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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 30-2

“Radar Principles”
(«Принципы радиолокации»)

Публикации в трудах конференций

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"The Impact of High-Order Phase in Ballistic Missiles Detection"

According to characteristic of ballistic missiles and their velocity, acceleration and jerk in radar echo, we establish the echo signal model with high-order phase echo signal characteristics, then analyze the target detection performance by numerical simulation to get the relationship among the optimal number of pulses, signal-to-noise ratio and jerk. Finally, the simulations verify the principle of the method is correct and can provide guidance for practical applications. [C1]

"LIDAR Depth Indicator of the Design and Research"

According to rope friction hoist in the process of ascension, because the steel wire slips or peristalsis and becomes tensile deformation by long-term usage. There will cause deviation between the display of the indicator and the actual location of lifting container. That may even cause accidents. This paper introduces a composition of new depth indicator, working principle and designing method which based on laser infrared radar technology. It can realize many functions, such as the precise indicating of the location of the lifting container and real-time monitoring, etc. Have no assistant calibration switch, without measuring transmission error, fast response and intuitive, convenient operation, etc. [C2]

"Adaptive RFI Suppression Algorithm Based on CEMD for SAR Data"

This paper proposes a novel adaptive filtering method based on complex empirical mode decomposition (CEMD) for narrowband radio frequency interference (RFI) suppression applied to SAR. This method decomposes the RFI contaminated signal into a finite and often small number of Intrinsic Mode Function (IMF). The sum of some selected IMF components is taken as reference input of adaptive filter based on the characteristics of CEMD. Experiment results show that CEMD provides an effective way to obtain reference input. The proposed method can effectively subtract RFI component from the RFI contaminated signal, which is the primary input of the adaptive interference canceller. The point-target simulation is used to show the working principle of the proposed algorithm. Experimental results based on SAR real data are also shown to verify the proposed algorithm. [C3]

"A heterodyne 77-GHz FMCW radar with offset PLL frequency stabilization"

This contribution describes the realization of a heterodyne frequency-modulated continuous-wave (FMCW) radar system operating in the frequency band from 76 GHz to 77 GHz. To implement the heterodyne principle two voltage controlled oscillators (VCOs) are operated in order to produce frequency ramp signals with a fixed frequency offset. This allows to mitigate effects occurring in homodyne systems like, e.g., DC-offsets or low-frequency noise components. To avoid large divider values in the control loop the presented system is based on an offset phase-locked-loop configuration. In the presented implementation the same downconverter is used to implement the offset-loop for both VCOs, which has the positive effect that errors and noise influences in the downconversion process-at least partly-cancel out in the final FMCW output signal. [C4]

"Reflector-based digital beam-forming radar system for space debris detection"

The paper considers a novel radar system concept for space debris detection based on a reflector antenna and utilizing digital beam-forming techniques. The main operational principles of the system are discussed. First, a classical radar system and its performance aspects are considered. Then in terms of the considered aspects, the performance enhancements of the novel digital beam-forming radar are demonstrated. [C5]

"A MIMO radar for Sense and Avoid function: A fully static solution for UAV"

Up to now, UAV are employed in crisis or war times. For training purposes, some areas are especially attributed for UAV deployment in a limited space area and in a limited time slot. In the future, both for emerging civilian applications and for training purpose, these limitations will no longer be acceptable and UAV will have to be

inserted in the general air traffic. Thus, "Sense and Avoid" systems will be mandatory. The radar is the most pertinent non-cooperative "all-weather" sensor because it provides, by essence, accurate ranging, direction and closing speed. In this paper, we propose a low cost radar solution based on the coherent "MIMO" principles. This design allows the implementation of the radar within the UAV airframe without any moving part. [C6]

"A dual-use system for radar and communication with complete complementary codes"

A dual-use architecture is proposed for both radar and communication. The proposed method uses complete complementary codes for both radar and communication signals, whose outputs almost become zero sidelobe. In this paper, the principle of the proposed method and simulation results are described. [C7]

"Radar target detection and Doppler ambiguity resolution"

A Continuous Wave (CW) radar with a linear Frequency Modulation (FM) and a very short chirp duration is considered in this paper. A single target range and Doppler frequency measurement consits of a sequence of L chirp signals with the same chirp duration. The maximum unambiguously measurable radial velocity in this case is limited by a minimum chirp duration. Therefore fast moving targets will cause ambiguous measurement results, that have to be resolved. The technique of resolving ambiguities on the basis of several subsequent measurements with different ambiguity interval lengths is well known as Chinese Remainder Theorem (CRT). It has been extensively described in literature [2]. Two different signal processing approaches to apply this technique for the resolution of ambiguities are compared in this paper. These do not differ in terms of the ambiguity resolution itself, because they are based on the same principle. The detection performance however is different. [C8]

"Increasing vehicular safety at intersections by using LFMSK modulated radar sensors"

This paper deals with environment perception for automotive application especially in intersection-related scenarios. The recognition of relevant objects within intersection-related scenarios is performed not at least with high performance 24 GHz radar sensors. These sensors are dedicated to detect objects in the surroundings of the equipped demonstrator vehicle. The modulation of the transmit signal plays an important role for precise measurements. In this paper a linear frequency modulated shift keying (LFMSK) measurement principle is proposed. [C9]

"Recent advances in RF tomography for underground imaging"

Underground imaging for tunnel detection is proposed using the principles of radio frequency (RF) tomography. In RF tomography, a set of distributed transmitters and receivers are deployed arbitrarily above the ground, or slightly buried. These transmitters radiate suitable narrowband, low-frequency waveforms into the ground. The resulting wavefront impinges upon underground objects, scattering electromagnetic energy in all directions. Receivers sample the scattered signal, mitigate direct-path leakage, retrieve the phasor of the scattered signals, and relay this information to a base station. After adaptive processing of measured data, an image of the underground facilities is achieved. [C10]

"Advantages and restrictions of holographic subsurface radars"

Holographic subsurface radars (HSR) are not in common usage now; possibly because of the historical view amongst radar practitioners that high attenuation of electromagnetic waves in most media of interest will not allow sufficient depth of penetration. It is true that the fundamental physics of HSR prevent the possibility to change receiver amplification with time (i.e. depth) to adapt to lossy media (as is possible with impulse subsurface radar or ISR). However, use of HSR for surveying of shallow subsurface objects, defects, or inhomogeneities is an increasingly proven area of application. In this case HSR can record images with higher resolution than is possible for ISR images. This paper presents experiments with HSR imaging in media with different degrees of attenuation, and illustrates the principle of HSR through an optical analogy. [C11]

"Communication in automotive systems: Principles, limits and new trends for vehicles, airplanes and vessels"

