1]. Disadvantage is high signal processing capacity that may become available first after 10-15 years. [C11503]

"Simple Sea Clutter Canceller for Noise Radar"

In the last decade the noise radar technology is intensively investigated. The low transmitting power and nonspecific waveform makes that the noise radar has very good LPI properties. The simultaneous emission and reception of signals in such kind of radars make them sensitive to near-far problem. Strong echoes, originated from ground clutter can completely mask the weak target return. In case, when the radar is placed on a vessel, except of zero-Doppler ground returns the dominant part of return power consists of Doppler-spread sea clutter echoes. The papers present a simple adaptive sea clutter canceller, which can be used to mitigate near-far problem "on the sea". [C11504]

"Radar signals monitoring"

Due to technical development it is possible to combine ELINT/ESM functions of electronic intelligence equipment. Time effectiveness is one of the most important factors of such equipment. The usage of omnidirectional and wideband reception allows to shorten time detection of signals. This however cause that pulses stream is combination of pulse trains coming from number of emitters. The analysis requires then an operator interaction what results with time recognition lengthen. The paper presents the concept of automatic radar activity monitoring on the base of omnidirectional and wideband acquisition of signals. The effective method of pulses streams matching to radar emission separates number of radar emitters. Results of method performance are presented and discussed. [C11505]

"PCL-Signal-Processing for Sidelobe Reduction in Case of Periodical Illuminator Signals"

Passive coherent location (PCL-) systems deal with illuminators of opportunity, whose signals are usually not adapted to radar applications. Especially in the case of signal inherent periodicities the target echoes are often covered by sidelobes of clutter. In order to reduce high correlation sidelobes and enable highly accurate range measurements, a signal adaptive filter processing is introduced. Its mathematical description explains that aiming at low sidelobes and highly accurate range estimation for arbitrary signals results in a filter method providing a phase correlation. The SNR obtained by this filter method turns out to be dependent on the amplitude variation of the signal frequency spectrum. The effectiveness of the side lobe reduction is demonstrated on experimental data of analogue TV-signals to verify that accurate unambiguous range estimation is possible, even for strongly periodical signals. [C11506]

"Homomorphic Inverse-FEXP filtering for target detection in sea SAR images"

Generalized linear filtering techniques allow signals that have been nonadditively combined to be separated, and the analytical convenience of the principle of superposition for linear systems to be preserved. In this paper we employ Fractionally Exponential spectral models (FEXP) to adaptively modify homomorphic filtering of sea Synthetic Aperture Radar (SAR) images, thereby improving target detection in sea SAR imagery. The presented method demonstrated reliable results when applied to ERS1 and ERS2 SAR PRI of the Mediterranean Sea and North Sea. [C11507]

"The Experimental System PALES-A Multifunctional Antenna System"

The experimental system PALES is built to study the capabilities and problems arising with a 'Shared Aperture' antenna. In contrast to similar systems known from literature the capabilities of the multibeam system are enhanced by array signal processing in beamspace. First experimental results obtained by applying STAP, STCM and ICA processing are shown in the paper. [C11508]

"A Flexible Digital Receiver Architecture For Radar Applications"

This paper presents a modular architecture of a digital receiver for radar applications. The focal point will be the concept of the digital part including the A to D conversion (ADC) process and the effective embedding and integration into the Radar Processor environment. All used components should be "commercial-off-the shelf" (COTS) like ADC-mezzanine boards and processor boards in order to minimize development costs. [C11509]

"Rain Clutter Filtering from Radar Data with Discrete Wavelet Transform"

Moving weather systems will have a nonzero Doppler response at rate at which the rain droplets are approaching the radar system. The complete data the radar collects contain the returns of both the target and the clutter. The signal processing block in a radar system uses filtering operations to extract the target information while suppressing the clutter. Typically the filters are designed based on Doppler Frequency using a Fourier filter bank. Instead of the frequency domain, the wavelet analysis allows the time-scale domain in processing. The filter bank in this study utilizes Discrete Wavelet Transform (DWT), DWT coefficients represent the results of a multi-resolution analysis of the radar signal. We study the operation of a DWT filter bank and a Fourier filter bank (FFT). Our experiments indicate that the Fourier filter bank filter the rain clutter very well. However, a DWT filter bank has different time resolution for different frequency ranges. With very heavy rain clutter affecting to the target signatures, our experiments indicate that the wavelet filter bank performs better than the Fourier filter bank. The experiments were performed in MATLAB environment and data is real radar rain clutter data from Finnish Air Force medium range air surveillance radar (low PRF). The objectives of this study were to develop a DWT based filtering system and to test it's operation in one situation of rain clutter and then to compare it's results to those from the FFT method. [C11510]

"A Classifying Algorithm for Radar Signals Using the Wigner-Ville Distribution and the RBF Probability Density Function Estimator"

A radar signal recognition can be accomplished by exploiting the particular features of modulation presented in a radar signal observed in presence of noise. These modulation features are the result of slight radar component variations and acts as an individual signature of a radar. The paper describes a radar signal classification algorithm based on using the Wigner-Ville Distribution (WVD), noise reduction procedure with using a two-dimensional filter and the RBF neural network probability density function estimator which extracts the features vector used for the final radar signal classification. The numerical simulation results for the P4-coded signals are presented. [C11511]

"The GPOF-based Ground Return Deembedding in Stepped Frequency Ground Penetrating Radar"

The work is devoted to a problem of detecting shallow underground objects like anti-personnel mines using ultra-wideband ground penetrating radar (GPR). In case of step-frequency radar, an inverse discrete Fourier transform (IDFT) is a standard data processing technique to convert the raw radar data into the range profile. The latter can be used for detecting buried targets and estimating their depth. Here, an advanced data processing algorithm based on a general-pencil-of-functions (GPOF) method is proposed to improve the radar performance. [C11512]

"Experience of Creation of Multichannel Scanning Radiometers"

The article considers the principles of construction of radiometric receivers in cm, mm and submillimeter wave bands. The basic characteristics, construction and results of measurement of main parameters of scanning mirror antenna and microwave channels including filters, modulators, multifrequency horn feed antennas that combines submillimeter range with millimeter and centimetric ranges are offered. The results of development of a radiometer with digital processing, results of optimization of sensitivity of this radiometer are given. The results of development of a radiometer with a pilot signal and its experimental performances are circumscribed. The comparative estimation of sensitivity for the different schemes and constructions of radiometers is given. [C11513]

"Discretization Process Impact on Compressed LFM Signal Parameters"

Digital signal processing is a backbone of a modern radar receiver. Signal discretization and its side effects have significant influence on radar performance. It makes crucial the awareness of the effects, as well as its qualitative and quantitative evaluation. The paper presents the problem of random displacement effect of pulse beginning in accordance to the closest discrete time value. This effect has strong impact on characteristics of pulse

compression filter. Characteristics evaluation of the discretization process has been performed on the base of proposed discrete time generation algorithm. The testing results are shown, as well as its discussion and some practical conclusions. [C11514]

"FMCW Radar Transmitter Based on DDS Synthesis"

This paper presents some design problems and aspects of building FMCW radar transmitter based on DDS. Significant parameters of this radar are small targets detection possibility, small resolution cell and high range resolution. It requires resolving a problem of generation microwave signals with excellent linear frequency modulation and very good phase noise performance. One of possible solution is DDS (direct digital synthesis) technology, which is rapidly advancing. [C11515]

"A Fully-Pipelined Parallel Architecture for Kalman Tracking Filter"

The Kalman filter is a set of mathematical equations that provides an efficient computational (recursive) mean to estimate the state of a process, in a way that minimizes the mean of the squared error. This filter is very powerful in several aspects: it provides estimations of past, present, and future states, and it can do so when the precise nature of the modeled system is unknown, and even with the presence of measurement and process noise. Moreover, Kalman filter for linear estimate is the most complex and precise algorithm used for target tracking. However, using Kalman filter algorithms in software for multi-target tracking (MTT) radar system would result in a very long computational time which may not be suitable for today's warfare constraints, or real-time processing. Consequently, a hardware alternative has to be developed which may result in big area overhead which is not suitable for today's area constraints such as sensor nodes in a sensor network. In this paper, we break the arrays into their scalar forms, and develop fully-pipelined hardware architecture for the radar tracking Kalman filter, with time division multiplex blocks to decrease the silicon area.. The proposed architecture contains 6 multipliers, 2 dividers, 9 adders, 5 subtracters, one control unit, and some registers and multiplexers for pipeline and control. Simulation results show that the loss in accuracy between the exact track and the estimated is found to be only 4.9%. [C11516]

"Global operations in SIMD cellular processor arrays employing functional asynchronism"

We present a new approach to execution of global image processing operations on massively parallel cellular processor arrays. Combining conventional synchronous processing with simple asynchronous propagations we achieve performance increase on global operations without additional hardware cost. By the example of watershed transformation we demonstrate the benefits of mixed synchronous/ asynchronous approach. In addition, we investigate asynchronous grey-scale data processing and its applications in image processing. [C11517]

"The Relationship of Signal Processing, Communication Technologies and RF Circuit Design and the Impact on the Future of RF and Microwave Education"

Radio frequency engineering and hence RF and microwave education have traditionally been based on the assignment of narrow bands of the electromagnetic spectrum. As well, signals have usually been described appropriately using discrete tones. Today digitally-modulated signal are most commonly used to transmit RF signals and the bandwidth of communication channels is broadening. The broadening is taken to the limit with proposed Ultra Wideband systems. The next generation of RF and microwave hardware engineers must have an appreciation for the complexities of signals and be grounded in wideband design. [C11518]

"Karhunen-Loeve Transformation in Radar Signal Features Processing"

One of the most difficult tasks in the radar signal processing is an optimal features extraction and classification. The multifunction radar systems can not be classified and precisely recognized by most of new and modern Electronic Support Measure and Electronic Intelligence devices in the real time. It is directly combined with a possibility of measurement radar features. The number of radar features is sometimes measured a bit much and more often a few. This paper provides an overview of the new methods of measurement emitter signal features parameters and their transformation. This paper presents some aspects of radar signal features processing using Karhunen-Loeve 'a expansion as a feature selection and classification transform. [C11519]

"A Multiple Beam Antenna System using Discrete Lens Arrays"

Conventional radar systems are usually based on complex structures employing not only high performance antennas but also baseband or RF processors. The antennas shall scan the space in the search for potential targets. Scanning can be usually made either mechanically or electronically. Mechanical scanning, although trivial

in its conception, is usually expensive and not agile enough for some applications. Electronic scanning, a very elegant approach, usually demands the use of phase shifters or complex beam forming architectures, which can also lead to very expensive systems. As an example, Butler Matrixes, which allows the generation of multiple beams, make use of complex structures with vertical transitions, rather cumbersome when dealing with planar circuits. In addition, phase shifters at high frequencies introduce undesirable losses that degrade the radar noise figure. In this paper, a simple solution using lenses is presented, using a planar construction. A discrete lens array (DLA) operating at 8.2GHz, built entirely with conventional planar circuit techniques is designed and measured. The prototype was able to scan the far field region within -40deg and +40deg, both in azimuth and elevation as for a circular lens. RF-MEMS switches can be employed for confining agility to the system. The optical system proposed here allows a first-order real time determination of the direction of arrival (DOA) for a target, using a DLA as the main element. The DOA accuracy is a function of the array size, as shown in this work. [C11520]

"Ultra-broadband Nonlinear Microwave Monolithic Integrated Circuits in SiGe, GaAs and InP"

Analog MMIC circuits with ultra-wideband operation are discussed in view of their frequency limitation and different circuit topologies. Results for designed and fabricated frequency converters in SiGe, GaAs, and InP technologies are presented in the paper. RF type circuit topologies exhibit a flat conversion gain with a 3 dB bandwidth of 10 GHz for SiGe and in excess of 20 GHz for GaAs processes. The concurrent LO-IF isolation is better than -25 dB, without including the improvement due to the combiner circuit. The converter circuits exhibit similar instantaneous bandwidth at IF and RF ports of >7.5 GHz and >10 GHz for SiGe BiCMOS and GaAs MMIC, respectively. Analysis of the frequency behaviour of frequency converting devices is presented for improved mixer design. Millimeter-wave front-end components for advanced microwave imaging and communications purposes have also been demonstrated. Analysis techniques and novel feedback schemes show improvement to the traditional circuit design. Subharmonic mixer measurements at 50 GHz RF signal agree very well with simulations, which manifests the broadband operating properties of these circuits. [C11521]

"Photonic Microwave Filters"

Novel photonic microwave filters based on time delay introduced by a dispersive media are presented. This is followed by description and analysis of issues concerning microwave filters theory, architecture, tuning, reconfiguration and processes of obtaining negative taps. [C11522]

"Multiphase Signals Based on the Recurrent Sequences of Maximum Length"

This paper is concerned with the particularities of the new class of complex (multiphase) signals created based on the maximum length sequences (m-sequences) and investigation of their properties by means of the spectral and correlation analyses. Ambiguity function apparatus will also be used for these signals investigation. [C11523]

"Research into Multiple Element Antennas to Enhance Performance of Wireless Communication Systems"

The paper concentrates on two specific areas of applications of multiple element antennas (MEAs) to enhance performance of wireless communication systems. The first area concerns multiple input multiple output (MIMO) systems, in which MEA are used both at the transmitter (TX) and receiver (RX) to increase the communication transmission rate or enhance the received signal quality via diversity. The other area encompasses wideband smart antennas (MISO/SIMO systems) where MEAs are used only either at the transmitter or receiver sites. With respect to MIMO, suitable signal propagation models are developed, which in an approximate or exact manner take into account interactions between antenna elements and scattering objects. In parallel to the theoretical models, two types of experimental facilities for MIMO testing, a simple transmit/receive diversity testbed and a full MIMO testbed, are described. The last part of the paper describes smart antennas, which use the concept of full spatial signal processing to obtain beam forming over a wide frequency band. [C11524]

"Comparison of A Planar and Finite Difference Time Domain Technique to Simulate the Propagation of Electromagnetic Waves in Biological Tissue"

Due to the recent advances in ultra wide-band (UWB) radar technologies, there has been widespread interest in the possible medical applications of UWB microwave radar. Therefore, the development of accurate numerical techniques to predict the propagation of UWB signals in biological tissue is of great interest to researchers as an aid in developing signal processing algorithms. Two techniques for modeling the propagation of electromagnetic (EM) waves in human tissue are presented and compared in this paper: the planar and finite difference time domain (FDTD) technique. A four layer biological model is considered, three layers of normal tissue, and one

layer of cancerous soft tissue (sarcoma). The two modeling techniques are used to predict the response of the model to the UWB input signal, with particular focus on the response of the sarcoma layer. Both the Planar technique and the FDTD technique identify the presence of the soft tissue sarcoma quite easily. However the FDTD technique predicts more subtle phenomena such as multiple reflections, albeit at a high computational cost. [C11525]

"Vertical Handover Support for Multimode Mobile Terminal using Multi-Homed MIPv4"

Basic mobile IPv4 (MIPv4) operation constraints applications bound to the same home address (HoA) to use the same physical interface because traffic is only tunneled towards a single care-of-address (CoA) by the home agent (HA). This prevents different applications from using different physical interfaces. Solutions to address this problem have been proposed that require configuration of filters in the HA to tunnel traffic towards different CoAs but these require modifications to the network, and additional signaling between the mobile terminal (MT) and the network. This paper describes a solution to support multimode operation using MIPv4 with no changes to the network, as well as the multimode MT architecture supporting such MIPv4 operation. [C11526]

"Short-Pulse Imaging System"

The paper concerns imaging system which can be utilized in various applications generally and medicine particularly. It allows obtaining the cross section of the object under test located on a revolving platform and excited with ultra short pulses. The cross section is calculated on a base of measurement data matrix constituted by the received signals, reflected from the object under test for subsequent angle locations. Phase shift between the signals within the matrix is here the fundamental information. [C11527]

"Probing Efficiency Algorithms Nonlinear Single-Channel Processing Gaus Signals on a Background Gaus Interferences"

In this paper efficiency algorithms nonlinear processing Gaus signals on a background Gaus interferences is esteemed. [C11528]

"Modern Digital Matched Filters and Correlators for Active Radar"

This article is consideration algorithm of construction the matched filter and correlator, for the fissile radar-tracking system operating a broadband noise signal with direct orientation on modern element base. In the article the example construction of a channel of processing on the basis of microcircuits in a programmed logic (PLD) is shown. [C11529]

"Determination of the Soil Parameters from Multichannel Remote Sensing Data"

Possibilities of soil parameter determination by dual-frequency multipolarization radar for terrain remote sensing are analyzed. It is shown that the sensitivity for soil moisture and roughness is rather weak at X- and Ka-bands. There is correlation between polarization ratios and soil erosion. [C11530]

"Modern Digital Matched Filters and Correlators for Active Radar"

First Page of the Article [C11531]

"Research of Amplitude-Time Characteristic of Television Signal Reflected From a Meteoric Trail in Spased Radar System"

In this paper the technique of processing the television signal reflected from a meteoric trail for research of parameters of amplitude-time characteristics of signals in the spaced radar system is considered. [C11532]

"Signal Characteristics of the Retransmission Meter During Monitoring a Fluctuating Reflector"

Statistical characteristics of the signal amplitude in a repeater meter are considered when sensing various fluctuating reflectors. A comparative analysis of the distribution laws for signal amplitudes at the outputs of radar and retransmission sensors is carried out. [C11533]

"Online Target Tracking and Sensor Registration using Sequential Monte Carlo Methods"

In tracking applications, the target state (e.g., position, velocity) can be estimated by processing the measurements collected from all deployed sensors at a central node. The estimation performance significantly

relies on the accuracy of the sensor positions/rotations when data fusion is conducted. Since in practice precise knowledge of this sensor information is seldom available, in this paper we propose a Sequential Monte Carlo (SMC) approach to jointly estimate the target state and resolve the sensor position uncertainty. [C11534]

"Time-Frequency Analysis using Particle Filtering: Closed-Form Optimal Importance Function and Sampling Procedure for a Single Time-Varying Harmonic"

We consider the problem of tracking the frequency and complex amplitude of a time-varying (TV) harmonic signal using particle filtering (PF) tools. Similar to previous PF approaches to TV spectral analysis, we assume that the frequency and complex amplitude evolve according to a Gaussian AR(1) model; but we concentrate on the important special case of a single TV harmonic. For this case, we show that the optimal importance function (that minimizes the variance of the particle weights) can be computed in closed form. We also develop a suitable procedure to sample from the optimal importance function. The end result is a custom PF solution that is more efficient than generic ones, and can be used in a broad range of important applications that postulate a single TV harmonic component, e.g., TV Doppler estimation in communications and radar. [C11535]

"Performance of high-bandwidth TRABOL protocol for radar data streaming"

TCP-friendly Rate Adaptation Based on Loss (TRABOL) is a high bandwidth overlay transport protocol that dynamically adapts the data transmission rate based on the packet loss feedback received from an end user. TRABOL performs AIMD based congestion control such that transmission rate satisfies minimum and target rate requirements of the end user. Additionally, rate is adapted, while remaining friendly to the TCP cross traffic and efficiently using the bottleneck link bandwidth. This paper investigates the impact of different AIMD increase and decrease functions for congestion control on performance of the TRABOL protocol. A network emulator test bed is used for the performance evaluation, measuring the effectiveness of different AIMD rate control schemes in meeting bandwidth requirements of the end user, TCP-friendliness, bandwidth efficiency, and response time of the protocol. [C11536]

"Optimization of Pulse-Modulated Signal Processing in Passive System"

Passive surveillance system (PSS) is one of basic equipment in process of the electronic intelligence (ELINT). During the past ten years multilateration PSS have been engaged in air traffic control too. Absence of the signal transmitting and receiving of the signal source only is one of their main advantages. Important parameters of PSS are range and quality of the signal analysis (Vosecky and Juranek, 1989). The possibility of PSS range increasing by receiver bandwidth optimization is the topic of paper. Theoretical analysis of energetic conditions and some problems of pulse-modulated signal analysis are presented. Results of modeling and simulations show in the paper too. [C11537]

"Cost-Reference Particle Filtering for Dynamic Systems with Nonlinear and Conditionally Linear States"

Cost-reference particle filtering (CRPF) is a methodology for recursive estimation of unobserved states of dynamic systems using a stream of particles and their associated costs. It is similar to the standard particle filtering (SPF) methodology in that it is comprised of similar steps, that is, (1) propagation of particles, (2) cost (weight) computation, and (3) resampling. The main difference between CRPF and SPF is that the former uses very mild statistical assumptions and the latter is based on strong probabilistic assumptions. In problems where some of the states are linear given the rest of the states, one can employ an SPF scheme with improved filtering performance. In the literature on SPF, this methodology is known as Rao-Blackwellized particle filtering. In this paper, we show how we can exploit a similar idea in the context of CRPF. [C11538]

"Networks of Maritime Radar Systems: Sensor Selection Algorithm for PD = 1 Based on the Modified Riccati Equation"

This paper presents a novel sensor selection algorithm for target tracking, based on the Modified Riccati Equation (MRE). The MRE provides an upper bound of the Cramér-Rao lower bound (CRLB) and is easily calculated. Using the MRE, it is possible to include sensors with a probability of detection $P_d = 1$. State estimation is done with a modified Particle Filter (PF), taking into account missed detections. The performance of the MRE sensor selection scheme is studied for single and multiple steps ahead, and, for the case of $P_d = 1$, compared with other methods. [C11539]

"Radiometric Space Complex for Research of Spectral Lines of Oxygen"

At present the research in the field of altitude temperature profile and pressure of Earth atmosphere is of considerable importance. One of feasible methods of acquiring results is the interpretation of resonance line of oxygen at frequencies of 50...60 GHz. In the present article the results of creating radiometric complex in the range of 50-60 GHz are considered. The complex has four radiometric channels and joint scanning antenna system. The high sensibility has been achieved due to minimum losses in the antenna and VHF tract. A good stability of the complex parameters has been achieved by the benefit of digital processing of signal and periodic calibration of the radiometer by the spatial noise generator and cold space. The experimental characteristics of the unit are given in the article. [C11540]

"Radiolocation and Digital Signal Processing Students' Research Group"

First Page of the Article [C11541]

"On the Ambiguity Function for Accelerating Target in FMCW Radar"

In the paper we are concerned with the FMCW radar detection of an accelerating target, echo of which is buried in an additive white Gaussian noise. For this problem, we derive and analyze three-dimensional generalized ambiguity function for target range, velocity and acceleration. We interpret known properties of this function and obtain new ones. This allows us, for example, to specify resolution and regions of unambiguous velocity and acceleration. [C11542]

"Parametric Optimization of Transition from Square Waveguide to Bifurcated Waveguide"

The problem of finding an optimal shape and geometry of the transition from square waveguide to bifurcated waveguide is considered. [C11543]

"Direction Finding Devices with 8ГрВ—8 Butler Matrix and Eight-Element Antenna Arrays"

The paper concerns the devices for an instantaneous direction finding of radiation sources or targets illuminated by microwave signals. The investigated devices were made up of classic 8times8 Butler matrix and with 8 directional antennas placed on the circle and in the sector. There are presented the results of computer simulations which took into consideration dimensions of real double ridged antennas and non-zero distances between their phase centres. [C11544]

"Eight-Port Planar Butler Matrix using Circular Interferometers Systems"

The main elements of detecting and warning systems used to detect and measure parameters of signals radiated by different sources of energy are specialized receivers. They contain antenna arrays and signal forming circuits. The paper introduces an eight port Butler matrix design of signal forming circuit. The method and results of theoretical analysis as well as results of measurements in the range of 2divide4 GHz are also presented. [C11545]

"Time-Frequency Analysis of Radar Backscattered Signals using Phase Coupled Frequencies Extracted from Time-Varying Bispectrum Estimates"

A new approach to time-frequency analysis of radar echo responses obtained from moving objects is represented. The suggested approach is based on the extraction of phase-coupled harmonics from time-varying bispectrum estimates of transient sequences separated from the total radar backscattered signal by a sliding window. A coherent, homodyne, and continuous-wave radar has been employed for measuring multi-component, non-stationary, and nonlinear frequency modulated signals backscattered by moving objects. The experimental study underpinned with the theoretical assumptions of the suggested approach has demonstrated clean recovery of time-varying phase-coupled frequencies for test targets like a swinging metallic sphere or a walking human. The obtained time-frequency distributions of phase-coupled harmonics can be recommended as a new information feature in automatic radar target recognition systems. [C11546]

"Comparison of several algorithms for suppression of foliage clutter"

Detection and recognition of targets, obscured by foliage clutter is an active research area. We address here the important question of foliage clutter modeling. The observed clutter is an highly impulsive random process and can be modeled more accurately with symmetric alpha stable (SalphaS) random process. In fact this is the first objective of this paper. The second one is the comparison of several wavelet (wavelet-like) algorithms for foliage clutter suppression. These algorithms are evaluated through artificial doppler signal corrupted by artificial clutter, following SalphaS distribution and real radar clutter using X-band portable continuous wave radar. [C11547]

"Spectral and Noise Purity of Coherent Multiple-Frequency Chirp Exciter for L Band Radars"

This paper presents results of spectral analysis and design performance of the up-converter module of the coherent multiple-frequency chirp exciter for long distance L Band surveillance radars. Some measured results of spectral and noise purity of the exciter with coherent frequency synthesizer driven from high stability oscillator source are included. The experimental results are in good agreement with requested values. [C11548]

"High-Speed DDS-Based Generator of Pulses with an Arbitrary Frequency Modulation"

We present design and performance verification of a high-speed programmable pulse generator based on an integrated direct digital synthesizer (DDS). The generator can produce pulses with an arbitrary frequency modulation, instantaneous frequency up to 140 MHz, and widths ranging from microseconds to milliseconds. The pulses can be formed into arbitrary sequences with the minimum spacing of 150 ns. We experimentally verify performance of the generator for pulses with the linear frequency modulation (LFM), obtaining an excellent performance in terms of the compression ratio and side-lobes level. We also demonstrate the ability of our generator to produce pulses with a nonlinear frequency modulation (NLFM). Experimental analysis of an exemplary NLFM pulse produced by the generator confirms that NLFM allows to reduce the side-lobes level without deteriorating the compression ratio. [C11549]

"Space-Time Adaptive Processing analysis for the moving target on the sea surface indication purpose"

Space-time adaptive processing (STAP) can improve target detectability in a presence of a ground clutter for airborne radar. Ground clutter echo has a wide spectrum as a result of the radar platform (airplane or satellite) motion. To reject clutter echo and preserve target echo, STAP employs antenna array. Simultaneous filtering in both spatial (angle) and frequency domain can improve performance. In this paper we propose a new application of STAP. Assuming an antenna array standing on a sea shore, the objective is to detect targets on the sea surface. Unfortunately sea clutter has different statistical properties compared to airborne clutter. As a consequence, basic STAP algorithm is not optimal in any sense. Future research will face the problem of evaluating performance of STAP applied to sea clutter. We hope to develop a new algorithm that can perform better in the presence of sea clutter. [C11550]

"Label Processing and Node Implementation in Optical Packet Switching Networks"

In this paper we give an overview of a developed packet switching node. First the most important aspects of label multiplexing techniques in all-optical packet switched networks are discussed. Then we present an approach, which was chosen and implemented in this work. We show the main functionalities required in the node in detail, and present the experimental results of data transmission. [C11551]

"High Speed Digital Receivers for Electronic Warfare Applications"

This paper describes the design, fabrication and test results of a dual channel high speed data acquisition and real-time digital signal processing module. The board incorporates two Atmel TS83102, 2 Gsa/sec, 10-bit analog to digital converters and up to three Virtex-II field programmable gate arrays (FPGAs); the board also has two high-speed serial (Hotlink) interfaces and a VME64 interface. Typical applications include electronic warfare, radar, and software defined radios. [C11552]

"Intrapulse Analysis of Complex Signals using IFM Receiver"

The multichannel IFM system capabilities for the internal structure analysis of the complex signals have been presented in the paper. Time analysis was used to obtain instantaneous phase for LFM, PSK and FSK signals. Some phenomena have the place for complex signals receiving using IFM systems. For the LFM and FSK signals instantaneous frequency estimation this phenomena have disadvantageous character, but for PSK signal case this effects are helpful for bit code recognition. To estimate the instantaneous frequency for few type complex signals the time analysis for one channel of microwave frequency discriminator have been done. The results of the analysis have been presented, too. [C11553]

"Polarisation of Electromagnetic Waves Analysis for Application in Mobile Communication Systems"

The polarisation property of electromagnetic waves for applications in mobile communication systems has not been examined into detail yet. Due to multi-path effects and changes in the underlying coordinate systems of the involved antennas, the polarisation state of an electromagnetic wave at the receiving antenna of a mobile station

is very likely to change. The presented project involves a data measurement and detailed visual investigation of these polarisation properties in the field of GSM mobile communication at the frequency band 1800 MHz. The measuring system mounted on a special car moves along a predefined trajectory around a GSM telecommunication cell. The collected data, which are received from a dual polarisation antenna, together with the information of the location, orientation and velocity of the system, which is provided by other sensors, is subsequently processed by the standard signal analysis hardware and the digital signal processing software, so that the polarisation behaviour of the received wave can be identified and visualized. The visualisation system is based on a digitized map into which the data received from GPS is inserted specifying the actual position of the measuring system. A particular polarisation state is simultaneously assigned to the position data in the digital map. The data analysis and signal filtering is performed to estimate multi-path propagation effects and to reduce the influence of them on the quality of the link. The results of this project could be for instance used in future generations of wireless mobile communication systems, where the polarisation dependent effects may contribute to increase reliability and capacity of the transmission service. This research was performed within the AMPER project, which is supported by the EU Commission. [C11554]

"Monopulse IFF interrogator antenna with optimised parameters, minimising the possibility of generating false replies by transponder"

This paper describes the results of field research and measures conducted by CNPEP RADWAR S.A. of solutions used in monopulse antenna for portable interrogator "friend or foe" IFF set with optimised parameters, minimising or practically eliminating false replies from friendly objects remaining on the back radiation hemisphere. This solution has a crucial importance on the battlefield for the survivability and the ability to minimise losses caused by fratricidal fire. The author has conducted field tests of the real equipment configuration taking into consideration the probability of identification as the main evaluation criteria instead of traditional antenna coverage diagram. The results fully confirmed the operational requirements for the designed antenna. The basic idea of design can be applied to any other antenna system, especially for secondary radiolocation devices. [C11555]

"A Real-time Multiresolution Time-domain EMI Measurement System based on Ultra-fast High Resolution Analog-to-Digital Converters"

In the past and now measurements of electromagnetic interference (EMI) are carried out by EMI-receivers operating in frequency-domain. By a time-domain EMI measurement system the measurement time can be reduced by several orders of magnitude. In this paper a novel real-time time-domain EMI measurement system that uses a hardware implementation of the Fast Fourier transform and the detector modes is described. A multiresolution Time-domain EMI system has been developed that processes the EMI Signal by several parallel analog-to-digital converters with an improved dynamic range. The signals are digitized by three 10 bit ADCs which operate at 2.3 GS/s. The obtained EMI signal with a high resolution is further processed in real-time by a decimation filter and a short time fast Fourier transform on the field programmable gate array. By this way the measurement time can be reduced by a factor of 2000 in comparison to EMI receivers and spectrum analyzers. Due to the real-time implementation auxiliary outputs that are provided by EMI receivers as well as spectrum analyzers can also be provided by a time-domain EMI measurement system. The two tone intermodulation distortion as well as the measurement accuracy of the Time-domain EMI Measurement System have been experimentally investigated in the frequency range 30 MHz-1 GHz. The maximum deviation in comparison to an EMI receiver has been 1.5 dB. [C11556]

"Photovaractor with Enhanced Quality Factor"

In this paper methods are discussed to increase quality factor and capacitance ratio of a dual-depletion region InGaAs/InP p-i-n photodiode operating as a varactor to implement optical control of microwave circuit. [C11557]

"A High Speed and Power Controlled CMOS Edge Detector for 2.5 Gb/s Clock Recovery Circuit"

The ever-growing demand to high-speed transmission of data has forced the designers to make faster and much more reliable circuits and systems for users. Among many of methodologies for data formats to be transmitted, the binary data is of great interest. There are various pulse code modulations (PCM) for transmission of binary data among which, non return to zero (NRZ) and return to zero (RZ) are well-known. RZ is more reliable and easier to use in comparison with NRZ but it is slower. Since there is no zero between any two bits in NRZ, its bit rate is two times more than that of RZ in the same conditions. But this reality makes the designers to consider an edge detector for NRZ data. This paper introduces a novel edge detector designed for 2.5 Gb/s clock recovery circuit. This baud rate represents the free-running frequency of phase locked loop (PLL). The advantage of this edge detector is its flexibility to encounter with frequency changes. Moreover, it doesn't

dissipate constant power meaning that its dissipated power is proportional to the frequency of the received data. Therefore the jitter and extra power dissipation produced by conventional edge detectors are removed. Finally, the simulation of this edge detector for a 0.18 μm technology and its comparative results are given. [C11558]

"Analysis of Amplitude Limiter Application for Suppressing Spurious Signals"

The paper is dedicated to the analysis of influence of amplitude limiting on main signal which contains spurious signals. A mathematical analysis of the limiting process was done. The analysis was divided into two approaches. First is based on operations on the signal waveform in the time domain. The second relies on the approximation of an ideal limiter characteristic by the 15-th degree polynomial and excitation by superposed sine signals. The obtained results show a possibility of improving the main signal to spurious signal power ratio up to 6 dB. [C11559]

"Methods to Increase Polarization Contrast of Radar Objects"

The scope of this work is to analyze methods for increasing radar-contrast between different scattering object surfaces. Methods for radar contrast enhancement by polarization analysis of the scattered signal, i. e., radar contrast control, orthogonalization and polarization compensation methods are analyzed in this paper for deterministic and stochastic cases, and compared with conventional RCS radar analysis. The results of the analysis show that radar contrast obtained by using polarimetric methods is enhanced compared to conventional RCS analysis, and indicate that to enhance contrast it is necessary to control the receive -transmit antenna polarization according to changes in the polarization state of the transmitted and the received waves. [C11560]

"On the Performance of Adaptive Antenna Array in Mobile Fading Environment"

This paper presents the performance of steered beam adaptive array antennas in mobile fading environment. Here, deterministic and simulation models of the mobile fading channels are investigated and used to explain the behavior of steered beam adaptive arrays in terms of output signal-to-interference-plus-noise ratio (SINR) and pointing accuracy. [C11561]

"S-Band communication transceiver for satellites"

This article presents the results of my work on the designing and developing of the digital communication transceiver module intended to be used onboard low cost imaging student satellites. The main target for this device is the European Students Earth Orbiter (ESEO) minisatellite, and later, its extended version in the European Student Moon Orbiter (ESMO). [C11562]

"Time-Frequency Characteristics of Ultra-Wideband Signals for Radio Systems"

The time and frequency analysis of ultra-wideband (UWB) signals for radiocommunication systems is presented in the paper. The results of computation are shown. A process of synthesis of the ultra-wideband signals from the spectrum for different parameters is analyzed. The influence of limitations of signals' spectrums over the shape of rebuilt pulses is discussed. Distortions of popular Gaussian and Rayleigh pulses in UWB band 3.1-10.6 GHz are shown. [C11563]

"The Method of Regression Analysis Approach to the Specific Emitter Identification"

Automatic emitter recognition is one of the most difficult tasks in the radar signal analysis. In most cases, the modern ESM/ELINT systems cannot recognize the different devices of the same type or class. New method of the radar identification with a very high precision recognizing is the Specific Emitter Identification (SEI). The main task is to find non-intentional modulations in the receiving signals. This paper provides an overview of the new methods of identification emitter sources based on regression analysis. This paper presents some aspects of mathematical analysis, radar signal features extraction, selection and classification. [C11564]

"Mixed Method Based on Intrapulse Data and Radiated Emission to Emitter Sources Recognition"

One of the principal functions of the ESM/ELINT system is gathering basic information from entire electromagnetic spectrum and its analysis. In most cases, based only on primary features of incoming radar signals, the modern electronic intelligence system cannot recognize the different devices of the same type or class. New mixed method of the radar identification based on radiated emission and intrapulse analysis is presented in this paper. Signal scenario, features extraction, selection, classification procedure and finally experimental results are shown in this paper. [C11565]

"An Array Antenna with Wideband Beam Steering Capability Employing Spatial Signal Processing"

An array antenna with capability of beam steering in azimuth over a wide frequency band using only spatial signal processing is presented. Filters and tapped-delay networks employed in conventional wideband linear arrays are avoided by using a two-dimensional rectangular array structure. In this array, only constant real-valued weighting coefficients, realized using amplifiers or attenuators, are used to form a desired radiation pattern. In order to estimate direction of arrival of a wideband signal, the MUSIC algorithm in conjunction with an interpolated array technique is applied. In the interpolated array technique, a composite covariance matrix is generated, which is a simple addition of covariance matrices of narrowband virtual arrays, being stretched or compressed versions of a nominal array. A working prototype of this wideband array is presented. Its operation is assessed via full EM simulations and measurements. [C11566]

"Algorithms of Signals Censoring in Adaptive Whitening Filters"

The problem of signals censoring in the training sample, on which the estimation of correlative parameters is produced in the adaptive whitening filter, has been considered. Efficiency of proposed censoring algorithms is defined on the model of detector, presenting itself adaptive lattice whitening filter and incoherent square amplitudes of signals accumulator. [C11567]

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"Aerosol Layer Discrimination using Laser Radar and Genetic Algorithms"

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"Auto-Regressive Aperture Extrapolation for Multibaseline SAR Tomography"

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"Ionospheric Electron Concentration Effects on SAR and INSAR"

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"A Multivariate Approach to Iceberg and Ship Classification in HH/HV ASAR Data"

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"An advanced architecture design for a high performance oblique backscattering ionosonde-WIOBSS"

WIOBSS is a new kind of the full phase-parameter, digital Ionospheric Oblique Backscattering Sounding System that has been developed by Ionosphere Lab in Wuhan University for Ionospheric monitoring and research. It

bases on the principle of pseudo-random noise (PN) phase modulated pulse compression and employs long coded pulses, a high PRF, and coherent integration to achieve adequate sensitivity while operating at lower power (less than 800 watts). By means of WIOBSS system, we can get a lot of useful information, such as the dynamic change character of the Ionosphere, Doppler frequency shift and spread about the channel. According to the character of WIOBSS, this paper provides a discussion on its architecture design in detail. The experimental results demonstrate that this architecture is computer controlled by software, designed as VXI bus-based modelled radar digital signal processing system, and its flexibility, versatility, upgrading can fully satisfy the demands of WIOBSS. [C11622]

"Research on self-calibration of HF ground wave radar antenna arrays"

Since the sea echo is one dimensional signal, this paper, based on an arbitrary triangular array, presents that Space-Time DOA Matrix Method, which is originally used to estimate two dimensional angles of arrival under ideal conditions, can be reshaped to be used under amplitude and phase errors. When we apply the reshaped algorithm to one dimensional signals, some groups of equations can be obtained by taking the use of redundant information and then estimate the array's amplitude and phase errors simultaneously so as to achieve self-calibration. Its validity is verified not only by Computer simulation, but also by comparing treatment results of measured data before and after calibration with the GPS-measured result. [C11623]

"Design of test software for Over-The-Horizon Radar system"

Due to the relatively coarse resolution in range and azimuth, low detection probability, various clutters or interferences, and time-varying ionospheric propagation channel, the measurements of targets collected from Over-The-Horizon Radar(OTHR) has much uncertainty. Furthermore, ambiguity on target returns derived from the ionospheric multimode propagation effect makes data association and tracking more difficult. In this paper, according to the real requirements of data processing subsystem, a test software package has been discussed and developed for the design on data processing software. It provides an assistant platform for testing, debugging, and verifying some key techniques, such as data pre-processing, adaptive association and tracking, propagation mode identification, and multi-path cancellation. [C11624]

"Frequency-resolved coherent LIDAR using a femtosecond fiber laser"

We present a frequency comb-based, frequency-resolved coherent LIDAR (FReCL) that provides higher performance than that of conventional pulsed range/Doppler LIDARs, dramatically reduces local oscillator timing requirements, and compensates for path dispersion. [C11625]

"A Mapping Methodology for Space-Time Adaptive Processing in Heterogeneous Processors Environment"

Space-time adaptive processing (STAP) is the key technology of new generation airborne digital signal processing systems. A major challenge in implementing STAP is to meet the real-time requirement while using fewer processors. To meet these requirements, a unified framework for STAP task mapping is developed. In this framework, a STAP task model is firstly brought forward, which exploits the fact that tasks in each stage are independent. Different types of processors are considered and a four-step task mapping methodology is developed. Experimental results show that our methodology can save processors while meeting real-time requirement [C11626]

"Investigation on fading of High Frequency radio signals propagating in the ionosphere-Results from a Jindalee radar experiment"

High-Frequency (HF) radio-wave propagation in the ionosphere is still widely used. The ability to measure and understand the behaviour of the channel, and the knowledge of how the channel will affect the propagating signals, is imperative to ensure the reliability, and maintain adequate performance, of modern wide-bandwidth HF systems. An experiment to study the fading of HF signals propagating in the ionosphere has been conducted. Using the Jindalee Over-The-Horizon (OTH) radar, the behaviour of the ionospheric channel and wide bandwidth signal fading were observed. In this paper results from the experiment will be presented, and the potential uses for the set of experimental data will be discussed. [C11627]

"Design of reconfigurable receiver for HF surface wave radar"

The paper describes the design of receiving system for short-range high frequency surface wave radar, which employs monopole/cross-loop antenna (one monopole and two cross-loops). The frequency synthesis of system is provides by two DDS chips, whose working clock comes from the same clock source. The signals offered by

DDS is one for RF and the other for LO. By applying mixer- free demodulation and digital down conversion based on software, a reconfigurable radar receiver can be designed. The tasks of digital signal processing is finished by single ADSP21060. This paper presents the principle and design method of IF digital radar receivers based on single digital signal processor. Field experiments proved the radar system can work successfully.