This paper deals mainly with state of the art and next-decade technologies for fiber-optic data buses in automotive applications. Nowadays, fiber-optic data buses in automotive applications are exclusively used in the infotainment domain, MOST (Media Oriented System Transport). Current data rates are in the order of 150 MBit/s. Consequently, the use of LEDs and polymer optical fibers (POF) is sufficient. For higher data rates, also alternative solutions are discussed: The LED as transmitter can be replaced by a vertical surface emitting laser (VCSEL), and the plastic fiber (POF) by a polymer-cladded silica (PCS) fiber. Due to the inherent fact that, as a

result, the fiber diameter is reduced, the detector area of the well-known Silicon photo diodes can also be reduced greatly. As a consequence, data rates can be extended into the Gbit/s-region. Furthermore there are different physical layers like optical wireless and radio frequency systems (Radar) to be taken into account. [C12]

"94 GHz person scanner with circular aperture as part of a new sensor concept on airports"

In the following paper, a new concept for increasing the aiport security is proposed. As a part of this innovative system, a W-band person scanner with a circular aperture for 360° scans has been built up. The usage of the Synthetic Aperture Radar (SAR) principle allows the detection of concealed objects with a resolution of 3mm in azimuth and 3 cm in range direction. [C13]

"Design and implementation of an integrated high resolution imaging ground penetrating radar for water pipeline rehabilitation"

Accurate and timely detection of leaks in water supply pipes is a significant environmental issue. Development of efficient non-invasive methods would lead into significant water saving and prevention of health hazards introduced by water leakage. This paper shows the ability to use a High Resolution Ground Penetrating Imaging Radar (GPIR), to be used as an instrument for water pipeline rehabilitation situations, parallel to the existing industrial equipment. In the framework of the European research initiative WATERPIPE, a Decision Support System (DSS) for the rehabilitation management of the underground water pipelines has been developed, parallel to the implementation of the GPIR. This paper briefly presents the system design, the basic principles of the algorithms' implementation and some indicative results from the initial use of the GPIR system. [C14]

"FPGA based IF digital receiver for the PARSAX-Polarimetric agile radar"

An FPGA-based digital receiver has been developed to perform real-time processing for the PARSAX radar. It is a fully polarimetric FMCW radar with dual-orthogonal sounding signals, which has the possibility to measure all elements of the radar targets polarization scattering matrix simultaneously, in one sweep. This paper presents the design principles including the range profile interpretation, optimal parameters selection and processing gain analysis. A novel parallel deramping processing architecture suitable for FPGA implementation is introduced; the overall digital de-ramping processing has been implemented in one chip of FPGA and verified by experimental results. [C15]

"High power S band T/R module"

The paper describes S-band T/R Modules designed for use in an Active Phased Array. Brief principles of its operation are described and electrical and mechanical information are presented. Main parameters of T/R Modules are shown in the form of characteristics. Results of measurements in wide range of the ambient temperature are presented as well. Basing on the obtained results, conditions of Transmit Modules operation are defined. [C16]

"Principles of the electromagnetic modelling of some microwave components, based on the circular waveguides with azimuthally magnetized ferrite"

The principles of electrodynamic analysis of the characteristics of the ferrite control components (nonreciprocal digital phase shifters, cut-off switches and isolators) which use circular waveguides, entirely filled with azimuthally magnetized ferrite or containing a coaxial disc- or ring-shaped area of the medium alluded to and a dielectric one, surrounding it or taking up its hollow, resp., and work in the normal TE01mode, are enunciated: i) employment of complex confluent hypergeometric and eventually also of real cylindrical functions; ii) indispensability of inventing of numerical methods for evaluation of some special functions of the mathematical physics: the Euler gamma function, its logarithmic derivative and the confluent functions in the complex field, as well as of the cylindrical ones in the real domain; iii) elaboration of techniques for numerical solution of complicated transcendental equations, involving complex confluent and possibly real cylindrical functions, too; iv) introduction of a new class of real numbers, called L numbers, connected with the purely imaginary roots of the equations mentioned; v) development of numerical schemes for computation of the phase curves of geometries regarded and of iterative procedures for finding the differential phase shift provided by them; vi) laying down of criteria for the operation of configurations as phase shifters, magnetically controlled cut-off switches and isolators. Each of the maxims pointed out is elucidated in detail. [C17]

"Design and simulation GaN based class-S PA at 900MHz"

A Class-S Power Amplifier architecture seems to be an attractive alternative for classical PAs due to offered very high efficiency operation. Switching mode PA principle assumes combined operation based on digital, single-bit

Delta-Sigma (ΔΣ) modulated signals and RF analog signals, what complicates design and analysis procedures. However the Class-S PA topology is known, there are not any universal design methods which can be unambiguous applied to considered architecture. Presented work defines and describes design method for Class-S PA based on GaN HEMT transistors. Moreover main simulation results for Class-S architecture based on Current Switching Class-D (CSCD) configuration at the carrier frequency of 900 MHz have been performed. [C18]

"Analysis of rectangular microstrip structures by the method of moments"

Rectangular microstrip structures (RMS) are widely used in various microwave devices. Using the method of moments and principle of partial images, various techniques are created to determine charge distribution in 2D models of microstrip structures (their cross-section). In this paper, a technique for calculating surface charge distribution and total capacitance of complex 3D rectangular microstrip structures is proposed using the mentioned method and principle. To demonstrate feasibility of the proposed technique, three RMS were investigated. Obtained results are compared with the data published by other researches. Total error is typically less than 5%. [C19]

"Potentialities of the Doppler spectrum of backscattered microwave signal in the problem of remote sensing of the sea surface"

Information about sea waves and the near surface wind speed is very important for meteorology. It is well-known that this information, in principle, can be obtained from a backscattered microwave signal. Evidently, the sea state determines both spectral and power characteristics of backscattered microwave signal. However, usually only a radar cross section is used for retrieval of the near surface wind speed. Considering only a radar cross section we lose the important information about the movement of sea surface that can be used for retrieval of key sea state parameters. In this paper the new description of a sea state is suggested and basic features of the microwave Doppler spectrum are discussed. We consider some features of various sea states and analyze their manifestation in the Doppler spectrum. [C20]

"Principles of the electromagnetic modelling of som microwave components, based on the circular waveguides with azimuthally magnetized ferrite"

The principles of electrodynamic analysis of the characteristics of the ferrite control components (nonreciprocal digital phase shifters, cut-off switches and isolators) which use circular waveguides, entirely filled with azimuthally magnetized ferrite or containing a coaxial disc- or ring-shaped area of the medium alluded to and a dielectric one, surrounding it or taking up its hollow, resp., and work in the normal TE01mode, are enunciated: i) employment of complex confluent hypergeometric and eventually also of real cylindrical functions; ii) indispensability of inventing of numerical methods for evaluation of some special functions of the mathematical physics: the Euler gamma function, its logarithmic derivative and the confluent functions in the complex field, as well as of the cylindrical ones in the real domain; iii) elaboration of techniques for numerical solution of complicated transcendental equations, involving complex confluent and possibly real cylindrical functions, too; iv) introduction of a new class of real numbers, called L numbers, connected with the purely imaginary roots of the equations mentioned; v) development of numerical schemes for computation of the phase curves of geometries regarded and of iterative procedures for finding the differential phase shift provided by them; vi) laying down of criteria for the operation of configurations as phase shifters, magnetically controlled cut-off switches and isolators. Each of the maxims pointed out is elucidated in detail. [C21]

"Intelligent Traffic Management system base on WSN and RFID"

With wireless communication and the speedy development of micro-electro-mechanical system (MEMS), the wireless sensor network (WSN) has aroused enthusiasm in the world. The research of intelligent transportation system base on WSN is a hotspot to solve the traffic problems in recent years. This paper first introduces intelligent transportation system base on RFID and WSN, then discusses the hardware and software design principles of the system. It has produced the wireless long-distance automatic monitor sensor network design realization plan, finally it forecasts the development of intelligent transportation system. Practice shows that the system is characterized by low cost, economic and pragmatic and high reliability. [C22]

"An impact point of shipboard artillery shell calculating system based on DSP and matlab-simulink simulation"

This paper introduces an impact point of shipboard artillery projectile calculating system based on DSP, and expatiate the system model, mathematical model, working principle and matlab simulation models. Because

radar having detected the trajectory of flying artillery projectile, the system calculate the whole trajectory and impact point coordinates, using DSP techniques. The simulation experiment indicate that the feasibility and practicality of the system. [C23]

"Fault diagnosis expert system of artillery radar based on neural network"

The fault of new type artillery radar is highly complex and correlative. The neural network technology was incorporated into the radar fault diagnosis after the fault features of new type artillery radar and the shortage of the expert diagnosis system were analyzed. There are many difficulties in the process of the servicing for the artillery radar, such as technology level is low, fault diagnosis is difficult. To resolve the problem, a fault diagnosis expert system was realized based on RBF(Radial Basis Function) neural network. The collectivity structure of expert system, structure and function of software were discussed. Accordingly, several key techniques such as the fault diagnosis principle of RBF neural network, knowledge database, reasoning engine were also given in detail. The application results showed that the expert system proved its feasibility and practical, the servicing efficiency and fault diagnosis ability are improved. [C24]

"Leveling technology based on NN and adaptive fuzzy control of hydraulic system"

In the field of modern national defense and civilian technology, we often need to precisely adjust a bearing platform. The platform with certain equipment to the horizontal position improves the system performance. Short time, high speed, high precision and well stability is required in the leveling system. However, the leveling system is a nonlinear time-varying system. "involvement coupling" problem between the hydraulic legs, legs and dip angles will appear in the process of leveling. In this paper, the "surface-adjust-surface" leveling technique is proposed by the leveling method. The method is based on the target surface with multi-point and multi-direction control by outputting control variables from leveling the relative position between surface and target surface. Use the neural network to train the motion characteristics of the switch-valve-controlled hydraulic cylinder. It combines the fuzzy control technique and the leveling method based on target surface. Forms of the intelligent algorithm are based on target surface to solve the problems of strong coupling and weak leg in the process of leveling. The method realizes multi- point control. Online application and experimental verification were in a certain type of weapon equipment and a certain type of radar vehicle. The result shows that the method not only has the advantage of simple principle and stable-reliable control performance, but also perfectly realizes precise and rapid leveling of hydraulic overloading platform. It has broad prospects for widespread application. [C25]

"Remote Monitoring System of the Motor in GPRS Based on LabVIEW and Embedded TCP/IP"

According to the demand of actual application for motors, the software and hardware structure of remote wireless monitoring and control system for the motor based on LabVIEW and GPRS were designed. The paper presented the design principles of the motor's speed measurement system based on the singlechip, studied the communication protocol of the serial interface between singelchip and GPRS module. The remote computer monitoring platform was established with network communication technology of LabVIEW and database technology. The system was not affected by geographic location restrictions and it was suitable for the remote monitoring and control system of the motor in different districts. [C26]

"Design and Practice of GPS Inspection Data Acquisition System to Telecom Pipeline Network"

Pipeline network is an important component of the telecommunications system, effective management of pipeline networks, pipeline networks and equipment to ensure safety and efficient utilization of a basic work. The network GPS inspection data collection system was designed based on unistrong expansion product in this paper. the advantages of the system was analyzed based on briefly described the overall design of the system, and principles of data acquisition and data processing methods were described, and finally system application practice was detailedly explicated, and made a detailed analysis. The actual application shows that the program can effectively meet the telecommunication resource management pipeline fast, efficient, timely, and with the original data and GIS platform for seamless docking of the job requirements. [C27]

"A target selection method for ASM based on ICP algorithm"

It's a hard task for anti-ship missile (ASM) to select the target ship from multi-objects acquired by terminal guidance radar. In this paper, a method to select the target in a ship formation is presented based on iterated closet point (ICP) algorithm. The principle of this method is described as follows: (1) a ship formation is independently detected by fire-control radar and terminal guidance radar, and the detected ships by each sensor are separately described with two point sets in a plane; (2) the target selection is realized by matching this two point sets based on ICP algorithm, i.e. finding the correspondences of points in the two point sets; (3) the correspondence of the designated ship in the point set detected by fire-control radar is the target ship to be

selected. Compared with former MPR (mutual Position Relationship) method, the performance of the method in this paper is hardly influenced while the ship formation changes the course during the self-control phase of ASM. This superiority is validated by simulation results. [C28]

"3D imaging of passive objects using dual-sided phase conjugating sequentially switched lens"

In this paper we introduce a new concept of a dual sided phase conjugating lens operating as an imaging sensor for continuous wave or pulsed signals for passive target 3D localization. We describe the principle of operation and demonstrate the core resolution properties for single and multiple objects by the way of numerical simulation. Particularly it is shown that the characteristic resolution of a single target by the lens operating under Gaussian pulse excitation is approximately the same as that obtained using UWB synthetic aperture radar techniques. The present concept offers major advantages with respect to existing time reversal techniques which involve computationally expensive high speed digital signal processing of the scattered field. The lens only requires hardware to collect the field scattered from the target(s) and to refocus it onto these target(s). This property should be of high potential for imaging applications where refocusing has to be accomplished in a real time i.e. when high speed target acquisition is necessary. Alternatively the lens can be operated in conjunction with a conventional imaging regime, i.e. to collect the scattered field data, send it to a post processing unit for mathematical image localization. [C29]

"UWB cylindrical microwave imaging system with novel image reconstruction algorithm"