[C11628]

"Wideband modelling and measurement of trans-ionospheric radar waveform propagation"

A propagation model has been developed to simulate the corruption of wideband radio waveforms (such as radar chirps) as they pass through a non-homogeneous ionosphere. The ionosphere is modelled by a series of phase changing screens and a split-step Parabolic Equation method is used to describe the propagation of the complex electromagnetic field in planes normal to the propagation vector. Wideband characteristics of the channel are calculated by propagating spectral components of the waveform spectrum through the phase screens and then reconstituting the signal at the ground via a Fourier transformation into the time (delay) domain. By estimating the ionospheric drift velocity, the channel scattering function (signal power vs Doppler frequency and time delay) is calculated for a given satellite orbit and pulse repetition frequency (PRF). [C11629]

"Performance of a tetrahedral antenna array in the HF band"

Analysis of and measurements on an 8-element uniform linear array for HF surface-wave radar are described. The array covers 8 to 16 MHz with beam-steering over a 90° arc. A total of 16 tetrahedral antenna elements are used, arranged in eight doublet pairs. Theoretical analysis of the array is described, and measured radiation patterns taken on board a small boat in the North Sea are presented. [C11630]

"Evaluation of the Efficiency of Object-Based Classification in the Identification of Geological Structures Case Study: Extraction of the Morphology of the Normal Faults"

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"HF radar receiver designed for surface current radar system"

The paper presents the design methods of the HF radar receiver for the short-range Ocean State Measuring and Analyzing. The radar system adopts Frequency Modulated Interrupted Continuous Waveform (FMICW) and operates at 12–14 MHz. The receiver has only once mixing and band-pass sampling structure. After sampling the data, a new DDC (Digital Down Converter) algorithm is used during the demodulation. It is a modified DDC algorithm, in which no filter is used. The receiver uses cross-loops/monopole as receiving antenna, and the radar signals are generated by DDS chips. The structure of the system is quite simple and the antenna is portable. It proved that all modules of the system worked well during the field test of the radar system. [C11632]

"Beacon-assisted quick determination of skywave propagation modes"

Determining the propagation modes of high-frequency radar ray within the ionosphere and extracting their corresponding information quickly are quite important for over-the-horizon radar system. In general, the diagnosis to the ionosphere is implemented with special equipments. The equipments, often called ionosondes, have a capability of sounding over the full HF band and the whole illumination area at the price of complexity and time-consuming. When the ionosphere is disturbed drastically, error to estimate ionospheric parameters by ionosondes would be somewhat larger as a result of long processing time. In this paper, a technique for skywave propagation mode determination and parameter estimation has been proposed. Signal transmitted by radar and received by beacons has been used for estimation in the proposed method. The analysis for the dataset collected from an experiment in a short link (700 km) show that the presented algorithm can offer some ionospheric information quickly, which would be helpful to improve accuracy of tracking and coordinate registration. [C11633]

"Wuhan Ionospheric oblique backscattering sounding system (WIOBSS): System description and initial results"

The Wuhan Ionospheric oblique backscattering sounding system (WIOBSS) used for ionospheric research was established in Wuhan Hubei, China (30.35°N, 114.33°E). WIOBSS is a monostatic pulse Doppler radar using interpulse phase codes and pulse compression for good sensitivity. The operating frequency of WIOBSS is optional in MF and HF band. The peak power of pulse is no more than 500 W. There are two basic sounding modes, fixed frequency and sweep frequency modes. The ionospheric bitemporal response and scattering function can be measured in real time and the Doppler ionogram drawn by scattering function includes the information of group delay, multipath, Doppler frequency shift and spread with high resolution. Furthermore, a

theory for measuring the phase data of backscattering echo based on pulse compression system is put forward and applied to WIOBSS. [C11634]

"Single-mode photonic crystal waveguides for RF delay generation"

The group delay in low-loss, single-mode, 1-mm-long photonic crystal slab waveguides is measured using the phase-shift technique. Slow modes appear a promising approach for compact and massively integrated optical delay lines for signal processing. [C11635]

"Inhabitants Tracking in a Cluttered Home Environment via Floor Load Sensors"

Several studies have focused on tracking inhabitants in a smart environment. However, these approaches have often required inhabitants to wear devices, or they have needed lengthy pre-calibration before tracking could be engaged. Such approaches are often intrusive, thus making inhabitants uncomfortable when the ultimate purpose is to provide convenient services. Thus, the approaches are somewhat controversial. In this study, we constructed an environment consisting of load sensors, with wooden flooring covering the surfaces as in a normal home environment. The wooden flooring provided a flat surface for inhabitants to walk on but caused clutter in the load sensor. Thus, we applied Probabilistic Data Association and LeZi-Update to analyze the cluttered pressure phenomenon collected by the load sensors and to determine the inhabitants' locations and track their movements. With our non-intrusive approach, there is no need for inhabitants to wear any devices, and there are no complicated pre-settings, unlike other approaches. [C11636]

"Compression-Designs in Artificial and Living Systems"

A novel practical and theoretical foundation for signal processing, named processor coding, is advanced as the computational time compression dual of source coding. Source coding is concerned with signal source memory space compression while processor coding is with signal processing computational time compression. Since source coding and processor coding solutions are characterized by compression designs, their combined use is given the name compression-designs (referred as Conde in short). A compelling and pedagogically appealing descriptive diagram of Conde is also given which highlights its remarkable successful application to knowledge-aided (KA) airborne moving target indicator (AMTI) radar subjected to severely taxing environmental disturbances. [C11637]

"Cascade Coupling and Support Vector Clustering Based Novel Sorting Method of Radar Pulses"

A novel sorting method is presented in this paper. The 3-dimension feature information is composed of direction of arrival, radio frequency and pulse width in this method which sorts radar pulse sequences by employing support vector clustering (SVC) and cascade coupling. The experiment result shows that the method can sort efficiently radar signals in the complex pulses environment and the performance is superior to that of K-Means clustering sorting. [C11638]

"Integrated Management Architecture for FMC Based on IMS/NGN"

Integrated management architecture for FMC based on IMS/NGN is overviewed with WiBro which is a new and promising access technology that supports end-to-end QoS with SBLP. KT's integrated control platform for FMC services is described as well. [C11639]

"Analysis and Design of GPS based Target tracking system and MIL-STD-1553B Radar Target data"

The proposed system entitled "Analysis and Design of GPS based Target tracking system and Radar Target data" will help the pilot, test engineers and radar evaluation team in real time and during offline by means of analyzing the path of the target aircraft and HACK aircraft in desired map and will provide navigation specific parameters such as latitude, longitude, altitude, speed, range etc. The system will save the target information during flight. The system will work in both online and offline mode. In this system the data is received from two independent systems (i) GTTS: Target information is received from the data modem and (ii) RADAR: Target information tracked by the RADAR available on MIL-STD-1553Bus. Using GTTS and RADAR data, the flight position of the targets is calculated and the path of the flight is shown on the map. This system also provides different zoom in and zoom out features for different map selection. [C11640]

"Utilization of chirp-z transform to improve the performance of target number detection of low resolution radar"

Although it is difficult to resolve formation flight targets for low resolution radar, several signal processing methods are proposed to solve the problem. All these methods need to first obtain the I/Q data of the range gate containing the formation targets. In this paper, chirp-z transform (CZT) is proposed to be used in obtaining peak I/Q data of range gate, which can reduce the amplitude and phase errors and assure the effectiveness of further signal processing. Simulation results show that by applying CZT to obtain target echo data and then perform Doppler analysis or one-dimensional (1D) cross-range imaging, the target number can be effectively determined [C11641]

"Hardware/Software Exploration for an Anti-collision Radar System"

Anti-collision radars help prevent car accidents by detecting obstacles in front of vehicles equipped with such systems. This task traditionally relies on a correlator, which searches for similarities between an emitted and a received wave. Other modules can then use the information produced by the correlator to compute the distance and the relative speed between the moving vehicle and the obstacle. We implemented such a system using FPGAs. We used hardware blocks to implement the high demanding computing correlator and a soft-core processor to compute the distances and speeds. In order to improve the maximum detection distance reached by the correlation algorithm, we developed and tested a modified version of a Higher Order Statistics based algorithm. This work results in a detailed description of this new algorithm, its possible implementations and the corresponding FPGA synthesis results. [C11642]

"Ultra wideband spiral antenna-time delay removal"

This paper deals with the time delay removal of an Archimedean spiral antenna which operates from 400 MHz to 4845 MHz. As it is known, spiral antennas show a dispersive behavior, thus, in time domain, a Γ -B \ddot{u} chirp Γ ,B \ddot{u} pulse will be displayed at the output. For time delay removal two procedures are investigated: the first one uses an error-term flow graph for the frequency signal as for Vector Network Analyzers while the second one supposes to place a reference metallic plate at a certain distance in order to identify the phase dispersion given by the antenna. In the second case the received signal is passed in time domain by applying an ifft, the multiple reflection are removed and the phase variation due to the time propagation is subtracted. After phase correction the time domain response as well as the side lobes level are decreased. The antenna system made up of two Archimedean spirals is employed by a stepped frequency continuous wave radar (SFCW) which works with a frequency step of 35 MHz. [C11643]

"Ionospheric clutter cancellation and wavelet analysis"

A new approach based on wavelet analysis to mitigate ionospheric clutter from the high frequency surface wave radar Doppler/range image is presented in this paper. [C11644]

"PAMIR with reconfigurable antenna frontend"

Two reconfigurable antenna frontend configurations of the PAMIR SAR/GMTI imaging radar, an experimental active phased array system with a very high simultaneous bandwidth of 1.82 GHz in X-band are described: an interferometric and a linear aperture configuration. Broadband beamforming together with azimuth wide scan capability (Γ ,B \ddot{u} i Γ ,B \pm 45 Γ ,B $^\circ$ @1.82 GHz bandwidth of the antenna aperture) requires a switchable true time delay network with time increments equivalent to a fraction of a wavelength. PAMIR serves as an ideal airborne platform for future broadband SAR/GMTI research activities including interferometric image formation. [C11645]

"Characterization of In-Phase/Quad-Phase Digital Downconversion Via Special Sampling Scheme"

This study explores the characterization of a Special Sampling Scheme (SSS) for In-Phase and Quad-Phase (I/Q) downconversion using mathematical analysis. The SSS is an under-developed signal sampling methodology that can be used with military and industry radar receiver systems. The SSS processes a digital input signal-stream sampled at a specified sampling frequency, and downconverts it into In-Phase (I) and Quad-Phase (Q) output signal-streams. Using the theory and application of the SSS, the main objective to be accomplished is the mathematical characterization of the effects of input, output, and filter coefficient parameters on the I/Q imbalances when using the SSS. We use Matlab to examine and to characterize the SSS to generate parameters suitable for an implementation with a digital circuit. [C11646]

"Mobile Robots for Harsh Environments: Lessons Learned from Field Experiments"

Mobile robots for harsh environments provide useful means for automating the collection of research data in the field by reducing human involvement. MARVIN II has been designed and constructed to autonomously collect radar measurements to determine properties of the polar ice sheets. This paper discusses the lessons learned

from a number of field experiments with its predecessor MARVIN, and how these lessons influenced the new design of MARVIN II. [C11647]

"Transient response optimization of ultra wideband antennas (using particle swarm optimization)"

For some ultra wideband applications (i.e. radar, positioning, etc.), it is crucial to know the transient responses of antennas. Optimization process searches for the dipole shape, which accomplishes two required parameters- namely good matching and minimal distortion. The dipoles have derivative characteristics. The distortion is evaluated from the derivative of the excitation impulse with the radiated impulse. The particle swarm optimization method was used in the process of optimization. This method was implemented in MATLABreg, where the antenna structure is generated. The antenna is subsequently simulated in the CST Microwave Studioreg. The optimized ultra wideband dipole is perfectly matched and minimally distorts the applied signal. [C11648]

"Application of Polarization Coherence Tomography to GB-POLInSAR Data"

First Page of the Article [C11649]

"Complete Inversion of Agricultural Vegetation Parameters by Pol-InSAR: Multibaseline and .k-radar Approaches"

First Page of the Article [C11650]

"Estimation of Built-up Area Characteristics from Polarimetric Interferometric Multiple Track L-Band SAR Data"

First Page of the Article [C11651]

"Ground-based Radar Interferometry for Monitoring Unstable Slopes"

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"Toward the use of Earth Observation Wind Data for Marine Search and Rescue Operations"

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"Change Detection using Multi-PASS and Multi- DATE Data at P and L bands"

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"Preliminary Testing of a Water-Vapor Differential Absorption LIDAR (DIAL) Using a Widely Tunable Amplified Diode Laser Source"

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"Network of RF Ground Sensors for Applications in Precision Agriculture"

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"Polarimetric Characteristics of X-Band SAR Sea Clutter"

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"High Resolution SAR Interferometry: Influence of Local Topography in the Context of Glacier Monitoring"

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"Building Height Estimation using Fine Analysis of Altimetric Mixtures in Layover Areas on Polarimetric Interferometric X-band SAR Images"

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"Oil Spill Detection with RADARSAT-1 in the Baltic Sea"

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"Modelling of Scattering from Point Like Targets"

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"Spotlight-Mode SAR Image Formation Utilizing the Chirp Z-Transform in Two Dimensions"

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"Scene Analysis of SAR Images using Joint Time-Frequency Analysis"

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"Variational Unsupervised Classification of Polarimetric Images"

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"Multifrequency Full Polarimetric SAR Classification with Multiple Sources of Statistical Evidence"

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"SAR Raw Data Generation Using Inverse SAR Image Formation Algorithms"

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"A Comparison of Hurricane Eye Determination using Standard and Ultra-High Resolution QuikSCAT Winds"

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"Use of Enhanced-resolution QuikScat/SeaWinds Data for Operational Ice Services and Climate Research: Sea Ice Edge, Type, Concentration and Drift"

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"Diurnal Melt Detection on Arctic Sea Ice Using Tandem QuikSCAT and SeaWinds Data"

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"ISAR and Aerial LIDAR Comparison to Observe and Quantify the Terrain and Environment of the Historical Native North Carolina Settlements"

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"Ultra High Resolution Rain Retrieval from QuikSCAT Data"

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"The Surface Effect of Rain on Microwave Backscatter from the Ocean"

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"The Effect of Rain on ERS Scatterometer Measurements"

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"Error Evaluation of BAQ Algorithm for Internal Calibration Data of Spaceborne SAR"

BAQ is the efficient algorithm for SAR echoes data compression that has the Gauss distribution. Internal calibration is the important system resource, which is to calibrate the system gain change before and after the imaging and also provide more accurate reference function for the range compression. But the echoes are different from calibration data. This paper discussed whether the error brought by BAQ compression algorithm could be accepted by this system. Both the theoretical simulation and the experimental results indicate that the internal calibration data only can be directly transmitted but not compressed, which has the important reference to engineering design. [C11676]

"Small Target Detection in Sea Clutter Based on Doppler Spectrum Features"

Small target detection in sea clutter is a challenge problem in radar signal processing community. Based on the analysis of sea clutter Doppler spectrum characteristics, two target detection algorithms are proposed, namely, a Bayesian detection algorithm based on joint Rayleigh distribution model and a feature detection algorithm based on the entropy feature extracted from signal's Doppler spectrum. The detection performances of the proposed algorithms are evaluated based on the data collected by the McMaster IPIX radar at the east coast of Canada [C11677]

"Multiple-input Multiple-output Radar and Sparse Array Synthetic Impulse and Aperture Radar"

Radar theory and radar system have developed a lot for the last 50 years or so. Recently, a new concept in array radar has been introduced by the multiple-input multiple-output (MIMO) radar, which has the potential to dramatically improve the performance of radars in parameters estimation. While an earlier appeared concept, synthetic impulse and aperture radar (SIAR) is a typical kind of MIMO radar and probes a channel by transmitting multiple signals separated both spectrally and spatially. To the best knowledge of the authors, almost all the analyses available are based on the simple linear array while our SIAR system is based on a circular array. This paper first introduces the recent research and development in and the features of MIMO radars, then discusses our SIAR system as a specific example of MIMO system and finally the unique advantages of SIAR are listed [C11678]

"Space-aero Bistatic Forward-look SAR"

A novel mode of space-aero bistatic SAR, in which the spaceborne transmitter is side-look and the airborne receiver is forward-look, is studied. The characteristics of the traditional forward-look SAR is discussed to compare with the special space-aero bistatic forward-look SAR. Because the range direction of the transmitter is the azimuth direction of the receiver in this mode, the forward-look SAR does not like the traditional forward-look SAR, it can acquire high azimuth resolution by using the range compression. Through the analysis of Doppler characteristic and echo signal model, the equidistance line of this mode is quite similar to that of squint SAR is pointed out, which enables the transplantation of existed well-rounded imaging algorithm of squint SAR to this mode. The imaging algorithm and simulation experiment are presented [C11679]

"Study on Imaging Algorithm of De-chirped FM-CW SAR"

There is a growing interest in the frequency modulated continuous wave (FM-CW) SAR for its small cubage, light weight, cost-effective and high resolution. In this paper, the author deduced the imaging process in detail, discussed the production and the removing of residual video phase (RVP) as well as the slope factor, then the improved imaging algorithm is presented by combination de-sloping, range migration correction with pulse compression. The derivation and the simulation proved the algorithm is feasible and correct [C11680]

"Calibration of mutual coupling using direct wave for multi-carrier bi/multi-static radar"

An algorithm for mutual coupling calibration in multi-carrier bi/multi-static radar is presented. Based both on the mathematical model of the mutual coupling and subspace principle, the algorithm using direct wave signal is proposed for estimating mutual coupling matrix of uniform linear array. The direction of arrival (DOA) estimation with mutual coupling is also discussed. The computer simulation results show the validity of the new calibration algorithm [C11681]

"Automatic Target Recognition Using Multiple Radar High Range Resolution Profiles"

Radar automatic target recognition (ATR) based on multiple high range resolution profiles (HRRPs) is concerned. To relax the target aspect sensitivity and use more statistical information of the HRRPs, in this paper we extract the average range profile and the variance range profile together as the feature vectors for both training data

and test data representation. And a decision rule is established for ATR based on the minimum Kullback-Leibler distance (KLD) criterion. The recognition performance of the proposed method is comparable with that of adaptive Gaussian classifier (AGQ with multiple test HRRPs, but the proposed method is much more computationally efficiently. Experimental results based on the measured data show the minimum KLD classifier is effective [C11682]

"An Improved DPT-based Estimator and its Application to Maneuvering Air Target Detection for OTH Radar"

In this paper, we propose an improved DPT-based estimator, and give its application to maneuvering air target detection in over-the-horizon radar (OTHR). The discrete polynomial-phase transform (DPT) is an efficient analysis tool for the polynomial-phase signal (PPS), and it provides accurate estimation on the parameters of the PPS. However, the DPT-based estimator requires a sufficiently high input signal-to-noise ratio (SNR). To overcome this limitation and extend the scope of its application, a pre-processing method, including frequency-band compressing and time-frequency filtering, is added before the nonlinear operator involved in the original algorithm. The resulting algorithm is proved to have a rather good performance in low SNR cases, and can be applied to enhance the detection performance of the maneuvering air target in OTHR. The simulation results are given to demonstrate the validity of the proposed algorithm [C11683]

"Division of Imaging Intervals and Selection of Optimum Imaging Time for Ship ISAR Imaging Based on Measured Data"

In this paper an inverse synthetic aperture radar (ISAR) imaging algorithm for ship targets based on the division of imaging intervals and the selection of optimum time is proposed. The relative motion of a ship on the ocean wave can be broken into three components, namely pitch, roll and yaw, which makes the Doppler frequency vary with the slow time. So during the whole slow time the echoes are not linear frequency modulation (LFM) signals any more. Under this condition the division of the imaging intervals and the selection of the optimum imaging time during the considered imaging interval are of great importance for ISAR imaging of ship targets. The imaging results of the measured data demonstrate the effectiveness of the proposed approach [C11684]

"Synthetic Bandwidth Method Integrated with Characteristics of SAR"

Stepped-frequency subpulse signals are widely used to obtain ultra-high range resolution. The stepped-frequency subpulse signals can be combined to one single signal with high bandwidth by using synthetic bandwidth methods. In practical SAR imaging motion error and the time delay of echo signal must be considered before applying the available synthetic bandwidth methods. This paper presents a method in which motion compensation and compensation in Doppler domain are integrated with time domain synthetic bandwidth method in order to get high quality SAR image [C11685]

"Research on Echo Simulation of Space-borne Bistatic SAR"

In order to research imaging algorithm problems of space-borne bistatic SAR, it is necessary to simulate echo data of actual scene. On the basis of point target simulation, a method of simulating space-borne bistatic SAR raw echo data utilizing gray image data of airborne SAR is presented in this paper. First of all, gray data of airborne SAR image is added and averaged to compute different targets RCS. Then, raw data of actual scene is generated using the model of scene echo signal of space-borne bistatic SAR. Finally, imaging processing is fulfilled utilizing BP algorithm toward echo data. The imaging result verifies the correctness of this simulation method [C11686]

"Research on Calculation of Radial Acceleration of Maneuvering Target within One Pulse Echo"

For fixed carrier frequency transmitting pulse, the acceleration of maneuvering target will cause change of square phase of echo signal. In this paper, the short time fractional Fourier transformation (STFRFT) is used to analyze one radar pulse signal. And then the relation between peak of transformation domain and pulse width is deduced quantitatively. In succession, the relation between single-noise ratio and the shortest pulse width necessary to get acceleration is discussed. Lastly, simulations have been made to verify the theoretical results [C11687]

"Particle Detection and its Radar Application"

In this paper we introduce a new detection algorithm based on Monte Carlo sampling method. The proposed method is numerical in nature. We use importance sampling to estimate unknown parameters and calculate likelihood ratio and call it particle detector (PD). This detector can be used in wide range of detection problems.

We have also presented an adaptive radar detection algorithm based on our proposed particle detection scheme [C11688]

"A Study of the Correlation between SAR Echoes Scattered by Fluctuant Rough Ground"

This paper deals with the influence of ground fluctuation and roughness on the correlation between distributed satellites SAR echoes. The model for a rough surface is presented based on the facet theory followed by its statistical scattering property. Then a formula to calculate the correlation between echoes scattered by rough surface is proposed. The influence is shown by several simulation results, where the terrain fluctuation is imitated by a 2-dimension correlative random process. The simulation results indicate that the ground fluctuation and roughness deteriorate the correlation if the two satellites are cross-track separated, and have a little influence on the correlation if the two satellites are along-track separated [C11689]

"A Simple Simulation Method of Ground Clutter for Airborne Pulse Doppler Radar"

A simple computer simulation method of ground clutter for airborne pulse Doppler (PD) radar based on the analysis of cohered video is presented. Its simulated process and formula are discussed in detail. According as the simulated results of 2-D clutter for side-mounted radar, this paper discusses the influence of different pulse repetition frequencies (PRF) and different main beam direction on the spectrum of temporal-spatial 2-D clutter. The analysis results for airborne PD radars clutter simulation and clutter suppression has significant meaning in practice [C11690]

"Fusion of Multi-Sensor SAR Images via Adaptive Selection of Wavelet and Contourlet Coefficients"

Using SAR images of different spectral bands relative to the same scene can obtain a better knowledge of the scene than the one obtained using only one image. Fusing these images can provide more comprehensive information. In recent years, the fast growth of multiscale geometric analysis (MGA) has brought out abundant tools for image processing, such as curvelet and contourlet transform. In this paper, a novel fusion method based on adaptive selection of wavelet and contourlet coefficients is proposed for SAR image fusion. The main merit of the proposed method is that the wavelet transform can locate sparse of spot strangeness of SAR image effectively and contourlet transform can give a sparse representation of line strangeness, thus it can combine advantages of these tools, and get more details than other methods. The experimental results of four SAR images demonstrate that this algorithm performs better than classical fusion methods both in visual effect and object evaluation [C11691]

"Study of location based on T-R and T/R-R mode in Bistatic Radar"

In this paper we analyze some methods for the location in bistatic radar and present two novel methods for location in the shipborne passive synthetic impulse and aperture radar (SIAR) that is a ground-wave over-the-horizontal-radar (GW-OTHR). The novel methods are based on the analysis of overwhelming error we encountered in practice. Since the accuracy of location in bistatic radar is sensitive to the position of target, we explore redundant information to interpolate higher accuracy position information when radar works in T/R-R mode. The approaches ameliorate the performance of detection when limited information about target can be acquired. Moreover, analysis and simulation results which show the efficiencies of the two new approaches are presented [C11692]

"Polyphase Orthogonal Code Design for MIMO Radar Systems"

Multiple input multiple output (MIMO) radar can effectively improve radar performance by transmitting specially designed orthogonal signals. A novel hybrid algorithm is presented to numerically optimize such orthogonal code sets. The proposed algorithm integrates a statistical genetic algorithm (GA) with the traditional iterative code selection method. The simulation results show that the proposed algorithm is effective for the design of polyphase signals used in MIMO radar [C11693]

"In Time Passive Localization using Multi Base-Line Phase comparison Receivers"

A new in time passive localization system based on multi base-line phase comparison receivers is proposed. The new system uses short base-line to avoid the long base-line phase illegibility then uses the phase differences without illegibility to get the signal arriving angle and to detect the emitter's range. The GDOP and simulation performance have also been discussed in this paper [C11694]

"Radar Target Recognition Based on Low Frequency Bispectra"

Bispectra is widely used in the target recognition based on high resolution range profile (HRRP), but now using features generated from bispectra often need much storage and computation. In this paper, the low frequency part of bispectra is taken as the feature, then time domain processing and frequency domain processing are used to make the feature is more robust to the dimension change. Similarly the method is used to decrease the dimension of integrated bispectra, good result is obtained too. Experiments based on the measured data testified the efficiency of the proposed method [C11695]

"An Efficient Kernel Optimization Method for High Range Resolution Profile Recognition"

A kernel optimization based on fusion kernel for HRRP is proposed in this paper. Based on the fusion of the 1-norm and 2-norm Gaussian kernels, our method combines the different characteristics of them so that not only is the kernel function optimized but also the speckle fluctuations of HRRP are restrained. Then on the radar measured data the presented method is employed to the kernel optimization of KPCA and the classification performance of the extracted is evaluated via a SVM classifier. Finally, experiment results are compared and analyzed, which prove our method effective [C11696]

"Cochannel Interference Suppression for Ship-Based Passive Synthetic Impulse and Aperture Radar"

Power distribution and correlation characteristic of cochannel interference are analyzed in ship-based passive synthetic impulse and aperture radar (SIAR) scenario. Characteristic of interference at interested range bin is estimated accurately using echoes from some positive and all negative frequency range bins after stretching with cosine weight. Thereafter, Karhunen-Loeve transformation is used to the echo from interested range bin and interference is suppressed provided that its power is stronger than radar echoes. Theoretical analysis and suppression procedure presented are confirmed by real data acquired in year 2005 [C11697]

"Design of UWB Radar Receiver Based on Intersection of Frequency Spectrum"

In this paper, the influence of intersection of frequency spectrum on ultra wide band (UWB) radar receiver is analyzed, corresponding to which a novel method of designing filterbank based on the minimum variance criterion in frequency domain is presented. And a specific filterbank with flat passband, narrow transient band and deep stopband attenuation is designed. When utilized in UWB radar receiver, the spectrum aliasing of the input signal can be reduced without increasing the sampling rate of A/D. Moreover, the input signal can be reconstructed perfectly in real time [C11698]

"Research on the Specific Problems in Multi-Target Tracking of TWS Radar"

In this paper, some specific problems in multi-target tracking of sector scan TWS radar are analyzed. Based on dual azimuthal sectors, we have proposed an approach for previous plot-track correlation, which reduces the times of gate correlation greatly. Besides, a target-emerge-time prediction algorithm that fixed the formula of adaptive alpha-beta filtering & predicting is also established via analyzing the difference between two consecutive sampling intervals to the same target. The simulations are given in the end [C11699]

"Radar Micro-motion Target Resolution"

Micro-motion such vibration and rotation induces unique phase modulation or Doppler modulation and offers a new way of characterizing objects. When multiple vibration/rotation targets detection and identification are considered, the echo signal is multi-component sinusoidal modulation signal. So far multi-target resolution is still a major challenge facing radar signal processing community. In this paper, A new conception, multi-target micro-Doppler is introduced, and then B-distribution (BD) is applied to implement micro-motion target resolution (MMTR). Based on multi-target micro-Doppler, a complete scheme is presented for micro-motion target resolution. BD for resolving multiple vibration/rotation targets is demonstrated with synthetic data, and simulation results confirm our expectations [C11700]

"Synthesis of the Optimal Discriminator for a FMCW Radar with the Beat Signal"

The algorithm of optimal data processing for linear frequency modulated continuous waveform (LFM CW) radar is considered. It is shown that such algorithm can be performed by means of tracking range measurement consisting of the non-linear discriminator and linear averaging circuits. The structure of discriminator is synthesized and fluctuations of spectral density for optimal discriminator realizing the algorithm of correlation processing w.r.t high-frequency LFM-signal as well as discriminators used in practical radar-altimetry is

compared in this research [C11701]

"An Effective Method for Ship Imaging of Real Data in Helicopter SAR System"

In view of unsteady flying, the helicopter brings about great errors to moving targets imaging, especially the SAR imaging of moving ship. Therefore an effective method is proposed in this paper and it is based on an idea that uses motion compensation and general second-step keystone transform twice and at the same time, finds an isolated point and estimates Doppler parameters in virtue of WVD transform which are used to remove range walk and curvature. What's more, the detailed proving course of this method is given in this paper. In the end, the SAR imaging of moving ship is acquired in azimuth frequency domain and this paper also analyzes the echo signals of moving targets under different conditions. The simulation result of three moving point-targets and the imaging result of real ship data have confirmed this method [C11702]

"Fast and Robust GSC Beamformer based on Variable Diagonal Loading"

In this paper, a fast and robust GSC beamforming algorithm based on variable diagonal loading is proposed using multistage Wiener filter techniques. Firstly, the loading level can be accurately determined through MSWF decomposition. In conjunction with match filter loading method, the efficient technique achieves the advantages of robust capabilities. The whole algorithm does not requiring computing the covariance matrix and its eigen-decomposition, so the computation load is greatly saved. Simulations demonstrate its effectiveness and robustness [C11703]

"Fast DOA Tracking of Coherently Distributed Sources Based on Subspace Updating"

In this paper, we address the problem of tracking the direction (DOA) of coherently distributed (CD) sources using subspace updating. The conventional multiple signal classification (MUSIC) algorithm, which should estimate covariance matrix, can not perform DOA tracking until it acquires covariance matrix. In addition, MUSIC algorithm needs spectrum peaks search and inverse matrix operator, so it can not estimate DOA of distributed sources rapidly. By contrast, the proposed algorithm uses subspace tracking to estimate signal subspace iteratively, then, the central angles are estimated using TLS-ESPRIT for CD sources. This algorithm can rapidly track DOA of CD sources even when their angular spreads are slightly wide [C11704]

"Parallel Processing Design of Multi-channel LIF Digital Receiver"

This paper presents a design method for parallel multi-channel low-intermediate-frequency (LIF) digital receiver. It is based on the DSP sub-array with a simple topology and operation timing to evaluate and determine the processing capability and then construct the parallel processing array for multi-channel signals according to the restriction of operation timing. With this method the design of multi-channel digital receiver may be simplified. As an example, a design of shortwave band receiver is used to show how to apply this method [C11705]

"SAR Images Despeckling Based on Hidden Markov Mixture Model in the Wavelet Domain"

In this paper, an efficient despeckling algorithm is proposed based on the hidden-state Markov random field (MRF) and the hidden Markov tree (HMT) in the wavelet domain for synthetic aperture radar (SAR) image. The minimum mean square error (MMSE) despeckling technique without the log-transform is fused in the algorithm. This algorithm also employs a new hidden Markov half tree model, which improves its computational speed. The clustering and the persistence of wavelet coefficients are taken into account in this model, which are characterized by the MRF model and the HMT model respectively. Experimental results show that our method achieves good performance in terms of noise suppression and edges preservation, and that its running time is less than that of the HMT by twenty times approximately [C11706]

"The Detection of Deception Jamming against SAR Based on Dual-Aperture Antenna Cross-Track Interferometry"

This paper is concerned with the detection of deception jamming by using the cross-track interferometry. A new scheme of deception jamming detection is investigated on the basis of dual-aperture antenna cross-track interferometric cancellation. First, the deception jamming is introduced with its mode and the jamming signal characters. Second, this scheme is discussed on its spatial cancellation algorithm and applicability in detail. Finally, its validity is demonstrated effectively with point target simulation in detecting deception jamming [C11707]

"A Novel KICA Method for Ground Bounce Removal with GPR"

Nowadays ultra wideband ground penetrating radar (GPR) is widely used in landmine detection. For shallowly buried plastic landmines, the ground bounce is usually much stronger than the weak return from landmines and their arrival time is very close with each other, so ground bounce removal is very important for the following detection, imaging and target recognition. In this paper, kernel independent component analysis (KICA) is first introduced to ground bounce removal with GPR. A novel scheme is proposed for the automatic independent component (IC) selection, which is vital for any ICA based ground bounce removal algorithms. Experimental results based on field-test data show that the proposed method has good performance [C11708]

"Applying Fractional Processing to Radar Satellite Constellations"

This paper introduces a new distributed SAR processing based on fractional Fourier transform for ground moving targets imaging. According to the analysis of the minimum mean-squared error, the distributed SAR representation is given. The multi-channel Doppler imaging used adapting coefficient to handle azimuth domain processing. Compared with the traditional approaches, it can achieve a better result of clutter cancellation by using optimal beamforming in the fractional Fourier domain. The effectiveness of this method has been tested through simulation [C11709]

"A new method of improving the weak target detection performance based on the MIMO radar"

Based on the spatial diversity of the multiple input multiple output (MIMO) radar, a new method is presented to improve the detection performance of weak targets in clutter in this paper. First, the general spatial diversity condition is deduced. Accordingly, by selecting suitable MIMO radar spatial configuration, the target and clutter in a detection unit may be regarded as the non-fluctuating and the fluctuating components, respectively. Therefore, an effective method to exploit the spatial diversity to increase the signal-to-clutter-plus-noise ratio of the receiver is proposed. Compared to the conventional radar, it is shown that superior detection performance may be obtained with the proposed method, especially for the weak target in clutter. Finally, detailed numerical experiments are also provided to demonstrate the effectiveness of the proposed method [C11710]

"A Modified Parametric Adaptive Matched Filter without Dimensionality Loss"

The parametric adaptive matched filter (PAMF) for space-time adaptive processing (STAP) has been an interesting research area in the airborne radar data processing community over the last decade. The existing PAMF however has a problem of dimensionality loss which in turn causes a loss in coherent processing gain and a loss in Doppler resolution. Proposed is a modified PAMF which uses both forward and backward predictions to eliminate the dimensionality loss. The performance of PAMF using simulated data generated by the high fidelity airborne radar simulation software, RLSTAP, as well as real airborne data collected by the multi-channel airborne radar measurements (MCARM) system is assessed with the result of the conventional STAP as a benchmark. The PAMF outperforms the STAP in the sample reduced space [C11711]

"Approximate Invariance of the Inverse of the Covariance Matrix and Its Applications"

Space-time adaptive processing (STAP) normally requires knowledge of the inverse of the covariance matrix (ICM) of undesired signals for detecting desired target signals. The computation of the real-time ICM is impractical at current computer speeds. Presenting two theorems, this paper shows that the ICM is approximately invariant to clutter changes if radar and platform parameters remain unchanged. Potential applications of this approximate invariance are manifold. One of applications we suggest in the paper is a pre-built space-time non-adaptive processor (PSTAP). Both simulated data generated by the high fidelity simulation software, RLSTAP, and real data collected by the multi-channel airborne radar measurements (MCARM) system are tested. The results indicate that PSTAP performs virtually the same as STAP. A moving target has been detected from the MCARM data [C11712]

"An IMF-product detector for the UWB radar signal"

We develop an intrinsic mode functions (IMF) product detector for UWB radar. The UWB noisy data are decomposed into finite number of intrinsic mode functions (IMFs) by empirical mode decomposition (EMD) method. The detection method is based on the IMF point-wise product detection. The proposed method was tested in the case of low signal-to-noise ratio (SNR), the large similarity between target signal and background noise, and absence knowledge of noise's probability density function (PDF). The test data comes from the UWB radar experimental system. We compared the performance of the proposed detector with that of Teager energy operator (TEO), and showed the superiority of the proposed detector over TEO [C11713]

"Improved Evolutionary Particle Filter Algorithm Applied in Radar Tracking"

In particle filter algorithm, resampling is always used to release sample impoverishment phenomenon, but it weakens the diversity of samples set and cause the algorithm unrobust. Based on imitating biology evolution regulation, paper (Mo Yi-wei, et al., 2005) brought forward the evolutionary particle filter (EPF) algorithm. On the cost of much calculation, this method ameliorates the diversity of samples set to relieve the effect caused by samples impoverishment, but in paper (Mo Yi-wei, et al., 2005) the way to select the variation strength is not related. In radar tracking, this paper brings forward an improved evolutionary particle filter (IEPF) algorithm, in which variation strength is based on state noise and measurement noise. What's more, unlike EPF in previous paper, in which the evolution proceeds at each step, the algorithm sets threshold of effective particles to determine if variation is necessary at current step, and much calculation is saved. Simulations demonstrate the feasibility of proposed algorithm [C11714]

"Flying Attitude Measurement System Research on the Rotary Pill"

Through studying the RCS of the rotary bullet pill with slot and the relationship between its RCS and its flying attitude, a new type of system is established, which can get the rotate speed, swing cycle and pose angle of the rotary pill from the data of a velocity radar, by using the ordinary velocity radar and processing the signal of the radar. Then, the terrain of velocity radar is much enlarged [C11715]

"New Method for the Simulation of Coherent K-distributed Clutter"

In this study, a new method for the simulation of coherent K-distributed clutter is presented. This method is based on the principle of each quadrature component of K-distributed clutter can be modeled, exactly or approximately, by a weighted sum of products of two independent Gaussian variables. This method can generate correlated coherent clutter with arbitrary complex ACF (autocorrelation function). At the same time, compared with the classic methods ZMNL (zero memory nonlinear) and SIRP (spherically invariant random process), it doesn't need solving nonlinear equations, so the algorithm complexity is decreased dramatically [C11716]

"An approach to sample broadband radar signal with low-rate ADC using adaptive beamforming technique"

To directly sample broadband radar signal with high-rate analog-to-digital converter (ADC) suffers from high cost and low sampling precision. In this paper a novel method is presented to sample a wide-band signal with multiple low-rate ADC channels by using adaptive beamforming technique. This method has the advantages of low cost, low sampling rate, high precision, easy implementation, and it is robust to channel errors. The effectiveness of the proposed approach is verified by simulated data [C11717]

"Bandpass Sampling and Quadrature Demodulation in Synthetic Aperture Radar"

There is an increasing performance demand in receiving system of synthetic aperture radar (SAR) in recent days. Different kinds of digital quadrature demodulation (DQD) algorithms are studied and compared in this paper. All DQD algorithms are divided into two classes: with-mixer algorithms and mixer-free algorithms. The condition of mixer-free algorithms is deduced. The performance of different algorithms is evaluated based on simulated echo data of one point target. Simulation shows that filtering delay method is a tradeoff between efficiency and precision. The work in this paper provides a guide to design digital receiver in SAR [C11718]

"Optimum M-sequence Search via Immune Clonal Selection Algorithm"

The binary pulse compression codes such as the Barker code or m-sequences have been widely used in modern radar systems. The selection of the initial shift register of m-sequence, whose pulse compression waveform has low peak power and large compression ratios, is a key technique in pulse compression waveform design. Based on the antibody clonal selection theory of immunology, we propose the immune clonal selection algorithm (ICSA) to select the best initial shift register of m-sequences. Compared with the standard genetic algorithm (SGA) and a hybrid genetic algorithm (HGA), the approach we used can overcome the prematurity available and has higher searching results. Experimental results prove the feasibility and validity of this algorithm [C11719]

"An Improved Dominant Mode Rejection Adaptive Beamforming Algorithm"

Dominant mode rejection (DMR) algorithm, applied to low SNR signal circumstance, is a typical eigenspace-based algorithm which has small computational load and fast convergence speed. But for a real adaptive array which applies DMR algorithm, it is important to maintain the robust performance of the adaptive array in different SNR signal circumstances, because it's hard to obtain prior-knowledge of the strength of the signal. Through analyzing the algorithm structure, this paper proposes an improved DMR algorithm, which rejects the signal

components more weakly. Compared with conventional DMR algorithm, the improved DMR algorithm is more robust against signal mismatch, such as DOA mismatch. It has larger array gain' in high SNR case and maintains satisfying performance in low SNR case as well. Simulation results verify the conclusions [C11720]

"Research on SAR Jamming Technique Based on Man-made Map"

Based on the scattering characteristics of targets, aimed at the different radar parameters, in this paper a method is presented to transfer the position of every point in the desired man-made maps into the corresponding point in the time-domain, and then store them into the DRFM in advance. When jamming is needed, the data in DRFM is convoluted with the received radar signals, and then the result signal is retransmitted. After radar processing a composite map including the real and the jamming information is gotten. Finally, analysis of the simulation result shows that if the radar parameters are estimated accurately, a man-made map can have a good deception jamming effect. If not it still can have a good covering jamming effect in a certain area [C11721]

"ISAR High-Resolution Imaging of Sparse Aperture"

An algorithm for estimating full aperture by sparse data is proposed in this paper. For big vacant aperture in sparse data, by measuring sparse data actually, accurate sparse data frequency domain energy distribution estimate can be obtained with parametric approaches. With estimated power spectrum as prior information, minimum weighted norm as the restraint, underdetermined equations are solved to interpolate vacant aperture, thus wide aperture data segment estimate is obtained. This algorithm can be effectively applied to ISAR imaging in sparse data. Resulting simulation and actual data processing results confirm validity of the proposed algorithm [C11722]

"An Effective Approach to Ground Moving Target Imaging for Single Channel SAR System"

Based on the envelopes and the characteristics of Doppler spectrum of returns in single channel synthetic aperture radar (SAR) systems a method is proposed, which adopts two order Keystone transform to adjust the range curvature of echo data, then range walk rates of echoes' envelopes are estimated to make some adjustments of walk and the Doppler parameters of moving targets are obtained through analyzing the Doppler spectrum of the moving targets. At last the images and positions of ground moving targets are gained, which make it possible that the moving targets can be indicated in right locations in SAR image. In addition the key motion parameters of moving targets can be estimated by the relationship between the Doppler parameters and motion parameters of ground moving targets. The results of the measured data show that this method can image ground moving targets and estimate motion parameters effectively [C11723]

"Fully-Polarized Scattering Center Extraction and Parameter Estimation: P-SPRIT Algorithm"

In this paper, a novel method called P-ESPRIT algorithm is proposed for fully-polarized scattering center extraction and parameter estimation. The P-ESPRIT algorithm is a joint processing between polarization and super-resolution essentially. It is able to estimate the number, position, intensity and normalized scattering matrix of scattering centers instantaneously for each channel rather than the one which extracts parameters from each channel separately, and its performance is better than the latter because the fully-polarized information is used. It has computational advantage over other methods like MUSIC and ML because it needn't search. Its validity is proved by the experimental results based on simulated and real data [C11724]

"Adaptive Filtering in Polarization Domain with the Criterion of LCMV"

The radar targets can be detected by polarization information when they are difficult to be distinguished from clutter or interference environment by information derived from time and frequency and spatial domains. The traditional methods of polarization filtering are not suitable for the detection of targets in an environment containing strong jams because the signal to interference ratio (SIR) is usually very small and the polarization state of the jam is unknown or distributed continuously. This paper proposes a novel algorithm of adaptive polarization filtering based on the principle of linear constraint minimum variance (LCMV), which achieves the optimal receive of signal by adopting the variable polarization of antenna. For the realization of algorithm and the adaptive fast varying interference, a recursion polarization filtering algorithm is given which can adapt the polarization states of the jam at sampling speed. Simulations are shown and results are in good agreement with theoretical analysis [C11725]

"Effects of Multiple Targets on the Mean Level STAP Detector"

Robustness of the constant false alarm rate (CFAR) mean level adaptive detector for phased array radar equipped with a space-time adaptive processing (STAP) algorithm is analysed when the secondary data is

contaminated by multiple interfering targets at different ranges. Closed-form analysis is first given based on the assumption of Gaussian interference and Swerling I target models. The deleterious effect on target detection is then experimentally examined using the multi channel airborne radar measurements (MCARM) database. It is found that both the probability of detection and the false alarm rate decrease in accordance with the sum of the signal power of the interfering targets. In addition, the false alarm rate is very sensitive to the presence of interfering targets, in the sense that a small sum (below the noise floor) of their signal power can lower the false alarm rate [C11726]

"Ultra-wideband Radar Signals Generated with Two-channel"

Synthesis of ultra-wideband (UWB) linear frequency modulated radar signals is a very important technology for microwave imaging, target identification and detection of low radar-cross-section (RCS) targets. In this paper a new method of UWB radar signals generated with two-channel is presented. The realization structure is given, and the principle of signal synthesis is analyzed. At the same time, an automatic adjustment measure of signal phase is proposed because of discontinuity of signal phase in this method. The simulation and experiment results show that radar signals with large instantaneous bandwidth can be generated by means of this method on the condition that the high-speed digital devices are limited [C11727]

"Signal Processing Method for Distributed SAR Imaging Improvement"

A commonly known design requirement for synthetic aperture radar (SAR) systems is the minimum SAR antenna area constraint, and there are range-Doppler ambiguities. So in conventional SAR, there is a well known trade-off between unambiguous swathwidth and resolution. However, if spatial sampling is added, the maximum unambiguous illumination area will increase with the number of receivers; through this method multiple beams can be formed to reject range-Doppler ambiguities. As is well known, multistatic synthetic aperture radar operates with multiple receive antennas distributed among different platforms which can be used to increase the special sampling. And constellations of formation-flying microsatellites are currently under study in the Held of remote sensing. Basing on this multistatic modes, this paper is intended to study signal processing method of SAR Doppler ambiguities resolving to improve image quality [C11728]

"A method or radar targets position acquisition based on Possibilistic C_means algorithm"

Targets position acquisition is a key technique in radar data processing system. The existence of sea clutter result in the coupling of targets in radar video which lead to the distortion of targets position acquisition. A method for radar targets position acquisition based on possibilistic C_means algorithm is used to solve the problem. During marking different targets by the connectivity and combination algorithm, a method based on possibilistic C_means algorithm is presented to segment coupled targets. The result of the experiment showed that this method can use azimuth and range of radar video simultaneously to realize target position acquisition which can overcome the targets splitting caused by conventional method based on one-dimensional acquisition and can segment coupled targets caused by several factors effectively, thus improving the accuracy of targets position acquisition [C11729]

"Pulse compression for radar pulse signal in matched Fourier transform domain"

In this paper, a new method of pulse compression, matched Fourier pulse compression technology is proposed. The method can achieve pulse compression of multi-targets echoes in matched Fourier transform domain, and the peak position of each compressed echo changes linearly with its time delay. So the method as conventional method, namely matched filter pulse compression can be applied to radar signal processing. The theory about pulse compression of matched Fourier transform is given in this paper. Then theory simulation is made. The simulation results prove that the theory is right, and that the method is feasible [C11730]

"A New Method of Improving Range Resolution Based on Waveform Characteristic Identification"

As an important index of radar, the range resolution is mainly limited by bandwidth of radar system. In this paper, a new method of improving radar range resolution is proposed based on waveform characteristic identification techniques. The results of data simulation and real test of flight show that the range resolution can be improved markedly with the proposed new method, and for the radar with 2 MHz bandwidth, its range resolution can reach about 80 m, which is twice as much as that using the conventional method [C11731]

"Interferogram Phase Noise Suppressing using Nonlinear Partial Differential Equation"

The phase noise-suppressing method applied on the interferogram of interferometric synthetic aperture radar (InSAR) is studied. Filtering phase noise in an interferogram is an important aspect in InSAR data processing.