In this paper, we apply an ultra wideband radar technique to detect and locate small cylindrical objects in a dielectric cylindrical body emulating the woman's breast. We propose a new image reconstruction algorithm which exploits the monopulse radar principle involving a 2-element array antenna. Using the difference of two signals received by the elements of this array, the part of the signal due to a background being symmetric with respect to the axis of the array is removed. The remaining part is the signal which is due to a scattering object located in the off-axis position of the array. The acquired set of difference signals obtained for various locations of the probing antenna is suitably scaled and mapped to show an internal image of the scanned body. The operation of this system including the new image reconstruction algorithm is demonstrated via full EM simulations and experiment. The proposed imaging approach should be of considerable interest to researchers working in the field of microwave techniques for breast cancer detection and location. [C30]

"Research on High-precision Real-time Online Measurement of Liquid Level Changes"

The problem of low precision exists in current measurement techniques. This paper introduces the structure and working principle of the liquid level measurement system of laser triangulation and carries out a high-precision real-time on-line measurement of the water surface height variation by using the liquid level measuring system. This paper introduces the structure of the laser triangulation displacement measurement system and its working principle, testing its characteristics and anglicizing the reason of error. [C31]

"Development of a wireless communication and localization system for VRU eSafety"

Based on the experience from two predecessor projects, a novel architecture for the detection of vulnerable road users (VRU) is developed. It combines communication and localization, following the function principles of a secondary radar. Challenges are in the accuracy, the scalability, the bandwidth availability and the limited cost and complexity of the devices. This paper describes the objective of the overall project, the architectural approach of the wireless protocol and the design flow, which has been chosen for the development, which is still in progress. [C32]

"Sub-swath mosaic algorithm of WS-InSAR"

Wide swath SAR is an important development direction of space-borne SAR, and it has some characters such as wider swath and short interval, so, ScanSAR mode can be used in deformation, especially small deformation in the future. In this paper, on the base of geometry imaging principle, sub swath mosaic method based on co-registering and weight is put forward. In the end, the method is validated by an example, the result indicates that it has not mosaic imprint and the mosaic method is a better mosaic method for wide swath SAR. [C33]

"Remote sensing retrieval of soil moisture using ENVISAT-ASAR images: A case study in suburban region of Peking, China"

Soil moisture is a highly variable component of soil, and plays an important role in materials and energy exchanges between earth and atmosphere. It is also the basic parameter of crop growing and crop yield forecast. With the features of observing large area synchronously, timely, and economically, remote sensing

technique makes dynamic soil moisture monitoring possible. Soil moisture remote sensing monitoring has 30 years history and many researches have been done home and abroad in this field, including visible and infrared remote sensing based NDVI methods, hyper spectral remote sensing based algorithm, and microwave remote sensing orientated methodology and so on. Among these methods, microwave has great advantage in retrieval soil moisture because of the characteristics of all-weather, penetrability and not affected by the cloud. Through study people found that microwave is one of the most effective methods in retrieval soil moisture in various technologies. This paper summarizes the major microwave sensors and the principle of microwave remote sensing, and introduces the microwave model and soil moisture algorithm. Based on ENVISAT Radar data, with suburban farmland (wheat and corn as the main crop) of Peking as the study area, we established the microwave scattering characteristics database of local exposed surface. We used the selected model to simulate the response characteristics of backscattering coefficient influenced by a variety of parameters, such as soil moisture, surface roughness, incidence angle, polarization, etc. Then we got the updated inversion empirical model of the exposed surface, and evaluated the accuracy of model with the actually surveyed data in the field. This article makes certain contributions to the active microwave soil moisture retrieval methods study, and provide a viable model for water resources decision-making support to the Peking municipal government. [C34]

"Integration of LIDAR data and geological maps for landslide hazard assessment in the Three Gorges Reservoir area, China"

The water storage and millions of immigrants work have a great impact on engineering geological condition which may cause slope instability in the Three Gorges Reservoir area, China. This paper presents regional assessment of landslide hazard from Zigui to Badong based on Light Detection and Ranging (LIDAR) data in combination with geological maps and landslides information of this area. Four essential parameters, including engineering rocks, slope, slope structure and water impact, are extracted from this data. The informative model is employed to create landslide hazard map. The result shows that informative model successfully identified the stable regions as well as instable reservoir banks. Reservoir water and engineering rocks are principle control on slope stability in this area. We also divided the study area into fourteen sections according to the landslide hazard map. [C35]

"A fast range migration compensation method"

Coherent integration is usually used in matched filter radar signal processing to improve target signal to noise ratio (SNR), but the accumulation time is restrained by target's motion according to the conventional radar design principle. Keystone transform can correct range migration without the exact value of target velocity and as a result, the SNR is improved through coherently accumulating all pulses. But the usually used interpolation method has very huge calculation burden. In this paper, a fast range migration compensation method without interpolation based on keystone transform is proposed, which greatly reduce the computational cost, and is more suitable for real-time processing. The simulation results verify its effectiveness. [C36]

"A general two-dimensional spectrum based on polynomial range model for medium-earth-orbit Synthetic Aperture Radar signal processing"

The kth-order polynomial range model (PRM) for Medium-Earth-Orbit (MEO) Synthetic Aperture Radar (SAR) signal processing is proposed, analyzed, and verified in this paper. The coefficients of the PRM are calculated according to the relative state vectors between the satellite and the given target on earth, which implies power series expansion around the beam center crossing time. In addition, the relevant two-dimensional spectrum is deduced out as well by using the principle of stationary phase (POSP) and the series reversion approximation. The accuracy of this spectrum is flexible and limited both by the order of the PRM and the order of the spectrum in an expanded form. Therefore, the PRM-based spectrum is general for MEO SAR with any azimuth resolution at any orbit height. [C37]

"Radar velocity-measuring system design and computation algorithm based on ARM processor"

The real-time monitoring of vehicles velocity has become essential for traffic safety. Therefore, in order to improve the method of monitoring the velocity of vehicles on road, this paper has designed a new radar velocity-measuring system which is based on ARM processor. This system is based on Doppler principle and spectral estimation algorithm, in its hardware design part, and it takes full use of the underlying resources of ARM processor, to achieve sample, digital signal processing and peripheral control in the separate ARM core. In the software design part, it analyses the main program flow, at the same time, since the ARM processor does not support hardware floating-point operations, it puts forward the usage of fixed-point numbers to store and calculate floating-point numbers, which makes the data loading and storage minimization; And it uses ARM assembly language to write the core algorithm and takes full advantage of the 5-stage pipeline of ARM

processor, to achieve the right register allocation and instruction scheduling for fine-grained control, and also to avoid the pipeline interlocks. Experimental results indicate that the accuracy of this velocity measurement system can reach ±1km/h. It not only can be used in traffic enforcement agencies, but also has low cost, low power consumption advantages. [C38]

"Key technique analysis of data fusion with infrared sensor in defense system"