But any improper altering of the wrapped phase may influence the quality of derived DEM because the interferometric phase contains the topographic information. Therefore, one of the difficulties in phase noise filtering is how to remove the noise and preserve the spatial resolution effectively. In this paper, an adaptive approach based on nonlinear partial differential equations (PDE) is presented for removing the noise in the interferogram. Finally, this approach is compared with some existing approaches for InSAR noise filtering and the experimental results by processing spaceborne and airborne data are used to confirm that the method is more effective in reducing noise in the interferogram [C11732]

"MIMO radar performance in clutter environment"

In this paper we examine the effects of K-distributed clutter on the performance of a spatial MIMO radar system. Multistatic systems provide a set of received data containing more information than in the mono/bistatic case. This increased quantity of information can be exploited to achieve improved detection also in severe clutter conditions. The processing of the received echoes has to take into account the extra information provided and the environment that the radars are in. Thus here we propose two different ways for signal processing and moreover we report their performance [C11733]

"Adaptive Beamforming Passive Radar Based on FM Radio Transmitter"

Target detection by non-cooperative illuminator is a study hotspot in electronic warfare field, with 'four countering' potential advantages for passive radar. First of all, direct path interference (DPI) suppression which is the technique bottleneck of moving target detection by non-cooperative FM radio transmitter is analyzed in this paper. Secondly, a space-time-frequency domain synthetic solution to this problem is introduced: adaptive nulling array processing is employed in space domain; DPI cancellation based on adaptive fractional delay interpolation (AFDI) technique is used in time domain; additionally, coherent integration is utilized. Finally, an experimental system is schemed by regarding FM radio transmitter as non-cooperative illuminator, simulation results by real collected data show applying this method is effective in moving target detection [C11734]

"Elimination of ionospheric multipath propagation effect for over-the-horizon radar"

In this paper, the mechanism and form of ionospheric multipath effect in skywave over-the-horizon radar has been described firstly. According to its various forms, a scheme based on validating region adaptive determination and energy-weighted data association in data processing algorithm has been proposed to eliminate the multipath effect, and its performance is evaluated simply. In an integrated simulation environment, elimination scheme is tested and verified. The simulation results and analysis are also given, and finally some valuable conclusions on practical application are drawn [C11735]

"On Concept and SCR of PCL AEW Utilizing Illuminators of Opportunity"

In this paper, the concept of PCL AEW radar system utilizing illuminators of opportunity such as FM broadcast was proposed for the first time, followed by its system description and characteristics analysis. To analyze the critical factor of SCR for passive radar, the vertical radiation pattern for FM broadcast and the corresponding elevation angle for target or AEW were derived, with the aid of bistatic radar equation, the SCR for this novel passive radar system was obtained and simulated. Finally, it is come to a conclusion that a reasonable SCR lies in the range of -60~110 dB and constant SCR holds for an ovals of Cassini just as the SNR does for bistatic radar [C11736]

"Software Radar: New Reality"

New conception of software radar (SR) providing high degree of programmable ability is described. The SR architecture is tailored to efficient execution of all traditional radar-algorithm with maximum flexibility. History of SR design during the last twenty years analyzed and accompanied by bibliography. Great achievements in SR implementation became after appearance of high performance DSP and FPGA. Attention devoted to methodology of software algorithms verification using half real simulation. Two goal has been achieved: analytical approach gave new calculated results of algorithm efficiency and checked software implementation of the new algorithm using simulation [C11737]

"The Analyses and Improvement of Passive Radar Pulse Pairing Histogram Statistic Method"

Based on the mathematics model of pulse pairing histogram statistic method, this paper discusses the ambiguity reason of high-frequency pulse signal pairing using the histogram statistic method, and computer simulation is applied to prove that the extended pulse pairing histogram statistic method can not resolve the ambiguity of high-frequency pulse signal entirely, then this paper gives the method of multilevel extended pulse pairing

histogram statistic method to wipe off the false peaks, computer's simulation proves the valid of ambiguity elimination [C11738]

"Accelerated GRECO based on GPU"

Graphical electromagnetic computing (GRECO) is implemented by programmable pipeline of modern GPU (graphics process unit) to obtain the electromagnetic scattering of complex target. The speed of the simulation is improved up to 20 times compare to the raw GRECO. The ray tracing algorithm based on GPU is applied to obtain the contribution of multiple scattering of target with concave structure [C11739]

"A New Algorithm of Target Classification Based on Maximum and Minimum Polarizations"

The polarization signature of a given pixel in a radar image represents scattering mechanisms from various scattering elements. This paper presents an analysis of maximum and minimum polarizations of five kinds of polarization signatures: co-polarized, cross-polarized, completely polarized, completely unpolarized, and total available power signatures. We propose a new algorithm of target classification based on these maximum and minimum polarizations, then, conduct the experiment on the measured polarimetric SAR data. Experimental results show that this algorithm is robust to pixel-by-pixel target classification in radar images [C11740]

"A Kind of Dual-Channel GMTI Real-Time Processing Method Based on Frequency DPCA"

In this paper, current situation of GMTI technology would be discussed firstly. After that, a kind of dual-channel GMTI real-time processing method based on frequency DPCA would be presented. After analyzed the principle of clutter-suppression and the diagram of the algorithm, the processing result to both simulation data and real echo data from X-band dual-channel SAR system by the algorithm would be presented. The results proved this method is reasonable and reliable [C11741]

"Target Detection with Adaptive Power Regression Thresholding for HF Radar"

High frequency (HF) radars are capable to detect and track targets at extremely long ranges. But the signal environment that includes external noise, different kinds of clutter and interference will significantly limit the detection performance and system capability. This paper considers a new approach to solve the target detection problem in a complex HF radar signal environment. It uses a conventional constant false-alarm-rate (CFAR) detection procedure but the thresholding scheme is based on regression analysis of power spectrum values along range and Doppler cells. The CFAR detection test rule was combined with a local peak determination procedure. The proposed detection scheme has been tested using real HF radar data and gave very promising results [C11742]

"A Special Operation Mode of BoomSAR in Application to Foliage Penetration Imaging"

BoomSAR system is a SAR device embarked in the basket of a boom lift, which provides a cheap and flexible platform to evaluate the performance of radar system and signal processing algorithm, especially for foliage penetration imaging. The common BoomSAR system moves along a straight line to produce the synthetic aperture effect. This paper introduces a special operation mode of BoomSAR, where the rotation of boomlift arm is adopted to form a curving synthetic aperture trajectory. The experimental results show the feasibility and effectiveness of this special operation mode in application to foliage penetration imaging and the theoretical resolution performance is achieved [C11743]

"A Wavelet-Based Algorithm to Compensate Fast-Moving One-Dimension Target's Range Profile"

The fast-moving target can cause one-dimension range profile aberration, evidence impacts on movement compensation and the performance of imaging algorithm, so in this paper, by analysis of the wideband echo signal model of fast-moving target, then wavelets transform method which can with well capability on low SNR compared with appeared algorithm is proposed to compensate the influence of high speed moving. Computer simulation shows the proposed method can compensate the range profile aberration of fast-moving target effectively [C11744]

"A Novel Adaptive Pattern Control Method Based on LCMV"

This paper describes a simple adaptive pattern control (APC) method based on linearly constrained minimum variance (LCMV) algorithm. The desired static pattern weights are imposed on constrain set which make the overall beamformer sidelobe response equal to the desired quiescent response and simultaneously form nulls in the direction of interference. The sidelobe has many ripples in condition of small training sample size and the

diagonal loading (DL) technology is applied to this method, which improve the convergence speed of sidelobe. The effectiveness of this new method is illustrated by the designed simulations [C11745]

"Performance Analysis of Mutual Coupling Compensation in Adaptive Arrays"

In this paper, the performance of mutual coupling compensation in adaptive arrays is studied. It is indicated that the adaptive array after mutual coupling compensation can suppress interference thoroughly. However, the output power of noise changes with the direction of desired signal, which causes the degradation of the output signal-to-interference-plus-noise ratio (SINR). Therefore, the thermal noise is mainly responsible for the output SINR degradation after mutual coupling compensation. This conclusion derived from the paper is expected to be valuable for the engineering application of an adaptive array. The simulation results demonstrate further the conclusions [C11746]

"Method for Radar Clutter Distribution Test Based on Distribution Transform"

In this paper, we present an effective method for testing radar clutter distribution in the case of short observation sequence. The proposed method firstly transforms a clutter sequence from an unknown distribution by a hypothetic distribution function and the inverse function of standard normal distribution, and then tests whether the transformed sequence comes from a standard normal distribution using simple third-order moment to decide the original sequence distribution type [C11747]

"Image Rejection Research on Digital IF Quadrature Detector for Complex Band-pass Signal"

Two kinds of definitions of image rejection ratio (IRR) for complex band-pass signal are put forward, and the signal processing flow for digital IF quadrature detector is discussed in this paper. Simulation results of different definitions of ERR for a sort of complex band-pass signal are presented, which employ Bessel interpolation approach, low-pass filtering approach, polyphase filtering approach and frequency domain approach, respectively. The analysis and simulation results indicate that the values of IRR of different definitions for the same IF quadrature detector approach differs from 5 to 15 dB, and excellent IRR can be obtained with frequency domain approach, which is a more ideal IF quadrature detection approaches at present [C11748]

"A New Anti-interference Preprocess Method for DOA Estimation Based on Uniform Circular Array"

In process of super-resolution DOA estimation, many anti-interference preprocess methods are applied ahead of estimation algorithm, in order to suppress influence of interference, especially active jamming. In this paper, a new anti-interference method based on uniform circular array is proposed. It is based on the theory of function fitting, and DFT is used in the process. With the help of it, the minimum clutter-to-signal ratio and the maximum signal-to-noise ratio (SNR) can be acquired at the same time. At last, a MUSIC algorithm adopting the proposed preprocess method is implemented in simulations. The merits of it are showed in the experiments [C11749]

"An Unsupervised Segmentation Method Using Markov Random Field on Region Adjacency Graph for SAR Images"

A fast approach to obtain segmentation of SAR images has been suggested here based on the local statistical characteristics using Markov random field (MRF) model on region adjacency graph (RAG). First, an initially over-segmented image derived from the watershed segmentation algorithm as well as the original SAR image is taken as the inputs of the proposed method. Secondly, a MRF is defined on RAG of the initial over segmented regions, with a novel multilevel logistic (MLL) model for the region class labels and Gamma distribution for the marginal distribution of each class in the SAR images. The criterion used for getting the optimal segmentation is the maximization of the posterior marginal (MPM), which minimizing the expected value of the number of the misclassified regions in the over-segmented image. In the implementation, the expectation maximization (EM) algorithm is used to estimate the parameters of Gamma distribution, and the parameters of the MLL model is derived from the RAG. Experimental results on real SAR images show that the proposed method can reduce the computational complexity greatly and provide precise segmentation results [C11750]

"Passive Radar Imaging Algorithm Based on Subapertures Synthesis of Multiple Television Stations"

In this paper, we presents a passive radar imaging algorithm based on signals received from multiple television stations at various aspect angles and bistatic equivalence theorem. The algorithm reconstructs a target image by synthesizing the subapertures of multiple television stations available into a large equivalent aperture. In addition to the high efficiency in imaging and low complexity in computation, the algorithm requires neither transmitting wideband signals nor large angular rotations of object. Its validity is shown from simulation results [C11751]

"Design and Implementation of Millimeter-wave Active phased Array Radar"

The paper describes characteristics of millimeter wave active phased array radar (MWAPAR), introduces scheme and architecture of millimeter-wave radar based on active electronically scanned antenna (AESA), and discusses several key problems related to system design. Experimental results of measurements of its performance are also presented and potential applications are finally discussed [C11752]

"Target Detection in Long Duration Energy Integration by Time-Frequency Distribution and Morphological Filtering"

A new energy integration detection scheme is proposed to detect a nonlinear frequency modulate (FIM) embedded in strong complex additive white Gaussian noise (CAWGN). In this scheme, the optimal kernel of Cohen's time-frequency distribution (TFD) is designed to realize local coherent integration of a signal. Thresholding and morphological filtering are used to extract the time-frequency (TF) support region of the signal from the TFD of an observation. Simulated results show that in the strong noise background with low ratios of signal to noise (SNR) the proposed method is effective [C11753]

"Planar Near Field Measurement System and Computer Simulation for UWB Radar Antenna"

This article describes an UWB radar antenna planar near field (PNF) measurement system under construction. Unlike the conventional antenna or RCS time domain test system, the UWB radar signal instead of the carrier free short time pulse was used to excite the antenna, which can satisfy the need to measure SAR and other UWB radar antennas measurement. In order to validate the data analysis program, we use the FDTD analysis software to calculate the electrical field of MtimesN points in a fictitious plane at different times just like the actual PNF sampling in the time domain (TD). The calculated results can be considered the actual oscilloscope's sampling output signal. Through time-frequency domain transform and FD near to far field transform, we get the almost same radiation pattern comparing to the FD measurement and simulation results [C11754]

"Research on Bistatic SAR Motion Compensation"

Bistatic SAR imaging of stationary scenes is well studied theoretically, and SAR images show the success of the bistatic flight campaign. Besides of technical problems-like the synchronization of the oscillators and the processing of bistatic raw data imaging-motion compensation including autofocus is not well studied theoretically all the same, which is a major area in bistatic SAR. Motion errors of the platform result in image distortion and the azimuth displacement, then motion compensation must be done. This paper proposes a method of SBMC for the special case of equal velocity vectors and parallel flight paths of transmitter and receiver, which is based on the bistatic-to-monostatic movement errors conversion (BMMEC). In the end, the phase gradient auto-focus (PGA) for bistatic SAR motion compensation is also studied, which is a validity SBMC approach [C11755]

"An S-band Direct Radar Frequency Source"

The overall high performance requirements for the modern radar system set higher and higher requirements for the radar frequency source, such as high spectrum purity, low phase noise and wide bandwidth, fast frequency switching speed, and complex signal generation capability, etc. and drive continuously the development of radar frequency source technique. This paper describes the design and implementation of an S-band direct radar frequency source for an ultra-low-altitude target acquisition radar and presents the result of development [C11756]

"Multicomponent Quadratic FM Signals Analysis Using Radon-CPF Transform"

In this paper, the identifiability problem arising from the application of the cubic phase function (CPF) to multicomponent quadratic FM signals is identified first. To solve this problem, an algorithm that combines the CPF and Radon transform is presented. Simulations validate the proposed method [C11757]

"Implementation of Radar Emitter Intelligent Recognition System Based on Neural Network"

The paper, in the light of the practical research work on the radar emitter intelligent recognition system (REIRS) based on neural network, gives an account of the structure, algorithm and the implementation method of neural network hardware based on DSP. It also analyses the experiment results of the recognition system at the same time. It summarizes the technical features of the system and its application foreground in the EW on other sides at last [C11758]

"2-D WSF at Subarray Level Based on Ideal Patterns"

2-D subarray level super-resolution finding has an important application in phased array radar. We study super-resolution methods at subarray level for coherent sources and propose the signal model of WSF (weighting subspace fitting) algorithm at subarray level. Constructing simplified array manifolds is an effective way to reduce calibration cost and expense of phased array largely. We post-process the digital subarray output by bringing in weighting network that can increase the flexibility of array processing greatly. By finding the simplified array manifold based on ideal subarray patterns, we can overcome the drawback of the direct simplified array manifold method (the available direction finding range can't be adjusted) and suppress uninteresting sidelobe sources better. But the precision of the direction finding is decreased accordingly. Simulation results demonstrate the validity of the proposed method [C11759]

"Analysis of First-order Sea Clutter in a Shipborne Bistatic High Frequency Surface Wave Radar"

The features of the first-order sea clutter in a shipborne bistatic high frequency surface wave radar (HFSWR) are analyzed. Some formulas of the first-order Bragg frequency are firstly presented derived from the radar geometry, and then the broadening mechanism of the first-order spectrum is discussed. The distributions of the first-order peaks are represented by computer simulations. The processing results of experimental data confirm partially the theoretic analysis. Finally, the author discusses the seeming conflicts between theoretic and experimental results [C11760]

"Technique of Doppler compensation for phase-coded signal pulse compression"

Codes used in phase-coded pulse compression waveforms suffer from Doppler mismatch. Based on an analysis of the effects of Doppler mismatch on quasiphase-coded waveforms and the performance results, a new technique of Doppler compensation is proposed. This technique solves the problem of the sensitivity of phase-coded signal to Doppler. It is proved that pulse compression performance is quite well by using this technique, and it meets the project's requirement very well [C11761]

"On Usage of Radar Equation"

This paper begins with essential physical meaning of basic radar equation and its parameters. It then proposes a method that calculation models should be created separately for radar transmit channel and receive channel based on the practical composition of a radar system so that the radar equation can be correctly used. It also points out some problems which should be specially emphasized in usage of the equation. Finally it discusses the theoretical guidance which these physical meanings of different forms of the radar equation have on the engineering design of a radar [C11762]

"An Improved Super-Resolution Direction Finding Method at Subarray Level for Coherent Sources"

2-D subarray level super-resolution direction finding method has an important application in phased array radar. We study the method suited for coherent sources and propose the signal model of WSF (weighting subspace fitting) algorithm at subarray level. Constructing simplified array manifolds can reduce calibration cost and expense of phased array enormously. We post-process the digital subarray outputs by bringing in weighting network and thus increase the flexibility of array processing greatly. By constructing simplified array manifold based on approximate Gaussian subarray patterns, we can overcome the limitations of the method based on DSAM (direct simplified array manifold) whose available direction estimation area can't be changed and the sidelobe sources can't be suppressed completely. Compared with the simplified array manifold based on the Gaussian patterns, this new constructed manifold can reduce the cost and complexity of calculation largely, with the performance of direction finding is not degraded. Simulation results demonstrate the validity of the proposed method [C11763]

"Research on SDR Architecture for Radar Target Signatures Measurement"

According to software defined radio theory, four sections and four layers architectures for radar target signatures measurement are presented and researched, which can be applied to design to get more and more information including RCS or multi-scattering centers distribution etc. Versatile radar signals can be used in the measurement system, and the working frequency band and bandwidth are changeable, therefore, it is necessary for the design to update signal processing algorithms. The tradeoffs will be analyzed for measurements, the SDR measurement platform is designed. In the end, some characteristics of a complex target will be showed by experimental data [C11764]

"An Improved Joint Time Frequency Approach for Shadow Image of Bistatic Forward Scattering Radar"

An improved joint time frequency approach has been applied and evaluated for shadow image of bistatic forward scattering radar (BFSC). It is shown that the improved joint time frequency algorithm provides an effective and robust method to eliminate ground clutter and direct signal for shadow imaging of BFSC, which are the key factors to affect the quality of image. Compared with the method applied by paper Zhang Tao, et al., (2001), this method improves the image quality and robust ability [C11765]

"A Novel Robust Beamformer based on Worst-case Performance Optimization"

This paper considers robust array beamforming in the presence of steering vector errors. Recently, robust Capon beamformers (RCB), presented by Li Jian et. al, demonstrate the advantages of less sensitivity to steering angle error over conventional beamformers. But these methods suffer from the performance degradation with inaccurate choice of ϵ (ϵ is the module of steering vector errors). To deal with this drawback, a novel robust beamforming algorithm is proposed based on double constraint worst-case performance optimization, in which the parameter ϵ can be adaptively determined. Compared with the RCB algorithm, the proposed method has better performance in our simulation conditions [C11766]

"Novel Ground Bounce Removal Algorithms Based on Non-homogeneous Detector"

In this paper, a non-homogeneous detector (NHD) is developed for ground penetrating radar (GPR) for the first time. The homogeneousness of ground bounce (GB) and the number and position of buried targets (or target-like objects) can be determined by the general likelihood based NHD. Combined with NHD, principal components analysis (PCA) based and blind source extraction (BSE) based methods are also presented for GB removal, which are referred to as NHD-PCA and NHD-BSE algorithm, respectively. For NHD-PCA algorithm, PCA is only taken on target areas to avoid leakage of target signals energy and descend of signal noise ratio (SNR) in target areas. For NHD- BSE algorithm, since the number of targets can be priorly determined by NHD, it has much less number of components to be extracted than that needed by independent component analysis (ICA), therefore less computational load is required. Meanwhile, all sources selection strategies needed by ICA are unnecessary for NHD-BSE because of the known number of extracted sources. The experimental results show the good performance of proposed methods [C11767]

"A method for MTD detectability improvement using FFT/WFFT-DWT"

When the Doppler frequency of target mismatches the fast Fourier transform (FFT) bin frequencies, the high side lobe appears. Discrete wavelet transform (DWT) has been applied to output of weighed FFT (WFFT) to suppress side lobe. And then FFT/WFFT-DWT is proposed to improve processing gain (PG) further. PG formulae for both WFFT and WFFT-DWT are given. Experimental results demonstrate that FFT/WFFT-DWT can attain much higher detectability than FFT/FFT-DWT as well as FFT in unmatched state [C11768]

"Channelized Receiver with WOLA Filterbank"

Polyphase DFT filterbank is an efficient structure for channelized receivers, but its flexibility limited by the fixed relationship between decimating factor and channel number. In this paper, a flexible and efficient channelized receiver structure was proposed based on weighted overlap-add filterbank. In the structure, shift of input signals substitute shift of time windows. Filter coefficients are used to weight shifted signals rather than calculate convolution. DFT is employed after signal weighting, overlapping and adding. The structure is equal with polyphase DFT channelizer mathematically, but avoids its strict condition. It's a generalized form of polyphase DFT structure. Simulation results show the effectiveness of proposed structure [C11769]

"SAR Image Despeckling Using Local Contextual Hidden Markov Model in the Contourlet Domain"

Synthetic aperture radar (SAR) image despeckling is an important problem in the SAR applications. A novel despeckling approach using a local contextual hidden Markov model (LCHMM) in the contourlet domain is presented in this paper. The proposed method can not only use the multiresolution and multidirection characteristics of the contourlet transform, but also exploit the local statistics and capture the intrascale dependencies of the contourlet coefficients by using LCHMM. The experiments in despeckling SAR images show that the proposed method in contrary to other methods can obtain a better trade-off between smoothing the homogeneous areas and keeping the edges and can get better visual effect [C11770]

"Broad Beam HFSWR Array Calibration Using Sea Echoes"

A novel technique to calibrate nonlinear array of HFSWR (HF surface wave radar) by exploiting single-DOA (direction of arrival) sea echoes only is presented. It works online to supply precise channel unmatched factors in real time without interrupting regular radar operating. The technique exhibits excellent robustness and practicability when applied to the OSMAR (ocean state monitoring and analyzing radar) HFSWR system developed by Wuhan University [C11771]

"Ant Colony Fuzzy Clustering Algorithm Applied to SAR Image Segmentation"

A method of dynamic fuzzy clustering analysis based on ant colony algorithm for SAR image segmentation is proposed. The method confirms dynamically the clustering number and center by the stronger fuzzy clustering ability of ant colony algorithm. Texture feature of SAR image is calculated according to gray level co-occurrence matrix (GLCM), and the proper feature vector is selected through statistic analysis. The measurement SAR image segmentation experiment indicates that the algorithm can segment the target fast and exactly, and is an effective SAR image segmentation method [C11772]

"Detection and Recognition of High-speed Anti-Radiation Missiles with Simple Multi-antenna VHF Radar"

A new warning radar for detection and recognition of high-speed anti-radiation missiles (ARM) is presented. The radar adopts a special antenna construct and is developed on the basis of the resonant effect of VHF bands, which makes RCS increase remarkably. Practical detecting method is analyzed according to the features of high-speed ARM. The system boasts the merits of simplicity, low cost and small size, etc. Experiment results are given to show the validity of the method [C11773]

"The Performance Comparison of Adaboost and SVM Applied to SAR ATR"

In this paper, Adaboost and SVM are applied to SAR ATR (synthetic aperture radar automatic target recognition) respectively. The performance of these two classifiers is analyzed and compared in target aspect window with different size. First, PCA (principal component analysis) features are selected as target feature, and then Adaboost.M1 and SVM are used to classify, respectively. Experimental results based on MSTAR data sets show that Adaboost classifier has better robustness than SVM classifier [C11774]

"A Study on the Technologies of Ultrahigh-speed Data Acquisition and Signal Processing of Ultrawide-band Radar"

Ultrawide-band radars (UWBR) are of very high resolution and have become a new tool of detecting targets. The technologies of high-speed data acquisition and processing of ultrawide-band signals are the key technologies for ultrawide-band radars. A project of ultrahigh-speed, real-time, and direct RF acquisition is put forward in this paper. Pulse compression as a way of processing of ultrawide-band signals is studied. Experiments show that the high-speed data acquisition system may implement the high speed, high accuracy and real-time stable sampling of the ultrawide-band radar signals, and that the algorithm of pulse compression is actually feasible [C11775]

"Study of Calibration and Remedy of Distributed Small Satellite Radar Array"

Coherently combined processing of the echoes received by constellation of small satellite radars can obtain a wide swath of ground as well as a high azimuth resolution. However, the complicated errors (which mainly include three-dimensional baseline errors and gain and phase error in this paper) have a great effect on the result of the coherently combined processing, and even make it a failure. To solve this problem, a novel calibration and remedy method is proposed in this paper. This method can estimate and remedy the spatial steering vector of received signals accurately on the basis of the baseline errors confined in a meter. Its validity is illustrated through computer simulations [C11776]

"A Pre-Doppler Approach for Reduced Loss Bistatic STAP"

In this paper we investigate the effects of bistatic clutter spectral dispersion on STAP techniques. The use of reduced d.o.f. algorithms is considered since they enable localized training in the range dimension and thus limited effects of clutter non-stationarity. To this aim, the selection of appropriate adaptive degrees of freedom is demonstrated to be a crucial issue. Due to their intrinsic capability to yield reduced adaptivity loss and to their limited computational load, Pre-Doppler STAP techniques are shown to be a very appealing solution for clutter cancellation and slowly moving target detection in bistatic radar systems [C11777]

"A new approach for long low autocorrelation binary sequence problem using genetic algorithm"

Distinguishing reflected waveforms from two separated targets which are very close to each other is an important challenge in radar signal processing. Pulse compression is a technique used for accounting for this problem. There are several methods for compressing such as phase coding waveform and the goal of this paper is finding these optimal codes. In this paper, by combining several contents, a new optimum method based on Genetic algorithm is suggested. This method has low computational operation and its speed is faster than the other ordinary algorithms. This method is belonged to local or partial search methods and has following advantages: 1. It uses branch-and-bound strategy; 2. It's search logic, avoids codes redundant relative to three PSL-preserving operations and upper order of allomorphic forms of a code; 3. Although it is a partial search method, but it does not involved in local minimums; 4. It can be implemented by a simple scheme for partitioning and parallelizing the search by the fixed upper bound on PSL. 5. By using genetic algorithm, it is possible to optimize found codes by several factors simultaneously included in fitness coefficient like as PSL and Merit Factor, The efficiency and effectiveness of the algorithm is exhibited by resulted for code length 126 [C11778]

"A Fast Method for Time Delay, Doppler Shift and Doppler Rate Estimation"

For realizing the rapid estimation of time delay, Doppler shift and Doppler rate of moving targets in passive radar, we present a cross ambiguity function algorithm based on higher order ambiguity function (CAF-HAF). In this algorithm, higher order ambiguity function transforms the nonlinear harmonious signal's estimation to the linear harmonious signal's estimation, then zoom-FFT is used for estimating the frequency portion which the authors are interested about. Therefore, the CAF-HAF algorithm realizes the accurate estimation of the time delay, Doppler shift and Doppler rate of moving target with less computational cost Then the computation cost and the accuracy of the CAF-HAF algorithm are compared with the cross ambiguity function method based on the fractional Fourier transform (CAF-FRFT), showing higher efficiency and being more adaptive for real time signal processing [C11779]

"A Scheduling Simulation for a Multi-Function Phased Array Radar"

This paper describes a scheduling simulation which operates in non real-time to provide full closed-loop operation of the ground based radar simulation system (GBRSS) in support of missile defense tests against countermeasure. This simulation provides capability to evaluate the radar control program (RCP) performance of multifunction phased array radar, and key scheduling algorithms verification and validation [C11780]

"2-D ADBF at Subarray Level with Pattern Control Based on Subspace Projection"

ADBF at subarray level has important applications in phased array radar systems. We present the signal model of 2-D ADBF at subarray level, suitable for any plane phased array. We give 2-D ADBF at subarray level which can be generalized by ADBF at element level, but its limitation is that adaptive processing makes the sidelobe level of patterns increase remarkably. Therefore, we introduce 2-D ADBF at subarray level based on subspace projection. This method can obtain adaptive pattern the same as quiescent pattern in the absence of jammer, while improve sidelobe level of adaptive patterns markedly in presence of jammer. Simulation results indicate the validity of the introduced method [C11781]

"Ray-based Simulations of Received Signals from Ground Penetrating Radar"

Numerical simulation of ground penetrating radar (GPR) signals is potentially valuable in both survey design and data interpretation. We develop a method for numerically synthesizing GPR received signals using geometrical ray theory. The GPR reflected ray tracing scheme is implemented using wave front expanding method, based on Fermat's principle, reciprocity principle, and Dijkstra's shortest path algorithm. This method is good for complex layered models with inhomogeneous material and undulate interfaces, and can trace all reflected ray paths from one non-planar interface at one time, for a pair of source and receiver. Simulation experiments show it is effective [C11782]

"A Novel TDOA Location Algorithm for Passive Radar"

TDOA location is an important method for passive radar. The error of conventional TDOA method is often larger for the inference of mixture signals. In this paper, a novel TDOA location algorithm for passive radar has been proposed, which is based on CCA. Simulation result confirms the validity and practicality of the proposed approach. The important contribution of this TDOA location method proposed by this paper is it can improve the applicability of TDOA location, which will play an important role in military and civilian affairs [C11783]

"Quadrature Coherent Detector of Wideband Intermediate Frequency Signal"

On the basis of reviewing and contrasting the three processing methods of quadrature sampling of intermediate frequency (IF) signal: the LPF (low pass filter) method, the Bessel interpolation method and the polyphase filter method, this paper deals with the applicability of the three methods with wideband signals. Through the analysis of the progression of spectra and simulations on computer, it can be concluded that the maximum processing bandwidth is $f_s/2$ and the LPF method is more suitable for the quadrature coherent detector of wideband IF signal and the characteristics of the filter fit for it and something that deserve to be noticed are also given. Finally the application of wideband signal using the LPF method is illustrated with an example [C11784]

"Detection and Parameter Estimation of LPI Signals in Passive Radar"

It is desired for multi-static passive radar to intercept target radar signals simultaneously during the process of location which utilize the difference time of arrival (DTOA). However, many LPI techniques are adopted by airborne radar in practice such as low side lobe method and narrow beam technique. As a result, receivers will not locate in the coverage of major lobe simultaneously. One is covered by the main beam while others located in the side lobe of the antenna. Therefore the difference of signals' strength between these receivers will be more than 20 dB. The strong signal intercepted by the receiver in the main beam is analyzed by auto-correlation theory, and signal's periodicity is estimated. Then we take it as replica of the side lobe signal to define the model of mixing product. Furthermore, mixing product signal which has no relations to do with the modulation of signal is deduced. Finally, an example of real data process which validated its effectiveness in application is given [C11785]

"Gratinglobes Resolving in Sparse Array Beamforming"

Beamforming in sparse array often results in gratinglobes because of spatial undersample. In this paper, we investigate the concept of effective aperture to resolve gratinglobes. The central idea of effective aperture is to use transmit aperture with an appropriate element number to eliminate undersample in receive aperture. Quantitative analyze shows that the element number of transmit aperture is proportional to the inter-spacing of receive sparse array. Simulations demonstrate the design method can resolve gratinglobes effectively [C11786]

"2-D Angle-of-Arrival Estimation with Two Parallel Uniform Linear Arrays"

This paper proposes a novel estimator for two dimensional angles of arrival of multiple narrowband sources using two parallel uniform linear arrays (ULAs). Unlike the previous DOA matrix method, it is based on a reformulated signal model and takes advantage of the special structure of the arrays to estimate more sources. In addition, spatial smoothing technique is used to extend the proposed method to estimate coherent or highly correlated signals [C11787]

"Design of Solid-state Transmitter for Some HF Ground-wave Radar"

According to the demand for the full solid-state transmitter in some high frequency ground-wave radar, it mainly discusses the design of the core parts of the transmitter, which are the power amplifier module as well the control and protection system. It presents a method to optimize the design of power amplifier module, some aspects related with both the final power amplifier circuits and the matching designs are also discussed. Then, the operating principle of control and protection system is analyzed. With the control logic design of CPLD, the logic synthesis and timing analysis are completed. The test results indicate that the performance of power amplifier module is up to our requirement, and the control and protection system shows good performance in controlling and protecting the transmitter with great flexibility and adaptability [C11788]

"Dual-Polarized Signal Processing for Weather Radar"

In this paper, a new signal processing system is designed for dual-polarization weather radar. We first design the weather echo, then compute algorithms using to obtain the polarization parameters estimation by processing the echo. Finally we build a weather recognition model to classify the processed data and give a weather forecasting reference for this model [C11789]

"Diagonal Loading Level Estimation For Robust Beamforming"

Often in practice, the knowledge of the array steering vector is imprecise, the Capon beamformer may suffer considerable performance degradation. In order to improve the robustness of the Capon beamformer, diagonal loading has been a popular method. However, for most of these methods, it is not clear how to choose the appropriate diagonal loading level. Based on our cost function, an iterative search method for choosing the loading value is proposed. Using the appropriate diagonal loading level found through the search process, the effectiveness and better performance comparing with other methods have been showed via a number of

numerical examples [C11790]

"Detection and Imaging of Aerial Moving Targets Based on Spaceborne SAR"

According to the characteristic that the bandwidth of spaceborne SAR is generally quite wide, a new method called "sub-band double carrier frequency conjugated processing" is presented in this paper. The approach can decrease the equivalent central frequency of the synthetic signal and remove the Doppler ambiguity. Consequently, Keystone transform can be used to correct the linear range migration of the fast moving targets with low input SNR. After the target range curvature is corrected, time-frequency analysis can be used to implement low resolution imaging and targets detecting. The radial velocities of the targets can be obtained from targets detection, and high resolution imaging process can be completed to each moving target. The simulation results show the effectiveness of the new method [C11791]

"A New Method of Velocity Estimation for Inverse V-Shape Stepped Frequency Signal"

The signal processing of the stepped frequency radar signal and the interferences of target's velocity are introduced firstly. Then a new method of velocity estimation for the inverse V-shape stepped frequency signal is given, which is proved by the result of computer simulation. Finally, the experimental result from a real radar system validates the feasibility of the theoretical analysis [C11792]

"Design and Implementation of Channel Equalization for a Multi-frequency CW Ranging Radar"

A scheme for the project realization on channel equalization for a multi-frequency CW ranging radar is presented. Computer simulations and outfield experiments have testified the algorithm and the method of channel equalization described in this paper. Results obtained are encouraging, which shows the validity of the project scheme [C11793]

"Muti-Channel Digital LPI Signal Detector"

The theory of LPI radar signal interception is introduced and a method using multi-channel digital deramping is discussed in detail for FMCW signals. Many simulation experiments on the method have been done in several possible situations, and on the basis of them, the influences of mismatch factor and unsynchronized phase on the detection performance of the digital LPI radar detector are analyzed. At last, the method of estimating the parameters of LPI signal is summarized. It is demonstrated that the LPI radar signal can be extracted from the noise background by means of digital deramping [C11794]

"Polyphase Coded signal Design for Netted Radar Systems"

A modified simulated annealing algorithm (MSAA) is proposed as a statistical technique to design polyphase coded signals for orthogonal netted radar systems (ONRS) which have good autocorrelation and cross correlation properties. This algorithm is a combination of simulated annealing and Hamming scan algorithms. Some of the synthesized results are presented, and their properties are better than other known in the literature. The effect of Doppler frequency shift on the performance of these signals is investigated and found "thumbtack ambiguity function". The synthesized polyphase sequence sets are promising for practical application ONRS/multiple radar. The convergence rate of the algorithm is also good [C11795]

"Analysis on Rank of Channel Matrix for Monostatic MIMO Radar System"

Multiple-input multiple-output (MIMO) radar has shown its great potential on combating with target fades by averaging the target RCSs on many decorrelated channels, and hence significantly improves the system performance. The amount of decorrelated channels is mathematically represented by the rank of channel matrix. In this paper, an analysis on the rank of channel matrix for monostatic MIMO radar is given. It is found that the rank can be approximated by the bandwidth-aperture product. The sufficient condition to obtain a full-rank channel matrix is presented. As well, the effect of array structure on the rank is investigated. Sequentially, some suggestions are proposed to keep a large rank while using relatively small inter-sensor spacing. Finally, some simulations are given to verify the analysis [C11796]

"High Speed Real-Time Signal Processing System"

This paper introduces a real-time signal processing system which is composed of TS201 and FPGA. In the hardware part, using the architecture of 8 ADSP-TS201 processors and two FPGA fulfills the high speed processing. The system also contains a record board to save and transfer data to PC for analysis. In this system an effective algorithm is mapped, and various factors are considered, such as algorithm complexity and

resolvability, hardware processing ability and real-time capability, and CPU load balance of communication and calculation tasks. Parallel design and optimization on both system and instruction levels are emphasized, while realizing system. The system has been used in the actual project and its performance is excellent [C11797]

"DOA Estimation of Currents Based on Toeplitzization With HF Ground Wave Radar"

Echoes scattered from ocean waves with the same velocity of flow and in the same range bin are partially correlated in ocean current detection with HF ground wave radar, therefore decorrelation is needed before estimating the direction of arrival (DOA) of ocean currents by MUSIC method. In this paper the conventional MUSIC method is modified by performing a Toeplitzization on the array covariance matrix before implementing MUSIC method. Theoretical analysis and simulation show that this process can reduce the correlation between signals, and can therefore improve the performance of MUSIC remarkably. Finally by analyzing the measured data, it is shown that the improved method can detect the currents more effectively [C11798]

"Frame-overlapped Zoom-FFT Optimization in PD Radar Application"

This paper addresses a frame-overlapped zoom-FFT method applied to pulse Doppler (PD) radar echo spectrum analysis. The method can achieve high resolution of local spectrum, and improve the gain of coherent integration, so it can enhance the detection probability and the precision of parameter estimation for poor echo signal. Firstly this paper introduces the principal of frame-overlapped zoom-FFT. Then it addresses the parameter design criteria in high pulse repeat frequency (HPRF) PD radar application. Furthermore based on analyzing the effects on incoherent integration and target detection due to frame overlap, it illustrates the parameter design process by an example of PD radar spectrum analysis application and gives the comparison of overlap processing and no-overlap processing. Finally, a real-time spectrum analysis system implementation adopting the frame-overlapped zoom-FFT method is proposed [C11799]

"Spatial-Temporal Differential Analysis for Profiling the Atmosphere, 1, Theoretical Background"