This paper mainly presents an infrared sensor based bearing-only tracking approach based on bionics with single station system. First, an infrared sensor array based on insect's compound eye principle is designed. Then, an adaptive platform scanning mode is given. This mode based on gaze extends the range of space searching. Moreover, a registration technology and a bearing-only association gate are presented. Finally, use JPDA-IMM algorithm to estimate the states of the targets. The application of the system design in an engineering application proves its effectiveness and practicability. [C39]

"An overview of range detection techniques for wireless sensor networks"

Range detection is a key problem in wireless sensor networks (WSN). In this paper, a brief overview is provided for basic techniques for this problem. The fundamental principles for range detection are inherited from RADAR systems, but careful designs need to be made to balance the expected accuracy and the device complexity, considering the limited resources of a WSN. We will introduce some basic measurement principles of range detection for WSN and some available range detection systems. We will also discuss several signal processing algorithms used for range detection. [C40]

"Remote monitoring of open numerical control system"

This paper investigates hardware and software architecture of numerical control (NC) system for remote monitor, and realizes in open numerical control system on field bus. Using principles of digital dictionary and data acquisition, the remote monitoring system of open NC system is designed. After in-depth analysis of needs, the design of hardware and software is completed, and applied research on NC EDM machines is conducted. Besides, the development of prototype is completed and the functions of online data acquisition, remote monitoring and remote machining services are realized. [C41]

"Classification of human activities on UWB radar using a support vector machine"

In this paper, we classify seven different human activities measured by a ultra wideband (UWB) radar using a Support Vector Machine (SVM). The classification is done using the time variation of a signature of a return from a human subject. This time varying signature is unique to a particular motion because human's returns vary based on the change in the orientation of their torso and limbs. We exploit this time variation of a human's radar signature in order to classify the human activity recorded by the radar. The signature is captured by the Principle Component Analysis (PCA). The Support Vector Machine (SVM) is proposed as a classifier. The training process and the resulting classification accuracy are reported. [C42]

"Horizontal Dilution of Precision Analysis for Loran C/ Beidou Integrated Navigation System"

The positioning precision of system plays a very important role in ship navigation. As a navigation system, Loran C cannot meet the orientation precision, even not be used in some areas. Based on the principle of hyperbola location, in this paper we propose Loran C/Beidou integrated navigation system. We analyze the effect on the positioning precision of two navigation systems and the simulation of orientation precision is implemented. Additionally, we give the definition of the horizontal dilution of precision (HDOP). Theoretical analysis and extensive experimental data show that by integrating Loran C and Beidou, the orientation precision and usable area of Loran C was improved and the shortage of Beidou position system was covered simultaneity. [C43]

"Multi-cycle signal processing based on Keystone transform in LFMCW radar"

In this paper a Keystone transform based MTD processing is proposed for multi-cycle signals to solve the MTRC (migration through range cell) problem in linear frequency-modulated continuous wave (LFMCW) radar. Analysis shows that MTRC is introduced by the linear coupling of fast time and slow time in multi-cycle beat signals. Resorting to the decoupling principle of Keystone transform and under consideration of the characteristics of beat signals, a transform expression is given, which is independent of target parameters. The relation between this transform and the direct motion compensation is further discussed, and a general applicable condition is derived. Simulation results testify the conclusion and the efficiency of the method. [C44]

"A novel design of SAR scattering signal simulator based on AWG"

Synthetic Aperture Radar (SAR) raw signal simulation is crucial for SAR system design and processing algorithms. This paper proposes the simulation method of SAR RF signal via utilizing Arbitrary Waveform Generation (AWG). At first, the SAR imaging principle is analyzed. Then, the space-borne SAR scenario model is constructed. The echoes of point target are calculated, which is impulse response of the SAR signal acquisition. At the end, based on the scattering model expressions of a random roughness surface and the electromagnetic wave shadow theory, the Radar Cross Section (RCS) simulation parameters of terrain target is calculated. 2D-FFT method is utilized to improve simulation efficiency significantly. [C45]

"Measurement and mitigation of the ionosphere in L-band Interferometric SAR data"

Satellite-based repeat-pass Interferometric Synthetic Aperture Radar (InSAR) provides a synoptic high spatial resolution perspective of Earth's changing surface, permitting one to view large areas quickly and efficiently. By measuring relative phase change from one observation to the next on a pixel-by-pixel basis, maps of deformation and change can be derived. Variability of the atmosphere and the ionosphere leads to phase/time delays that are present in the data that can mask many of the subtle deformation signatures of interest, so methods for mitigation of these effects are important. Many of these effects have been observed in existing ALOS PALSAR data, and studies are underway to characterize and mitigate the ionosphere using these data. Since the ionosphere is a dispersive medium, it is possible in principle distinguish the ionospheric signatures from the non-dispersive effects of deformation and the atmosphere. In this paper, we describe a method for mapping the ionosphere in InSAR data based on a multi-frequency split-spectrum processing technique. We examine a number of PALSAR data sets, including fully polarimetric and single-polarization 28 MHz bandwidth data, where anomalous effects in phase, amplitude and image registration have been observed. We demonstrate the estimation of the ionosphere by means of the split spectrum technique for estimating differential TEC, whereby a radar waveform is transmitted over the full PALSAR spectral band and widely separated portions of the receive spectrum are processed independently and compared for dispersive effects, and quantify its performance. [C46]

"A modified range migration algorithm for airborne squint-mode spotlight SAR imaging"

Due to the reference signal based on the fixed reference range is used in the range migration (RM) algorithm, the RM algorithm is not available to process an airborne squint-mode spotlight synthetic aperture radar (SAR) data. Thus, a modified RM algorithm is developed, which can be applied on processing large scene squinted-mode spotlight SAR data without division. Based on the squint-mode spotlight SAR imaging geometry, the modified reference signal is used to dechirp the received signal. Then, using the principle of stationary phase, the presented formulation of the modified RM algorithm is analyzed. Finally, the effectiveness of the proposed method is demonstrated by some numerical simulations via a squint-mode spotlight SAR simulator. [C47]

"Monitoring the coseismic deformation of L'Aquila earthquake using D-InSAR technique"

The Mw=6.3 L'Aquila earthquake, taking place on 6th April 2009 in Italy, caused severe surface deformation. This paper described that the differential interferometric SAR (D-InSAR) technique and ENVISAT ASAR data were used to detect the L'Aquila co-seismic deformation fields. Firstly it introduced the basic principle and data processing flowchart of D-InSAR. Then it introduced the ENVISAT ASAR data and SRTM DEM. And it selected 3 interferometric pairs. It illustrated the procedure of two-pass InSAR data processing. Then it got the earthquake coseismic deformation field. Through interpreting and analyzing the coseismic deformation fields in detailed, it got the maximum deformation about 23cm in LOS direction. At last, it got some valuable conclusions in monitoring the earthquake deformation using two-pass D-InSAR technique. The test proves that SRTM DEM can be used in two-pass D-InSAR for monitoring the earthquake deformation. [C48]