We introduce a conceptually new method for processing multiple synchronized radar signals. The method is referred to as spatial-temporal differential analysis (STDA) and it operates with increments of signals from multiple receive channels at small spatial and temporal separations. To improve the radar detection and tracking capabilities, STDA takes advantage of the signal scintillations, which are regarded as a harmful phenomenon by conventional signal processing methods. To introduce the concept of STDA, we consider a specific task; measuring mean horizontal winds and turbulence with atmospheric wind profilers. We present a simplified technique for spaced antenna profiling radars which is based on structure functions which are statistical moments of the increments in a space-time domain. We demonstrate that STDA "senses" different characteristics of scatterers than conventional spectra and correlation function-based methods do. This new concept enables reliable measurement of characteristics of the atmosphere in the presence of strong clutter as well as comprehensive measurements of atmospheric turbulence which no other known methodology can provide [C11800]

"Approach Based on ICA and SVM to Identify Field Mixed Acoustic Targets"

With ICA to realize the blind separation from mixed acoustic targets, an identification method based on SVM is proposed through extracting LPC feature. SVM is employed to compute the output score and k-means algorithm is used as cluster LPC coefficients. Finally targets are identified by hybrid model. Simulation indicates that this method is effective in mixed acoustic targets identification system [C11801]

"Effects of geometry on clutter characteristics of hybrid bistatic space based radar"

For hybrid bistatic space based radar (HB-SBR) which is composed of a transmitter on a satellite and a receiver on an airplane, clutter is a serious problem for detecting slow moving target. The authors discuss the effects of geometry on clutter characteristics, such as Doppler-angle traces, isorange and isodoppler contours, Doppler ambiguities and so on, of HB-SBR which applies space-time adaptive processing (STAP) in this paper. It is shown that some unique clutter properties appear due to the great differences of platform speeds and heights between the transmitter and receiver in the hybrid mode. Some suggestions about bistatic geometry design are also made to improve the performance of moving target indication (MTI) [C11802]

"Highly Squint Airborne SAR Real-time Imaging"

A highly squint airborne SAR real-time imaging algorithm named the extended CS algorithm is introduced in the paper. Some important approximations of the classic CS algorithm are analyzed and the analyzed method is valuable for the selection of imaging algorithm for a SAR system. As the squint angle becomes larger, the

approximation error will be unacceptable and the algorithm should be modified. The presented extended CS algorithm adds phase information to compensate the cubic term of the range frequency Taylor expansion of the signal phase in the two-dimensional frequency domain which is ignored by the classic CS algorithm. In the classic CS, the effective chirp rate at any range is approximated to its counterpart at the reference range. The approximation error may become unacceptable as the range size of the scene is large, which can be resolved by dividing the scene into several partitions and respectively processing them. The validity of highly squint airborne SAR data imaging system is proved by the imaging results [C11803]

"A New Approach to Improve Coherence in SAR/GMTI Processing of Distributed Micro-satellites Systems"

In order to improve the capability of clutter cancellation in bistatic SAR/GMTI processing, a new method to improve coherence between two sets of echoes from two receivers is developed based on the distributed micro-satellites system with the constellation of SAR-train. According to the idea of equivalent mono-static, the coherence improvement can be achieved by match filter to the spectra of equivalent squint angle, i.e. the bistatic bisector. In this way, the decorrelation component induced by the along-track baseline is removed. Because of Doppler equals to equivalent radial wave multiplied by equivalent squint angle spectra, this method can be realized in two steps, as the first step the compensation of equivalent radial wave number error is achieved through range spectra cut and shift of the narrow band echoes. As the second step, the Doppler spectra not overlapped should be removed, by which the bistatic bisector can be aligned. Simulation results show the decorrelation components introduced by the along-track baseline can be fully eliminated using this method [C11804]

"Spatial-Temporal Differential Analysis for Profiling the Atmosphere, 2, Experimental Results"

We consider an application of the spatial-temporal differential analysis (STDA) to measuring characteristics of the atmosphere with spaced antenna wind profilers. STDA is a new method for processing multiple signals which utilizes spatial and temporal scintillations in the instantaneous signal power on the radar antenna. To test the practical potential of STDA, we used actual signals from the multiple antennas profiling radar (MAPR). The goal was to measure mean horizontal winds and characteristics of atmospheric turbulence in the presence of intensive ground clutter. The STDA results in the atmospheric boundary layer at a height of 300 m above the ground are compared with simultaneous measurements by a sonic anemometer located atop a 300-m tower 600 m distant from MAPR. Second-order structure functions for multiple radar signals were used for the processing. We demonstrate that this simplified STDA technique provides a good performance by reliably measuring mean winds in cluttered environment. It also enables comprehensive measurements of atmospheric turbulence which no other known methodology is able to provide [C11805]

"Spatial temporal and frequency methods to mitigate interference in HF surface wave radar"

In this paper, the spatial, temporal and frequency techniques to suppress interference in HF surface wave radar are presented. By exploiting the characteristics of the co-channel interference and deliberately selecting the secondary data, the proposed methods can effectively suppress both stationary and non-stationary interference. For most practical applications, the proposed interference suppression techniques can be combined to improve the interference mitigation performance of HFSWR. Furthermore, the adaptive operating frequency selection method can improve not only the interference rejection performance of HFSWR but also the frequency utilizable efficiency of the user congested HF band. The experimental results show that the proposed methods can effectively suppress the interference [C11806]

"Detection of weak pulse signal via stochastic resonance"

A novel nonlinear detector is proposed using a bistable stochastic resonance system which is constructed by Langevin equation. The performance of the detector is analyzed, and the probability of detection (PD), the probability of false alarm (PFA) are deduced by the probability density function (p.d.f) of Fokker-Planck equation. We compared the performance of the proposed detector with that of matched filter detector (MFD), and showed the superiority of the proposed detector over MFD under low signal to noise ratio (SNR) (below -10dB) [C11807]

"Research on Target Tracking Technology of OTHR based on MPDA"

Considering the problem of OTHR's target tracking, which estimates the state of a discrete-time, linear stochastic system whose observation process consists of a finite set of known, non-linear measurement models. MPDA (multipath probabilistic data association filter) is capable of exploiting multipath target signatures arising from discrete propagation modes that are resolvable by the radar. In this paper, numerical simulations are made under zero-clutter environment in planar measurement model and spherical measurement model of OTHR

respectively. When tracking a single, non-maneuvering target in an environment where up to four possible measurements of state are received, the simulation results show that the performance under spherical model is superior to that under planar model [C11808]

"New Beamformer for Coherent Signal Reception"

In this paper, a new three-stage beamformer is proposed for reception of coherent signals with the assumption that the directions-of-arrivals (DOA's) of the uncorrelated interferers have been estimated a priori. First, the estimated DOA's of the uncorrelated interferers are used to construct a transformation matrix. Secondly, the composite vector of the coherent sources is estimated based on the transformation matrix. Finally, using the estimated composite vector and the array correlation matrix, adaptive beamforming is performed. Experimental results show that the proposed beamformer almost achieves the optimum performance and rapidly converges. Finally, we also discuss how to counteract DOA error by high-order constraints [C11809]

"Digital I/Q Imbalance Compensation in Quadrature Receivers"

I/Q channels imbalance is one of major concerns in the design of quadrature receivers, which can influence the system performance significantly. In this paper we first analyze the effects of I/Q channels mismatches in detail, and furthermore discuss the relationship between I/Q imbalance and image signals. Then a new method for digitally measuring and correcting the imbalances is proposed based on the analytical results. In the correction process of this new method, phase errors are transferred into time errors, and later the famous Farrow structure is introduced to compensate the phase errors. Simulation results are presented to demonstrate and verify the efficacy of the proposed method [C11810]

"Helicopter-borne SAR Imaging Processing of Chirp-stepped Signal"

In this paper, the processing algorithm of high resolution range profile of chirp-stepped signal is studied in the view of system, and the process of chirp-stepped signal SAR imaging on helicopter platform is analyzed. Furthermore, technology difficulties of helicopter-borne SAR imaging are showed, and imaging results are presented by experimental data [C11811]

"A new method of motion error extraction from radar raw data for SAR motion compensation"

Due to the presence of atmospheric turbulences, airborne SAR raw data may be affected by deviations of the platform from an ideal straight line. Additionally, being rather expensive, the inertial navigation system (IMS) and the global position system (GPS) do not always provide desired accuracy and reliability. This paper presents a solution for aircraft motion error extraction from radar raw data. Based on the derived model, the acceleration in line of sight (LOS) direction is separated into range space invariant and variant components. The main idea is to extract these components of the acceleration from radar raw data. Then the displacement of the platform in LOS direction can be extracted and compensated. In addition, since the system under consideration in this paper operates with a constant pulse repetition frequency (PRF), the motion error introduced by forward velocity variation should be considered. This paper also presents a solution for compensating this motion error. Finally, we present results on real data aimed at validating the proposed methods [C11812]

"Suppression of Azimuth Ambiguities with Constellation of Micro-satellites"

To achieve wide-swath and full azimuth resolution in space-borne synthetic aperture radar (SAR), a space-borne radar usually utilizes low pulse repetition frequency (PRF) with a small aperture in azimuth. Consequently, the azimuth ambiguities are inevitable. As one solution to this problem, space domain filter can be utilized to remove the azimuth ambiguities based on the configuration of micro-satellites distributing along track. In this paper, an innovative method is proposed to simplify the calculation of the filter weight vectors. Simulation shows the validity of the method [C11813]

"A Fast BAVQ Algorithm For SAR Raw Data Compression"

In this paper, a fast BAVQ algorithm in SAR raw data compression is proposed. First, to reduce the data dynamic range, block adaptive quantization of raw data is implemented and the sign bit of raw data is coded separately. And then, VQ is applied in the absolute value of the raw data. The result of experiments shows that the complexity of VQ has been greatly reduced and the process of searching codebook can be simplified [C11814]

"A Novel Method for Direction of Arrival Measurement"

The radar seeker of missile under consideration uses monopulse techniques measure the target angular displacements. However, when multiple unresolved targets are present, the angular information cannot be extracted correctly. A novel method is proposed which implements a long coherent integration and the fractional Fourier transform to resolve such targets instead of the conventional Fourier transform. The accuracy of DOA measurements is guaranteed as shown in the simulation results [C11815]

"Improved Classification of Polarimetric SAR Data Based on Four-component Scattering Model"

In this, paper, we propose an improved classification algorithm which is based on the four-Component scattering model. Compared with the three-component model introduced by Freeman and Durden, the four-component scattering model introduces the "helix scattering" as its fourth component. Our algorithm emphasizes the existence of pixels with mixed scattering mechanism, and applies the result of decomposition as feature vector to initial merge and final iterative classifier instead of using the Wishart distance. We use L-band Pi-SAR images to demonstrate this new method. The experimental result verifies the effectiveness of this improved algorithm [C11816]

"Robust Constrained LMS Adaptive Beamformer"

In the paper, an approach is proposed for robust constrained LMS beamforming in the presence of pointing error, array geometry error and sensor phase error (generalized as array phase errors). The basic idea is to search the optimal weight vector with constrained LMS update, and jointly search the actual array steering vector of the desired signal based on steering vector-expanded algorithm. Despite its lower computational complexity however, it turns out that the proposed algorithm has improved performance. Compared with other recursive beamformers, simulations in the presence of given errors demonstrate that the presented algorithm has more effective and robust performance [C11817]

"Performance Analysis for Random Noise Ultra-Wideband Radar Signal"

The random noise ultra-wideband radar signal is introduced and its power spectral function is also given. Through the theoretical analysis and simulation, the statistical peak sidelobe level (PSL) of compression wave of the correlation receiver and the resolved ability are studied. The simulative result proves that the random noise ultra-wideband radar signal possesses lower PSL in a certain condition and better resolved ability with the comparison of the linear frequency modulated ultra-wideband radar signal [C11818]

"Processing ASAR IM Mode Data Based on Approximate Omega-K Algorithm"

This paper presents an alternating way of processing ASAR IM mode data based on approximate Omega-K algorithm. This algorithm is quite efficient because the interpolation is avoided and only two phase multiplications are required in addition to necessary FFT operations. The errors introduced by the approximation are analyzed based on the ASAR parameters. At last, the simulated point target and ASAR data are used to verify the algorithm. The experimental results show the ASAR data can be well focused [C11819]

"A Measurement Based Solution for Service Quality Assurance in Operational GPRS Networks"

First Page of the Article [C11820]

"An Indoor Distributed Image System Based on Impulse Radio"

This paper investigates a distributed imaging method based on impulse radio and time of arrival (TOA) in a typical indoor environment. In such a multi-path environment, the challenge is to detect the direct-path component in the received signal. A valid algorithm based on the generalized maximum-likelihood (GML) estimation to detect direct-path in the presence of dense multi-path is presented. In spite of pulse distortions due to multi-path propagation through the channel, our simulation in a typical office building shows that an acceptable imaging using UWB signals can be achieved. [C11821]

"A design method of frequency pattern Based on HF channel separation"

Considering the low frequency utility in HF communications, the paper proposes an approach to construct frequency graphic based on channel separation. It discusses the methods and strategies in frequency use. These help to improve HF communications. [C11822]

"Robust Adaptive Beamforming Based on Generalized Sidelobe Cancellation"

If the desired signal is present in training snapshots, conventional adaptive beamformer is quite sensitive even to slight mismatches between the presumed and actual signal steering vectors (spatial signatures). Such mismatches can occur as a result of environmental nonstationarities, look direction errors, imperfect array calibration, distorted antenna shape, as well as distortions caused by near-far mismatch, source spreading, and local scattering. It induces signal cancellation in the traditional adaptive beamforming and severely degrades the beamforming performance. In this paper, we develop a new approach to robust GSC (generalized sidelobe cancellation)-based adaptive beamforming in the presence of an arbitrary unknown signal steering vector mismatch. The proposed method involves two steps: the first step is to use a nulling broadened blocking matrix to exclude the desired signal component from the auxiliary channels, and the second step is to obtain optimal weight by sidelobe cancellation method. Finally, simulation results demonstrate that the proposed structure can considerably enhance the overall performance. It has greatly improved robustness as compared with existing adaptive beamforming-algorithms, and enjoys simple implementation [C11823]

"A Practical Intelligent Home System Based on Power Line Communication"

This paper presents a practical, cost-effective intelligent home system based on power line communication, in which manual keypad control, speech control and GSM/GPRS remote control are implemented. In this system, speech control is for old men and handicapped people who are unable to operate home appliances. A focusing fuzzy template matching algorithm is proposed to improve the accuracy of speech recognition under noisy background. GSM/GPRS remote control makes operation of home appliances and home surveillance feasible anywhere. Because of the implementation of power line communication technology, no rewiring is required, thus making the installation of such system simple, low-cost and efficient, which is favorable for the popularization of intelligent home. An experimental mini intelligent system is presents in the end. [C11824]

"Seeing the Difference in IP Traffic: Wireless Versus Wireline"

First Page of the Article [C11825]

"Design of the High-powered Digital Pulse Compression Real-time Processing System Based on ADSP-TS203"

In the modern radar pulse compression system the real-time processing is important besides simplifying the design of software and hardware. In this paper, the newest general-purpose DSP TS203 of ADI Company is applied to realize the real-time processing of the pulse compression in frequency domain. Registers configure and addressing methods to implement the pulse compression are discussed in detail. Results of simulation and system test show that it can ensure real-time processing and all parameters can also meet the requirements [C11826]

"Simple and Accurate DOA Estimator With UCA In Multiplicative Noise Environments"

Based on crosscorrelation of two elements on a uniform circular arrays and least squares, simple and accurate 2-D direction of arrivals estimator was proposed in the presence of multiplicative and additive noise. We analyzed the statistics performance of the estimator and gave the selection criterion of the optimal parameters. The Cramer-Rao bound (CRB) was derived. The results of numerical simulation shows the performance of the estimator is close to the CRB [C11827]

"Range Migration Compensation and Doppler Ambiguity Resolution by Keystone Transform"

In pulsed Doppler radar, when wideband signals are used and the target radial velocity is high, linear range migration occurs and cannot be neglected. The migration misaligns the range profiles within a coherent processing interval and degrades the coherent integration gain eventually. On the other hand, Doppler ambiguity must be resolved when the radar uses low or medium pulse repetition frequency. In the paper, Keystone transform is used for range migration compensation. Also, a parallel searching scheme of Doppler ambiguity resolution is proposed based on Keystone transform. The simulation shows the advantages of the algorithm [C11828]

"A Second-Order Conjugate Augmented MUSIC Algorithm for Direction Finding"

A new direction finding algorithm called second-order conjugate augmented MUSIC (SO-CAM) is proposed in this paper. The basic idea of SO-CAM is to use the conjugate augmented cross-correlation to derive the pseudo-data matrix from which the pseudo covariance matrix is constructed. Then the directions of arrivals (DOAs) of the signals are estimated by MUSIC algorithm. SO-CAM can resolve two times the number of DOAs when compared to MUSIC algorithm for uniform linear array (ULA). Moreover, simulation results show that the

resolution performance of SO-CAM algorithm is better than MUSIC and MUSIC-like in small sample case [C11829]

"A Synchronization-Based Algorithm for Calculating the Auto/Cross-Ambiguity Functions of Chaotic Signals"

This paper develops a synchronization-based scheme for calculating auto/cross ambiguity functions (AF/CAF) of the wide-band chaotic signals. In the direct implementation, the formulation of the time-scaling chaotic signals takes much computational load and its accuracy determines the quality of the calculated AF/CAF diagrams. By exploring the generation of the chaotic signal, it is found in this paper that the generalized synchronization theory can be used to produce its time-delay and time-scaling versions. With this theory, the AF/CAF diagrams can be accurately obtained. Numerical simulations show the performance of the proposed scheme [C11830]

"A Novel Method for Reconstructing 3D Scattering Centers Based on Multiple HRR Profiles and Its Performance Bounds"

Reconstructing three-dimensional scattering centers of radar targets without knowledge of viewing angles or relative radar-target motion is investigated. The performance bounds are deduced in which the parameter constraints and rotatory ambiguities are specially treated. We propose a novel method based on the signal subspace invariance in multiple one-dimensional projection sequences, which greatly outperforms in both computing complexity and reconstructing accuracy. Simulations show that our method approaches the Cramer-Rao lower bounds at ordinary SNRs [C11831]

"The Cao Method for Determining the Minimum Embedding Dimension of Sea Clutter"

To verify whether sea clutter has chaotic character or not, the minimum embedding dimension and time delay in phase space reconstruction are needed. This paper discusses two defects of false nearest neighbors (FNN) for calculating embedding dimension: noise sensitivity and effect of subjective parameter. It was confirmed that Cao method could overcome these limitations and settle on a suitable embedding dimension of time series and distinguish deterministic signals and stochastic signals clearly. It is concluded that sea clutter is composed of stochastic component and determined component together [C11832]

"Sea Clutter Suppression Based on Radon Transform at High Grazing Angles"

During final guidance, as radar working over sea surface at a very high grazing angle, it is hardly to distinguish target from clutter background due to the strong reflection of the sea surface. A novel method is presented to suppress the sea clutter in this paper. The proposed method based on Radon transform utilizes edge detection technique to find a boundary to separate the target and sea clutter in range-Doppler map. Simulations for sea clutter suppression and target three-dimensional imaging on the sea are conducted. Results show the effectiveness of our method [C11833]

"The Principle and Performance Analysis of Profile Clutter map"

The paper discusses the principle of radar profile clutter map and its corresponding algorithm. The performances of false alarm control and the detection performance of clutter are analyzed under the condition of Rayleigh distribution. When the system parameters are determined, the paper analyzes the affection to the detection probability corresponding to the number of repeat impulses, iterative coefficient and the average clutter-to-noise ratio in different false alarm probability, and so, the realization of building profile clutter map in low clutter-to-noise ratio is available. The simulation examples can demonstrate the validity of algorithm [C11834]

"Real-time Signal Processing Implementation of the Missile-Borne SAR Using High performance DSP"

In this paper, firstly the theoretical analyses of the traditional SAR imaging processing are made the time-domain sub-aperture algorithm which is used to implement missile-borne SAR are researched and a hardware system using the high performance DSP chip named TS203 to process digital signal practically are designed and the result of imaging are given [C11835]

"Clutter Reduction Based on Apex Shifted Radon Transform in Sub-surface Forward-Looking Ground Penetrating Radar"

In this paper a method is proposed to reduce none-apex hyperbola clutter due to target being located at the outside of imaging region and the inside of electromagnetic wave field in forward-looking ground penetrating

radar (FLGPR) measurements. This clutter reduction method is based on apex shifted Radon transform which maps the none-apex hyperbola clutter in radargram to an energy congregate region in the tau-q domain. The none-apex hyperbola clutter is estimated by using a q band-pass filter and the inverse transform. Then the estimated clutter is removed by subtraction method. Finally, remainder surface clutter is reduced by scale and shift. The effectiveness of the approach is demonstrated with an experimental data set, and it increases the signal-to-clutter ratio of near-surface target [C11836]

"Maximum Entropy Method for Angular Estimation"

In order to suppress angular glint in monopulse radar system, a novel method for angular estimation basing on spectrum entropy maximization is presented in this paper. Spectrum widen of difference beam echoes due to the pattern modulation is investigated. Basing on the relations between the spectrum widen, target angular motion center and waveform entropy, a novel method by searching maximum waveform entropy for angular estimation is presented to suppress angular glint. Compared with high-range-resolution angular estimation method available, the novel method performs more conspicuously in angular glint suppression. Simulations show the effectiveness of the new method [C11837]

"Radar Emitter Signal Fractal Feature Based on Wavelet Transform"

Fractal feature can describe the complexity of radar emitter signal. Wavelet transform cannot only observe signal general framework and detail, but also reduce influence of noise. Hence wavelet transform can combine with the fractal theory to study the fractal feature of radar emitter signal. First, signal is decomposed by wavelet transform, and then fractal dimension is computed in different decomposition levels, so the signals with different complexity have different fractal dimensions. In the end the simulation experiments validate that this method is effective to distinguish radar emitter signal [C11838]

"Considerations for Non-cooperative Bistatic SAR with Spaceborne Radar Illuminating"

Bistatic radar, especially illuminating of opportunity, has recently been one of interesting research hotspot due to its military stealth and economic advantages. In this paper, we consider non-cooperative bistatic SAR using aircraft as receiver and spaceborne radar as illuminating of opportunity. Firstly, we qualitatively describe the relationship between geometry and resolution of bistatic SAR. Then, we study receiver geometry configuration from imaging resolution and receiving data aspects. Theoretical analysis shows that observation time has relation with the azimuth initial position of receiver beam footprint, which is relative to transmitter beam footprint, and footprint velocity of transmitter and receiver respectively. Through example calculation, we find that observation time have weak relation with the aircraft velocity and strong relation with the azimuth initial position of receiver beam footprint, which is relative to transmitter beam footprint. The imaging area mainly depends on observation time and aircraft velocity and receiver main lobe beamwidth. Finally, simulations demonstrate that non-cooperative bistatic SAR system, in our case, can possess a short observation time range (1-3s) [C11839]

"Frequency diversity to low-angle detecting using a highly deterministic multipath signal model"

In this paper, based on a highly deterministic multipath signal model, we derives 4-rays echo signal formula in multipath. Use MTD to detect the low-angle moving target, but its performance is limited by the multipath propagation factor. Frequency diversity method can resist the multipath fading. Simultaneous detecting in multiple diversity channels can improve the low-angle detecting performance. And this paper puts forward multiple diversity channel accumulation algorithm to advance the detecting performance to a higher position. Simulation shown this technique is effective [C11840]

"Research of Acquiring Eigenvector of Real Symmetric Matrix"

A systolic array processing method that works out the eigenvectors based on the Jacobi algorithm for eigenvalue/eigenvector decomposition (EVD) is presented in this paper. According to systolic array processing architecture, it is of highly parallel and can get eigenvectors when eigenvalues are worked out. It is easy to perform, for it works with coordinate rotation to avoid complicated algorithm such as multiple, divide and evolution etc. At last some simulations show the precision and delay can be satisfied when the method is applied to real time domain [C11841]

"Adaptive Radar Clutter Suppression Based on Real Data"

Adaptive radar clutter suppression algorithm and realization are important things in radar signal processing system. The paper firstly discusses a method based on the maximum average improvement factor to compute the weight vector of adaptive clutter filter in theory, and then describes a simple, low-cost adaptive MTI system

for bimodal clutter suppression, which uses precomputed filter coefficients stored in the weight coefficients library. Results of applying this adaptive MTI filter on real radar data demonstrate that the filter gives an extensive reduction of clutter in the radar image [C11842]

"Lidar signal denoising based on wavelet domain spatial filtering"

Lidar is an effective tool for remotely monitoring target or objects, but the lidar signal is often affected by various noises or interferences. Therefore, detecting the weak signals buried in noises is a fundamental and important problem in the lidar systems. In this paper, an effective noise reduction method based on the wavelet domain spatial filtration is presented to denoise lidar signal. This method can effectively detect the edge of lidar signal and reduce noise. The performance of our method is investigated by detecting the simulating lidar signals in noise. The simulation results show that our approach performs well in identifying the edge of signal and detecting weak lidar signal buried in noises [C11843]

"A Jamming Technique against Airborne SAR"

The research of jamming against SAR is becoming more and more important since SAR is playing a very important role in modern military affairs. At present, the jamming methods against SAR are mainly focused on direct-wave jamming (DWJ) technique. This paper gives a DWJ jamming technique against a certain airborne SAR. Jamming scheme is presented and simulating data is produced. After imaging processing, famous jamming effect is obtained [C11844]

"Application of RELAX Algorithm to ISAR Superresolution Imaging"

Superresolution array processing methods have been applied to inverse synthetic aperture radar (ISAR) imaging in order to enhance the resolution for many years. Nevertheless, because the excellent performances of the methods are based on the accurate knowledge of the data model, the performance of superresolution methods is degraded extremely, when the signal-to-noise-ratio is not very high, and the number of snapshots is not very large or the system errors exist in the array. This drawback prevents greatly their applications in practical systems. So, the study of robust processing methods is main subject at present. The relaxation (RELAX) algorithm can relax the hypothesis of the additive noise and the system errors. The application of the RELAX algorithm in ISAR imaging is presented in this paper. The RELAX algorithm can yield more accurate spectral estimates than the fast Fourier transform (FFT) or estimation of signal parameters via rotational invariance techniques (ESPRIT) algorithm. Therefore, the higher resolution can be obtained by using the RELAX algorithm instead of the FFT or ESPRIT algorithm when the target flies smoothly. The simulation results show the effectiveness of RELAX algorithm [C11845]

"Burst Mode Imaging with ENVISAT-1 ASAR Alternating Polarisation Data"

ENVISAT-1 ASAR (alternating polarisation) AP burst data segments frequency-time energy in Doppler histories according to the position of target relative to the burst timeline, at the same time, the energy that a scatterer contributes to the received echo ensemble depends on the relative scatterer position following the azimuth antenna pattern, hence the focused image exhibits the radiometric modulation, an effect known as scalloping. This paper investigates the applicability of the band-limited RD algorithm to process ENVISAT-1 ASAR AP burst-mode data, and shows its ability to remove the influence of the azimuth antenna pattern and to preserve phase information. Then the paper illustrates a strategy of filtering the power detected image to suppress the periodic modulation of the impulse response. Finally, the band-limited RD algorithm and the method of filtering in image power domain are verified by processing the ENVISAT-1 ASAR AP mode burst data [C11846]

"Simulation of Coherent Correlation K-distribution Sea Clutter Based on SIRP"

The method of spherically invariant random process (SIRP) allows independent control of the margin probability density function (PDF) and the autocorrelation of clutter, which overcomes the infection of zero memory nonlinear (ZMNL) on autocorrelation. The simulation model of coherent correlation K-distributed clutter using SIRP, with the modeling of coherent pulsed radar clutter, was presented and simulated on computer. The validity of scheme is proved by our simulated results [C11847]

"Analysis of Doppler Features of Spiral Maneuver of Reentry Missile with Time-Frequency Transform"

To have excellent penetration capability, the tactical ballistic missile (TBM) maneuvers during the process of reentry, which makes the realization of interception somewhat difficult. In this paper a kind of trajectory maneuver-spiral maneuver is researched. At first, the mathematical model of spiral maneuver is developed. Then

based on a hit-to-kill missile, the simulation results verify the accuracy of the mathematical model. With the moving window Fourier transform, analysis of the time-varying Doppler signature in the joint time-frequency domain can provide useful information for target detection, recognition, tracking and interception [C11848]

"Micro-Doppler Signature Classification"

The micro-Doppler signature of a target is a time varying frequency modulation imparted on the radar echo signal by moving components of the target. Battlefield radar output the radar's baseband signal as audio and soldiers listening on headphones are able to identify the target from its micro-Doppler signature. Automation of this capability is desirable for improved reliability and reduction in classification time. For the first time dynamic time warping (DTW), a speech recognition technique, has been applied to the problem [C11849]

"High Accurate Multiple Target Detection in PCL Radar Systems"

A new approach in multiple target detection in PCL (passive coherent location) radars based on TV and radio ambiguity function processing is presented. Fast computation and high accuracy are the presented algorithm capabilities. Presented algorithm is a new and simple method which could provide perfect detection in noisy environment up to SNR=-30 dB [C11850]

"Resolution Theory of Polarization Sensitive Array Signals"

Resolving electromagnetic (EM) signals in both polarization and space domains is investigated based on polarization sensitive array (PSA). The resolution theory of PSA signals is brought forth, which parallels the resolution theory of radar signals. Novel concept of the ambiguity degree function of PSA signals is proposed and expressed in close form, depending on their polarization angles and arrival angles. The ambiguity degree function predicts whether two EM signals can be resolved or not. Two signals cannot be resolved when they come from exactly the same direction. However, the polarization discrimination can improve the resolving power [C11851]

"Low Cost Millimeter Wave Radars in the automotive field"

The first practical radar applications date from before World War 2, but radar techniques are widely used nowadays in a large number of mostly military or 'professional' civilian applications. They make use of extremely high frequencies generated by traditionally expensive technologies. Recent advances in electronics components, in terms of speed of development and cost, allow us to predict radar being used for civilian mass-market products, such as motor cars. In particular, these advances concern RF components in the millimeter wave bands with high-speed, wide-range digitization systems and digital signal processors [C11852]

"Survey on Radar ECCM Methods and Trends in its Developments"

With the development in the technology of electronic countermeasures, ECCM technology has become an essential issue of the performance of radar. This paper firstly presents the current developments in the technology of radar ECCM at home and abroad, and points out the challenges confronting radar ECCM methods at home; then analyzes the trends in the developments of radar ECCM methods, with a focus on the outlook of the application of modern signal processing methods and intelligent technology in radar ECCM, as well as the connection between the development of modern radar system and the progress of ECCM technology [C11853]

"An Adaptive Compensation of Moving Clutter Doppler Shift for Helicopter MTD Radar"

The accurate estimation and compensation of the moving clutter Doppler shift are essentials for the moving target detection of the airborne radar system. In this paper, a technique for the real-time estimation and compensation of the moving clutter Doppler shift due to the moving radar platform is presented for the airborne pulsed Doppler radar system. A new algorithm employs the dwell-time based clutter-lock MTD method in order to estimate and compensate the mean Doppler shift within antenna beam dwell time by using high speed DSP based Doppler FFT processing. Through the helicopter-borne radar flight test using real-time radar data acquisition system, the moving clutter Doppler spectrum is measured and analyzed in terms of various operational parameters [C11854]

"Collision Avoidance Radar for UAV"

A critical sensor characteristic for obstacle awareness and avoidance for UAV is assessed with the compliance of the equivalent level of safety regulation. Based on the assessment of the obstacle awareness and collision avoidance sensor, the small-sized, light-weighted radar sensor is proposed for the suitable candidate in meeting

with the system requirement as well as operational requirement of smart unmanned vehicle. The conceptual radar design result is also presented with the design parameters and the radar detection and avoidance procedure are simulated with the probability of obstacle detection and the avoidance scenarios. As a result of performance assessment for obstacle detection performance, probability of detection is more than 90% at the given required detection range. The performance of collision avoidance mode is also simulated based on the various radar range and range-rate data in the four different flight scenarios [C11855]

"Averaging of Sorted Bigenvalues for STAP"

Optimum STAP requires knowledge of the true interference covariance matrix. In practice, this matrix is not known and must be estimated from training data, which must be target-free and statistically homogeneous with respect to the range gate under test. These conditions are often not satisfied, which degrades the detection performance. Particularly, for ground moving target indication radar, the clutter Doppler frequency depends on range for all array geometries, except linear side-looking. This range dependency leads to problems in clutter suppression through STAP techniques. In this paper, we study issues associated with a novel technique, which works on the eigenanalysis of homogeneous clutter, to address this clutter range dependency problem. Simulation results show a significant improvement in processor performance as compared to conventional STAP techniques [C11856]

"A Novel Algorithm for Arbitrary Array Pattern Control With Broad Nulls"

A new algorithm for the optimal pattern synthesis of arbitrary arrays with prescribed broad nulls is presented, this method is similarly to the quadratic beampattern constraints method. The approach is to assume that the given array elements are used as elements of an adaptive array, with the adaptive beamforming theory, angles of interferences can be obtained, the null width and gain is controlled by introducing a large number of interfering signals at several angles throughout the prescribed broad nulls. Using the recursive least squares method, the width and relative gain of the broad nulls can be gotten [C11857]

"A Fast realization for spatial spectrum estimation on high speed DSP"

This paper is analysing the parallel decomposition of MUSIC algorithm in the spatial spectrum estimation by decomposing each step of the algorithm into different parts that can work simultaneously. 4 pieces of TI Corporation's high speed DSP chip (TMS320C40) are used for the parallel realization in this method. Consequently the calculation is greatly enhanced [C11858]

"Asymptotically Optimal Rank Test Detection in Long Tailed Clutter"

In this paper, the problem of finding optimum rank test signal detection in long tailed clutter is considered. For deriving the detector two assumptions are accepted. First a large number of reference samples are assumed, this assumption is realistic in a two dimensional radar detector. Besides, it is assumed that the signal to noise power ratio (SNR) is enough to achieve a considerable detection probability. As a result of these assumptions, the detector is optimum only asymptotically. The performance of this detector is compared with other commonly used rank test detectors. The results show that between these rank detectors, the performance of the rank sum test detector is very close to that of optimum detector [C11859]

"A Novel Preprocessing Approach for SAR ATR"

In this paper, a new preprocessing approach is proposed for SAR ATR. The effect of DC (direct current) bias among images on the ATR performance is studied and a new preprocessing method is proposed. The alignment, amplitude compensation and DC bias removal can be done efficiently in the frequency domain. Experimental results are provided to demonstrate the performance of the proposed approach [C11860]

"Null Function as a Fast and Accurate Algorithm for Noisy Environment Target Detection in PCL Radars"

A new fast and very accurate algorithm for target detection in PCL (passive coherent location) radars is presented. This algorithm in noisy environment that SNR is low as -45 dB operates, with an error less than 20 percent. Presented algorithm is capable for target detection by few samples of signals and obtains real-time processing in passive radars [C11861]

"Novel Long-Term Coherent Integration Method For Moving-Target-Detection"

In radar signal processing, clutter suppressing and moving targets detection are basic problems. In order to

detect the weak targets effectively, a novel method of long-term coherent integrated moving-target-detection based on the fractional Fourier transform is proposed in this paper. This method can compensate the Doppler migration and suppress the clutter effectively by using the discrete FRFT as the swept-frequency filter bank. The simulation results show that it has better performance of weak targets detection than the classical MTD and its computation burden is acceptable, which prove the validity of this method [C11862]

"Imaging Performance Analysis of Space-Air Non-Cooperative BSAR"

Space resolution expressions presented in terms of satellite parameters for space-air non-cooperative BSAR system are derived considering the effect of Earth rotation and circular Earth surface on spacecraft platform. Based on the expressions, spatial attitude optimization scheme for aircraft platform is given to optimize space resolution once the spacecraft as non-cooperative transmitter is determined. The derived expressions also provide insight into the relationships between the resolution performance and satellite orbit parameters: the orbit altitude is of the importance rather than the orbit inclination angle; antenna beamforming technique is necessary for system utilizing low orbit spacecraft in strip mode since the imaging scene length is very limited and the resolution performance is not satisfying. Simulation results with Envisat satellite and GLONASS satellite as transmitter respectively demonstrate these analyses [C11863]

"Principles of UWB Multisite Radar Devices for Searching Survivors in Rubble"

A combination of prospective ultrawideband (UWB) technology and multisite radar systems (MSRSs) technology is considered for detection and coordinate measurement of motionless survivors in rubble. Main attention is paid to effective detection of weak signals from a moving human chest due to breathing in a background of clutter (intensive reflections from environment) as well as to high accuracy of survivor position determination, especially its angle coordinates. Large signal attenuation and unknown additional delay of signals propagating through rubble are taken into account [C11864]

"A Monopulse Based Correlation Technique for De-Garble Processing of SSR Replies"

Secondary surveillance radar (SSR) aids in the identification of aircrafts and often works in conjunction with the primary radar for better target awareness. An important module of the SSR system is the reply signal processor unit. One of the major issues in reply processing is the occurrence of garbled replies, which occurs due to the overlapping of replies. Overlapping occurs when range difference between the two targets is less than de-garble resolution (3045 m). In practical scenarios SSR replies are often garbled (e.g.: formation flights). So efficient de-garbling algorithms are required for providing the target identification. In this paper a new algorithm towards de-garbling of SSR replies is discussed. The information derived from the delta to sigma ratio channel (Delta/Sigma) and the Sigma (sum) channel of the monopulse receiver are effectively combined for separating the garbled replies [C11865]

"Real-time Net-booting System In Large-scale DSP Network"

The demand from radar application and the key technique on real-time net-booting a large-scale DSP network is substantially analyzed. In the large-scale scenario, we have scrutinized the booting performance and constructed a real-time net-booting system, an inexpensive implementation with it. In the end of the paper, a practical application via TigerSHARC DSP processor is introduced [C11866]

"Novel Approaches for DOA Estimation of Coherent Sources in the Presence of Impulsive Noise"

This paper is concerned with the direction of arrival (DOA) estimation of coherent sources in impulse noise fields modeled as symmetric alpha stable (S alphaS) distribution. Robust covariation (ROC) based MUSIC and fractional lower moment (FLOM) based MUSIC cannot be used to estimate the DOA under these conditions. New forward-backward smoothing (FBS)-covariation matrices and FBS-FLOM matrices are first defined by applying the spatial smoothing idea to covariation matrices and FLOM matrices. Two novel algorithms based on FBS-covariation matrices and FBS-FLOM matrices are presented in the meantime. Theoretical analysis shows that noise subspace can be estimated by the eigen-decomposition of FBS covariation matrices and FBS-FLOM matrices so as to estimate the DOA of coherent sources in impulse noise. Moreover, performance of two new algorithms is analyzed by comparison. Computer simulation results verify the correctness and effectiveness of the proposed methods [C11867]

"Relative Speed Step Size in SAR processing for Moving Target Detection"

Ground moving target indication (GMTI) using synthetic aperture radar (SAR) is studied in this paper. For systems using long integration time relative speed between the target and the SAR platform has to be included

in the detection algorithm. A separation between the true relative speed and the relative speed used in the SAR process will cause unfocused targets. Unfocused targets decrease the detectability. In the detection phase of SAR moving targets blind hypothesis on relative are used. The step size between the hypotheses or the quantization step in relative speed is a trade off between the number of hypotheses to test and detectability. A large number of tests will increase detectability but will also increase computation load and vice versa. The importance of relative speed increases as the azimuth integration time gets larger. Long integration time is associated with low signature moving targets detection in strong clutter environment and especially for SAR GMTI at low frequencies. In this paper we determine the optimum quantization of relative speed for moving target detection. The optimum quantization is derived from the moving target impulse response. By using the optimum quantization the computation burden in SAR GMTI is reduced and the detectability secured [C11868]

"Blind Signal Separation Based on Feed-forward and Feedback Neural Network"

The algorithm based on feed-forward and feed-back NN combines both the algorithm based on feed-forward NN and the algorithm based on feed-back NN. It separates the signal blindly by modifying the feed-forward separating matrix and the feed-back separating matrix at the same time. It has both strong adaptability and fast convergence ratio. Finally, the algorithm was used to separate several typical radio fuse signal blindly, and the computer simulation was made. The simulation result was ideal, indicates the algorithm to be effective [C11869]

"Multiresolutional Maneuvering Target Tracking with Average Interpolation and Parallel Implementation"

The difficulty for tracking maneuver target is to decide whether a maneuver occurs and when the target begins to maneuver. Since target tracking is a real time problem, the crucial factor is to detect the target maneuver as accurately and quickly as possible. A new approach for the maneuvering target tracking is presented, especially for the target maneuver detection in heavy noise. The algorithm is based on the criterion where the maneuver detection delay is made minimum, which replaces the original measurements by those of the average interpolation to reduce the delay to avoid tracker divergence, and uses wavelet transforms to increase the probability of detection. However, it requires much more computation time, which may be critical in a real-time application. With parallel processing techniques, a parallel implementation of the algorithm is also proposed by multibus computer system with three CPUs. Simulation results show that our scheme has the superior performance than conventional algorithms especially for tracking maneuvering targets in heavy noise, while approaching the same computation time as those. The algorithm has great potential for real-time applications [C11870]

"The Imaging Principle and Method based on Distributed Multi-channel radars"

We propose the imaging principle based on distributed multi-channel radars, in which multiple sparse transmitters and receivers are appropriately arranged according to the request about wave-number samples. The imaging radar can reconstruct target two-dimensional reflectivity function by coherent processing the echo signals in multi-channels. Moreover, large antennas are not required, and movement compensation need not be performed. For the distributed radars with the given distribution of transmitters and receivers, the phase errors are analyzed and the coherent processing methods in ISAR technique are applied to image targets. Finally the simulations are given to validate the imaging performance [C11871]

"Adaptive Multipath Cancellation Algorithm in Passive Radar"

In passive radar system, multipath components including direct wave heavily degrades the performance of target detecting. This paper is focused on adaptive multipath cancellation algorithm in passive radar. In order to evaluate the level of cancellation required, the self-ambiguity of FM is analyzed, and the necessary minimum ratio of interference suppressed is brought forward. According to the similarity of multipath model and FIR filter, high order adaptive filter is introduced to suppress interference from far distance obstacles. Simulation and field experiments are carried out to verify its performance and feasibility [C11872]

"Range Alignment in ISAR Motion Compensation Based on Minimum Sum"

A new technique is proposed for range alignment in inverse synthetic aperture radar (ISAR). The basic idea is to perform range alignment using a minimum sum criterion. By minimizing the sum of the combined envelope of two adjacent echoes, the amount of range shift between them can be automatically tracked out. The combined envelope is constructed by a 'max' operation, which only reserves the larger elements of the two echoes. This algorithm has been used to process real ISAR data and the results demonstrate the effectiveness of the method [C11873]

"Fast and Accurate Polynomial-Phase Signal Parameter Estimation"

A new method for estimating the parameters of a complex polynomial-phase signal in complex white Gaussian noise is proposed. Its computational complexity is comparable to the S. Peleg's method, but it approaches the Cramer-Rao bound (CRB) down to much lower signal-to-noise ratio (SNR) values. Simulation results are included to demonstrate the performance of the proposed method [C11874]

"Using the Amplitude Fluctuation Property of Target HRRP for Radar Automatic Target Recognition"

Due to the aspect sensitivity of high-resolution range profile (HRRP), traditional radar HRRP target recognition methods usually use average profile within some target-aspect region as the target-aspect template. Actually, the amplitude fluctuation property of target HRRP also represents some feature information of the target. Based on the scattering center model, a new feature extraction method using the amplitude fluctuation property of target HRRP is proposed in this paper. The weighted HRRP feature extracted by the new method can represent the scatterer distribution in every range cell, thereby it can describe the scattering property of the target better. The experimental results based on measured data show that the new feature extraction method can greatly improve recognition performances [C11875]

"Radar Automatic Target Recognition Based on Complex High-Resolution Range Profiles"

Radar high-resolution range profile (HRRP) has received intensive attention from the radar automatic target recognition (RATR) community. Usually, complex HRRPs are not fully used for RATR but only their amplitude vectors, while the phase information of them is discarded due to the fact that the initial phase of a complex HRRP is strongly sensitive to target position variation. However, the phase information of complex HRRPs may also contain valuable target discriminant information, which may further improve the recognition performance. This paper concerns RATR using complex HRRPs. To deal with the initial phase sensitivity of complex HRRPs, we extract the complex HRRPs' feature subspace within each target-aspect sector of each target via principal component analysis (PCA) as the corresponding template during the training phase, while in the test phase, project the test sample onto each feature subspace and search the optimal approximation of the test sample with the minimum reconstruction error to decide which target the test sample belongs to. It is shown that the whole process is independent of the initial phases of complex HRRPs. Furthermore, to make the proposed recognition method more practical, a fast time-shift compensation algorithm is proposed. In the recognition experiments based on measured data, the proposed recognition method using complex HRRPs achieves better recognition results than that using only the amplitude vectors of the complex HRRPs [C11876]

"A novel similar clutter jamming (SCJ) method to high-resolution SAR"

A novel similar clutter jamming (SCJ) method to high-resolution synthetic aperture radar (SAR) is discussed. The obvious properties of this method are that its jamming signal is matched to the SAR's receiver and is provided with similar statistical characteristic of high-resolution SAR clutter. Resorting to CV distance and simulation validate that the simulated clutter distribution after SAR processing system is good fit with the theoretical high-resolution clutter distributions [C11877]

"Radar Targets Detection in Formation Based on Time-Varying AR Model"

A novel method for radar targets detection in formation is proposed based on the instantaneous frequency (IF) estimation of radar echoes. The time-varying autoregressive (TVAR) model is selected to model the signal and the IF is estimated using the phase of model polars. With the polars selection process and the fusion of the echoes' time-varying frequency estimation at different range cells, the algorithm is enhanced in robustness [C11878]

"The Study of Radar Resolution Experiment Method"

The article introduces the factors that influence radar resolution, due to the definition of radar resolution, analyzing the shortcomings in radar resolution experiment and giving a new method of radar resolution experiment-simulation method [C11879]

"Radar HRRP Target Recognition using influence region of samples"

The k-nearest neighbour (KNN) rule using Euclidean distance is actually the same as template matching method under the maximum correlation coefficient criterion (MCC-TIMM), which has been widely used in high resolution range profiles (HRRPs) based radar automatic target recognition (RATR). The nearest neighbor rule treats each

training sample equally without consideration of different recognition performances due to its congregation around the other samples coming from the same class and segregation from those of the rest classes. In this paper, we propose an adaptive method that takes into account the effective influence size of each training sample and the statistical confidence with which the label of each training sample can be trusted. The experimental results confirm the effectiveness of the proposed method [C11880]

"Fractal Features and Detection of Meteor Interference in OTHR"

Backscatter signal from OTHR receiver may contain strong noise and interference background, among which the meteor echo is a typical and strong Impulsive interference. This meteor echo may inject transient but great power into the receiver, arise the noise floor in the range-Doppler map and decrease SNR. So it must be suppressed before target tracking. Many solutions are presented for meteor echo excisions, among which the meteor position must be estimated firstly. Usually the ocean clutter is so strong that it may cover other signals such as target and meteor, so it must be suppressed before position estimation. Different from these approaches, this paper proposes a novel algorithm of meteor position estimation without depressing clutter. The main idea is focused on the different fractal dimension corresponding to the ocean clutter and the meteor echo. Accounting for the real-time processing requirements, an effective of directional fractal dimension based on the fractional Brownian motion model is also proposed. Experiments prove that it is an effective method [C11881]

"Range Pre-filter Realization of Ground Real-time Imaging processor for Spaceborne SAR"

Under the condition of meeting resolution, the SAR real-time imaging processor can satisfy the demands of the processing band through pre-filter and down-sample. Because of the special position in the signal processor, ranger pre-filter needs very high operation speed and better response performance. The principles of pre-filter and the methods to achieve the pre-filter are introduced in this paper. The study, focusing on the difference between ADSP-TS101S and XC4VSX35. FPGA in implementing the high performance filter, results that FPGA has the advantage over DSP. In conclusion, the results of the practical experiments are given to illuminate the rationality of the design [C11882]

"Fast Algorithm for Root-MUSIC with Real-Valued Eigendecomposition"

A fast algorithm for the root-MUSIC with real-valued eigendecomposition is considered. This algorithm reduces the computational complexity in the eigenanalysis stage of root-MUSIC because it exploits the eigendecomposition of a real-valued covariance matrix. The asymptotic performance of root-MUSIC with real-valued eigendecomposition (RVED-root-MUSIC) is analyzed and compared with that of conventional root-MUSIC. The coefficients of the polynomial for root MUSIC is deduced and given the concrete calculation formula, so that the speed of polynomial finding roots gets the bigger exaltation. The results of this comparison show identical asymptotic properties of both algorithms in the case of uncorrelated sources and a better performance of RVED-root-MUSIC in scenarios with partially correlated or fully coherent sources. Additionally, our simulations and the results demonstrate an improved performance of RVED-root-MUSIC relative to conventional root-MUSIC [C11883]

"Design of Multi-carrier Digital Frequency Synthesizer for Coast-ship Multi-static GroundWave OTH Radar"

To design a digital frequency synthesizer of multi-carrier frequencies for the coast-ship multi-static ground wave over-the-horizon (OTH) radar, an analysis of the approach has been made by using multiple DDS chips AD9854. The constitution of the radar is introduced briefly. The synthesizer generates multiple signals of linear frequency modulated interrupted continuous wave (LFMICW) which should have different carrier frequencies as well as controllable initial phases and will be transmitted simultaneously. An effective method for generating LFMICW by advanced DDS technology is proposed in the paper. The designs of the FPGA control logic and the peripheral circuits are presented as well. The synthesizer has been implemented in the experimental radar system. The experimental results indicate that the phase noise of the frequency synthesizer is $-92.6\text{dBc}@1\text{Hz}$, which has met the stability demands for long term coherent integration in high frequency ground wave radar [C11884]

"Advanced High Precision Radar Gauge for Industrial Applications"

This paper presents a highly accurate and reliable radar gauging system for continuous level measurement in industrial bulk storage tanks. The radar system has a compact size and is explosion proof. It consists of a stepped frequency continuous wave (SFCW) transmitter and receiver with monostatic gastight antenna. The frequency range is from 9.5 to 10.5 GHz. With advanced signal processing software algorithms implemented in the microprocessor, the accuracy of plusmn0.3 mm over whole measuring range has been obtained. Even if under severe multi-path effect from tank wall and mismatched high-mode interference in standpipes, an

accuracy of plusmn1 mm can still be attained [C11885]

"Performance Analysis of A Long-Term Integration Algorithm for Space-borne Radar Based on Segment Processing"

Long-distance detection and tracking of weak targets in outer space is one of the key problems for the space-borne radar. Long-term Doppler integration technique is commonly used to improve detection range while the transmitter power is fixed. However, the real-time processing ability and memory volume limitation of DSP chips usable in outer space make it hard to implement long time Doppler coherent integration. Therefore, a long-term integration processing algorithm is proposed, combined intra-segment FFT processing and inter-segments DFT processing in the integration period to achieve long-term coherence ability. More emphasis is put on the performance analysis of the proposed algorithm. It proved the algorithm is quite fit for the real-time processing and greatly reduces the memory demand. Compared with the ideal theoretic coherent integration gains, SNR losses of the segment processing are only 2.4 dB. Finally, the computer simulations demonstrate the validity of theoretical analysis results [C11886]

"Suppressing Range Ambiguity for Spaceborne Synthetic Aperture Radar Based on Linearly Constrained Minimum Variance Algorithm"

The range ambiguity of the spaceborne synthetic aperture radar (SAR) is serious, because of the wide swath and the large detection range. This also decreases the radar image quality. Increasing the antenna height can solve this problem. But usually the satellite platform can not load the large antenna. So the range ambiguity suppression is an important problem for the spaceborne SAR. In this paper, the mathematical model of the range ambiguity is presented first. The difference between the average range ambiguity signal ratio (ARASR) and the distributed range ambiguity signal ratio (DRASR) is analyzed. Then an approach of the range ambiguity suppression for the spaceborne SAR based on the linearly constrained minimum variance (LCMV) algorithm is proposed. Simulation results prove that this approach improves not only the ARASR but also the DRASR under the condition that the antenna height is not needed to be changed. This method will be useful for achieving the wide swath [C11887]

"Prediction of Sea Clutter Based on Chaos Theory with RBF and K-mean Clustering"

Artificial neural network (ANN) has been widely applied in time series analysis, typically, it can give an effective method to solve complicated problems which are too complex to understand in physic and statistic method, or observation data varied statistically and the data generated in nonlinear mechanism. Based on the underlying dynamic mechanism of the sea clutter, to reconstruct the nonlinear model of dynamical phase space, correlation integral (also called C-C method) and Cao method are used to get time delay τ and embedding dimension m in this paper. Furthermore, an algorithm of radial basis function (RBF) with k-mean clustering to adjust and modify the networks is also presented to predict the nonlinear characteristic sea clutter for the goal of detecting the weak target signals beneath the sea clutter. With the new algorithms, computation complexity can be deduced while its reliability can be greatly improved. It also can satisfy the real-time requirement in real application. More detailed calculates and test results are presented [C11888]

"An Improvement on Adaptive Diffusion for Detecting Nonstationary Signals"

Time-frequency analysis aims to construct a density function of time and frequency to reveal the frequency components in signals to be analyzed and the evolution of the frequency of signals with time. The Wigner distribution (WD) is one of the most fundamental and widely used methods for analyzing nonstationary signals in the fields of radar, communication, etc. Despite its remarkable properties, the application of the WD is greatly limited by the existence of interference terms. An adaptive diffusion method originally used in image processing was proposed to remove the interference terms of the WD by Julien Gosme, Cedric Richard and Paulo Goncalves in Nov 2005. This method is to be invalid in the presence of very strong interference terms generated by signals whose distributions are interweaved together in the time-frequency plane of the WD. We combine the diffusion technique with difference method for removing these interference terms to efficiently improve the resolution and readability of the time-frequency representation of the Cohen class [C11889]

"DVB-T Signal Cross-Ambiguity Functions Improvement for Passive Radar"

This paper proposes a digital video broadcasting-terrestrial (DVB-T) signal cross-ambiguity functions (CAF) improvement technique by modifying the guard interval and the pilots in the direct channel, which can remove the unwanted deterministic peaks in the DVB-T passive radar effectively. The key of CAF improvement is the pilots modification directly on the pilot carriers based on the DVB-T signal ($f_s=64/7$ MHz), which reduces the

computation complexity and is convenient for realization as compared with the conventional filters and equalizers. The DVB-T signal is acquired by the experiments ($f_s = 64/7$ MHz). A thumbtack CAF is achieved at the expense of 13.4% power loss (-0.6 dB) [C11890]

"Receiving Signal Processing of Wideband MIMO Radar Based On Transmitting Diversity"

Multiple input multiple output (MIMO) radar is a new radar technique developed recently. This paper described the principle of wideband MIMO radar based on transmitting diversity and presented its receive signal processing method. Simulation results show that the proposed wideband receive signal processing method can effectively accomplish matched filter and simultaneously form multiple receive beams and surveillance multiple targets [C11891]

"TSAR Imaging of Multiple Targets Based on Adaptive Gaussian Chirplet Decomposition"

When multiple moving targets are close in the same radar beam and can not be separated in range, the conventional ISAR imaging motion compensation algorithms can not get clear images. However, these targets have different velocities and directions, so their Doppler histories of returned signals are different. In a short time, these Doppler histories can be treated as approximately linearly changing frequency signals. Based on which this paper proposes a new method of ISAR imaging of multiple targets using a fast refinement adaptive Gaussian chirplet decomposition algorithm. The method can separate different linear changing Doppler returned signals easily and get their parameters directly. After separating the returned signals of all targets, the conventional ISAR motion compensation algorithm can be used to get clear image of each target. The effectiveness of the method is demonstrated by numerical simulations [C11892]

"A Simple Multistatic Radar Based on Alamouti Space-time Code"

Bistatic and multistatic radar plays an important role in modern warfare. A simple multistatic radar is proposed based on Alamouti space-time code. The structure of the multistatic radar and signal model is studied. The detection performance of the multistatic radar is also analyzed. Taking advantage of spatial diversity gain, the radar performance is dramatically improved compared to the current multistatic radar [C11893]

"A New Approach for 2-D Spectrum Estimation"

In this paper, a new approach of 2-D MUSIC algorithm was proposed. Using the eigenvector and the eigenvalue of the covariance matrix simultaneously, this method dispenses with 2-D searching. The computation load of this 2-D method is alleviated effectively. The pairings of the estimated parameters are automatically determined and the estimation precision is high. Simulation results are presented to demonstrate the performance of the proposed method [C11894]

"Monte Carlo Evaluation of Multi-Look Effect on Entropy/Alpha /Anisotropy Parameters of Polarimetric Target Decomposition"

Entropy, alpha and anisotropy ($H/\alpha/A$) of the polarimetric target decomposition of Cloude and Pettier has been an effective and popular tool for polarimetric SAR image analysis and geophysical parameter estimation. However, multi-look processing can severely affect the values of these parameters. In this paper, a Monte Carlo method is used to evaluate the multi-look effect on these parameters for various media of grass, forest and urban. The effect of pixel correlation due to over sampling, and the mixed pixel effects will also be investigated. DLR/E-SAR and JPL/AIRSAR L-band data are used in this study. [C11895]

"Recent Advances in Polarimetry and Polarimetric Interferometry"

Radar polarimetry radar Interferometry and polarimetric SAR interferometry represent the current culmination in 'microwave remote sensing' technology, but we still need to progress very considerably in order to reach the limits of physical realizability. Whereas with radar polarimetry the textural fine-structure, target orientation, symmetries and material constituents can be recovered with considerable improvement above that of standard 'amplitude-only' radar; by implementing 'radar interferometry' the spatial (in depth) structure can be explored. With polarimetric interferometric synthetic aperture radar (POL-IN-SAR) imaging, it is possible to recover such co-registered textural and spatial information from POL-IN-SAR digital image data sets simultaneously, including the extraction of digital elevation maps (DEM) from either polarimetric (scattering matrix) or interferometric (dual antenna) SAR systems. Simultaneous polarimetric-plus-interferometric SAR imaging offers the additional benefit of obtaining co-registered textural-plus-spatial three-dimensional POL-IN-DEM information, which when applied to repeat-pass image-overlay interferometry provides differential background validation and environmental stress-change information with highly improved accuracy. Then, by either designing multiple dual polarization antenna

POL-IN-SAR systems or by applying advanced POL-IN-SAR image compression techniques, will result in 'POL-arimetric TOMO-graphic' (multi-interferometric) SAR or POL-TOMO-SAR imaging. By advancing these EWB-D-POL-IN/TOMO-SAR imaging modes, we are slowly but steadily approaching the ultimate goal of eventually realizing airborne and spaceborne 'geo-environmental background validation, stress assessment, and stress-change monitoring and wide-area military surveillance of the terrestrial and planetary covers'. [C11896]

"Study of Hurricanes and Typhoons from TRMM Precipitation Radar Observations: Self Organizing Map (SOM) Neural Network"

Precipitation radar (PR) on Tropical Rainfall Measuring Mission (TRMM) satellite provides high resolution vertical profile of reflectivity (VPR) of tropical storms. Three-dimensional downward-looking observations of tropical storms are very useful to study Hurricanes and Typhoons. The increased reflectivity measured in bright band (BB) region can lead to rainfall overestimate. It is also known that VPR of BB holds extensive information on the types of precipitation and their variability. Better knowledge of VPR of storms is important to understand cloud dynamics and microphysical processes, and to improve satellite retrieval algorithm. Because of a large number of VPR observation, it is of interest to classify the VPR into characteristic profiles so that it can be useful in studying and comparing different vertical reflectivity profiles. In this study, Self Organizing Map (SOM) Neural Network is used as a method to study and classify VPR of Hurricanes and Typhoons. SOM is unsupervised neural network. It forms a non-linear mapping of the data to a two-dimensional map grid that can be used as an exploratory data analysis tool for generating hypotheses on the relationships of VPR. Similarity relationships within the VPR data and its vertical structure can be visualized and interpreted. Preparation of vertical profile of reflectivity used as input vectors of SOM algorithm is one of the most vital steps. In total eleven Hurricanes and forty Typhoons are studied. VPR of Hurricanes and Typhoons are classified into characteristic profiles. The result of classification shows a distribution that indicates location of each characteristic profile within a storm when viewed from the PR. Percentages of contribution of each characteristic profile to Hurricanes and Typhoons can also be determined. By using SOM, VPR can be classified into various numbers of classes up to one hundred. In this study, VPR is classified into four classes. Two simple operations were performed. Firstly, SOM was applied to all VPR data regardless of rain type. Secondly, stratiform and convective portion of VPR was applied to SOM separately. For stratiform portion of Hurricanes and Typhoons, the bright band (BB) properties including the height of BB peak, BB thickness, reflectivity of BB peak and BB sharpness index of Hurricanes and Typhoons are investigated and compared to those of generic oceanic storm. Comparison of those BB properties of Hurricanes, Typhoons and generic oceanic storm reveals similarities and differences among them. [C11897]

"Polarimetric Analysis of Radar Signature of a Manmade Structure"

First Page of the Article [C11898]

"A Time Series Approach for Soil Moisture Estimation"

Soil moisture is a key parameter in understanding the global water cycle and in predicting natural hazards. Polarimetric radar measurements have been used for estimating soil moisture of bare surfaces. In order to estimate soil moisture accurately, the surface roughness effect must be compensated properly. In addition, these algorithms will not produce accurate results for vegetated surfaces. It is difficult to retrieve soil moisture of a vegetated surface since the radar backscattering cross section is sensitive to the vegetation structure and environmental conditions such as the ground slope. Therefore, it is necessary to develop a method to estimate the effect of the surface roughness and vegetation reliably. One way to remove the roughness effect and the vegetation contamination is to take advantage of the temporal variation of soil moisture. In order to understand the global hydrologic cycle, it is desirable to measure soil moisture with one- to two-days revisit. Using these frequent measurements, a time series approach can be implemented to improve the soil moisture retrieval accuracy. [C11899]

"Extended Multidimensional Speckle Noise Model and its Implications on the Estimation of Physical Information"

The presence of speckle noise in Synthetic Aperture Radar images prevents a correct interpretation, as well as, the information retrieval processes. It has been recently demonstrated that speckle noise may introduce biases into the retrieved physical information when multidimensional data is considered. In case of multidimensional SAR systems, for single-look data, it has been proved that speckle noise is due to the combination of multiplicative and additive noise sources. This paper details the extension of this noise model to multilook, multidimensional SAR data. [C11900]

"Rain Retrieval Performance of a Dual-Frequency Radar Technique with Differential Attenuation"

Constraint"

Assessments on the performance of dual-frequency (13.6/35.5 GHz) precipitation radar (DPR) rain retrieval techniques are performed through simple vertical rain profiles synthesized with arbitrarily defined and disdrometer-measured raindrop size distribution (DSD) data. A DPR inversion technique (DPR-IT) with the estimates of differential attenuation (DA), which used to resolve the path-integrated attenuation (PIA) information instead of relying on surface reference or iterative methods, is considered mainly for the analysis. Preliminary simulation results show that the DPR-IT with DA constraint can work as an independent way to extract the DPR PIA information, hence, the DSD parameters, especially in the regions of moderate to strong rainfall rates.

[C11901]

"Utilization of Support Vector Machine based on Neural Network to Suppress Ocean Clutter and Zero Frequency Disturbances"

The paper proposes a new multi-classifier for pattern recognition by combining neural network with SVM (support vector machine). The multi-classifier has the advantages of SVM and NN (neural network). According to the properties of Bragg peak, zero frequency disturbance and the target of moving with time-varying velocity among the echo signal of HFSWR (high frequency surface wave radar), the multi-classifier is utilized to process the result of decomposing radar echo with chirplet atom and separate them. Then the ocean clutter and zero frequency disturbances can be suppressed according the result of classifying. A new means by utilizing HFSWR to detect the target moving with time-varying velocity is provided in the paper. [C11902]

"Single Camera 3D Lane Detection and Tracking Based on EKF for Urban Intelligent Vehicle"

Road boundary detection and tracking is an important and integral function in advanced driver-assistance system. This paper proposes an algorithm, which can follow multi-kinds of lane, straight and curved, quickly and robustly. The algorithm uses several masks to extract blobs of road markings, combining with KNN function to remove the disturbance. Further more, road is modeled as a 3D surface, and some important parameters of current lane are provided on real-time by tracking based on Extended Kalman Filter (EKF). The results of experiments, which have been done in urban road, show that the algorithm is adapted to many road conditions. Even in a complex driving environment, it also has a good performance. [C11903]

"MAP Filtering for SAR Images Based on Heavy-Tailed Rayleigh Modeling of Speckle"

Traditional Rayleigh distribution cannot accord with the heavy-tailed statistics of speckle because of the use of central limit theorem. In this paper, speckle in synthetic aperture radar (SAR) amplitude image is modeled as heavy-tailed Rayleigh distribution based on the non-Gaussian assumption of complex echo in each resolution cell, and the maximum a posteriori (MAP) filter is presented using gamma prior distribution. Based on Mellin transform, parameters of heavy-tailed Rayleigh distribution are estimated from the observed image. The de-speckling experiments and their quantitative measures demonstrate that the MAP filter based on heavy-tailed Rayleigh modeling of speckle owns higher capability of noise suppression compared to the one using the traditional Rayleigh distribution and the linear minimum mean square error (MMSE) filter. [C11904]

"The Role of C-band Dual Polarization Radars for GPM Ground Validation"

Dual polarization weather radars have brought in significant advancement to precipitation observation, as rainfall rate estimation, microphysical characterization, and hydrometeor classification. The improvements have been mostly demonstrated at S-band frequency where attenuation effects are usually negligible. In Europe C-band is largely adopted in operational and research radars because of larger differential phase measurements, reduced antenna size and an overall lower cost with respect to that of S-band systems. The major disadvantage is that the signal attenuation is not negligible. In the context of GPM Ground Validation, techniques to compensate the reflectivity measurements for propagation effects are thus necessary to obtain GV products from ground-based C-band radars. The attenuation correction methodology using differential phase shift as constraint has shown a good performance. One of the advantages of polarimetric radar measurements is their self-consistency. Starting from the initial guess of attenuation correction provided by the rain profiling algorithm, self-consistency is used in an iterative technique to improve the accuracy of attenuation correction at C-band. The obtained accuracy is evaluated in terms of bias and standard error using C-band profiles generated from S-band dual polarization observations. [C11905]

"Development and Validation of Spaceborne Dualfrequency Precipitation Radar for GPM"

After the great success of the Tropical Rainfall Measuring Mission (TRMM), 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 DPR installed on the GPM core satellite. In order to estimate accurate precipitation rate value, calibration and validation of the DPR algorithms and products are essential. From the experiences of TRMM validations, it is important for the DPR algorithm validation to compare between precipitation rate through the calculation of DPR algorithm and that of the directly observed precipitation rate over the validation site. For this purpose, the most important and difficult issue is to construct the database of the physical parameters for the precipitation retrieval algorithms of DPR from the ground-based data using well-calibrated instruments. [C11906]

"Detection and Recognition of Target Signals in Radar Clutter via Adaptive CFAR Tests"

In this paper, adaptive CFAR tests are described which allow one to classify radar clutter into one of several major categories, including bird, weather, and target classes. These tests do not require the arbitrary selection of priors as in the Bayesian classifier. The decision rule of the recognition techniques is in the form of associating the p -dimensional vector of observations on the object with one of the m specific classes. When there is the possibility that the object does not belong to any of the m classes, then this object is to be classified as belonging to one of the m classes or to class $m+1$ whose distribution is unspecified. The tests are invariant to intensity changes in the clutter background and achieve a fixed probability of a false alarm. The results obtained in this paper agree with the simulation results, which confirm the validity of the theoretical predictions of performance of the suggested adaptive CFAR tests. [C11907]

"Polarimetric Characteristics of Radar Echoes from the Sea Surface as a Function of Incidence Angle"

This paper presents some initial results of polarimetric radar measurements made over a range of look-down angles using the DSTO high resolution multi-band radar. Specifically, X-band polarimetric measurements of the sea were made from 95 m high cliffs along the Great Australian Bight, for look-down angles of 3deg, 4deg, 5deg, 10deg, 15deg, 20deg, 25deg and 30deg. The analysis is addressing scattering matrix element statistics, entropy-alpha space distributions and correlation with visible spectrum imagery. [C11908]

"Evaluation of eCognition for Assisted Target Detection and Recognition in SAR Imagery"

Defence R&D Canada-Ottawa (DRDC Ottawa) has been assessing custom off-the-shelf (COTS) software products and developing custom tools that can assist image analysts (IAs) to complete their tasks more quickly and efficiently. In some cases, IAs are tasked with detecting targets of interest within large-area surveillance operations, and these detection tasks may be repeated with a regular flow of incoming imagery. SAR imagery is a data source of choice for large-scale detection operations due to its ability to image in all weather conditions without external illumination sources. An activity was undertaken to evaluate ecognition (a COTS product) for target detection in SAR imagery and as a means of facilitating workflow improvements in the course of target detection and surveillance activities. eCognition is segmentation-based classifier that uses fuzzy reasoning techniques, enabling users to represent fuzzy rules in a human reasoning-like form. It offers the promise of being a usable tool that fulfills the objective of providing improvements over the traditional practice of manual inspection for target detection and surveillance. This paper reports on the evaluation process and findings when using ecognition for ship detection and land vehicle detection in SAR imagery. [C11909]

"Target Classification by Means of Fully Polarimetric ISAR Images"

In ISAR systems, fully polarimetric capabilities have not been fully exploited for target classification or recognition. In this paper, a full system that reconstructs the polarimetric ISAR image and classifies the target is proposed and tested on simulated data. [C11910]

"A New Polarimetric CFAR Ship Detection System"

The objective of the proposed work is to develop optimal polarimetric Constant False Alarm Rate (CFAR) detector for ship detection. Polarimetric transformations and decompositions, clutter analysis, modeling, Principal Component Analysis (PCA), and multi-CFAR detection are the necessary components of optimal polarimetric CFAR ship detectors. The resulting CFAR detector outperforms the conventional polarimetric CFAR detector by providing higher probability of detection. Optimal polarimetric CFAR detection procedures are proposed in this report. Given the simulated polarimetric RADARSAT-2 data, different polarimetric transformations and decompositions are applied. The resulting images will be transmitted to an adaptive Principal Component Analysis (PCA) block. Through the adaptive PCA block, the image of the first principal component which has the highest SNR among all the images (including the original, transformed/decomposed images, and the images after the adaptive PCA) will be used for ship detection. Optimal multi-CFAR detection will be applied to this image and then the final decision will be made. [C11911]

"Accurate DEM Reconstruction from Permanent Scatterers and Multi-baseline Interferometry"

The application of the Permanent Scatterers (PS) Technique in multi-temporal data-sets, namely the identification and exploitation of sparse coherent targets, has shown that it is possible to estimate and remove interferometric phase components due to atmospheric effects and orbital fringes. So far, the application of the PS technique has been focused on the extraction of the motion field of the area of interest. However, it is also known that PS relative elevations can be estimated with sub-meter precision while smooth errors can be removed using a coarse resolution DEM or the data of the Shuttle Radar Topography Mission (SRTM). In this paper, we describe a new approach combining the PS Technique and standard interferometry to improve the quality of InSAR DEM's. ERS Tandem interferograms are exploited to increase the number of coherent pixels, while atmospheric effects are estimated and subtracted by means of the sparse PS grid. Prior information and PS elevation are used to reduce the probability of phase-unwrapping errors. Preliminary results are reported and the key-factors for its successful application (e.g. the number of Tandem acquisitions available, PS density) are discussed. [C11912]

"Ground Response Tracking for Improved Landmine Detection in Ground Penetrating Radar Data"

Recent advances in ground penetrating radar (GPR) fabrication and signal processing have made high fidelity detection of buried anti-tank landmines a practical possibility under field scenarios. However, detection of subsurface landmines at a low false alarm rate (FAR) requires the effective removal of the response from the air/ground interface (ground-bounce response). This in turn requires accurate and automatic tracking of the time of arrival of the air/ground interface in time-domain GPR data. Such tracking of the ground bounce response can be difficult to perform under certain conditions including the presence of surface-laid landmines, surface vegetation, snow drifts, and multiple subsurface structures like buried roadbeds. In this work, we will explore the application of a low-latency Kalman filter applied to ground bounce tracking in GPR data and resulting performance improvements for pre-screening algorithms under extreme weather conditions. [C11913]

"Man Made Target Detection in a Forest with a Subspace Detector SAR Processor"

This paper deals with the capability of a SAR processor based on a subspace detector to get better performance than a classical SAR processor for Man Made Target (MMT) detection in a forest. The new algorithm aims at using new models, different from the isotropic point one commonly used in SAR processors. The implementation of the Subspace Detector SAR (SDSAR) algorithm is described and detection performances between a classical SAR (CSAR) algorithm and the SDSAR one are compared when detecting a MMT in white Gaussian noise and in a simulated forest. [C11914]

"A Ka Band Imaging Radar: DRIVE on Board ONERA Motorglider"

Following previous studies, a concept of low-cost imaging Ka-Band radar is presented in this paper. This radar is integrated into under-wings pods that are fixed on a STEMME S10VT motorglider. This radar concept combines real aperture in the cross-track direction, by the antennas geometrical aperture, and synthetic aperture in the along-track direction, realized with the aircraft motion. Radar front-end uses FMCW (for Frequency Modulated Continuous Wave) technique which allows to reduce the power emission to a few Watts. In addition, the use of the millimeter band induces antennas size reduction, and makes possible the radar integration into pods. Thus, radar particularities are a low-size, a low-weight and a low-cost basis, making this radar suitable for future integration on board small vehicles, such as UAV (Unmanned Aerial Vehicle). The radar definition and specifications will be exposed, together with the first results obtained on April 2006. Two ways of operation will be exposed: An application as vertical sounder, using cylindrical horn antennas, and an application as SAR radar, using rectangular antennas. The two cases will be illustrated by samples of results. [C11915]

"Polarimetric Temporal Decorrelation Studies by Means of GBSAR Sensor Data"

In this paper, a study of the temporal evolution of the elements of 3×3 covariance matrix using an X-band polarimetric ground-based SAR sensor is proposed. Although the heterogeneity of the scenario allows to select different target typologies, the study is mainly focused on the analysis of azimuthally symmetric distributed targets. The fluctuations of the most representative elements of $[C]$ as a function of time and the decorrelation among the polarimetric channels are investigated. A relation with atmospheric parameters like temperature, humidity and wind is considered in order to make out the weight these parameters can influence the polarimetric signature of the observed area. [C11916]

"Study of the Influence of Vessel Motions and Sea-Ship Interaction on Classification Algorithms"

"Based on Single-Pass Polarimetric SAR Interferometry"

This paper analyzes the worsening effects the sea surface can induce on vessel classification algorithms working with SAR imagery. Two issues will be tackled, the complex motion history of ships and the polarimetric scattering mechanisms generated by the sea-hull interaction. Both can modify the information that allows to infer the geometry of ships dropping the classification capability. The current analysis will introduce a new classification approach based on polarimetric SAR interferometry that presents a low sensitivity respect the main distortions caused by the sea surface. Simulated SAR images obtained from GRECOSAR, a SAR simulator of complex targets, will show trustworthy vessel classification almost independent on the environmental conditions could be possible for incoming system configurations as Tandem TerraSAR-X. [C11917]

"Structural Parameter Estimation of Australian Flora with a Ground-based Polarimetric Radar Interferometer"

The application of polarimetric SAR interferometry technology is extended to ground based radar imaging (GB-POLInSAR), which has a limited field of view but provides wide band coverage. It also provides for easier deployment of broadband and multi-baseline techniques, from which we can estimate vegetation structure and extinction propagation using model based techniques. This micro-scale multi-parameter combination with good temporal resolution is a unique feature of ground-based sensors. In this paper we present both polarimetric and interferometric coherence calibration results for such a GB-POLInSAR system we have developed at the University of Adelaide. We then show an initial study of height estimation of Australian native plants based on the coherence parameter retrieval models of the polarimetric SAR interferometry technique using the broadband GB-POLInSAR system. [C11918]

"The TerraSAR-X Active Calibration Instruments and Performance Analysis"

This paper describes the development and system concept for an active and highly integrated, digitally controlled SAR system calibrator. For precise and high-quality SAR data, precise ground targets are necessary for external calibration of the SAR data. Compared to passive targets, active radar targets like transponders offer more features. The recording of the transmitted radar signals from the satellite becomes possible and allows additional data analysis and data correction. A total of 18 active transponder and receiver systems and 16 receiver only systems will be fabricated for the TerraSAR-X calibration campaign in fall 2006. [C11919]

"Early Results on Cloud Profiling Radar Post-launch Calibration and Operations"

The cloud profiling radar (CPR), the primary science instrument of the CloudSat Mission, is a 94-GHz nadir-looking radar that measures the power backscattered by clouds as a function of distance from the radar. This instrument will acquire a global time series of vertical cloud structure at 500-m vertical resolution and 1.4-km horizontal resolution. CPR will operate in a short-pulse mode and will yield measurements at a minimum detectable sensitivity of -28 dBZ. [C11920]

"The Elephant in Dual-Polarized Imaging Radar"

The elephant-in-the-room: It's so obvious, why didn't we see it before? In the context of "dual-polarized radar", especially Earth-observing synthetic aperture radar, the elephant is simply the relative phase between the two image outputs of a "dual-polarized" SAR. Capture the elephant-which for certain systems may be a minimal-cost transformation-to realize nearly a dozen quantitative image norms, most of which have not been exploited outside of the radar astronomy community. Even better, transmit circular polarization. [C11921]

"Review of Wire and Cable Applications, Practices and Installations on Offshore Floating Oil and Gas Platforms in the Gulf of Mexico"

On today's modern offshore oil and gas platforms there are many issues that need to be considered when applying and installing wire and cable such as type of circuit required (i.e. normal, emergency, UPS, DC, etc.), the electrical and mechanical performance, installation parameters, fire properties and regulatory compliance. This paper discusses these issues as they relate to the electrical, instrument, and process and safety systems found on the floating platform. Specifically, 1) medium voltage power, 2) low voltage power and control including DC and UPS circuits, 3) paging and alarm, 4) instrumentation, 5) distributive control and safety, 5) fire alarm, 6) navigational aid including radar, 7) obstruction lighting, and 8) communication including both internal and ship to shore. In the discussion, emphasis is given to the different regulatory requirements (i.e. U.S. Coast Guard, American Bureau of Shipping, etc.), any industry standards that apply and any new wire and cable types that are available [C11922]

"Two New Techniques for Direction of Arrival Estimation"

Direction of Arrival estimation (DoA) is one of the most demanding problems which one has to solve for localizing and tracking multiple rapidly moving targets as in radar, mobile communication and in other areas. In this paper, two new techniques for DoA estimation of signals impinging on the array are proposed. First, the usage of an electronically rotation of the plane of the linear array by small angle in one dimension DoA estimation is presented. Second, a modified Matrix Pencil (MP) technique for two dimensional DoA estimation is presented. The analysis of the two algorithms is discussed. The accuracy of the DoA estimation of the two proposed techniques is observed through simulated numerical examples. [C11923]

"Performance of the VI-CFAR in Homogeneous Weibull Background"

We study the performance of the newly proposed VI-CFAR in Weibull clutter. The VI-CFAR is a composite CFAR processor that dynamically selects between different conventional adaptive thresholding algorithms, depending on the background environment, in order to maintain constant false alarm rate (CFAR). It utilizes the concept of data variability, and computes a second-order statistic called the variability index (VI) to dynamically tailor the background estimation algorithm. Previously this type of CFAR has only been studied for the case of Gaussian background clutter. However, studies show that the Weibull distribution provides a better fit for many clutter situations. The VI-CFAR parameters for the case of Weibull clutter have been designed and performance curves for the homogeneous background case have been plotted. Results show that the VI-CFAR processor has satisfactory performance with low CFAR loss [C11924]

"A Novel DOA Estimation for Uniform Circular Arrays in Correlated Environment without Interpolation"

A novel DOA estimation for uniform circular arrays (UCAs) in correlated environment is proposed, which is based on the array virtual translation. Instead of transforming the steering vector of a UCAs to one with Vandermonde form, or interpolating, in the new approach the subarrays is designed by a virtual translating of the original array, then the MUSIC algorithm is employed to estimate the desired directions, the VT-MUSIC approach for short. Simulation results strongly verify the high performance of this approach [C11925]

"An Efficient Implementation of the Nearest Neighbor Based Visual Objects Tracking"

An independent visual objects tracking is less reliable than the data association of visual objects tracking. This paper describes a tracking method based on the nearest neighbor (NN) data association, which serves lower computational than do the multiple hypothesis tracking (MHT) or the joint probabilistic data association filter (JPDAF) but gives low reliability, if the number of targets is increased. This reliability can be increased by selecting appropriate visual object model. To obtain low computation while capable of handling non-rigid object, we propose an object model which combines the threshold of accumulated object region and the object bounding box. The elements of the association matrix are the distance function that is proposed as a mixture of object models of distance function. The combinations of object models of distance function are important mechanism for determining appropriate state of object correspondence which can be divided into six groups: updated track, missing track, newly track, grouped track, merged track and complex track. The missing track is solved by the track life time criterion while the grouping, the merged and the complex track are resolved by using the proposed NN algorithm again. The experimental results are correctly shown on various situations of correspondence problem from surveillance image sequences [C11926]

"Bio-Medical Sensing using Ultra Wideband Communications and Radar Technology: A Feasibility Study"

The aim of this work is to study the application of ultra wideband (UWB) technology to perform biomedical sensing and vital signs monitoring in humans. Among the numerous signals that can be measured, the heart rate (HR) is chosen as the first objective due to its importance. The research is pointed towards the development of a technique that can allow both, radar sensing and communications using the same UWB transceiver. Such a sensor, could use UWB radar principles to measure the heart beat rate and UWB communication standards to transmit these measurements. Readily available commercial transceivers with minor adaptations will be considered as possible to solve for the physical layer. Signal processing for target detection will be done at higher levels. Having sensors with such "duo" properties can make them ideal nodes for wearable computing, as well as sensor and body area networks [C11927]

"Security Enhanced Indoor Location Tracking System for Ubiquitous Home Healthcare"

Advances in sensor networking and location tracking technology enable many location-based applications but they create significant privacy risks. This paper describes our study on design of security enhanced indoor location-tracking system for in-building, ambient discovery application, location-dependent healthcare applications. Ceiling-mounted beacons are spread throughout the building which publish location information on RF and ultrasonic signals and allows applications running on mobile and static nodes to learn their physical location. The object to be tracked carries listener node, this node listens the beacons information as they arrived and forwards these beacons signals to the base station. A listener computes its position within the coordinate system, using the distances from multiple beacons with known beacon coordinates. This paper concentrates on privacy problem location aware sensor networks, since location information is especially privacy sensitive and potentially specific enough to reveal the identity of individuals. Also describe two ubiquitous home healthcare applications that use the location-tracking problem which we have implemented. [C11928]

"Music and Model-Order Selection for Spherically Invariant Random Vectors"

Under Gaussian assumptions, the eigen decomposition of the sample covariance matrix (SCM) is the basis for MUSIC and Information Criterion methods. When signals are modeled by Spherically Invariant Random Vectors (SIRV), a natural extension of the SCM is the Normalized Sample Co- variance Matrix (NSCM). We show that the NSCM preserves the eigen subspaces of the covariance matrix of a signal plus white noise model. Moreover, the ratio of the arithmetic mean to the geometric mean of the NSCM lowest eigenvalues is asymptotically proportional to a chi2-distributed random variable. This allows one to estimate the number of signals and then to use MUSIC, as we show in simulations. [C11929]

"Optimal Taper Design for Overlapped Subarray Formation"

Subarray formation is common in radar and sonar beamforming applications. Overlapped subarrays are of special interest, since they can provide additional control towards minimizing grating lobes. This paper proposes a methodology towards computing subarray tapers that optimally minimize sidelobe and grating lobe levels while providing a uniform weighting over the array. This also allows maximum flexibility for subsequent digital beamforming with multiple beams within the subarray beam mainlobe. Finally, resulting beampatterns are presented and compared with other design techniques. [C11930]

"A Novel Beamformer Robust to Steering Vector Mismatch"

It is well known that the performance of the minimum variance distortionless response (MVDR) beamformer is very sensitive to steering vector mismatch because of the signal cancellation. Such mismatches can occur as a result of direction-of arrival (DOA) errors, local scattering, near-far spatial signature mismatch, waveform distortion, source spreading, imperfectly calibrated arrays and distorted antenna shape. In this paper, an adaptive beamformer which is robust against the DOA mismatch is proposed. This method imposes two quadratic constraints such that the magnitude responses of two steering vectors exceed unity. Then a diagonal loading method is used to force the magnitude responses within a range of the arrival angles to exceed unity. The diagonal loading factor can be computed systematically by a proposed algorithm. Numerical examples show that this method has a significantly better SINR performance compared to previously published methods (including the MVDR), and a complexity comparable to the standard MVDR beamformer. [C11931]

"Millimetre Wave Radar Vision for the Mining Industry"

This paper examines the background and application of millimetre wave radar technology to control and direct the material mix introduced to refill large underground voids. In addition it documents the use of radars for surface mine visualisation to produce images of the bucket fill on large rope shovels and on draglines to help reconcile dig volumes and to specify dig and fill surface profiles. [C11932]