"Determination of Water Content in Automobile Lubricant Using Near-Infrared Spectroscopy Improved by Machine Learning Analysis"

The main objective of this paper is to determine the water content of automobile lubricant based on the near-infrared (NIR) spectra collected and to observe whether NIR spectroscopy could be used for predicting water content. Least square support vector machine (LS-SVM), back-propagation neural networks (BPNN) and Gaussian processes regression (GPR) were employed to develop prediction models. There were 150 samples for training set and test set, 6 inputs for one sample obtained by principle component analysis (PCA). LS-SVM models were developed with a grid search technique and RBF kernel function. The Levenberg-Marquardt algorithm was employed to optimize back-propagation neural network (BPNN) and models with 5 and 6 neurons in hidden layer were developed, respectively. The BPNN model with 5 neurons in hidden layer outperformed the one with 6 neurons. Three GPR models were built based on full data points (full GPR), subset of regressors (SR GPR) and subset of datasets (SD GPR), respectively, with Squared exponential (SE) covariance function. The

full GPR outperformed SR GPR and SD GPR.The overall results indicted that the Gaussian processes model outperformed LS-SVM and BPNN model. GPR was an effective way for the regress prediction. NIR spectroscopy combined with PCA and GPR had the capability to determine the water content of automobile lubricant with high accuracy. [C49]

"Detecting and assessing the land subsidence in coal mining area using PALSAR data based on D-InSAR technique"

Land subsidence induced by mining coal is one major issue in terms of damage to infrastructures. In this paper, the potential of L-band repeat-pass differential SAR interferometry for land subsidence in coal mining area is evaluated using ALOS PALSAR data. The focus is to detect and assess the land subsidence using PALSAR data based on D-InSAR technique. Firstly it introduced the basic principle and some applications of D-InSAR. Then it introduced the information of PALSAR and test data of coal mining area. It described the procedure of data processing of two-pass D-InSAR. And it got the deformation of coal mining area. It carried out interpretation and analysis on the D-InSAR results in details. The maximum settlement of land subsidence in this coal mining area was up to 42.4cm in vertical direction in 46 days. At last, it got some valuable conclusions in monitoring the land subsidence in coal mining area using two-pass D-InSAR technique. The test proves that PALSAR data is suitable for monitoring the land subsidence in areas with vegetated land cover, such as coal mining area. [C50]

"Antenna for the application in UWB-monopulse-radar technique"

Angular resolution and range resolution are two very important characteristics of a radar system. A very high range resolution requires an enormous bandwidth, which is available with Ultra-Wide-Band (UWB) technology. The frequency range extends from 3.1 GHz to 10.6 GHz in many applications, which complies with the frequency mask defined by the FCC for licence free operation. With such defined frequency range, the theoretical range resolution is approx. 2 cm. However in the radar systems not only the range but also angular resolution is of big interest. Possible solutions to increase the angular resolution include imaging algorithms and highly directive antennas. The application of imaging algorithms generally requires a movement of the antennas along a known track. On the other hand, highly directive antennas have a large aperture. Another way to increase the angular resolution without the aforementioned drawbacks is the monopulse radar principle [1]. The application of this technology in the UWB frequency range requires a directional UWB-180°-hybrid-coupler or UWB monopulse antennas. This paper presents an UWB antenna with integrated feeding network for UWB-monopulse radar. [C51]

"Vital signs monitoring with a UWB radar based on a correlation receiver"

In the first part of this publication, vital signs detection observing small amplitude changes due to the movement of a target in front of the radar is shown. In the context of vital signs monitoring the target is the chest of human beings. This basic principle is also used in continuous wave (CW) radars, but the presented impulse-based UWB radar has moreover a range gating capability. Consequently, the target distance can be obtained and different targets (persons) can be monitored. Several measurement results using this measurement principle for respiration and in particular for heart beat monitoring are presented and discussed. Furthermore, the shortcomings of this method are depicted. In the second part, advanced signal post-processing by decon-volution with a Wiener filter is presented, leading to an improved resolution performance for the realized UWB radar system. Promising results of this method show that small targets can be identified in a multi-target scenario. Therefore, the movement of small targets, e. g. the heart muscle within the human body, could be tracked directly. [C52]

"The role of the ambiguity function in compressed sensing radar"

As is clear from the ambiguity function (AF) uncertainty principle and the underlying matched filtering operation, pulse compression (PC) radars cannot accurately and simultaneously measure both the time delay and Doppler shift of moving targets. On the other hand, compressed sensing (CS) radar would seem to be emerging as a means to do just that, jointly to estimate the delay and Doppler shift, through convex optimization instead of matched filtering, such that PC resolution limits no longer apply. However, it turns out that the AF is closely related to the CS "dictionary coherence coefficient," which affects the optimization recoverability. In this paper we formalize this relationship. [C53]

"Space-time array processing based on ultrawideband throb signal"

Advanced radar and radio communication systems employ space-time array processing to improve performance in terms of detection, resolution, and interference rejection. In this paper, we present the principle of space-time array processing based on ultrawideband (UWB)-throb signal. Analogous to the well known (delay-Doppler)

ambiguity function, a space-time resolution (STR) function is derived and analyzed, by computer simulations, for different signal and array parameters, i. e., pulse width, throb rate, array interelement spacing, and number of array sensors. The structure of the STR function is composed of a narrow mainlobe and low-level sidelobes located on the temporal-angular plane. Antenna energy patterns generated from the STR function clearly demonstrate the dependence of angular resolution on the various signal and array-design parameters. The trade-offs between the various design parameters for achieving high-angular resolution as well as high-temporal resolution are attractive in practice. [C54]

"Ambigutiy function of SAR based on OFDM waveform"

Recently many researchers have turned their interests to Orthogonal Frequency Division Multiplexing (OFDM) signal since its promising features in radar. This paper concerns a novel Synthetic Aperture Radar (SAR) system which employs this OFDM signal. Though the OFDM will bring lots of advantages, the performance may be changed since the signal of SAR is different from conventional ones. To evaluate the change, this paper will give a theoretical analysis and the corresponding simulation results from the viewpoint of ambiguity function. This ambiguity function is equivalent to the role of Point Spread Function (PSF) which is often used in SAR for evaluating resolutions. Comparing to the conventional SAR with LFM signal, it is proved that the resolution of SAR based on OFDM is equivalent to the conventional one or even better. This ambiguity function also provides a principle for selecting various OFDM signals as the transmit signal of SAR. [C55]

"Study on Supercapacitor Energy Saving System for Rubber-Tyred Gantry Crane"