"Threat Estimation by Electronic Surveillance of Multifunction Radars: A Stochastic Context Free Grammar Approach"

Multi-function radars (MFRs) are sophisticated sensors that are widely used in military systems. It is shown that the stochastic context free grammar (SCFG) efficiently captures the essential features of the MFR dynamics compared to more traditional finite Markov models (regular grammars). The dynamics of the MFR are formulated as a mixture of two SCFGs-the mixture parameter determining the threat level. We then present a maximum likelihood threat estimation algorithm by capturing the noisy radar signals represented as strings from the MFR language. The relative simplicity of the SCFG model facilitates development of a systematic design procedure for electronic warfare (EW) surveillance algorithms [C11933]

"Event Detection Using Sensor Networks"

This paper investigates the use of a sensor network for detecting the presence of an event. The sensors monitor the signal emitted from the source and report the existence of the event when the received signal strength is above a certain threshold. In this paper, we derive analytical expressions for the probability of false alarms and the probability of no detection as functions of the threshold. Subsequently, we determine the optimal threshold that trades off the probability of false alarms and the probability of no detection [C11934]

"A Novel Subspace Coherent Signal Processing Algorithm For High-Resolution DOA Estimation"

In this paper, a novel subspace coherent signal processing algorithm for high-resolution direction of arrival (DOA) estimation is proposed, which is based on forward-backward averaging and subspace eigendecomposition, the FB-SED algorithm for short. The forward-backward averaging matrix is employed as the preprocessor for the linear arrays, and then the invariance property of noise subspace to power emitters is used to estimate the directions of the coherent sources. The simulation results indicate that the FB-SED algorithm provides higher resolution performance for two closely spaced coherent sources estimation compared to conventional forward backward spatial smoothing MUSIC (FBSS-MUSIC). Finally, it is shown that FB-SED algorithm is more robust than FBSS-MUSIC when there are array errors in the practical linear array [C11935]

"Multi-target Detection in FMCW Radar based on Six-Port Technology"

The traditional FMCW radar has its own limitation in multi-target detection. Six-port radar is proposed as a new way to solve this problem because of the phase measurement capability. The method of using six-port radar to suppress false alarm is discussed and computer simulations prove that the method is valid and practical. [C11936]

"A new approach to detecting vegetation-obscured tripwires"

Tripwire-operated fragmentation mines can be a significant hazard for deminers, especially during vegetation clearance. Several different technologies including thermal, acoustic, and electromagnetic have been evaluated as possible candidates for use in a reliable long-range detector which can find tripwires completely obscured by vegetation. An acoustic method has been proposed to detect non-metallic tripwires. The results of some experimental measurements using this approach are presented. Taut, non-metallic wires can be stimulated acoustically so as to generate a characteristic frequency component which may enable detection. [C11937]

"Robust Image Registration Technique for SAR Images"

Synthetic aperture radar (SAR) images are difficult to register with other images or maps of the same area because SAR images are corrupted with image speckle. The geo-reference of the image is conventionally realized by manual identification of ground control points (GCPs) and image rectification. There are two main tasks to geo-reference the SAR images. First one is to enhance the quality of images, reducing the noise and detecting the edges of the objects in the images to mark more clear points that are used as GCPs. The GCPs do not change with time and change in climatic conditions. The edges always remain same and can not be changed for a long time. This paper investigates the procedure for geo-referencing temporal images acquired for the same region by automatic identification of GCPs on the image by template matching technique. The procedure to extract high quality edge contours from SAR images and the process of automatic image-to-image and image-to-digitized map registration of SAR images has been presented [C11938]

"Lane Keeping System Based on THASV-II Platform"

A lane keeping system is designed and realized based on the second generation of Tsinghua active safety vehicle platform (THASV-II). The system integrates the lane detection and vehicle detection in the driving environment sensing module to improve the anti-disturbance ability of the lane detection. The image information captured by monocular vision and the obstacles data obtained by lidar are fused to recognize vehicles; a lane detection method based on the points set optimization is proposed. A preview PID controller is designed for the lateral control. Experiments of vehicle detection, lane detection and lane keeping are carried out on the THASV-II platform. [C11939]

"A Review on Vision-Based Pedestrian Detection for Intelligent Vehicles"

Vision-based pedestrian detection techniques for smart vehicles have emerged as a hot research topic in the field of vehicular electronics and driving safety. A vision-based system can recognize pedestrians in front of the moving vehicle, then warns the driver of the dangerous situation loudly or slows the vehicle down automatically to protect both drivers and pedestrians. In general, the vision-based pedestrian detection process can be divided

into three consecutive steps: pedestrian detection, pedestrian recognition, and pedestrian tracking. In this paper, a great variety of methods associated with these three steps is introduced and compared in detail. In addition, the implementation of vision-based pedestrian detection on vehicles is also presented. In the end, we analyze the difficulties and the research trend in the future. [C11940]

"A New Phase-shifterless Active Phase Array for Automobile Radar and Communication Systems"

A new kind of phased array for automobile radar based on coupled oscillator is introduced which need not phase shifters. The dynamic of nearest-neighbor coupled oscillators array is analyzed and simulated. It is shown that a constant phase gradient can be achieved by detuning the free-running frequency of the edge array elements. A S-band one-dimensional experimental array is presented, giving a measured phase progression among the array that is continuously variable over the range (-60deg, 60deg). [C11941]

"Phantom Track Generation in 3D through Cooperative Control of Multiple ECAVs Based on Geometry"

Radar deception through phantom track generation using multiple Electronic Combat Air Vehicles (ECAVs) is addressed which serves as a motivating example for cooperative control of autonomous multi-agent systems. The ECAV trajectories are represented by parameterized differentiable space curves in R^3 and necessary and sufficient conditions are derived to satisfy their state, speed and curvature constraints. Based on this geometric analysis, an algorithm capable of generating trajectories online and in real-time is developed. Results on local asymptotic straightening of trajectories and controls ensuring the existence of feasible trajectories satisfying all system and actuator constraints are presented. The basic algorithm based on the results developed in here is given along with simulation results, validating the proposed approach. [C11942]

"Research on the Algorithm of Target Recognition Based on Two-leveled RBF Neural Network and D-S Evidence Theory"

In this paper, we combine two leveled RBF neural network technique with D-S evidence fusion theory, and present an algorithm of target recognition based on double mode intelligent fusion of infrared and radar. An effective recognizing strategy is developed. Simulation on the algorithm is carried out and the results illustrate that the algorithm is efficient and effective. [C11943]

"Performance Improvement Through Error Fine Tuning In Interferometric SAR Signal Processing"

Efforts are continuously in hand in the world to improve upon the performance of the SAR interferometric signal processing. The quality of the InSAR products has been improved drastically in the last few years. However, in order to enhance the accuracy of the InSAR products and obtain results close to the real parameters further tuning of the InSAR processing is needed. In an innovative way, in this paper error evaluation at every step in the InSAR signal processing has been carried out and small algorithms have been incorporated to inverse the errors, thus fine tuning the InSAR signal processing. Methods and relationships have been developed to enable retrieve the accurate results as much as possible. The relevant processing steps have been identified and recommendations have been made to implement the results with better understanding of different InSAR applications. The necessary steps involved in processing the received data to the geometrically compensated digital models have been explained in an easy and comprehensible way [C11944]

"Performance Analysis of Meter Band Radar Height-Finding Approach for Low-Angle Tracking"

In this paper, a new meter band radar superresolution height-finding approach under clutter environments is presented in the presence of multipath, which cascades moving target indication (MTI) method and forward backward spatial smooth MUSIC (FBSS-MUSIC) algorithm, the MTISFBSS-MUSIC approach for short. The numerical simulation analysis of the presented approach is performed and root-mean-square-error of the target height estimation is given. It is demonstrated that clutter suppression method i.e., MTI cascaded superresolution height-finding approach is available for VHF array radar low-angle tracking applications [C11945]

"A Fully Three-Dimensional Simulation of a Ground-Penetrating Radar over Lossy and Dispersive Grounds"

A 3-D finite difference time domain (FDTD) simulation is done on a ground penetrating radar (GPR) operating above lossy and dispersive grounds. The radar consists of a pair of resistor-loaded bow-tie antennas and the ground consists of Puerto Rico clay loam. The clay loam is modeled by using a two term Debye model with a static conductivity. The simulation results show the GPR response of buried metal and plastic pipes. The results

are more realistic as the simulations include commercially used antennas and real ground conditions. The target signatures and target polarization characteristics of the pipes are also studied in the paper [C11946]

"A Novel Sorting Method of Radar Signals Based on Support Vector Clustering and Delaminating Coupling"

Modern electronic warfare faces complex and dense pulses environments, which brings a severe challenge to radar signal sorting. A novel sorting method is presented based on delaminating coupling and support vector clustering (SVC) in this paper. The 3-dimension feature information is composed of direction of arrival, radio frequency and pulse width in this method which sorts radar pulse sequences for the very first time by employing support vector clustering and delaminating coupling. The experiment result shows that the method can sort efficiently radar signals in the complex pulses environment and the performance is superior to that of K-means clustering sorting [C11947]

"Towards Cognitive Machines: Multiscale Measures and Analysis"

Numerous attempts are being made to develop machines that could act not only autonomously, but also in an increasingly intelligent and cognitive manner. Such cognitive machines ought to be aware of their environments which include not only other machines, but also human beings. Such machines ought to understand the meaning of information in more human-like ways by grounding knowledge in the physical world and in the machines' own goals. The motivation for developing such machines range from self-evidenced practical reasons such as the expense of computer maintenance, to wearable computing in health care, and gaining a better understanding of the cognitive capabilities of the human brain. To achieve such an ambitious goal requires solutions to many problems, ranging from human perception, attention, concept creation, cognition, consciousness, executive processes guided by emotions and value, and symbiotic conversational human-machine interactions. An important component of this cognitive machine research includes multiscale measures and analysis. This paper presents definitions of cognitive machines, representations of processes, as well as their measurements, measures and analysis. It provides examples from current research, including cognitive radio, cognitive radar, and cognitive monitors [C11948]

"Characterization of Rain Microphysics based on Disdrometer and Polarimetric Radar Observations"

Characterization of rain microphysics requires information on raindrop size distributions (DSDs). DSD measurements and retrievals, however, contain errors. In this paper, data from side-by-side disdrometer comparisons are presented to provide information that is not possible from single disdrometer measurements alone, allowing error effects to be quantified and a rain DSD model for radar retrieval to be improved. We also propose methods to mitigate sampling errors by filtering with sorting and averaging and by fitting to a Gamma DSD model with truncation and extrapolation. The Constrained- Gamma DSD model has thus been refined for the Southern Great Plains region of the United States. [C11949]

"Differential Reflectivity Calibration for NEXRAD"

There are now many S- and C-band weather radars around the world that are either dual polarized or soon will be. The most common polarization basis is horizontal and vertical. Dual polarization is accomplished via fast alternate transmission of horizontal and vertical polarization or simultaneous horizontal and vertical polarization transmission. In either case, such radars can measure copolar differential reflectivity (Z_{dr}) and copolar differential phase (Phidp). It has been shown that accurate estimation of these parameters can improve identification and quantification of precipitation. To minimize rainfall estimation error, measurement uncertainty of Z_{dr} should be less than 0.1 dB. Three methods for Z_{dr} calibration are presented and operational implementation is discussed. Concepts are illustrated with data from S-Pol, NCAR's polarimetric S-band radar. [C11950]

"Time-dependent Second Order Scattering Theory for a Weather Radar with a Finite Beam Width"

Multiple scattering effects from spherical water particles of uniform diameter are studied for a W-band pulsed radar. The Gaussian transverse beam-profile and the rectangular pulse- duration are used for calculation. A second-order analytical solution is derived for a single layer structure, based on a time- dependent radiative transfer theory. When the range resolution is fixed, increase in footprint radius leads to increase in the second order reflectivity that is defined as the ratio of the second order return to the first order one. This undesirable feature becomes more serious as the range increases. Since the spaceborne millimeter-wavelength radar has a large footprint radius that is competitive to the mean free path, the multiple scattering effect must be taken into account for analysis. [C11951]

"Precipitation Spectral Moments Estimation and Clutter Mitigation using Parametric Time Domain Model"

In this study the problem of precipitation signal spectral moments estimation in case of clutter contamination is considered. It is proposed to use a parametric model to estimate spectral moments of precipitation echoes and clutter. To estimate these spectral moments the maximum likelihood estimator based on the properties of Gaussian joint distribution of complex time series is used. The main advantage of this approach is that it does not suppress any part of the signal and the properties of weather echoes and clutter are estimated simultaneously. The performance of the proposed method is evaluated based on simulations of radar signals and compared to the performance of GMAP (Gaussian model adaptive processing). The proposed procedure is also applied to measurements collected by CSU- CHILL radar collected during summer 2004. [C11952]

"Oversampling and Whitening with the CASA Radar"

The CASA NSF ERC is using cutting edge radar technology to create a network of short range weather radar to observe the lower regions of the atmosphere that are currently out of sight. Range oversampling and whitening is one of the newest technologies available for increasing the accuracy of weather radar moment estimates. The CASA mission has incorporated range oversampling into the design of one the first prototype radars created for the mission. Due to several constraints, the MA-1 radar has several hardware design differences from the large state-of-the-art S-band weather radars that oversampling and whitening was developed and verified with. The oversampling and whitening process is validated with the suboptimal MA-1 radar configuration by producing results that adhere to theoretical expectations. [C11953]

"Two-year Microwave Radiometric Observations of Low-level Boundary-layer Temperature Inversion Signatures"

Temperature inversion indicates that the atmospheric temperature decreases with increasing height. Its occurrence tends to inhibit vertical motion of the atmosphere. Under the occurrence of temperature inversion, air pollutants cannot be dissipated through vertical mixing of the atmosphere and are accumulated near the surface. When temperature inversion lasts for a long time, human health can be in jeopardy due to deterioration of air quality and secondary pollutants, which are formed through atmospheric photochemistry and more toxic than original ones. It is vital to investigate the dynamics of temperature inversion for understanding and resolving its resulting problems. In this paper, temperature inversion signatures over three major cities on Taiwan are analyzed. They are measured by ground-based microwave radiometers installed in Taipei, Taichung and Kaohsiung from 2002 to 2004 supported by the Environment Protection Agency (EPA) of Taiwan. Characteristics of temperature inversion at the three cities are extracted using different classification methods. The characteristics of temperature inversion in Taichung and Kaohsiung show a similar trend but are different from that in Taipei. The numbers of the occurrence of temperature inversion in Taichung and Kaohsiung were much larger than that in Taipei. The main types of temperature inversion in Taiwan are radiation and frontal inversions. Compared to frontal inversion, radiation inversion on average occurs at a lower altitude, lasts a longer period, has a deeper thickness, and reaches a higher temperature difference of inversion. Frontal inversion plays a significant role for the inversion event lasting over 12 hours. [C11954]

"Detecting Weather Radar Clutter by Information Fusion With Satellite Images and Numerical Weather Prediction Model Output"

A method for detecting clutter in weather radar images by information fusion is presented. Radar data, satellite images, and output from a numerical weather prediction model are combined and the radar echoes are classified using supervised classification. The presented method uses indirect information on precipitation in the atmosphere from Meteosat-8 multispectral images and near-surface temperature estimates from the DMIHRLAM-S05 numerical weather prediction model. Alternatively, an operational now casting product called 'Precipitating Clouds' based on Meteosat-8 input is used. A scale-space ensemble method is used for classification and the clutter detection method is illustrated on a case of severe sea clutter contaminated radar data. Detection accuracies above 90 % are achieved and using an ensemble classification method the error rate is reduced by 40 %. [C11955]

"Implementation of Differential Repeat-pass SAR Interferometry for the Search for Earthquake Precursory Land-cover Deformation in Taiwan"

Worldwide, medium- to short-term earthquake prediction is becoming ever more essential for safeguarding man due to an un-abating population increase, but hitherto there have been no verifiable methods of reliable earthquake prediction developed-except for a few isolated examples of earthquake prediction in China and in

Greece. This dilemma is a result of previous and still current approaches to earthquake prediction which are squarely based on the measurement of crustal movements, observable only after a tectonic stress-change discharge (earthquake) has occurred. The prediction models were derived from past histories of measurements, mainly carried out during the past 30-40 years, although initiated soon after the San Francisco Earthquake of 1906. During the past decade it was proved and shown that it is not possible to derive reliable models for earthquake predictions from crustal movement measurements alone, and that an entirely new approach must be taken and rigorously pursued over years and decades to come. In support of this conclusion, there have been reported throughout the history of man anecdotal historical up to scientifically verifiable earthquake precursor or "seismo-genic" signatures of various kind-biological, geological, geo-chemical and especially a rather large plethora of diverse electromagnetic ones on ground, in air and space, denoted as "seismo- electromagnetic" signatures. The existence of all of these signatures can no longer be denied even by the fiercest seismological expert opponents; and it is absolutely high noon that those signatures be more rigorously assessed in order to develop a strategy for designing and carrying out controlled "seismo-genic" and "seismo-electromagnetic" studies on how to set up world-wide a network of measurement sites for conducting a holistic set of measurements for providing an improved understanding on why and how such precursor signatures are generated, and how and where those may best be observed subject to the rather poor signal-to-noise ratio (SNR), requiring much improved digital instrumentation as time goes on due to the ever increasing man-made electromagnetic noise generation. A number of pilot studies had been initiated, had been supported for a few years, and then aborted because of the high operating costs involved, the poor SNR making signal detection tedious if not impossible with the current state of the art in instrumentation, and because earthquakes don't appear upon demand. For example such major studies as the USGS/NSF NEHER Program of the early 1990's after the Loma Prieta M 7 earthquake of 1987; in Japan the ERSFP after the Kobe Earthquake of 1995; in Greece the ongoing electro-potential methods of Varatsov; in China, and in various regions as well as independent states of the former Soviet Union. There exists a rather large number of fiercely competing groups in Russia coming up with their own diversified yet highly incomplete modeling approaches seeking support from the West for unfortunately all too low-cost scientific mercenary services. No clear picture has evolved and should not be expected; and a much wider internationally coordinated investigation is required, which may well last for several decades before a unified approach and with it a solution to this vital problem may be found-if ever. In this overview a systematic analysis of main historical records, a summary of pertinent "seismo-genic" as well as observed "seismo- electromagnetic" effects and modern ground-based to air- and space-borne metrological signature investigations are presented. Specifically, remote sensing techniques not yet conceived but in urgent need-such as the remote sensing of the groundwater table-for advancing our understanding of this highly interdisciplinary complicated geophysical problem are being identified, and input is sought from participants for possible active future involvement. [C11956]

"Use of the SVM Classification with Polarimetric SAR Data for Land Use Cartography"

This study comes within the framework of the global cartography and inventory of the Polynesian landscape. An AIRSAR airborne acquired fully polarimetric data in L and P bands, in August 2000, over the main Polynesian Islands. This study focuses on Tubuai Island, where several ground surveys allow the validation of the different results. Different decompositions, such as H/A/alpha, or based on the Pauli formalism have shown their potential for land use discrimination. In order to take into account these different parameters into a supervised classification scheme, the SVM (Support Vector Machine) method is investigated. When dealing with only the coherent matrix elements, the results show that the SVM classification gives comparative results to those obtained with Wishart classification. Results are significantly improved when adding to the coherent matrix elements, other polarimetric parameters, as H/A/alpha or the co-polarized circular polarization correlation coefficient, rho_{rrll}, for the Support Vector definition. Finally the best results are given when merging all the parameters for P and L bands, in addition to the only VV single channel acquired in C band. [C11957]

"Assessing Vegetation Scattering Mechanisms of L-band AIRSAR Data on Sloping Forest Area"

In this paper an improvement of radiative transfer models that accounts for the depolarizing ground scattering and tilted scattering surface is presented to model vegetation scattering mechanisms. This study is implemented with the real L-band NASA (JPL) AIRSAR data in Jeju volcanic island. The vegetation scattering model in sloping surface is adequate to assess slight changes in microwave scattering mechanisms and to interpret the physical characteristics of eigen-parameters of the coherency matrix in sloping vegetated area. [C11958]

"Sensitivity of Dual-Frequency Rain DSD Retrieval to Particles in Melting Layer for Space-borne Radars"

Many dual-frequency DSD retrieval algorithms have been proposed for space-borne radars. A self-consistent backward iterative algorithm, based on non-Rayleigh scattering has been studied recently[1][2][3]. This algorithm

is based on a certain DSD model of rain, for which the attenuation caused by the ice or mixed-phase particles should be extracted accurately. Any error in the attenuation correction at one of the two frequencies would affect the accuracy of the DSD retrievals for rain region. This paper examines how the DSD retrieval for rain is affected by the reflectivity correction for attenuation due to the ice or mixed-phase particles in bright band. First, a non-coalescence and non-break up (N-N) model, with an adjustable thickness and the DSD at the bottom of the melting layer is used to generate the reflectivity and specific attenuation profiles. The profiles for varying DSD (N_w from 1000 to 8000, D_0 from 1.0 mm to 1.75 mm) are used to derive the alpha and beta coefficients for k-Z relationships for different heights, for a certain thickness of the bright band. Then the k-Z relationships are incorporated in Hitschfeld-Bordan method to evaluate the two way attenuation at the two frequencies. Last, the reflectivities in rain region, considered of the attenuation correction error, are made of use of by the self-consistent backward iterative algorithm [2] to retrieve the DSD. The simulation shows that the accuracy of the attenuation correction for Ka-band, the higher frequency, is crucial for the dual-frequency iterative algorithm to correctly retrieve the DSD. While the attenuation correction error at Ku-band remain negligibly small, the error at Ka-band could be as large as 0.47 dB, and this error would have been too large for backward iterative method to correctly retrieve the DSD. The method presented in his paper can be used to evaluate any rain DSD retrieval algorithms proposed for GPM. [C11959]

"Self-organizing Neural Networks for Unsupervised Classification of Polarimetric SAR Data on Complex Landscapes"

This paper refers to a study on the pixel-by-pixel unsupervised classification of a polarimetric SAR image of a Central Italy landscape. The polarimetric data have been processed by self-organizing neural networks to test their performance in classifying a complex landscape. The discrimination accuracy attained by the self-organizing map method is compared both against that of H/A/alpha-Wishart unsupervised procedure and of a supervised scheme. [C11960]

"Multi-temporal High-resolution Polarimetric L-band SAR Observation of a Wine-producing Landscape"

In continuation of the BACCHUS project, aimed at establishing a reference high quality geographic information system for vineyards, an airborne SAR survey has been carried out in fall 2005 in the Frascati area, near Rome (Italy) to demonstrate the potential of airborne radar remote sensing in vineyard characterization. This contribution reports on the polarimetric L-band and dual polarization C-band SAR data acquisition campaign supported by ESA and carried out on two dates in October 2005 (the first during the grape harvest and the other after the vintage completion). [C11961]

"Networking CSU-CHILL and CSU-Pawnee to Form a Bistatic Radar System"

This paper describes how the synchronization and networking capabilities of the transmit and receive chain used at the CSU-CHILL and CSU-Pawnee radars are used to form a bistatic radar system capable of observing clear air echoes from atmospheric boundary layer. An overview of the bistatic radar geometry and resolution volume are presented, along with a discussion of the methods used to achieve timing coherence. Some preliminary results from clear-air observations are included. [C11962]

"Snow Cover Maps with Satellite Borne SAR: A New Approach in Harmony with Fractional Optical SCA Retrieval Algorithms"

The standard method for retrieving snow-covered area with C-band SAR is based on thresholding the ratio between a wet snow SAR image and a dry snow reference scene. A new approach is suggested here, where the snow cover fraction is retrieved by using a gradual transition between snow free and snow covered conditions. The paper discusses the method and applies it on a set of Radarsat data acquired in Norway in May 2003. A near simultaneous aerial optical image and data from field campaigns are used to verify the results. [C11963]

"Low Back-scattering Bands Paralleling Pressure Ridges on First Year Sea-Ice"

Sea ice roughness characteristics are important parameters of climate and ocean circulation models. Pressure ridges are large features which size, orientation and density have a major impact on heat and momentum fluxes. Extraction of these information from satellite images is a necessary step since it could allow to introduce these parameter's variability into models. In this paper we explore the occurrence of linear structures of low back-scattering which had previously been observed alongside pressure ridges on satellite images recorded late at spring. Measurements described in this research paper were carried out offshore of Kuujuarapik on the East

coast of the Hudson Bay. The ice sheet is composed of a first year ice ranging from 1m25 to 1m55 in thickness. Data were collected from mid-April to mid-May which covers the melt initiation period for this region of the bay. Measurement sites were chosen to sample a range of ridge orientations relative to the SAR incident beam. Selection criteria were set to get ridges that display homogeneity of the snow field along their axis. Data from 4 field works are presented. We show a correlation between low return bands and snow structure slopes that develop downwind of pressure ridges. Also, we discuss the impact of the snow wetness content on image resolution. [C11964]

"C-Band SAR Based Estimation of Baltic Sea Ice Thickness Distributions"

These level ice charts are automatically derived from man-made ice thickness charts using novel SAR information [1]. The aim of the present study has been to include some navigationally meaningful information about the degree of ice deformation into these level ice thickness charts. To this end, we propose a procedure where the SAR image is first segmented, and then an ice thickness distribution is assigned to each segment. For this purpose ice thickness measurements based on a helicopter-borne electromagnetic induction sensor (EM) have been made in the Baltic Sea. The critical phase in the proposed approach is to establish a statistical relationships between the C-band SAR measurements and the EM-based ice thickness measurements. This analysis is fundamentally complicated by the location inaccuracies between SAR and EM data sets. [C11965]

"Linear Deformation Rate Derivation from Multi-baseline Differential Interferogram Stacks"

Decorrelation caused by temporal changes influences phase unwrapping of differential interferogram in repeat-pass D-InSAR phase delay due to atmosphere disturbance degrades the accuracy of D-InSAR for small deformation monitoring. In this paper, we present a stacking D-InSAR approach using multi-baseline differential interferograms to estimate the linear deformation based on Rank Defect Free Network Adjustment Model (RDFNA) and to increase the deformation temporal sampling rate and estimate the linear deformation accurately. The Minimum Cost Flow (MCF) algorithm based on Delaunay triangulation network generated with sparse grids is adapted for phase unwrapping of individual interferogram. Scatterers with high coherence values over a given threshold in the interferogram stack are selected for the network generation. Therefore, with the multi-baseline differential interferogram stack, the linear deformation rate can be calculated with the unwrapped phase of each point accurately. [C11966]

"Automatic Change Detections from SAR Images Using Fractal Dimension"

It is very difficult to detect changes from SAR images because of two major difficulties associated with SAR, which are the removal of speckle noise and the registration of information between images. Speckle is a chaotic phenomenon because that the scattering signals within a resolution cell are summed up coherently. Therefore, SAR signal can be modeled by a spatial chaotic system and characterized by its fractal dimension. Then, simplified procedures for SAR image change detection are proposed because that the process of image despeckling is unnecessary. The proposed approach is applied to multitemporal polarimetric SAR images for change detections. The experimental results of using a simple image difference (DI) technique, the principal component analysis (PCA), and the proposed (Fractal) approach are compared. The effects of misregistration for different approaches are also presented. Simulation results reveal that misregistration affects less and less as SNR is increased. When SNR is low, by using DI or PCA methods, the overall performance of change detection is degraded by spurious differences due to misregistration. On the contrary, Fractal method can tolerate misregistration effect at low SNR. In addition, when the difference between changed classes is small, it is fail to detect changes by using of either DI or PCA method. In contrast, the Fractal method can still effectively detect land cover changes. [C11967]

"Feasibility of Snow Avalanche Volume Retrieval by GB-SAR Imagery"

The feasibility to estimate the volume of snow displaced in an avalanche by means of the LISA (Linear SAR) ground-based synthetic aperture radar (GB-SAR) system has been investigated. During more than 100 days of the winter 2005- 2006 the system has acquired data in its topographic mode, being able to monitor near 50 natural avalanches and 4 artificially triggered. With an acquisition rate of one image every 12 minutes, the LISA instrument has shown its ability to monitor localized changes of the snow cover. The resolution in height of the topographic maps generated has been found to be inadequate to estimate the snow volume involved in the avalanches studied. [C11968]

"Assimilating Passive Microwave Brightness Temperature Data into a Land Surface Model to Improve the Snow Depth Predictability"

This paper introduces the application of the ensemble Kalman filter (EnKF) technique for the assimilation of

passive microwave remote sensing observations into a landsurface model, to improve the snow depth (SD) predictability. A new landsurface model, currently developed at the Japan Meteorological Agency (JMA), which is based on the simple biosphere model (SiB), is used as a forward model to predict the change of the snow pack. The microwave emission model of layered snowpacks (MEMLS) is used as observation operator, to transfer the model prediction into the corresponding satellite brightness. The assimilation system was applied using data from the coordinated enhanced observation period (CEOP) Asia-Australia monsoon project (CAMP) Eastern Siberia Taiga region for the period from November 2002 to March 2003. The data sets includes JMA-GSM model output, which is used as forcing data, satellite brightness temperature observation from the advanced microwave scanning radiometer (AMSR-E) and in-situ snow depth (SD) observation and the current AMSR-E snow depth product for comparison. The assimilation results are in good agreement with the data from the snow depth observation sites in this region and improve the forecast of the land-surface model. Furthermore, comparison with the AMSR-E SD product showed, that the assimilation results are also in better agreement with the in-situ snow depth observation. [C11969]

"Meso-Scale Variability of Soils and Forest Canopy Properties is Connected to Geomorphologic Features in Eastern Amazonia"

In this study we investigated the relationships between landscape features such as terrain elevation and slope with two variables that drives forest productivity, soil texture and leaf area index (LAI). The study was carried out at the Tapajos region in Para State, eastern Amazonia. Twenty-four 0.25 ha plots were sampled along a ~150 km north-south transect in October 2002. Soil samples were collected (0-10 cm) in three random points in each plot for texture analysis. LAI was measured at 25 points regularly distributed in each plot. The geomorphologic attributes for each plot were extracted from the Shuttle Radar Topography Mission (SRTM) data linearly resample to 10 m spatial resolution. Terrain slope was linear and negatively related to the soil clay content ($r^2=0.73$). Soil sand content had an expected opposite pattern ($r^2=0.72$). The soil content of clay and sand along the elevation gradient can be strongly explained by a cubic polynomial curve ($r^2=0.82$ and 0.81 , respectively). LAI showed to be a logarithmic function of slope ($r^2=0.61$), excluding plots located in the Valley regions. Moreover, LAI showed a linear and positive relationship with soil clay content ($r^2=0.52$). Similarly to the relationships found between terrain elevation and soil texture, the 3rd order polynomial could explain 64% of the LAI variability over the Tapajos. Therefore, we concluded that topography is a major driver of the patterns of soil texture at the landscape scale and the combined effect of topography and soil can largely explain the patterns of LAI over the Tapajos. The combination of SRTM data and field-based information has the potential to increase the accuracy of ecosystem scale estimations of forest productivity in the Amazonia. [C11970]

"Monitoring of Tobacco Planted Acreage Based on Multiple Remote Sensing Sources"

Monitoring of tobacco planted acreage is a very important step for tobacco's management and monitoring. The paper presents a monitoring method by data fusion of multiple remote sensing sources. It extracts tobacco areas according to the NDVI value and classifies the fusion image with texture information, then classifies the SAR data to acquire tobacco plot in cloudy area. After classification post-processing and manual interpretation, the classification precise satisfies the demand. Applied results are in good agreement with the theoretical study, which shows its effectiveness and applicability. [C11971]

"Waveform Design for First Generation CASA Testbed"

The first testbed of X-band radar systems deployed by the Center for Collaborative Adaptive Sensing of the Atmosphere (CASA), in central Oklahoma called IP-1 (Integrated Project 1) will have a low unambiguous velocity due to their short wavelength, and increasing the PRF will result in multiple trip overlays since storms can extend over a large distance. The range-velocity ambiguity is more severe for X-band radars compared to the conventional S-band. However, low cost radars limit the ability to support complex waveforms due to hardware requirements. In addition the radar observations at short ranges are contaminated by ground clutter. This paper describes the waveforms for the individual radar nodes based on operational requirements such as scan speeds, volume coverage pattern and system/hardware limitations to resolve range and velocity ambiguities along with clutter suppression. [C11972]

"Analysis of Aqua AMSR-E Derived Snow Water Equivalent over Himalayan Snow Covered Regions"

We have made an endeavor to investigate the snow water equivalent (SWE) variations in Himalayan mountain region which is the most difficult terrain to access during winter seasons. The area also covers the large glaciers such as Siachen and Gangotri. A time series multi scale of SWE L3 product derived from Aqua Advanced Microwave Scanning Radiometer (AMSR-E) data have been analysed for three consecutive winters during 2002

-2005 for Himalayan Snow cover region. A major emphasis is on the study of SWE trend in the two glacier areas viz. Siachen and Gangotri. It has been observed through AVISR- E 5-day product that snow cover area (SCA) over whole Himalayan region is very dynamic. AVISR-E derived 5-day SWE is analysed at the two test sites viz. Patsio (Lat 32deg 45 17.89" N and Lon 77deg, 15', 43.13"E) and Dhundi (Lat 32deg, 22, 05"N and Lon 77deg, 15 E) concurrently with the available in-situ data .The result indicates that in the peak winter days only we found reasonable co-relation. At the Patsio, minimum and maximum SWE observed are 26 mm and 108 mm respectively using in situ data. [C11973]

"A Complex of Multi-Frequency at 3GHz, 5.6GHz, 20GHz and 37GHz, Polarimetric, Combined, Short Pulse, Short Range Action Radar- Radiometers for Soil and Snow Remote Sensing and Surveillance"

A complex of polarimetric (dual polarization), spatio- temporally combined active-passive devices of S (~3GHz), C (~5.6GHz), Ku (~0GHz), and Ka (~37GHz) band of frequencies is represented, for bare and vegetated soils, waved water surface and land snow cover microwave reflective and emissive characteristics multi-frequency, polarimetric, simultaneous and spatially coincident measurements. The complex is dedicated to solve problems applied to soil (bare and vegetated) and snow moistures retrieval, to near water surface wind and wave field parameters retrieval, by synergetic application of various kind microwave means of remote sensing, as well as applied to surface and sub-surface targets detection and identification tasks solution. The complex is set in ECOSERV Remote Observation Centre's control-test experimental site, in Armenia, which is equipped by facilities for microwave devices absolute calibration, by spatially distributed stations for in-situ measurements of soil and moistures and temperatures, and has a local meaning small weather station. This paper has an aim to attract attention of researchers who are interested in such kind measurements and to invite them to perform their own or joint measurements using available facilities. [C11974]

"Synergistic use of AMSR-E and MODIS Data for Understanding Grassland Land Surface Phenologies"

In recent investigations into the response of native grasslands to global environmental changes, rainfall variability has been offered as a key factor for explaining ecosystem structure and function. In particular, changes in the temporal patterns of precipitation were shown to alter critical aspects of the carbon cycle. To understand the impact of rainfall variability in grasslands, an understanding of the dynamics of surface moisture is critical. Here we characterize spatio-temporal patterns of two standard data products from AMSR-E: vegetation water content and surficial soil moisture. In addition, we explore the sensitivity of these products to an extreme precipitation event as modulated by land cover type. The sensitivities of vegetation water content and soil moisture retrievals were found to be dependent on the NDVI value, with an apparent loss of sensitivity at higher NDVI values. Despite the coarse spatial resolution of the data, the difference in between predawn and afternoon vegetation water content was found to be a potentially source of information about canopy water stress. [C11975]

"ALOS Calibration and Validation Activities in Sweden"

This paper describes the Swedish activities to support calibration and validation of the Japanese satellite ALOS. Data over three test sites from the instruments PALSAR and AVNIR-2 will be provided by JAXA for evaluation purposes. The main activity during 2006 is a PALSAR calibration experiment using four 5-m radar reflectors, which will be deployed at the test site in southern Sweden. The ALOS data will also be used for developing forest applications, e.g. detection of clear-cuts and storm damages. [C11976]

"PALSAR Characterization and Initial Calibration"

This paper describes the initial results of the PALSAR characterization using the data acquired in the commissioning phase for the five modes of FBS, FBD, DSN, SCANSAR and POL, and using the active radar calibrator deployed at the calibration site in Japan. This paper also describes the radiometric and geometric performances of the PALSAR images shortly. This paper will end up with the parameters which should be evaluated and determined within the calibration phase. [C11977]

"Advantage of the Remote Sensing Data Utilization in Studying Inundation Risks in Terms of Land-Use"

A series of Landsat TM, ETM and radar data were used to establish land cover and flood risk maps as a function of land cover in Bac-Hung-Hai region in Northern Vietnam. Land cover in one key parameter which has an influence on the occurrence of inundation in that region. Both spectral and textural features were considered in order to improve land cover classification. The radar data was used to reduce the effects of cloud cover. The

results obtained illustrate the important role that remote sensing can play in the assessment of flood risk.

[C11978]

"The Application of Polarimetric Calibration using Polarimetric Scattering Characteristics of Urban Areas to ALOS PALSAR"

This paper discusses an ambiguity resolution of polarimetric calibration parameter. Since ALOS was successfully launched on January 24, 2006, the utilization of polarimetric data observed by PALSAR is expected for various remote sensing applications. Thus, polarimetric calibration becomes important issue. However, there is a possibility that calibration algorithm has a 180deg sign ambiguity with respect to cross-polarized components of a calibrated scattering matrix. The reason is that two polarimetric calibration parameter sets are derived. On the other hand, we found that a 180deg phase shift of cross-polarized component occurred due to the change of an angle between a direction parallel to a building wall and a radar line of sight in azimuth plane. Thus, we examined that this scattering property was applied for selecting a correct polarimetric calibration parameter set. The experimental result shows that urban structures can be used for polarimetric calibration. [C11979]

"Calibration of Spaceborne Polarimetric SAR Data using Polarization Orientation"

For ALOS/PALSAR in orbit, removal of not only polarimetric system distortion but also the effect of Faraday rotation is important. The author investigated a new calibration method using polarization orientation induced in build-up areas. Its fundamental concept is simple and is that two polarization orientation angles from two polarization combinations should be identical after calibration. This method is applied to simulated data that is distorted from JAXA L-band Pi-SAR data. An advantage of this method is that strong backscatters from buildup areas can be used to decrease an influence of noise. [C11980]

"On the use of Symmetric Target Tilt Angle for PALSAR Calibration"

PALSAR L-band SAR will be affected by Faraday rotation. In this study, PALSAR system is briefly described, and the Freeman calibration method is considered for PALSAR calibration. However, this method requires the deployment of a minimum of one corner reflector (CR) for the calibration of each scene, and this is not convenient in practice. In this paper, the use of human-made and natural symmetric targets is investigated for the calibration of SAR subject to Faraday rotation. The target scattering vector model (TSVM), which permits a unified decomposition of point and distributed target scattering, is used to derive a new calibration method that does not require the deployment of CRs. It is shown that the orientation (i.e. target tilt angle) and roll invariant maximum polarization parameters of symmetric target scattering can be used to measure and remove Faraday rotation and channel imbalance errors from PALSAR data. Antenna gain and cross-talk incidence angle variations are measured using data acquisitions over the Amazonian forests, under low Faraday rotation conditions. [C11981]

"The Application Image Coregistrator on Grid Technology"

This paper describes the co-registration image using the Grid technologies. Image co-registration is basilar for interferometry SAR remote sensing applications, but because of its very time-consuming algorithm and because of the necessity of elaborate interferometry image in real time, it can be greatly benefited by Grid computing.

[C11982]

"Simultaneous Perturbation Stochastic Approximation Algorithm for Automated Image Registration Optimization"

Automated intensity-based image registration approaches become popular and urgent when facing today's increasing data mining and frequent fusion demands. As a core part of an automated image registration system, many kinds of gradient-based optimizers were proposed in the past decade. In this paper, a local gradient-free optimizer, namely the simultaneous perturbation stochastic approximation (SPSA) algorithm, was firstly applied for the automated multi-source image registration using the mutual information as a similarity measure. Results of rigid experiments on the image pairs of ASTER-ASTER, ASTER-Map and SAR-SAR showed the SPSA optimizer has much more flexibility and efficiency than the traditional gradient ascent optimizer. It is more suitable as a local optimizer to the automated image registration system. The main shortcoming of this algorithm is too many control parameters needed during the execution process. [C11983]

"Random Feature Selection for Decision Tree Classification of Multi-temporal SAR Data"

The accuracy of supervised land cover classifications depends on variables like the chosen algorithm, adequate training data and the selection of features. It has been shown that classification results can be improved by

classifier ensembles. In the present study decision trees have been generated with random selections of all available features and combined into such a multiple classifier. The influence of the number of selected features and the size of the multiple classifiers on classification accuracy is investigated using a set of 14 SAR images. Results of multiple classifiers are always better than those of a decision tree based on all available features. Maximum accuracies were achieved with multiple classifiers that use decision trees based on 70% of the available features. The visual inspection of produced maps underlines the high quality of the results. The area is classified into homogeneous fields with little noise, only. [C11984]

"The Gradient Structure Tensor as an Efficient Descriptor of Spatial Texture in Polarimetric SAR Data"

In this paper, the analysis of spatially nonstationary texture from polarimetric SAR data is studied. A previously introduced model named Anisotropic Gaussian Kernel (AGK) was shown to be a pertinent descriptor of local orientation and allowed a simple representation of the complex spatial structure in SAR images. Here, two methods for the estimation of the model parameters are proposed. The first one is an enhancement of the previously developed algorithm and the second one is a new approach based on the Gradient Structure Tensor (GST) operator. These two methods are employed to analyse texture in PolSAR intensity channels. [C11985]

"The Multiscale Change Profile: A Statistical Similarity Measure for Change Detection in Multitemporal SAR Images"

In this paper, we present a new similarity measure for automatic change detection in multitemporal SAR images. This measure is based on the evolution of the local statistics of the image between two dates. The local statistics are estimated using a cumulant-based series expansion which approximates the probability density functions in the neighborhood of each image pixel. The degree of evolution of the local statistics is measured using the Kullback-Leibler divergence. An analytical expression for this detector is given allowing a simple computation which depends only on the 4 first statistical moments of the pixels inside the analysis window. The concept of multiscale change profile (MCP) is also introduced and its optimized implementation is presented. MCP yields change information on a wide range of scales and better characterizes the appropriate scale to be used for the detection. Two simple examples of application show that the MCP allows the design of change indicators which provide better results than a monoscale analysis. [C11986]

"Copula-based Stochastic Kernels for Abrupt Change Detection"

This paper shows how to obtain a binary change map from similarity measures of the local statistics of images before and after a disaster. The decision process is achieved by the use of a zz-SVM in which a stochastic kernel has been defined. Stochastic kernel includes two similarity measures, based on the local statistics, to detect changes from the images: 1) A distance between marginal probability density functions (pdfs) and 2) the mutual information between the two observations. Distance between marginal pdfs is evaluated by using a series expansion of the Kullbak-Leibler distance. It is achieved by estimating cumulants up to order 4 from a sliding window of fixed size. Mutual information is estimated through a parametric model that is issued from the copulas theory. It is based on rank statistics and yields an analytic expression, that depends on the parameter of the copula only, to be evaluated to obtain the mutual information. Preliminary results are shown on a pair of Radarsat images acquire before and after a lava flow. A ground truth allows to show the accuracy of the stochastic kernels and the SVM decision. [C11987]

"Land-cover Classification using Multi-temporal/polarization C-band SAR Data"

This paper presents a fuzzy logic fusion methodology for land-cover classification with multi-temporal/polarization Radarsat-1 and ENVISAT ASAR data. For feature extraction from each multi-temporal/polarization data, a traditional feature extraction approach (i.e. extraction of average backscattering coefficient, temporal variability and long-term coherence) and principal component analysis (PCA) were applied and compared. A data-driven fuzzy logic approach was applied to the classification of those features. In the fuzzy logic approach, fuzzy membership functions based on smoothed kernel density estimation and likelihood ratio functions were derived and various fuzzy combination operators were tested. A case study from an agricultural area has been carried out to illustrate the proposed methodology. [C11988]

"Modeling Coastal Waters from Hyperspectral Imagery using Manifold Coordinates"

In [1] [2], we introduced a direct data driven method of modeling nonlinear structure in hyperspectral imagery based on Isometric Mapping [15]. More recently, we have further improved the scaling of the approach [2], making it a practical method for large-scale hyperspectral scenes. The new method extracts a set of data

manifold coordinates that directly parameterize nonlinearities present in hyperspectral imagery, both on land and in the water column. In the water column, this is particularly important because of the nonlinear, attenuating properties of the medium. In this paper, we model hyperspectral imagery acquired by the NRL PHILLS [5] at the Indian River Lagoon, Florida in July 2004. In our previous efforts [3] using a small subset of data derived from the surf zone outside of the lagoon, dominant manifold coordinates were shown to parameterize bathymetry directly with a high degree of correlation to a radiative transfer look-up table (LUT) approach. In the present work, we construct a full scene manifold coordinate representation and use this as the basis of a LUT for samples with known depths as determined by the SHOALS LIDAR. Sequestered test data presented to the manifold based LUT yield a mean estimated depth which differs from the LOAR retrieved depth by less than 0.44 m for depths between 0-10 m with a standard deviation less than 1.2 m. [C11989]

"A Simple Model for Scattering Coefficients of Vegetation Canopies"

A new simple microwave backward and forward scattering model for vegetation canopies is developed in this study. This simple model has only ten input parameters for a natural earth surface, which is modeled as a two-layer structure comprising a vegetation layer and a ground layer. The computation results of this model are compared with the experimental measurements, which were obtained by a ground-based scatterometer and the NASA/JPL air-borne synthetic aperture radar (SAR) system. It is found that the scattering model agrees well with the experimental data, even though the model uses only ten input parameters. [C11990]

"Simulations of L-Band Backscattering from a Quasi- Periodic Corn Canopy"

Retrieval of soil moisture under corn canopies has been investigated by many researchers and is still a problem that is not fully assessed. Corn is an organized canopy. This feature produces effects not observed from natural canopies. One such effect is the dependence of sensor response on the azimuthal direction. The aim of this study is to explore these distinguishing effects by Monte-Carlo simulations. [C11991]

"Electromagnetic Scattering from Multilayer Rough Surfaces Separated by Arbitrary Dielectric Profiles"

Radar remote sensing of soil moisture content at low frequencies requires an accurate scattering model of realistic soils, which often involves multilayer rough surfaces and inhomogeneous dielectric profiles. In this paper, a hybrid analytical/numerical solution to two-dimensional scattering from multilayer rough surfaces separated by arbitrary dielectric profiles based on the extended boundary condition method (EBCM) and scattering matrix technique is presented. The reflection and transmission matrices of a rough interface are constructed using EBCM. The inhomogeneous dielectric profile is modeled as a stack of piecewise homogeneous dielectric thin layers. The scattering matrices of an inhomogeneous dielectric profile are computed by recursively cascading reflection and transmission matrices of individual dielectric interfaces from the bottom dielectric interface to the top interface. The interactions between the rough interfaces and the inhomogeneous dielectric profile are taken into account by applying the generalized scattering matrix technique, in numerical simulations, the actual field-collected soil moisture data are used, in particular, the dielectric profiles during both dry and wet ground conditions are examined. The numerical simulations are performed to investigate both bistatic scattering coefficients and copolarized phase difference due to different subsurface roughness parameters and ground conditions. Simulation results show that the bistatic scattering coefficients at low frequencies are sensitive to subsurface roughness parameters and copolarized phase difference strongly depends on soil moisture contents. [C11992]

"Polarimetric SAR Detection of Man-Made Structures Using Normalized Circular-pol Correlation Coefficients"

Polarimetric synthetic aperture radar (SAR) backscatter from man-made structures is often quite different than scatter from predominantly natural areas. Backscatter from natural areas is often characterized by near zero values for linear-basis covariance matrix off-diagonal terms of the form $\langle SHVS^*HH \rangle$ and $\langle SHVS^*VV \rangle$. A new approach is proposed to detect man-made structures using circular-pol RR-LL correlation coefficients. This method uses a normalization term, which enhances the return from man-made structures and eliminates most of the unnecessary details of the backscatter from natural areas. [C11993]

"A Numerical Model of Radar Scattering from Steep and Breaking Waves"

Ocean gravity waves can be rather steep and even breaking depending on wind speed. Analytical modeling of both the evolution of such strongly nonlinear waves and electromagnetic (EM) scattering from them is currently impossible. At the same time, numerical modeling of these processes poses a significant challenge in terms of

the complexity of codes and computational time. In this study, we employ an efficient and fast numerical solver which is based on a uniform approach equally convenient when dealing with both hydrodynamic and EM parts of the problem. As a result, a sequence of large-scale wave profiles is produced that follows through all stages of wave breaking. The small-scale roughness is treated statistically by employing the Pierson-Moskowitz spectrum, and it is added on top of smooth gravity waves. Using the EM code, the scattering problem is solved assuming an impedance boundary condition. The same spline description of the surface profiles of gravity waves is used in both hydrodynamic and EM codes. Backscattering cross sections and corresponding Doppler spectra were the subjects of this study. The numerical calculations demonstrate spike events, with the backscattered signal at horizontal polarization exceeding the backscattering signal at vertical polarization. [C11994]

"The Difference Scattering dRCS from a Dielectric Target above a Rough Surface"

The difference field RCS (d-RCS) has been defined to analyze the scattering from the target above a rough surface. The electric field integral equations (EFIEs) of the difference induced current on the rough surface, the induced electric current and magnetic current on the dielectric target under a TE wave incidence are derived. A small portion of the rough surface towards the target along the specular direction is taken to compute the scattering contribution from the rough surface towards the target, which improves the computation speed. A numerical iterative approach is developed to solve the EFIEs and bistatic d-RCS. The surface length for iterations is dependent on the scattering angle and discussed for comparison with Johnson's method. Using the Monte-Carlo method to generate the P-M (Pierson-Morkowitz) ocean-like rough surface, bistatic d-RCS of the dielectric target, e.g. a cylinder or a square column, above the rough surface is numerically simulated. The induced electric and magnetic currents on the dielectric target, and the difference induced current on the rough surface are numerically discussed. [C11995]

"A New Semi-empirical Model for the Analysis of Surface Roughness Heterogeneity"

The use of a theoretical backscatter model to analyse medium to low spatial resolution microwave data is still very complicated, particularly because of the difficulty in defining a unique roughness parameter, capable of adequately representing heterogeneous terrain. In this paper, an approach is proposed for roughness analysis and the modelling of backscattering, under conditions of surface heterogeneity. The proposed backscattering model has been validated with IEM (integral equation model) simulations and radar data, for high radar incidence angles, and within its domain of roughness validity. [C11996]

"Mapping and Projection Algorithm: A New Approach to SAR Imaging Simulation for Comprehensive Terrain Scene"

A novel fast algorithm of polarimetric image simulation for SAR observation over comprehensive terrain scene is developed based on the mapping and projection principles. It incorporates penetrable and impenetrable objects, volumetric and surface scatterers in the imaging space with the extinction, attenuation, shadowing and multiple scattering effects. Scattering of the vegetation canopy is modeled as a layer of random non-spherical particles by using the vector radiative transfer model. Scattering from the ground surface and building objects is calculated by using the IEM rough surface model. As an example, the polarimetric SAR images for a virtual terrain scene, composed by tree canopies, farmland, buildings, rough land surface, hills and rivers, are simulated. [C11997]

"Inversion of Combined Radiative Transfer Models for Imaging Spectrometer and LIDAR Data"

The spectral information domain provided by imaging spectrometers contains information about the biochemical composition of a vegetation canopy such as foliage chlorophyll and water content. The spectral information content also enables indirect assessment to the biophysical parameters LAI and fractional cover. On the other hand, the information domain observed by LIDAR provides direct measurements of the vertical and horizontal canopy structure describing the canopy height and the vertical distribution of canopy elements. The leaf optical properties, which are directly related to the foliage biochemistry, scale to the canopy as function of canopy structure and spatial arrangement of canopy elements. Further, the spatial heterogeneity and canopy structure dominate the radiative transfer especially within forest stands. Consequently the LIDAR signal, e.g. recorded as full waveform, can improve the accuracy and robustness of forest canopy parameter retrieval by reducing uncertainties related to the canopy structure. On the other hand the accurate interpretation of the LIDAR signal depends on the spectral properties of canopy elements as well as the background. The two sensors and their different information domains are thus mutually dependent but also complement each other. A synergistic exploitation of the information domains observed by Imaging Spectrometry and LIDAR based on radiative transfer modeling will therefore provide a new approach to optimize the retrieval of forest foliage biochemical composition and the canopy structure. [C11998]

"Automatic Detection of Spots and Extraction of Frontiers in SAR Images by Means of the Wavelet Transform: Application to Ship and Coastline Detection"

After reviewing and discussing the difficulties of dealing with automatic interpretation methods in SAR imagery, the advantages of using a multiscale time-frequency framework will be established. Then, a specific technique for automatic spot detection, based on the Wavelet Transform (WT), will be presented and justified. The performance of the proposed algorithm will be tested, validated and compared with respect to other algorithms. The particular difficulties of automatic ship detection in near shore waters will be then briefly discussed and, aiming to increase ship detection rates in these regions, a novel automatic algorithm for the extraction of elongated structures such as the coastline will be presented and tested. [C11999]

"Hydros Soil Moisture Retrieval Algorithms: Status and Relevance to Future Missions"

In 2002 the Hydrosphere State Mission (Hydros) was selected by NASA as the alternate mission for a flight opportunity under its Earth System Science Pathfinder program. The Hydros mission objective was to collect the first global scale measurements of the Earth's soil moisture and land surface freeze/thaw conditions, using a combined L band radiometer and radar system operating at 1.41 and 1.26 GHz, respectively. Although NASA cancelled the Hydros mission in December 2005 due to insufficient funding and its reversion back to alternate mission status, the development of accurate soil moisture retrieval algorithms and associated error analyses begun under the Hydros project are still relevant to SMOS and to other potential future soil moisture missions. [C12000]

"The BYU SAR: A Small, Student-Built SAR for UAV Operation"

Students at Brigham Young University have developed a new, low-cost synthetic aperture radar (SAR) system, the BYU muSAR. The simple design, based on a linear frequency modulated continuous wave signal (LFM-CW), reduces the size and power compared to a conventional pulsed SAR system. This enables the BYU muSAR to fly on a small UAV, further reducing the cost of operation and extending the use of SAR into new areas. Design parameters and specifications for the BYU muSAR are presented in this paper, together with results from experimental data collection and test flights. [C12001]

"Range Non-linearities Correction in FMCW SAR"

The limiting factor to the use of Frequency Modulated Continuous Wave (FMCW) technology with Synthetic Aperture Radar (SAR) techniques to produce lightweight, cost effective, low power consuming imaging sensors with high resolution, is the well known presence of non-linearities in the transmitted signal. This results in contrast and range resolution degradation, especially when the system use is intended for long range applications, as it is the case for SAR. The paper presents a novel processing solution, which completely solves the non-linearity problem. It corrects the non-linearity effects for the whole range profile at once, differently from the algorithms described in literature so far, which work only for very short range intervals. The proposed method operates directly on the deramped data and it is very computationally efficient. [C12002]

"Tracking Separating Targets with Possibly Merged Measurements Using Generalized Janossy Measure Concept"

This paper is concerned with tracking a group of separating targets, using possibly merged measurements from active or passive RF or IR/EO sensors. Assuming that each sensor subsystem performs single-scan-based signal processing to generate, as a recently-developed or soon-to-be-developed capability, a probabilistic assessment of the number of targets from which a single detection originates, a new kind of tracking approach based on the generalized Janossy measure concept is proposed. [C12003]

"Research of Vision Localization and Measuring System for Magnetic Field Distribution"

According to the special measurement requirement of the magnetic field distribution of radar electromagnetic focusing system, an automatic measurement instrument based on vision localization has been developed. The principles of vision localization and model construction of measurement instrument are described. Two key points of nonlinear calibration and coordinate transformation are analyzed in detail, and some experiments based on this method are given. The application of the vision localization shows that it can calculate all the real coordinates of holes accurately. As a result, the three-dimensional rectangular robot can fulfil the measurement task perfectly [C12004]

"Target Detection Based on The Artificial Neural Network Technology"

As it is difficult to detect small ship targets from complex background in an IR image because of the impact of kinds of noises, complex background and the smallness of the target, this paper puts forward a method of background prediction utilizing the neural network. The method estimates the background of the input image nonlinearly, gains the residual error image, and detects the target. By comparison, NARX whose hidden layer transfer function utilizing L-M algorithm can achieve more excellent target detection than other neural networks like BP in training speed and stability, thus it is research valuable in the field of small target detection in complex background [C12005]

"Road Scene Analysis by Stereovision: a Robust and Quasi-Dense Approach"

A stereovision method is presented in this paper, to compute reliable and quasi-dense disparity maps of road scenes using in-vehicle cameras. It combines the advantages of the "v-disparity" approach and a quasi-dense matching algorithm. In this aim, road surface and vertical planes of the scene are first extracted using the sparse "v-disparity" approach. The knowledge of these global surfaces of the scene is then used to guide a quasi-dense matching algorithm and to propagate disparity information on horizontal edges. Both algorithms are presented and compared. Then, our approach is presented and examples of quasi-dense disparity maps are given. Finally, the efficiency of the method is illustrated by the accurate positioning of a bounding box around a vehicle in a bad contrasted video sequence [C12006]

"Global Localization Robust to GPS Outages using a Vertical Ladar"

This paper presents a localization strategy for vehicles in urban environments by mapping and updating natural landmarks provided by a 2D ladar (laser range scanner) when GPS data is unavailable or has a too poor quality because of multi-tracks or bad satellite visibility. The method relies on an approach that takes profit of successive passages in the same area. From the modelling point of view, a particularity of the method is due to the use of linear landmarks-sidewalk edges-which implies the management of topological connections. Real experiments carried out in real conditions prove the feasibility of this approach [C12007]

"Evidential versus Bayesian Estimation for Radar Map Building"

This paper discusses the role played by signal detection algorithms in the mobile robot map building problem. Typical mapping techniques make the assumption that the internal signal detection, which is required to produce an (r, ρ) point estimate, is ideal. That is, the probability of detecting the signal is unity, and the probabilities of a false alarm or missed detection are zero. In the case of grid mapping, this allows for the occupancy probability to be distributed under the constraint of a unity summation amongst affected cells. In the case of SLAM, this allows for a feature's (x, y) coordinates to be modeled with (Gaussian) probability density functions. This paper shows that typical signal detection algorithms contain all the necessary measurement models to exactly calculate the map occupancy estimates. Furthermore, once restrictive signal assumptions are relaxed, it's shown that evidence theory and not Bayesian theory should be used in the combination and updating of the map estimates. The ideas presented in this paper are demonstrated in the field robotics domain using a millimeter wave radar sensor. Target presence and absence beliefs are derived directly from signal likelihood ratios as opposed to a priori assigned constants as is typical for mapping algorithms. Results obtained from outdoor sensing experiments, show the improvement of this new model, given targets of fluctuating radar cross section (RCS) [C12008]

"Millimeter-Wave Radar for Rescue Helicopters"

A collision avoidance and warning system for civil helicopters in Japan has been developed. A real-time warning method was applied using an image fused from a coloured video, an IR sensor data and mm-wave radar measurements. This paper focuses on the FM-CW mm-wave radar sensor and the associated antennas, working at 94 GHz. Flight tests were conducted in order to detect power lines. Thanks to two different antennas, power line response was measured in vertical and horizontal polarizations. Maximum detection ranges are of 800 and 600m respectively. This variation comes from the antenna gain difference. Radar resolution is limited by the allocated bandwidth at 94 GHz which is 200 MHz. Comparisons were conducted on the ground with an integrated FM-CW radar working at 77 GHz and achieving 500 MHz bandwidth [C12009]

"A Compact 24 GHz Sensor for Beam-Forming and Imaging"

A compact 24 GHz sensor setup for experimental verifications of radar imaging and digital beam-forming has been designed and realized. The sensor consists of a FM-CW radar front-end and a remote radar electronic unit. The front-end consists of a switched antenna array of 25 linearly arranged elements fed by one transmitter and two parallel homodyne receivers connected to separate receive antenna elements. The remote radar electronic unit includes the base-band signal generation, analog inputs for data acquisition and programmable

digital circuitry for measurement control, data storage and interface handling. The sensor can be operated from a notebook computer via standard PC interfaces, thus forming a compact imaging radar system well suited for field tests. The sensor addresses primarily short and medium range automotive applications, but its flexibility in signal generation, sampling and coherent signal processing makes it interesting for many other application fields. In this article, a detailed description of the total system is given and exemplary signal processing methods for imaging and beam-forming are introduced and demonstrated with measurement results [C12010]

"Real-Value Space ESPRIT Algorithm and Its Implement"

Real-value space ESPRIT (RVS-ESPRIT) algorithm transforms complex data into real data, via constructing real-value transformation, so as to reduce computation, through rearranging data and forward-backward averaging improves the performance and precision of estimating parameter. This paper analyses the rotational invariance principle of RVS-ESPRIT algorithm, the relationship between RVS-ESPRIT and complex space ESPRIT, and give the implementing algorithm of RVS-ESPRIT. Its performance is compared with other algorithm by simulation [C12011]

"A Novel Simple DOA Estimation Algorithm Based on Direct Data Domain Approach Using Phase-Only Conjugate Gradient Method"

Recently, a direct data domain least square (D3LS) approach has been developed so quickly for array signal processing in mobile communication and radar application. With D3LS approach, only a single data snapshot is required, instead of multiple snapshots needed to form a covariance matrix in conventional algorithms. Moreover, The phase-only algorithms are so attractive due to the advantage on simple hardware implementation. Therefore, this paper proposes a novel simple direction of arrival (DOA) estimation algorithm based on D3LS approach using phase-only conjugate gradient (CG) method. Simulation results show that the proposed algorithm can estimate the DOAs of signals accurately and deal well with coherent signals [C12012]

"Ultra-Wideband Data Acquisition Circuit Based on Nonperiodic Equivalent Sampling"

A new equivalent sampling circuit for nonperiodic UWB signal is presented in this paper. In order to sampling the UWB narrow pulse effectively, the sampling speed must be very high according to the Nyquist law, the equivalent sampling method is a valid solution in a simple way. However, the condition for the traditional equivalent sampling is that the signals to be measured are periodic or duplicate, so it's necessary to improve the equivalent sampling method to adapt to the nonperiodic UWB pulses train after PPM, which changed the intervals of pulses according to PN code. Experimental results of this implementing circuit are provided to demonstrate the effectiveness and feasibility of the proposed method [C12013]

"Low Cost Measurement of Small Boat RCS at 94GHz"

This paper discusses a procedure to measure the radar cross section (RCS) of small boats at 94 GHz. It describes a simple and moderately low cost set of hardware that was used to perform these measurements. Results include polar patterns made from the peak RCS at each angle and probability density functions to characterise the distribution of RCS. In the case of the largest boat, a 41 ft fly-bridge cruiser, it was possible to process the high resolution range profile data to identify the positions of the larger scatterers. Analysis of the measured data for all of the craft shows a linear relationship between the median RCS of the non-metallic boats and their physical cross-section when viewed side on [C12014]

"GPRS Communication System Designed for High Congestion Risk Circumstance"

A GPRS communication system is presented in this paper, including image data fusion with the help of neuro-fuzzy, image data compression with controllable compression rate, effective congestion control. The combination system adopts a new fuzzy neuron network (FNN) which can appropriately adjust input and output, and increase robustness, stability and working speed of the network. Besides FNN, wavelet transform also be applied to compression algorithm for a higher and controllable compression rate. As shown by experimental results, the communication system can obtain composite image data effectively, can compress and decompress image data dynamically, can prevent the congestion significantly, which proves that it is a more practical and more effective method than traditional methods for communication in wireless networks, and it is especially better at video data transmitting [C12015]

"Joint Angle and Frequency Estimation with Uniform Eigenvalue Weighting"

In this paper, we address the problem of joint angle and frequency estimation based on uniform linear array (ULA). We derive a new version of ESPRIT-type algorithm to solve this problem. The proposed method follows

the classic data stacking and real processing techniques for signal subspace estimation. We transform the estimated real signal subspace back to the complex domain. The purpose of this transformation is to avoid a potential bad-conditioned invariance equation and unbalanced weighting for the joint eigenvalue estimation. Then the complex invariance equation is formed and solved. By such a procedure, we show that the simple joint eigenvalue estimation method can still be applied after the complex invariance equation is solved. By the more sophisticated and reliable joint eigenvalue estimation technique, we can obtain a uniform weighting for this estimation. Numerical simulations validate the proposed algorithms. [C12016]

"P1E-4 Coded Excitation Improves Vascular Wall Shear Rate Estimation"

There has been great interest in developing accurate ultrasonic velocity estimators to measure wall shear rate (WSR), in vivo. In this study, we implemented coded pulse excitation methods onto a commercial scanner and used flow-angle-corrected correlation methods to obtain WSR estimates with high spatial resolution near vessel walls. We tested the method on flow phantoms that generated a similar time-averaged shear range to human arteries (100-600 1/s), and on carotid arteries of a volunteer. Phase-modulated (PM = 13-bit Optimal) code and frequency-modulated (FM = 2.1μs pseudo-chirp) pulse with similar excitation energies were programmed into a Siemens Antares system. RF data recorded using ultrasound research interface (URI) was decoded offline. The accuracy and precision of WSR measurements were compared among broadband (BB)/narrowband (NB) and coded/uncoded data. eSNR was enhanced 15 dB using codes compared with BB pulses, and 5 dB compared with NB pulses. Experimental results show that coded pulses overall yield the minimal errors in WSR estimation (-10 % bias (B) and 4% standard deviation (SD)), compared with those of BB (30% B, 15% SD) and NB pulses (20% B, 10% SD). Errors increase with WSR for all pulses. ECG-gated acquisitions from the carotid artery of a volunteer yielded the comparable WSR values at peak systole of 853 1/s (PM), 820 (FM), 729 1/s (NB), and 590 1/s (BB), while the coded pulses provided the lowest variances. Our study shows that coded excitation techniques can increase both the precision and accuracy in WSR estimation over a broad range of shear rate. The study also demonstrates the feasibility of in vivo application of coded excitation in WSR flow imaging [C12017]

"1J-5 Quantitative Dual-beam Doppler Ultrasound Investigations"

The lack of knowledge of the beam-flow angle represents one of the major sources of uncertainty in Doppler measurements. Not only are some new, appealing applications of the Doppler technique prevented, but some basic clinical procedures are made more difficult than desirable. This paper reports on the Doppler angle ambiguity problem and on the classic solutions so far proposed in order to overcome the related limitations. The main features of a recently introduced dual-beam method are described. Starting from the classic problem of measuring the true velocity in a single sample volume, the application to the measurement of full velocity profiles is discussed. Combination of this method with a new multi-channel multi-gate system is shown capable of contributing to arterial mechanics investigations by allowing the simultaneous measurement of wall shear rate and wall distension in major human arteries. Finally the feasibility of accurate volumetric flow measurements is discussed, and work-in-progress is reported [C12018]

"6I-3 Low-Cost Transceiver Unit for SAW-Sensors Using Customized Hardware Components"

This paper presents a low-cost transceiver unit for wireless surface acoustic wave (SAW) sensors. Different types of radar principles are compared. Due to the simplicity of the hardware, the FMCW (Frequency Modulated Continuous Wave) concept is selected. It is shown that the linearity of the frequency sweep of the oscillator is the crucial point for the sensor resolution. Consequently, this contribution gives special attention to the signal generation. The customized hardware components—a mixer, a hybrid, a band-pass filter and two amplifiers—affect the signal-to-noise ratio while the readout range of the system additionally depends on the gain of the antennas. An ADC (Analog to Digital Converter) and a DSP (Digital Signal Processor) complete the hardware setup. The system is tested with delay-line temperature sensors based on the phase evaluation of the reflections. The first prototype of the interrogation unit achieves a temperature accuracy of about 0.2degC, a readout distance of 3 meters and its overall costs do not exceed 1000 euro [C12019]

"Combined Membership Functions in Fuzzy Signal Detection"

In this paper, we propose a model for a constant false alarm detection (CFAR) that uses fuzzy logic to describe the uncertainty on the decision about the presence or the absence of a target. The received signal is processed and the membership function to three regions, namely; "signal present", "signal absent" and "uncertainty" is evaluated. The membership functions from different observations are combined according to some fuzzy fusion rules to obtain the global decision. The results obtained showed that the fusion rule defined by $\min(x+y, 1)$ gives better performance detection than the other rules [C12020]

"P2D-8 An I/Q Demodulator with Phase Shifter for Beamforming Applications"

The I/Q (quadrature) demodulator and phase shifter described in this paper allow a smaller, simpler and cheaper implementation of a continuous wave (CW) Doppler beamformer for ultrasound compared to existing delay line based solutions. It could also be used in radar or other beamforming applications like "smart or adaptive" antennas. The primary challenge in this design was the realization of the phase shift function and how to maintain a dynamic range of 160 dB/Hz with a power consumption of less than 200 mW per channel. A key architectural change allowed the desired performance to be achieved. The design described has a patent pending [C12021]

"P1J-4 High-Q FBARs Using Epitaxial AlN Films"

FBARs (Film Bulk Acoustic Resonators) are attractive candidates for RF filtering in radar phased array modules providing that their insertion loss can be reduced to 1 dB or less. One of the factors that contributes to the increased insertion loss of FBAR filters at X-band is the difficulty in achieving high crystalline quality in thin (<0.5 μm) sputtered films. We describe an FBAR fabrication process using single crystal AlN films that are deposited epitaxially on SiC substrates. It is intended that this process would ultimately be compatible with GaN wide-band-gap integrated circuits that would provide the switches required for a switched filterbank and the LNAs. The single crystal FBARs showed the expected resonator behavior but with lower Q and lower piezoelectric coupling coefficient (k_2) than desired. Improvements to decrease film roughness, minimize electrode losses and improved fabrication process will result in the performance expected of single crystal films [C12022]

"3B-6 Motion Compensation on Synthetic Aperture Sonar Images"

The problem of horizontal displacement errors or sway errors in the tow-path of the synthetic aperture sonar (SAS) platform has a devastating effect on the quality of the reconstructed image if they are left uncorrected. The Displaced Phase Center Array algorithm is the most effective of the micro-navigation algorithms developed to date to obtain these path errors, which exploits in a unique way the spatial and temporal coherence properties of the sea-floor backscatter. This DPCA algorithm is described below in detail as well as the way how to compensate for this motion [C12023]

"Application of Millimetre Wave Radar Sensor to Environment Mapping in Surface Mining"

This paper presents the application of a millimetre wave radar technology to environment mapping in surface mining. Sensor requirements for ranging and surface profiling in shovel and dragline operations were determined based on machines performance requirements. Frequency modulated continuous wave (FMCW) technique was selected to achieve the correct range resolution while fast Fourier techniques (FFT) was used to extract the range data from the radar output. Radar data processing was undertaken using stochastic environment representation technique in real-time. The results of field trials show successful radar performance in terms of the system's accurate measurement of excavation terrain, real-time imaging, robustness, reliability and penetration through dust and water [C12024]

"Robust Parallel Filtering for Mobile Agent Tracking"

In this paper we develop a robust method of target/mobile agent tracking involving two independent estimators with separate measurement systems. The outputs of the two estimators are combined using simple trigonometry (post-estimation data fusion) and provide a robust and reliable tracking path. We demonstrate that through the use of recent advances in robust set-value state estimation, our robust parallel filter approach performs well even when the individual filters do not. Brief comparisons with common data fusion methods are conducted in order to demonstrate the advantages of our parallel (post-estimation fusion) approach [C12025]

"Design of GPS/MM/GPRS Integrated Location System for the Mobile Robot"

A MM (map matching) method based on credibility algorithm is proposed in this paper to improve location precision of GPS (global positioning system) for the mobile robot. It can find the exact road on which the robot moves in the electronic map quickly when the longitude and latitude of the robot is known. How to extract longitude and latitude from GPS data stream is also introduced. AT commands are used to establish GPRS (general packet radio service) link for transmitting location messages and telecommands between the robot and control center. The analysis of map matching diagram and simulation are given in the final. A great deal of on-the-spot experiments prove that this system has the better positioning precision than that of positioning of single GPS receiver [C12026]

"2B-5 Ultrasound Imaging with Beamforming Adapted to Target"

For over fifty years adaptive beamforming (ABF) algorithms have been applied in RADAR and SONAR signal processing. These algorithms reduce the contribution of undesired off-axis signals while maintaining a desired response along a specific look direction. Typically, ABF achieves higher resolution and contrast than conventional beamforming (CBF), at the price of an increased computational load. In this paper we develop a novel ABF that can be applied to medical ultrasound, named the Time-domain optimized near-field estimator, or TONE. We performed a series of simulations using ultrasound data to test the performance of this algorithm and compare it to conventional, data independent, delay and sum beamforming. We also performed experiments using a Philips SONOS 5500. CBF was applied using the default parameters of the Philips scanner, whereas TONE was applied on single-channel, unfocused data with plane wave transmit. TONE images were reconstructed at a sampling of 67μm laterally and 19μm axially. The results obtained for a series of 5 20μm wires in a water tank show a significant improvement in spatial resolution when compared to CBF. We also analyzed the performance of TONE as a function of speed of sound errors and array sparsity, finding TONE robust to both [C12027]

"WSN06-6: Performance Evaluation of Localization by Acoustic DS-CDM Signals"

The authors have proposed a beacon signal radiation system from the power-line for time synchronization among wireless and wired nodes. The considered application of the radiation system is an indoor fine-grained localization. Our rangefinder uses direct-sequence code division multiplexed (DS-CDM) audible sound signals. This technique significantly improves performance in obstructed and noisy environments because of the spreading gain. In this paper, it is shown that the obtained average and worst accuracy of the localization in a 4 m² plane is 1cm and 4cm, respectively, if there is no obstacle. Even if there are obstacles, the proposing method is possible to measure the location by the diffracted sound wave. If the obstacle is relatively small, its accuracy is within 5cm. On the other hand, if the obstacle is relatively large, a method to determine the presence of the large obstacle is proposed. These results are shown experimentally. [C12028]

"Source Detection and Localization in Array Signal Processing"

Estimating the number of sources and locating the direction-of-arrival are important problems in array signal processing. In this paper, we propose noneigenvalues decomposition fast algorithms for radiating source detection and localization by using LU and QR factorizations of the sample cross-spectral matrix. The threshold values between the signal subspace and the noise subspace eigenvalues of the cross-spectral matrix are proposed. The developed algorithms improve the performance and reduce the computational loads of eigendecomposition based methods when the number of multiple sources is much lower than the number of array sensors. Simulations results, show the high performance and accuracy of the proposed algorithms, are presented. [C12029]

"Adaptive monopulse with STAP"

Monopulse is a well known technique for high accuracy estimation of target parameters such as azimuth and elevation as well as the radial velocity. In conjunction with an adaptive processor for cancellation of interference one obtains so called adaptive monopulse. Interference may be either jamming or clutter or both. In this contribution some properties of adaptive monopulse applied in a clutter environment is discussed. We focus on an airborne radar scenario so that the adaptive monopulse includes a space-time adaptive processor (STAP). Several different STAP architectures are compared with respect to their aptitude for target parameter estimation [C12030]

"Real-Time Implementation of Airborne Radar Space-Time Adaptive Processing on Multi-DSP System"

The space-time adaptive processing (STAP) algorithm that is well-known in area of multi-channel airborne radar requires very high computing power and hardly implements. In this paper, detail analysis of computation steps of partially-adaptive STAP algorithm is presents, which indicates that there is a natural, inherent parallelism in STAP algorithm. A parallel algorithm based on multi-DSP system of partially-adaptive STAP is presented. The execution model, task mapping strategy and performance evaluation functions of this algorithm, is also illustrated. Data remapping is used between successive computation steps of STAP. The effectiveness of the implementation is demonstrated with experimental results [C12031]

"Further Research on Space-Time Multiple-Beam STAP Algorithm"

The system DOFs (degree of freedom) of traditional localized STAP algorithms are fixed, such as JDL and

STMB etc. This paper presents some further research on the STMB STAP algorithm, which adjusts system DOFs adaptively with variable interference environment, so it reduces large computational complexity and improves the performance of jammer suppression. The validity of the research is proved by measurement data processing result [C12032]

"Ionosphere Decontamination of High Frequency Radar Echoes"

The ionosphere contamination imposing on the high frequency (HF) radar echoes has to be suppressed since it severely degrades the detection performance of HF radar. In this paper, the mechanism of the ionosphere contamination from the ionosphere distortion is exposed for the first time by analyzing the course of HF radar signal processing. According to the high spatial correlativity of the ionosphere contamination, then the rank one phase error estimation (ROPE) autofocus method in imaging radar is suitably modified and applied to the ionosphere decontamination of HF radar echoes. Finally the simulation examples are presented and the excellent performance of this approach is demonstrated when the ionosphere slowly distorts [C12033]

"Properties of Digital Beamforming with Subarrays"

Digital beamforming with array antennas is often applied at subarray outputs. These subarrays can be considered as new array elements; their phase centre is separated by more than half a wavelength. This leads to grating effects when the beam is scanned digitally. We present a mathematical description and properties of digital beamforming and solutions to the grating problem obtained from different optimisation problems. The efficiency of this digital processing is sensitive against the underlying subarray configuration. From this sensitivity it can be derived that partially overlapping subarrays are better suited to reduce grating lobes than non-overlapping (single layer) subarrays or fully overlapping (double layer) subarrays [C12034]

"Optimizing and Implementing the Fast Algorithm for Real Time SAR Imaging"

A fast correlation algorithm in SAR imaging is presented to lower down the computation burden of range compression and azimuth focusing processing. It is based on the decomposition method of DFT. In order to minimize the computation amount, the relationship of number of padding zeroes and the decomposition scheme to computation complexity is investigated, which is dependent on the number of correlation filter coefficient taps. Then for different numbers of correlation filter coefficient taps, the number of padding zeroes and decomposition scheme are optimized. This algorithm is superior in computational efficiency compared with other algorithms. It is applied to real time SAR imaging and proved to be effective in computation [C12035]

"Design Considerations of The Active Scalable Array Antenna"

Based on the developing requirements of universality, multifunction, modularization and low-cost of modern radar, this paper presents a new architecture of active scalable array antenna (ASAA), describes the function characteristics, and gives two potential structures and the corresponding configurations, design rules and design requirements. Also, a developed fabricated X-band RF scalable array module (SAM) is reported in this paper [C12036]

"Analysis of STAP on MDV for Spaceborne SAR-GMTI Applications"

Space-time adaptive processing (STAP) holds tremendous potential for the new generation spaceborne radar to get good performance of ground/sea moving target indicator (GMTI). A system scheme based on the fully adaptive space-time processing of spaceborne SAR-GMTI mode of operation is presented in this paper and the minimum detectable velocity (MDV) of target in GMTI mode is analyzed. Theoretical analysis and simulations demonstrate the effectiveness of the system scheme [C12037]

"Research on Ship Target Auto-Recognition Technique for Low Resolution Radar"

An auto-recognition method of ship with low resolution radar is presented in the paper using multi transform technique. The radar target echo is sampled and preprocessed to suppress clutter first. Then characteristic vectors of the target are extracted with FFT transform, Mellin transform, wavelet transform and frame correlation processing. Experiments are carried out for the proposed method with three kinds of real radar echo data of ship target, the results indicate that the characteristics vector extracted by the proposed method in this paper is valuable for target classification [C12038]

"Further Results on Peak Sidelobe Control in Adaptive Arrays"

Adaptive arrays (or adaptive beamformers) are now widely used in radar, sonar, and communications to

suppress various kinds of interference. In radar applications, adaptive beampatterns with low sidelobes and stable mainlobe shapes are desired so as to mitigate pulsed deceptive jammers or sidelobe targets and to accurately measure the direction-of-arrival (DOA) of a target using monopulse techniques. In practice, there are many kinds of data modeling errors that would degrade the performance of adaptive arrays. In this case, adaptive beamformers tend to suffer too much performance degradation (poor interference rejection, distorted mainlobes and high sidelobes). We have previously proposed a quadratical constraint based method, referred to as integrated peak sidelobe control (IPSC), which can precisely control the peak sidelobes and produce stable mainlobe shapes of adaptive beampatterns. In this paper, the effects of target signals on IPSC are investigated and a signal removal scheme is given to further improve its performance. The performance of IPSC is also compared to the more recently devised second-order cone programming (SOCP) based new approach, referred to as distributed peak sidelobe control (DPSC). Numerical results indicate that IPSC outperforms DPSC in both the interference rejection performance and the beampattern control quality. Moreover, the former is computationally far more efficient than the latter [C12039]

"Temporal Side Manifold-A New Approach for Spatial Spectrum Estimation Using Temporal Information"

The present algorithms on 2-D temporal-spatial spectrum estimation are deteriorated when the number of signals become close to the dimension of the array. The expenses of the hardware and the software have to be increased to alleviate this degradation. In this paper, a kind of new signal model and approach for 2-D temporal-spatial spectrum estimation is proposed. Through the temporal projection, the maximal number of the signals this method can deal with is much more than present algorithms. Simulation results are presented to demonstrate the performance of the proposed algorithm [C12040]

"Wideband Phased Subarray Jammer Nulling Technique"

High-resolution radar imaging systems are vulnerable to external interferences. When jammer power is large, it has a great impact on detectability and identifiability of the target. A jammer nulling method is presented after stretch processing and narrowband filtering which uses LMF signal in this paper. Moreover, The algorithm is simple in computation and easy in practical engineering. At last the computer simulation demonstrates the effectiveness of the method [C12041]

"Benefits of Space Time Adaptive Processing for Air to Air operations"

The aim of the paper is to give an overview of capacities and interests of space-time adaptive processing (STAP) for air to air operations. In order to evaluate the benefits of STAP without artifact effects due to the chosen algorithm, a less computation load implementation of the maximum likelihood ratio test has been developed and is detailed in the paper. Results of simulations are shown and point out the expected benefits of STAP for clutter reduction in air to air operations [C12042]

"Detection Performance Analysis of Distributed OSCA CFAR with Noncoherent Integration"

A novel distributed detector, called order statistic cell-averaging (OSCA) detector, are proposed in the case of noncoherent integration. In this detector, each sensor transmits its test cell sample and a designated order statistic (OS) of its reference observations surrounding test cell to the fusion center. At the fusion center, the global noise power level is obtained with cell-averaging (CA) processing. Under the assumption of chi-square family target model and exponential clutter for independent square-law detector, the exact formulas of probability of false alarm (Pfa) and probability of detection (Pd), are derived. Finally, the corresponding detection performance is calculated with numerical analysis [C12043]

"Experimental System and Experimental Results for Coast-ship Bi/multistatic Ground-wave Over-the-horizon Radar"

This paper deals with a novel bi/multistatic radar system, which is spoken of as the bi/multistatic ground-wave (GW) over-the-horizon (OTH) radar based on the technique of synthetic impulse and aperture radar (SIAR). This radar can also be named as multi-input single-output (MISO) radar which uses several antennas to transmit orthogonal waves in one sector or the whole space and uses an omnidirectional antenna to receive target echoes. The receiver is installed on a moving ship and the transmit beams are formed through space-time signal processing in the receiver, which is the same as "passive position" without emitting energy. In this paper, an introduction is given to the operating principle of this radar as well as the experimental system and the results obtained [C12044]

"Study on HPRF Pulsed Doppler Stepped Frequency Radar System"

Stepped-frequency radar has the ability of high range resolution. It normally adopts frequency time transformation (IDFT) processing to get the range profile of targets. Alternatively stepped frequency radar can also use time-frequency transformation (DFT) processing, with which it is regarded as a kind of Doppler (PD) radars. Through parametric design and signal processing methods, DFT method can achieve both unambiguous velocity and high resolution ranging in a single dwell under HPRF mode. This paper gives parameter design principle for HPRF PD stepped-frequency radar system, and its system implementation methods. Both theoretical analysis and simulation result prove that this radar scheme can simultaneously achieve unambiguous velocity and high resolution ranging [C12045]

"Lightning Interference Cancellation in High-Frequency Surface Wave Radar"

The performance of high-frequency surface wave radar (HFSWR) is known to suffer from the lightning impulsive noise. In this paper, the characteristics of lightning interference in range, Doppler and spatial domain are analyzed and a new Doppler-domain cancellation scheme based on adaptive beamforming is proposed. The new scheme has no special requirement for the distribution of ocean/ground clutter in range-Doppler map and therefore is more preferable in practical HFSWR environments [C12046]

"STAP Processing Without noise-only reference: requirements and solutions"

In presence of non-stationary clutter or jamming, estimation of the characteristics of noise from signals received in adjacent range gates is no more efficient, and processing must be defined based exclusively on the samples received in the range cell under test. In this paper, we first review the requirements for STAP processing, highlighting the importance of non-stationary clutter. We then derive a robust noise-only reference procedure, and demonstrate its efficiency with new experimental results from airborne X-band monopulse radar. In conclusion, other approaches of STAP processing without noise-only reference are briefly described, and the requirement for further work on CFAR detection for these applications is emphasized [C12047]

"Stretch Processing for Long Integration Time Passive Covert Radar"

The paper presents a study of possibility of increasing the passive covert radar sensitivity by extending the coherent integration time. The long integration time induces the target range migration of moving targets. To overcome this problem, the usage of stretch processing is investigated. The paper shows, that even a simplified algorithm applying stretch processing concept, can significantly improve the radar sensitivity [C12048]

"Study on Distinguish of Two Overlapped Target Signals in DBF"

This paper studies the method how to solve for the real azimuths of each target when two targets are in the same beam so as to distinguish the two targets using the same phase property. By means of the directly calculation according to a formulas, this method possesses the merit of easy and convenient to realize [C12049]