In order to solve the problem that the existing Rubber-Tyred Gantry (RTG) Crane consumes massive generating/braking energy through resistance, produces plenty of heat, causes excessive fuel consumption and exhaust emission during working, the relation of energy flows of the existing system is analyzed and the value of the improvement of energy saving is confirmed in the paper. Firstly, the constitution and principle of the RTG energy saving system are proposed. In addition, the topology and principle of the bi-directional DC/DC converter are anatomized. Thirdly, after analyzing a model for supercapacitor voltage equalization strategy, a voltage equalization method for RTG energy saving system is proposed, namely active voltage equalization method, and design of active voltage equalization circuit parameters and control strategy are given. Finally, simulation analysis of the series connection of supercapacitors module is performed. [C56]

"Application of wireless communication based on GPRS in power plant's CEMS"

The wireless data exchange system based on GPRS used in monitoring smoke emission in power plant is designed, the principle and the blue print of the system are described and the terminal hardware and Software are also described in details. A conclusion was presented at last. [C57]

"Object recognation with surveillance radar systems"

In this thesis have written description and principle of radar systems and them classification. As well as radar systems are used where and for what. The most optimal signal transmission and principles of systems in general. [C58]

"RF Effect Algorithms of Terrain Environment in Signal-Level Radar System Simulation"

In radar system simulation, the reliability of simulation results depends not only on radar and target models, but also on RF (radio frequency) environment models, including clutter, multipath and diffraction. In radar function simulation, all of these factors are treated as a single pattern-propagation factor and can only give limited information for radar models. In signal-level simulation, radar models require that simulated echoes should include information such as delay, phase shift, doppler frequency, polarization, etc. By discussing and analyzing the principles and algorithms of RF environment effects of ground, a ground RF environment model is proposed, which can provide a reliable RF environment for signal-level simulation of radar systems. A simulation example involving clutter model is carried out and analyzed. [C59]

"Analysis of induced surface currents on high velocity target using a relativistic approach"

Radar is an electromagnetic system used for the detection and location of objects based on reflection. It operates by radiating energy into space and detecting the echo signal reflected from an object or target. This work analyzes how currents are induced on targets by the electromagnetic waveforms radiated by an antenna when the object is moving at high velocity. It is assumed that the target is a perfect electric conductor moving at high velocity. This work analyzes how the amplitude, the frequency and the duration of these currents are affected by the target velocity. The transmitted electromagnetic waveforms can then be calculated using vector

potentials and by using the Lorentz transformation, the electromagnetic waveform is transformed from the stationary reference frame to a moving reference frame. Currents induced on the object can be modeled by using the transformed waveform and the equivalence principle. The object radiates an electromagnetic waveform as a consequence of the induced currents. The radiated waveform is calculated using the vector potentials and once more the reflected waveform is transformed from the moving reference frame to the stationary reference frame using the Lorentz transformation. Finally the equivalence principle was used to calculate currents induced in the antenna by the reflected electromagnetic waveforms. The relationship of the induced current on the antenna as a function of the target velocity is analyzed. [C60]

"Accurate time interval measurement method based on Vernier caliper principle"

An accurate method by using main clock and vernier clock is introduced to measure time interval. Vernier clock is used to count the time interval. The corresponding count results are sampled by the main clock. The relationship between the sum of sampling sequence and time interval is investigated. By utilizing the sampling sequence, we can calculate the precise time difference easily. The implementation steps are listed and the resolution is analyzed. [C61]

"Study on the magnetic sensitivity of four frequency differential ring laser gyro"

The magnetic-induced drift is an important error to limit the precision of four frequency differential ring laser gyro (DILAG) in navigation application. Different from the traditional magnetic shielding technology, this paper introduces a new method to decrease the magnetic sensitivity of DILAG, simply by adjusting the frequency stabilization mode. Firstly, the physics principle of the method is illustrated. Then, the concrete steps for implementing are given in detail, including the hardware structure and the software flow. Finally, repeatable experiments are carried out and the results verify the validity of the method, which may be helpful to researchers. [C62]

"Antenna array system for UWB-monopulse-radar"

This paper describes an antenna array configuration for the implementation in a UWB monopulse radar. The measurement results of the gain in the sum and difference mode are presented. Next the transformation of the monopulse technique into the time domain by the evaluation of the impulse response is shown. A look-up table with very high dynamic of over 25 dB and flat characteristic is obtained. The unambiguous range of sensing is approx. 40Г‚В° in the angular direction. This novel combination of UWB technology and the monopulse radar principle allows for very precise sensing, where UWB assures high precision in the range direction and monopulse principle in the angular direction. [C63]

"Nanosecond Pulser Based on Serial Connection of Avalanche Transistors"

Generation and measure of nanosecond pulse with large amplitude are difficult problems in the field of exploration. The principle of avalanche transistor is analyised and four-stage serial connection of avalanche transistors is designed. Experimental results show that across the 50Г‚Вї load the amplitude of the output pulse can reach 666V and half-width is 3.4 nanosecond. Repeat frequency of the pulse can reach 10KHz. Time-domain waveforms of the pulse and the measure data are shown in the paper. The pulser and the RL-loaded bowtie antenna get matched. The pulser can be fabricated easily and works well. It can be used in UWB Ground Penetrating Radar to improve its validity. [C64]

"A New Three-satellite High-precision RDSS/RNSS Combination Positioning Method"

Under the guidance of the comprehensive RDSS, a new three-satellite high-precision RDSS/RNSS combination positioning method is proposed in this paper, which uses a special designed RDSS/RNSS satellite and the others RNSS satellites to determine user position. The key research focuses on its principle and intending performance and lifesaving application. [C65]

"A 76GHz phased array antenna using a waffle-iron ridge waveguide"

A 76GHz phased array antenna using a waffle-iron ridge waveguide with a non-metal contact structure has been developed. The structure has the advantages of avoiding losses due to imperfect metal contact and facilitating the construction of small-size multi-layer stacked structures. The principle of a 16-column phased array antenna with a size of 62mmЧ 62mmЧ 25mm is presented. It is shown that the phase difference between all adjacent radiators in the phased array is the same, confirming the validity of the fundamental operation of the antenna. [C66]

"Classification of radar signals using time-frequency transforms and fuzzy clustering"

A method based on Smoothness Pseudo Wigner-Ville distribution and kernel principle component analysis is proposed to extract features of radar emitter signals. Then, these discriminative and low dimensional features achieved were fed to the classifier which is designed based on fuzzy Support Vector Machines (SVMs). In simulation experiments, the classification of two-class LFM signals was compared with four kernel functions. And the classifier attains over 83% overall average correct classification rate for five radar signals. Experimental results show that the proposed methodology is efficient for complex radar signals detection and classification. [C67]

"EM scattering by conductor plate coated with multilayered medium having metamaterials"

The electromagnetic scattering of conductor plate coated with multilayer medium is investigated based on the physical optics (PO) theory and the principle of equivalent impedance boundary condition (IBC). Compared with the multilayered plate coated with right-handed medium, the radar cross section (RCS) of plate composed of metamaterial and right-handed medium has a reduction of 5.76dBsm in the mirror direction. It shows that metamaterials can become a candidate of the radar absorbing material (RAM), which offers a new idea for the development of stealth technology. [C68]