"Design of a Two-channel Ultra High Frequency Data Acquisition System Based On FPGA"

In this paper, design and realization of a two-channel ultra high frequency data acquisition system is introduced, capable of up to 1 Gbps sample rate, 8 bit resolution. With the large scale FPGA chip from Xilinx Inc, we can realize sample data receiving and digital signal processing. This system is flexible to extend and works steadily, so it can be used in such radar system as SAR which needs wideband signal sampling [C12050]

"Novel Filter Design for detecting weak targets of slow speed out of multi-mode clutters"

The paper presents a novel stagger MTI filter design algorithm, which can detect weak targets of slow speed out of multi-mode clutters. The method is carried out by slipping pulses, and the best pulse repetitive frequencies selected by gradient-GA make the first notches of the filter banks as shallow as possible, so the weak targets in the first notch can be detected. Multi-model clutters can be suppressed by MTI filter, and blind-velocity can be appeared out of three times velocity of sound. Combined GA's the capability of the whole searching and not limited by selection of initial parameter with the gradient algorithm's advantage of fast searching, it can offer fewer initial population and low computation complexity. The simulation and performance analysis demonstrate the feasibility and validity of the algorithm [C12051]

"A Novel Algorithm for Estimating DOA of Coherent Signals on Uniform Circular Array"

A novel algorithm is proposed to estimate direction-of-arrival (DOA) of coherent signals on a uniform circular array (UCA), which is called MODE-TOEP algorithm. Firstly, the mode excitation method is used to transform the

UCA in element space into a virtual uniform linear array (VULA) in mode space. Then a Toeplitz matrix can be reconstructed to estimate DOA of coherent signals successfully. MODE-TOEP algorithm has less computational burden due to not using spatial smoothing. Simulation results show that MODE-TOEP algorithm is effective and has a better performance compared to conventional mode spatial smoothing (MODE-SS) algorithm [C12052]

"The Universal Implementation of Space-Time Adaptive Processing"

Space-time adaptive processing (STAP) is the key technology of new generation; airborne digital signal processing system. The primary differences between STAP methods are the order of the operations performed and the choice of transformation matrix. The operations performed in different methods are similar to each other, such as FFT and QR decomposition. This similarity makes the idea of universal platform be very attractive. Based on a parallel computational model the model, a universal real-time platform for STAP is developed. Scalable cluster-organized multi-processors structure is adopted as hardware architecture. Common operations are built into software libraries and a heuristic methodology is used for task mapping. Two STAP methods are applied. Results show that the universal platform can meet the real-time requirement, and its scalability is good [C12053]

"UWB signature analysis for detection of body-worn weapons"

Presented work is dedicated to the study of innovative principles, which can be used for the remote detection of concealed, body-worn weapons & explosives (CW&E). The approach is based on the analysis of the late time response (LTR) of the human body illuminated by a UWB signal: if CW&E are attached to the body it will essentially influence the LTR characteristics. A set of LTR parameters represents the unique signature of target. Our aim here is to demonstrate the ability of the developed approach to extract and to interpret the signature. In order to validate a feasibility of the approach analytical consideration, full-wave modeling and initial experiment have been implemented and results have been compared [C12054]

"Modified Range-Doppler Algorithm for Space-Surface BSAR imaging"

This paper reports progress in the development of an image formation algorithm suitable for space-surface bistatic synthetic aperture radar (SS-BSAR). An overview of the proposed algorithm in its current stage of development, a modification of the standard range-Doppler algorithm (RDA) is provided and some first experimental bistatic results obtained using the algorithm are presented [C12055]

"Application of Adaptive Stochastic Resonance in Noise Restrain"

The phenomenon of stochastic resonance (SR) in symmetric bistable nonlinear system is analyzed. The conditions which make the system to resonance are given and validated. In order to resolve the problem of improving the SNR while using airborne early warning (AEW) radar to detect slow speed target on the ground, an improved adaptive stochastic resonance system is proposed. The validity and feasibility of the system is proved by simulation experience [C12056]

"New Non-Stationary Target Feature Detection Techniques"

In a seminal paper, two algorithmic versions of the multichannel parametric adaptive matched filter (PAMF) applied to space-time adaptive processing (STAP) in an airborne radar application were shown to achieve superior test detection statistics over the conventional adaptive matched filter (AMF), which uses a non-parametric approach to estimate the detection weight vector. In fact, the performance of the PAMF approach is very close to the ideal matched filter (MF) detection statistics under exactly known covariance (the clairvoyant case). Improved versions of the two original multichannel PAMF algorithms, one new multi-channel PAMF algorithm, and a new two-dimensional PAMF algorithm (all four with fast computational implementations) have been summarized in recent papers. In this paper, we provide the detection performance of the four improved/new PAMF algorithms with simulated radar data. In all cases, the performance is at least comparable to, and in some cases superior to, the original multi-channel PAMF algorithms presented by M. Rangaswamy et al (2000), while achieving computational savings over the originals. [C12057]

"Chirplet Transform Signal Decomposition for Echo Detection and Estimation"

Decomposition and analysis of nonstationary signals is a challenging problem common to radar, sonar, EEG, speech processing, and ultrasound. The chirplet transform signal decomposition (CTSD) algorithm described in this work presents a computationally efficient method for separating overlapping echoes through successive detection. Performance of this algorithm is evaluated for different signals typical in ultrasound and target detection and ranging. As part of algorithm characterization, a system on a chip (SoC) hardware implementation

has been developed. [C12058]

"Optimization in the Complex Domain for Nonlinear Adaptive Filtering"

We present a framework that greatly simplifies the evaluations and analyses for optimization in the complex plane through the use of a generalized definition of analyticity. We derive the gradient, the relative (natural) gradient, Newton, and Newton variation updates by using this result and demonstrate its application in system identification using linear and multi-layer perceptron filters. [C12059]

"Virtual Array Processing for Active Radar and Sonar Sensing"

In this paper, we describe how an active radar/sonar imaging problem may be formulated as a virtual passive sensor array processing problem. We consider an active sensing problem where it is desired to form a range-Doppler image at a slow- time rate, even though the radar/sonar can transmit pulses at a fast time rate. By transmitting pulses at the fast time rate we can estimate the second-order statistics of an ambiguity vector, calculated at a coarse resolution. As we show this ambiguity vector plays the role of an array snapshot vector in passive sensor array processing. The noise free version of this ambiguity vector acts as a signature vector or steering vector, which can be steered around in delay and Doppler at a fine resolution to produce an image. We employ a MVDR-like principle to generate high resolution delay-Doppler images. [C12060]

"Adaptive Waveform Design for a Multi-Antenna Radar System"

We consider a radar system which uses an array of antennas, and is capable of adjusting the waveform transmitted through these antennas based on target and clutter statistics, on a pulse by pulse basis. A model for the radar returns which incorporates the transmit waveforms is developed. The target detection problem is formulated for that model. An algorithm is derived for designing the transmit waveform so as to optimize detection performance. [C12061]

"Synchronization and Performance of a Cooperative Pulse Transmission Algorithm for a Wireless Network of Active Sensors"

A cluster-based, cooperative pulse transmission scheduling algorithm is presented and analyzed for a wireless network of active sensors. Synchronization requirements are defined and addressed to accommodate time, frequency, and phase constraints. Performance metrics for the received signal- to-noise ratio (SNR) and the maximum pulse repetition frequency (PRF) are developed and analyzed. A trade-off is found to exist between the two metrics that can be managed by optimizing the number of nodes per cluster. The performance is shown to be substantially better than the conventional "hand-off technique and is validated through simulation for both uniform and random arrays. [C12062]

"Beamforming issues in modern MIMO Radars with Doppler"

In traditional beamforming radar systems, the transmitting antennas send coherent waveforms which form a highly focused beam. In the MIMO radar system, the transmitter sends noncoherent (possibly orthogonal) broad (possibly omni-directional) waveforms. These waveforms can be extracted by a matched filterbank at the receiver. The extracted signals can be used to obtain more diversity or improve the clutter resolution. This paper focuses on space-time adaptive processing (STAP) for MIMO radar systems which improves the clutter resolution. The size of the MIMO STAP steering vector can be much larger than the traditional SIMO STAP steering vector because of the extra dimension. An accurate estimation of clutter rank for the subspace method is developed, and is a generalization of Brennan's rule to the MIMO radar case. A data independent method for estimating the clutter subspace is also described. [C12063]

"Conference Record of The Fortieth Asilomar Conference on Signals, Systems & Computers"

The following concepts are discussed: capacity of ad hoc networks; MIMO radar; temporal analysis and mining in multimedia; advances in medical imaging; DSP architectures;- MIMO ad hoc networks; adaptive systems for communications; advanced optical techniques for biology; adaptive filters; sensor networks; computer arithmetic; image and video processing; performance analysis for communications; statistical signal processing and applications; biometrics and security in image processing; wireless networks; VLSI digital signal processing; video coding and analysis; speech and audio processing; resource allocation in networks; sparse adaptive systems; blind source separation; geospatial image processing; biomedical signal and image processing. [C12064]

"Pulse Amplitude Modulation Direct Sequence Ultra Wideband Sharing Signal for Communication and Radar Systems"

Applying to inter-vehicle communication and satellite communication and location among satellite formation, the sharing signal of integrated systems that applied with ultra wideband (UWB) signal was presented. Pulse amplitude modulation direct sequence ultra wideband (PAM DS UWB) sharing signal model was given, and its power spectrum density was introduced. The ambiguity function of PAM DS UWB sharing signal was derived. From numerical simulations, the PAM DS UWB sharing signal yielded the so-called thumbtack ambiguity function. For practical application, the discussion about estimating communication link and radar range was carried out. The relations among five parameters of the sharing signal were analyzed, too. The results show that the PAM DS UWB signal can be applied to integrated systems. [C12065]

"A Novel Noncoherent Monopulse Processing Scheme and Its Channels Imbalance Analysis"

The noncoherent processing can alleviate the effect of phase imbalances in receiver channels of monopulse radar. In this paper, a novel noncoherent processing scheme, which uses logarithmic amplifiers, is considered and explicit expressions are derived for the indicated angle as a function of various imbalances in the receiver channels. Its performance is then analyzed using shift in null position and deviation in slope of the angle sensitivity curve as criteria. Its performance in some aspect is superior to that of the conventional monopulse processing due to symmetrical channels and wide dynamic range. [C12066]

"MIMO Radar Ambiguity Functions"

Multiple-input multiple-output (MIMO) radar has been shown to provide enhanced performance in theory and in practice. MIMO radars are equipped with the ability to freely choose their transmitted waveforms at each aperture. In conventional radar systems Woodward's ambiguity function is used to characterize waveform resolution performance. In this paper we extend the idea of waveform ambiguity functions to MIMO radars. MIMO ambiguity functions are developed that simultaneously characterize the effects of array geometry and transmitted waveforms on resolution performance. Overall resolution performance is shown to be governed by a space- time covariance function that can be controlled by the system on transmit using waveform diversity. Visual examples are provided to illustrate the resolution enhancement possible using MIMO technology. [C12067]

"On Probing Signal Design for MIMO Radar"

A MIMO (multi-input multi-output) radar system, unlike a standard phased-array radar, can choose freely the probing signals transmitted via its antennas to maximize the power around the locations of the targets of interest, or more generally to approximate a given transmit beampattern, and also to minimize the cross-correlation of the signals reflected back to the radar by the targets of interest. In this paper, we show how the above desirable features can be achieved by designing the covariance matrix of the probing signal vector transmitted by the radar. Moreover, in a numerical study, we show that the proper choice of the probing signals can significantly improve the performance of adaptive MIMO radar techniques. Additionally, we demonstrate the advantages of several MIMO transmit beampattern designs, including a beampattern matching design and a minimum sidelobe beampattern design, over their phased- array counterparts. [C12068]

"High Resolution Capabilities of MIMO Radar"

Multiple-input multiple-output (MIMO) radar is a multistatic architecture composed of multiple transmitters and receivers, which seeks to exploit the spatial diversity of radar backscatter. In conjunction with centralized processing, MIMO radar has the potential to significantly improve radar functions such as detection and parameter estimation. MIMO radar is distinct from other types of array radars such as phased array or STAP, which process the signals of closely spaced elements and, hence, cannot capitalize on the spatial characteristics of targets. In this work, we explore the ability of MIMO radar and coherent processing to locate a target with high resolution and to resolve targets located in the same range cell. A distributed target model is developed. It is demonstrated that MIMO radar with centralized coherent processing is able to resolve scatterers with a range resolution well beyond that supported by the signal bandwidth. The location estimation capabilities are further illustrated by introducing a new two-dimensional ambiguity function. The analysis is discussed in the context of established results for randomly thinned arrays. The investigation of high resolution MIMO radar also includes comparison with the performance of non-coherent MIMO radar and the effect on performance of the number of sensors and their locations. [C12069]

"Sequential Detection for a Target in Compound-Gaussian Clutter"

Sequential detection allows the analysis of an incoming data flow and the detection of changes in the distribution

of these measurements. In this paper, we develop the sequential detection algorithm for a target under compound-Gaussian clutter. Both the target and clutter parameters are assumed unknown. We first derive estimates for these parameters, then discuss the sequential detection algorithm for two cases: target parameter is known and unknown. We consider detections for both the target appearance and disappearance. We examine the relationship between several performance measurements for the sequential detector, including the false-alarm rate and the average detection delay. In the numerical example part, we first illustrate the performance of our algorithms. Then we present an example of the optimal polarimetry design in the sequential detection.

[C12070]

"MIMO Radar Medical Imaging: Self-Interference Mitigation for Breast Tumor Detection"

In this paper, an application of multiple-input multiple-output (MIMO) radar techniques to medical imaging is investigated. MIMO radar, which can be viewed as a form of microwave tomography for medical imaging geometries, offers an alternative to current X-ray technology. Of particular interest is the detection of cancerous tumors in breast tissue. Previously, ultrawideband radar techniques have been considered. Here, an intermediate bandwidth is assumed, which enables the digitization of the entire baseband signal. However, this comes with the cost of self-interference because of transmitting and receiving simultaneously. Because the scattering response of tumors is weak compared to self-interference, mitigation of the direct transmitter-to-receiver signal is important to detection. In this application, three interference suppression techniques are considered: temporal mitigation, receive-array mitigation, and transmit-waveform optimization. Mitigation residuals, caused by calibration errors and signal nonlinearities, are included in the analysis. A system concept is introduced, and results from simulations using a simplified physical model are presented. [C12071]

"Real-time synthetic aperture imaging: opportunities and challenges"

Synthetic aperture (SA) ultrasound imaging has not been introduced in commercial scanners mainly due to the computational cost associated with the hardware implementation of this imaging modality. SA imaging redefines the term beamformed line. Since the acquired information comes from all points in the region of interest it is possible to beamform the signals along a desired path, thus, improving the estimation of blood flow. The transmission of coded excitations makes it possible to achieve higher contrast and larger penetration depth compared to "conventional" scanners. This paper presents the development and implementation of the signal processing stages employed in SA imaging: compression of received data acquired using codes, and beamforming. The goal was to implement the system using commercially available field programmable gate arrays. The compression filter operates on frequency modulated pulses with duration of up to 50 μ s sampled at 70 MHz. The beamformer can process data from 256 channels at a pulse repetition frequency of 5000 Hz and produces 192 lines of 1024 complex samples in real time. The lines are described by their origin, direction, length and distance between two samples in 3D. This parametric description makes it possible to quickly change the image geometry during scanning, thus enabling adaptive imaging and precise flow estimation. The paper addresses problems such as large bandwidth and computational load and gives the solutions that have been adopted for the implementation. [C12072]

"Near-Field, Broadband Adaptive Beamforming for Ultrasound Imaging"

For over fifty years adaptive beamforming (ABF) algorithms have been applied in RADAR and SONAR signal processing. These algorithms reduce the contribution of undesired off-axis signals while maintaining a desired response along a specific look direction. Typically, ABF achieves higher resolution and contrast than conventional beamforming (CBF), at the price of an increased computational load. In this paper we describe a novel ABF designed for medical ultrasound, named the time-domain optimized near-field estimator, or TONE. We performed a series of simulations using ultrasound data to test the performance of this algorithm and compare it to conventional, data independent, delay and sum beamforming. We also performed experiments using a Philips SONOS 5500. CBF was applied using the default parameters of the Philips scanner, whereas TONE was applied on single-channel, unfocused data with plane wave transmit. TONE images were reconstructed at a sampling of 67 μ m laterally and 19 μ m axially. The results obtained for a series of 5 20 μ m wires in a water tank show a significant improvement in spatial resolution when compared to CBF. We also analyzed the performance of TONE as a function of speed of sound errors and array sparsity, finding TONE robust to both. [C12073]

"The Jump Tracker: Nonlinear Bayesian Tracking with Adaptive Meshes and a Markov Jump Process Model"

Many tracking problems lie outside of the traditional situation of linear (or linearizable) measurements and dynamics addressed by the Kalman filter and its variants. This is especially true in applications where target

measurements are highly ambiguous and visibility is affected by unpredictable phenomena such as intermittent interference and low signal-to-noise ratios. Bayesian tracking provides the general solution to this more general class of problems. Conceptually, Bayesian tracking is straightforward: given the target measurements, apply Bayes' rule to compute the probability density of the target location at any given time, all the while assuming a target motion model. Bayesian trackers are computationally expensive; there are two basic approaches to their implementation: sequential Monte Carlo methods such as particle filtering, and deterministic methods that compute the target density directly. This paper presents a new approach to the direct method that is theoretically and computationally novel in several ways. First, recent results from the theory of adaptive moving meshes are modified and applied, an approach that is distinctly different from previously published direct methods that use fixed meshes to solve the Fokker-Planck equation. Second, a straight-line motion model based on a Markov jump process for the velocity is assumed. Straight-line motion punctuated by jumps in target velocity may be a more suitable assumption for some target dynamics than the traditional random walk assumed in the Kalman filter and many Bayesian trackers. The resulting linear partial differential equation that describes the target position density is relatively easy to solve numerically, especially compared to the Fokker-Planck equation that results from the random walk motion assumption. The proposed Bayesian tracking algorithm is a promising alternative to competing methods. It is also shown that, like particle filters, the adaptive mesh approach necessarily suffers from the curse of dimensionality. Simulation results are shown using the example of bistatic radar. [C12074]

"Bearings-Only Tracking Based on Multiple Sensor Measurements and Generalized Particle Filtering"

In this paper we address the problem of tracking by using bearings-only data obtained by more than one sensor. We apply the generalized particle filtering methodology which does not require any probabilistic assumptions, including prior probabilities and noise distributions in the state and observation equations. As a result, the proposed approach is much more robust in performance than standard particle filtering. We investigate the method when there is an exchange of information between the sensors. The advantage of the proposed method over standard particle filtering is illustrated through computer simulations. [C12075]

"Enhanced Imaging Over Complete Circular Apertures"

We consider enhanced imaging methods for spotlight synthetic aperture radar (SAR) data collected over a complete circular aperture of 360 degrees. Circular SAR has two unique features to its wide-angle non-planar collection geometry. First, it provides wide-angle information about the unisotropic reflectivity of the scattering centers in the scene. Second, unlike the linear collection geometry circular SAR reveals three dimensional information about the location of the scattering centers in the spotlighted area. In this paper, first we review traditional imaging techniques for far-field circular SAR geometries and present a GLRT based three dimensional imaging algorithm matched to limited persistence scatterers. The 3-D resolution of the circular SAR systems are limited by the sparse sampling elevation and the limited persistence of the reflectors in the scene. We employ Cramer-Rao bound analysis to characterize 3-D resolution for circular SAR systems for point targets with limited persistence. Finally, we present an enhanced imaging algorithms with non-quadratic regularization providing a sparse description of the target scene that is consistent with the collected SAR data with reduced sidelobes. [C12076]

"Optimal Signal Selection for FIR Matched Filtering in Pole-Only Noise"

With duration-limited signals there is the opportunity for perfect matched filtering by a suitable FIR filter whenever the accompanying noise has pole-only coloration. The maximal SNR value obtainable via matched filtering is itself sensitive to the signal pulse shape initially given. In some signaling situations (e.g. radar) we are unilaterally free to choose signal shape, and with this come prospects of further SNR improvement. Four distinct perspectives on optimizing signal selection are pursued, including a new single-frequency toneburst windowing approach that becomes a very good approximation for large signal sizes. Three of the approaches are capable of near-optimal SNR performance, but the whitener eigenvalue method introduced is recommended as the best possible way of selecting signals. Discussion is included of special multi-tonality issues which arise for smaller signals and for multiple maximum whitener eigenvalues. [C12077]

"Asymptotic Noise Analysis of Time Reversal Detection"

In time reversal, the received signal, including the additive noise component, is time reversed, energy normalized, and re-transmitted. The noise contained in the re-transmitted time-reversed signal has a significant impact on the time reversal detection performance. This paper carries out an asymptotic noise analysis of the time reversal generalized likelihood ratio detector, and develops an approximate closed form of the asymptotic

SNR gain of the time reversal detector compared with the conventional detector. We show that a rich scattering and low noise environment is preferred for time reversal. [C12078]

"Instantaneous Radar Polarimetry with Multiple Dually-polarized Antennas"

Fully polarimetric radar systems are capable of simultaneously transmitting and receiving in two orthogonal polarizations. Instantaneous radar polarimetry exploits both polarization modes of a dually-polarized radar transmitter and receiver on a pulse by pulse basis, and can improve the radar detection performance and suppress range sidelobes. In this paper, we extend the use of instantaneous radar polarimetry for radar systems with multiple dually-polarized transmit and receive antennas. Alamouti signal processing is used to coordinate transmission of Golay pairs of phase codes waveforms across polarizations and multiple antennas. The integration of multi- antenna signal processing with instantaneous radar polarimetry can further improve the detection performance, at a computational cost comparable to single channel matched filtering. [C12079]

"A Subspace-Based Approach to Sea Clutter Suppression for Improved Target Detection"

A key issue in detection of small targets on the ocean surface using active radar is low signal-to-clutter ratio (SCR), particularly in situations involving low grazing angle and high sea state. When sufficiently high pulse repetition rates are available, it is possible to obtain several samples of the clutter in a time interval short enough that key contributors to the clutter remain approximately stationary. This paper develops an approach to estimate the clutter subspace in such scenarios and exploit this estimate for clutter suppression and improved detection performance. [C12080]

"Maximum Likelihood Estimation of Range of Polynomial Amplitude Modulated Complex Scatterers"

We analyze the maximum likelihood estimator (MLE) of range from frequency samples of a radar return consisting of a superposition of complex scatterers whose amplitude have a polynomial amplitude dependence in frequency. Such scatterers arise from target components that contain edges, like flat plates, dihedral and trihedral reflectors, cones, cylinders and other basic geometric shapes. When the MLE of the linear prediction coefficients is used to estimate the scatterer's range, assuming constant amplitude, very closely spaced roots arise from the linear prediction polynomial. The mean square error (MSE) of the multiple root, corresponding to polynomial amplitude dependence, is computed in closed form in the presence of noise. A better approach is to constrain the linear prediction coefficients to account for the multiple roots while doing maximum likelihood estimation of these coefficients. Its mean square error performance is given by the corresponding Cramer-Rao bound (CRB), is computed for the repeated root sinusoids and is shown to be significantly more accurate than the MSE of the distinct(non-repeated) roots model. [C12081]

"Metrics for Target Tracking"

Model-based trackers generate a synthetic distribution function for the kinematic state of the target. The mean is used to locate the target, and the covariance is used to generate a confidence region about the mean. We shall show that a map-enhanced, multiple model algorithms can be used to reduce the tracking error and to make the confidence region more compact. [C12082]

"Higher Order SVD Based Subspace Estimation to Improve Multi-Dimensional Parameter Estimation Algorithms"

MIMO channel modeling from channel sounder measurements requires the use of high-resolution parameter estimation algorithms. Multi-dimensional subspace-based methods, such as R-D Unitary ESPRIT, are frequently used for this task. Since the measurement data is multi-dimensional, current approaches require stacking the dimensions into one highly structured matrix. In the conventional subspace estimation step, e.g., via an SVD of this highly structured matrix, this structure is not exploited. In this paper, we define a measurement tensor and estimate the signal subspace through a higher order SVD. This allows us to exploit the structure inherent in the measurement data already in the first step of the algorithm which leads to better estimates of the signal subspace. We show how the concepts of forward-backward averaging and mapping onto the real-valued domain can be extended to tensors. As an example, we discuss the impact on the accuracy of the R-D Unitary ESPRIT algorithm. However, these new concepts can be applied to any multi-dimensional subspace-based parameter estimation scheme. [C12083]

"Study and Simulations on CFAR Detection in Pulse Doppler Radar Processor"

The CFAR detector is an important part of radar processor. This paper studies and simulates the CFAR

detection in pulse Doppler radar processor. We present a scheme of realization for the CFAR detector in processor. To cell averaging CFAR, we study the questions on the false alarm probability, discovery probability and CFAR loss etc. The influence of finite reference cells on false alarm performance is analyzed and the modified threshold coefficients are given. We obtain the CFAR loss under different amount of reference cells, the relation of the CFAR loss and relative threshold coefficients, and processor input SNR for a certain discovery probability. Additionally, we study influence of the other parts of the processor on performance of CFAR processing such as the influence of pulse compression on false alarm probability and etc. [C12084]

"VisTRE: A Visualization Tool to Evaluate Errors in Terrain Representation"

New data sources and sensors bring new possibilities for terrain representations, and new types of characteristic errors. We develop a system to visualize and compare terrain representations and the errors they produce. [C12085]

"A 3D Outdoor Scene Scanner Based on a Night-Vision Range-Gated Active Imaging System"

We present a 3D outdoor scene scanner for the acquisition of kilometers-deep scenes in night conditions. Its imaging system is based on a compact and low-cost pulsed laser illuminator and a light-intensifier equipped CCD camera. By precisely synchronizing both the illuminator and the camera shutter, it is possible to acquire "slices" of the scene at specific known distances. We show that even with large laser pulses and without megahertz-capable electronics, the third dimension can be recovered for the whole range of the scene by processing only two images acquired in specific conditions. As the pixel intensities of the images produced by active imaging systems vary with the square of the range, and due to the limited dynamics of image sensors, scanning long-range scenes with shorter "slices" allows the camera gain to be adjusted with respect to the range and the accuracy to be enhanced. The imaging system as well as the different image processing steps are detailed in this paper and an example of typical results is given. [C12086]

"Aerial LiDAR Data Classification Using Support Vector Machines (SVM)"

We classify 3D aerial LiDAR scattered height data into buildings, trees, roads, and grass using the support vector machine (SVM) algorithm. To do so we use five features: height, height variation, normal variation, LiDAR return intensity, and image intensity. We also use only LiDAR- derived features to organize the data into three classes (the road and grass classes are merged). We have implemented and experimented with several variations of the SVM algorithm with soft-margin classification to allow for the noise in the data. We have applied our results to classify aerial LiDAR data collected over approximately 8 square miles. We visualize the classification results along with the associated confidence using a variation of the SVM algorithm producing probabilistic classifications. We observe that the results are stable and robust. We compare the results against the ground truth and obtain higher than 90% accuracy and convincing visual results. [C12087]

"Super-resolution Direction Finding at Subarray Level for Coherent Sources Based on Weighting Network"

2-D subarray level super-resolution direction finding methods have important applications in phased array radars. This paper studies ML (Maximum Likelihood) method at subarray level suitable for coherent sources and gives the corresponding signal model. Applying simplified array manifolds can make calibration cost of phased array reduced largely. We post-process the digital subarray outputs by bringing in weighting network which increases the flexibility of array processing greatly. The simplified array manifold based on Gaussian patterns we constructed can overcome the limitations of DSAM (Direct Simplified Array Manifold) method that available direction estimation area can't be changed and the uninterested sidelobe sources can't be suppressed completely, but the cost is that the precision of direction finding drops. Simulation results demonstrate the validity of the proposed method. [C12088]

"An Approach Based on Normalization Processing for Two-Dimensional Subarray Level ADBF"

Adaptive digital beamforming (ADBF) at subarray level has important applications in phased array radar systems. This paper studies two-dimensional ADBF methods at subarray level. We present the signal model of two-dimension ADBF at subarray level. Generalizing ADBF applied to one-dimension linear array to phased array at subarray level, we can obtain two-dimension ADBF at subarray level, but its limitation is that adaptive processing makes the SLL (sidelobe level) of the pattern increase remarkably. Therefore, we present two-dimensional ADBF at subarray level based on normalization. This method can obtain adaptive pattern the same as quiescent pattern for the case of absence of jammer and non-overlapped subarrays, while improve the SLL of the adaptive pattern remarkably in presence of jammers. Simulation results indicate the validity of the introduced method. [C12089]

"Digital and Super-Resolution Ultra Wide Band Inter-Vehicle Localisation System"

We develop a digital multiple-antenna ultra wide band frequency modulation radar system devoted to inter-vehicle localisation applications. In this system, the radio frequency signal received in each receiver is digitized by an analog-to-digital converter (ADC) at the intermediate frequency. The phase method is used for direction of arrival (DOA) and time of arrival (TOA) estimations that are used for localisation purpose based on the hybrid technique named DOA/TOA. The DOA is estimated by measuring the phase difference of the signals picked up by the elements in the antenna array and by using the MUSIC (multiple signal classification) algorithm; meanwhile the TOA estimation is based on the IFFT (inverse fast Fourier transform) or the MUSIC algorithm. The system presents a lot of advantages of ultra wide band technology; the digital solution in terms of signal processing by software radio without hardware changing; and the high resolution method for DOA/TOA estimation. The system is simulated using ADS (Advanced Design System) and Matlab is used for signal processing. The simulation results show a promising solution for an inter-vehicle localisation system in particularly and for localisation applications in general. [C12090]

"Low Altitude Wind Simulation over Mount Saint Helens Using NASA SRTM Digital Terrain Model"

On February 11, 2000, the Shuttle Radar Topography Mission (SRTM) was launched into space as part of one of the pay load of the Shuttle Endeavor. Using a new radar sweeping technique most of the Earth's surfaces was digitized in 3D in approximately 10 days. SRTM acquired enough data during its mission to obtain a near-global high-resolution database of the Earth's topography. This paper describe how this revolutionary data set can be used to simulate anywhere around the Earth low altitude wind conditions for various atmospheric conditions. More specifically, we will describe the various processing steps necessary to convert this high-resolution terrain model provided by the SRTM database into a Computational Fluid Dynamic (CFD) volumetric mesh that is compatible with an open source CFD solver called OpenFOAM running in parallel on large West-Grid supercomputers. This work is the result of a new virtual wind-tunnel under development at the University of Alberta. In the paper, we present wind flow over the Mount- Saint Helens in the United States for a simple wind flow boundary condition. [C12091]

"Optimizing Eigenvector-Based Frequency Estimation in the Presence of Identical Frequencies in Multiple Dimensions"

Recently an eigenvector-based algorithm has been developed for multidimensional frequency estimation. Unlike most existing algebraic approaches that estimate frequencies from eigenvalues, the eigenvector-based algorithm can achieve automatic frequency pairing without joint diagonalization of multiple matrices, but it is not applicable if there exist identical frequencies in certain dimensions. In this paper, we propose to use weighting factors to extend the eigenvector-based algorithm to handle identical frequencies in one or more dimensions. The weighting factors are optimized by minimizing the error variance. Simulation results demonstrate the effectiveness of the proposed approach [C12092]

"Opto-electronic free-space processor for UMTS signal filtering"

The availability of optoelectronic components operating in the multi-gigahertz domain (up to 20 GHz) is very attractive for implementing basic optical processing functions of microwave signals such as spectrum analysis, adaptive filtering, and correlation suitable in radar and electronic communication systems. We present an optoelectronic free-space processor for filtering up-link and down-link signals in UMTS base stations. The system uses a liquid-crystal spatial light modulator to set programmable filtering functions. We have demonstrated signal rejections higher than -40 dB at 2.3 GHz (from 2.1 GHz) and low insertion losses of -18 dB. Moreover, tunability of the filters implemented in the free-space demonstrator has also been successfully addressed [C12093]

"Automatic Land-mine Detection System using Adaptive Sensing with Vector GPR"

Ground penetrating radar (GPR) is a promising sensor for landmine detection, but there are two major problems to overcome. One is the non-planer (e.g. rough and/or undulating) ground surface. It remains irremovable clutters on a sub-surface image output from GPR. Geography adaptive scanning is useful to image objects beneath non-planer ground surface. The other problem is the distance between the antennas of GPR. When imaging the small objects such as an anti-personnel landmine close to antennas, it increases the nonlinearity of the relationship between the time for propagation and the depth of a buried object. In this paper, we modify Kirchhoff migration so as to account for not only the variation of height and pose of the sensor head, but also the antennas alignment of the vector radar. The validity of this method is discussed through application to the signals acquired in experiments [C12094]

"A Bayesian Approach to Building Footprint Extraction from Aerial LIDAR Data"

Building footprints have been shown to be extremely useful in urban planning, infrastructure development, and roof modeling. Current methods for creating these footprints are often highly manual and rely largely on architectural blueprints or skilled modelers. In this work we use aerial LIDAR data to generate building footprints automatically. Existing automatic methods have been mostly unsuccessful due to large amounts of noise around building edges. We present a novel Bayesian technique for automatically constructing building footprints from a pre-classified LIDAR point cloud. Our algorithm first computes a bounded- error approximate building footprint using an application of the shortest path algorithm. We then determine the most probable building footprint by maximizing the posterior probability using linear optimization and simulated annealing techniques. We have applied our algorithm to more than 300 buildings in our data set and observe that we obtain accurate building footprints compared to the ground truth. Our algorithm is automatic and can be applied to other man-made shapes such as roads and telecommunication lines with minor modifications. [C12095]

"Integrating LiDAR, Aerial Image and Ground Images for Complete Urban Building Modeling"

This paper presents a hybrid modeling system that fuses LiDAR data, an aerial image and ground view images for rapid creation of accurate building models. Outlines for complex building shapes are interactively extracted from a high-resolution aerial image, surface information is automatically fit with a primitive based method from LiDAR data, and high-resolution ground view images are integrated into the model to generate fully textured CAD models. Our method benefits from the merit of each dataset, and evaluation results are presented on a university campus-size model. [C12096]

"Practical Issues in Implementing Analog-to-Information Converters"

The stability and programmability of digital signal processing systems has motivated engineers to move the analog-to-digital conversion (ADC) process closer and closer to the front end of many signal processing systems in order to perform as much processing as possible in the digital domain. Unfortunately, many important applications, including radar and communication systems, involve wideband signals that seriously stress modern ADCs; sampling these signals above the Nyquist rate is in some cases challenging and in others impossible. While wideband signals by definition have a large bandwidth, often the amount of information they carry per second is much lower; that is, they are compressible in some sense. The first contribution of this paper is a new framework for wideband signal acquisition purpose-built for compressible signals that enables sub-Nyquist data acquisition via an analog-to-information converter (AIC). The framework is based on the recently developed theory of compressive sensing in which a small number of non-adaptive, randomized measurements are sufficient to reconstruct compressible signals. The second contribution of this paper is an AIC implementation design and study of the tradeoffs and non-idealities introduced by real hardware. The goal is to identify and optimize the parameters that dominate the overall system performance [C12097]

"Radar Target Signature Measurement Using DBF Technology"

Radar target signature is usually measured using step frequency radar system, in which the beam of antenna can not be changed. According to the need of the measurements, various beam width, various frequency band width and various beam scanning angle can be chosen. Digital beam forming technology can be applied to promote the measurements to a new level. Not only the desired main lobe can be got, but also the side lobe can be lowered. In addition, digital beam forming appears better efficiency in calibration and scanning adaptively. [C12098]

"Adaptive Nulling Methods with Multiple Constraints for Transmitting DBF"

Adaptive nulling methods with multiple constraints for transmitting digital beamforming (DBF) of uniform linear arrays (ULA) are proposed in the following three circs, with main lobe constraint only, with main and side lobes constraints, with main and side lobes constraints and given nulls constraint. And the optimum weight vector of transmitting DBF is derived by Lagrange multiplier approach and calculated with sample matrix inversion algorithm. The computer simulations show that the proposed methods are practicable and effective. [C12099]

"New Method of Velocity Compensation in a Stepped-Frequency Testing Radar"

A solution on velocity compensation for a dual-channel stepped-frequency testing radar is presented. The target's radial velocity was estimated real-timely by using high resolution range profiles of the target from two bands respectively, and then compensation was carried out to get the target's real location for automatic target range tracking. An effective method to calculate target's real location avoiding complex computation in direct compensation procedure is discussed. Experimental results are also given and analyzed in this paper. [C12100]

"Study of Design of Airborne Synthesized IFF and Electronic Countermeasure System"

An airborne identification system is designed, which has been named airborne synthesized friend or foe and electronic countermeasure system (ASIFFC) and incorporates technology of identification friend or foe (IFF) and electronic countermeasure. ASIFFC uses the coordination type IFF technology and the non-coordination type IFF technology, and it has independent capability in identification and tracking. ASIFFC presents a plan that is the combination application of many kinds of identification technology, and it is development trend of IFF technology. In the article, firstly, it carries on the system design to ASIFFC. Secondly, subsystems have been given a minute description. The Sending device of LSID sends radio frequency inquiry signal to the goal object which has been locked by the radar. The receiving device of LSID receives reflection signal of goal object. The LSID is carried on IFF on the basis of the receiving or sending signals. The pattern identification device (PID) withdraws the image information of a goal object and contrasts them with the data in the image database and distinguishes the friend and foe attribute of object. The dual identification technology enormously enhanced the identification reliability. [C12101]

"Near-Field Radar Imaging Simulation using FDTD Method"

In this paper, a two-dimension near-field imaging model is simulated by the finite difference time domain (FDTD), and two different imaging approaches are used to process the recorded data: back-projection (BP) and phase-shift migration. In the model, we assume a point source to emit a modulated Gauss pulse, and an array of receive sensors to collect object echoes. We first apply matched filtering to the raw data, and then use back-projection and phase-shift migration algorithms to image the objects by the processed data. The imaging results are presented to verify that these two algorithms can effectively image the near-field targets. [C12102]

"A Processing Detection Project Research of Weak Targets in the Complex Ground Clutter"

The paper present a project of improving the weak targets detection capability in the complex ground clutter at the same time maintaining the hardware's simplicity for the air-ground millimeter-wave terminal guidance radar. The project use the wide band chirp-subpulse stepped-frequency signal to detect targets, and get the target region's quasi two dimension image by processing the echo signal both in the time and frequency domain, thereby improving the weak target detection capability and providing the real guidance information. The theoretical analysis and computer simulation result proved the project's validity. [C12103]

"A New Approach of Target Identification Using Enhanced Radar Range Profiles"

Due to the aspect dependence of high resolution range profiles (HRRPs), traditional radar HRRPs target identification (ID) methods usually use averaged or weighted HRRPs as an aspect template. A major shortcoming is that HRRPs cannot provide information about target's cross-range. In this study, we present an application of statistics method on complex radar targets. The enhanced HRRPs extracted by this method were used in radar target identification. It is shown from simulation results that identification performance can be improved greatly by using the enhanced HRRPs features combined with a two-stage fuzzy classifier. [C12104]

"SAR Interferometry -Novelty in Real Scenario"

A lot of efforts have been put in so far in the InSAR signal processing to develop easier yet accurate methods of generating topographic maps and other products. In order to facilitate better understanding and application of the SAR interferometry, however, there still remain short comings while taking into account certain important factors during various steps. In this paper efforts have been made to encompass all areas in the conventional InSAR signal processing which possess an appropriate reference of relationship with the processing in the real scenario. Methods and relationships have been developed to enable retrieve the accurate results as much as possible. The relevant processing steps have been identified and recommendations have been made to bridge the gaps between the novel and the real InSAR signal processing. The necessary steps involved in processing the received data to the geometrically compensated digital models have been explained in an easy and comprehensible way. [C12105]

"The System Design of a Small Caliber MMW Earth Observing Radar"

To attain a small caliber millimeter-wave earth observing radar, a wide-band miniature MMW system is needed. In this paper, the miniature system design of a frequency-modulated stepping MMW radar is presented. Firstly, this miniature radar's advantage is analyzed for the need of small caliber earth observing missile. Then, the system configuration is provided to obtain the high range resolution and miniaturization. And in the meanwhile, the method to solve new system problems and optimized selection of system parameters is discussed according

to the small caliber terminal guidance radar. At last, experiment results are also given to proven the designed system 's performance. [C12106]

"A Novel Source Number Estimator Without Eigendecomposition"

In this paper, we present another source number estimator without the necessary eigendecomposition, it is based on the Lanczos process and Sturm algorithm and Finally, we provide a simulated data example to evaluate the proposed estimator. [C12107]

"Scattering Centers Measurements by a 2-D ESPRIT Type Method"

A 2-D ESPRIT type method is presented for the scattering centers measurements in step-frequency radar. This method estimates the signal parameter pairs directly unlike the matrix enhancement and matrix pencil (MEMP) method which contains an additional step to pair the parameters related to each dimension. We use a forward-backward prediction data matrix to increase the estimation accuracy and the robustness to noise. Results compared with the Fourier transform method show that the resolution and precision of the 2-D ESPRIT type method are both higher than those of the Fourier method. [C12108]

"A Study Of Air Target Detection Base On Signal Disturbance"

This paper introduces an allocation method for air target detection based on DBS TV satellite signal non-cooperation space-ground bistatic (multi) radar and analyses its fundamental principle. Upon the plenitude study of the characteristic of target information acquisition and information processing of bistatic radar, this paper puts forward a kind of target information acquisition technique that is different from the typical bistatic radar system. Basic principle for target detection and target information acquisition is analyzed. [C12109]

"Shielding, Radioabsorbing and Scattering Materials for Decreasing of Disturbances and for Enhance of Efficiency of Radar Work"

Georadar of OKO-M1 type working at 400 MHz central frequency in combinations with different type of radioshielding and scattering materials have been studied to determine a possibility of an improvement of noise immunity and functional characteristics of georadar at various conditions. A number of experimental georadar covers of several types based on radioshielding, radioabsorbing and scattering materials has been produced and tested. The investigations have confirmed the fact that usage of a shielding cover is useful both for suppression of interference with up-land objects and for decrease of aerial disturbances. We found that such georadar cover can decrease a level of the aerial interference disturbance up to 30 dB, and undesirable signal reflected from a metal object placed near over georadar can be decreased on a value of 15...23 dB. A scan picture becomes more clean and readable when georadar shielding cover is used [C12110]

"The Quantitative Analysis of Ground Penetrating Radar"

A method for presenting the result of ground penetrating radar (GPR) data processing in the form of structural model of the medium being probed that is obtained on the basis of the quantitative analysis of radar traces showing the reflecting boundaries and electrophysical parameters is considered in this paper. The basis for the method developed are results of studying the features of the reflected signal formations in in-homogeneous media. The method enables to algorithmize the construction process for the structural model of the model of the medium being probed, to decrease labour consumption for radar trace processing and to reduce human factor effect [C12111]

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




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