"Minimized Ku band microstrip circulator design"

Double Y-junction is a traditional central conductor shape for microstrip circulator. In order to minimize the dimension, An improved double Y-junction microstrip circulator design in Ku band is described in this paper. In addition, a simple principle of how to select a proper kind of ferrite is introduced. The experimental model and test results are given proved the efficiency of the design. [C69]

"A broad-band analog phase shifter design on I-Q vector modulator"

Phase shifter is widely applied in some area, including communication and radar. In the study, the principle of broadband analog phase shifter on I-Q modulating is introduced, which is validated by the theory design using Ansoft serenade. The microwave phase shifter on I-Q modulating broadband is simulated and the corresponding entity is designed. Finally, some test are done to the phase shifter, and we sum up the design experience, all those can provide some design experience with the engineers. [C70]

"Illumination method for millimeter wave imaging indoors"

This paper presents an effective illumination method for millimeter wave imaging indoors based on multi-phase diversity principle. Though limited to its ability to do the image recognition accurately, it still gives a good performance for millimeter wave imaging idoors. The results from a real-time indoor millimeter wave imaging are presented, clearly showing the hidden metal objects. [C71]

"A novel DOA estimation technique for coherent real-valued sources"

This paper proposes a new DOA estimation technique for coherent real-valued signal sources which is named Modified Covariance AR spectrum estimation of Modified Cross Correlation Sequence (MCCS-MC) algorithm. Firstly, we introduce the basic principle of the new technique: transform the DOA of the sources into frequency of a modified sequence, and get the arrival angles by power spectrum estimation of the sequence. Then we focus on the performance analysis of the proposed technique. Simulation results show that the algorithm not only solves the angle ambiguity problem in the DOA estimation of real-valued signals, but also precisely and stably estimates the arrival angles of coherent sine signals without spatial smoothing or matrix rebuilding. [C72]

"Innovative maritime communications technologies"

Current maritime systems are to a large extent based on legacy analog VHF radios for ship-to-shore communications near port waters, and relatively low bandwidth digital satellite communications (SatCom) for long-range ship-to-ship/shore communications. The cost of bandwidth for SatCom networks is expected to remain high due to the cost of launching satellites into orbit and also due to the stabilizers required for presently available on-board antennas. On the other hand, the legacy VHF system comprises low bandwidth radios incapable of supporting applications requiring high data rates. Unlike the terrestrial networks, advancement in maritime communication means is severely lagging behind its land counterpart. MARINTEK is the principle investigator of the MarCom project, a joint initiative between several national and international R&D institutions, Universities and Colleges, Public Authorities and Industry, funded by the industry itself and The Norwegian Research Council's MAROFF program, which is aiming at developing a novel digital communication system

platform to ensure the proliferation of innovative mobile network applications presently being widely implemented on land-based wireless systems [C73]

"Design and analysis of the root stiffness mechanism of the deploying and retracting mast"

According to working principle of the deploying and retracing mast, this paper presents that the mast needs to be stiffened by a root stiffness mechanism. The double-slider mechanism with a spring is designed as the root stiffness mechanism. Then motion of the root stiffness mechanism is studied to set up vibrating equation of slider 2 based on the Lagrange equation. Displacement and velocity expression of slider 2 are obtained. At last, the Matlab program is used to check correctness of theory analysis. Elastic coefficient of spring and length of bars are selected by the program. [C74]

"Notice of Violation of IEEE Publication PrinciplesExtended target tracking using an IMM based nonlinear Kalman filters"

Notice of Violation of IEEE Publication Principles"Extended Target Tracking Using an IMM Based Nonlinear Kalman Filters,"by Yucheng Zhou, Jiahe Xu, Yuanwei Jing, Georgi M. Dimirovskiin the Proceedings of the 2010 American Control Conference, July 2010, pp. 6870-6875After careful and considered review of the content and authorship of this paper by a duly constituted expert committee, this paper has been found to be in violation of IEEE's Publication Principles.This paper contains significant portions of original text from the paper cited below. The original text was copied without attribution (including appropriate references to the original author(s) and/or paper title) and without permission.Due to the nature of this violation, reasonable effort should be made to remove all past references to this paper, and future references should be made to the following article:"Extended Target Tracking Using an IMM based Rao-Blackwellised Unscented Kalman Filter,"by Zhiwen Zhong; Huadong Meng; Xiqin Wangin the Proceedings of the 9th International Conference on Signal Processing, October 2008, pp.2409-2412The unscented Kalman filter (UKF) and ensemble Kalman filter (EnKF) are developed to extended target tracking problem for high resolution sensors. The nonlinear Kalman filters are based on an ellipsoidal model, which is proposed to exploit sensor measurement of target extent. The ellipsoidal model can provide extra information to enhance tracking accuracy, data association performance, and target identification. In contrast to the most commonly used extended Kalman filter (EKF), the UKF and EnKF provide more accurate and reliable estimation performance, due to the presence of high nonlinearity of the model. Correspondingly, the EnKF has lower computational complexity than the UKF. An interacting multiple model (IMM) technique is combined with the filters to adapt the target maneuver and motion mode switching prob- lem which is vital for nonlinear filtering. The developed IMM-UKF and IMM-EnKF algorithms on extended target tracking problem are validated and evaluated by computer simulations. [C75]

"Real-time 3D imaging: A closer reality of industry and manufacturing applications"

Laser radar imaging technology has been primarily used in defense arenas, and the principle of CW laser radar imaging has been proposed and, in some cases, implemented. However, it has not been engineered for many potentially significant large applications. It is believed that, if some key problems are solved, this laser radar imaging technology can be engineered with significantly lower costs compared to the current practice and designed for broad usages in both civilian and defense applications. In this paper, real-time range imaging is introduced. The engineering aspects are also discussed. [C76]

"Near-field ultra-wideband imaging with two-dimensional sparse MIMO array"

In this paper, we investigate the feasibility of utilizing the concept of effective aperture for designing sparse multiple-input multiple-output (MIMO) array oriented for ultrawideband (UWB) near-field imaging. The array design approach based on the effective aperture concept was previously applied under narrowband far-field conditions. Numerical and experimental studies are performed to show that such method can be still feasible in the near-field of the UWB array aperture. Two-dimensional MIMO array is designed based on the design method with extension using the principle of separable aperture functions. The real 2-D aperture array is compared with its effective aperture measured with synthetic aperture radar (SAR) technique. The similarity of their beam pattern and imaging capabilities confirm the feasibility of the effective aperture approach, and demonstrate the potential of UWB near-field imaging system with 2-D sparse multi-static array configuration. [C77]

"Simulation and analysis of the dual point-source decoying ARM"

According to the existing research of noncoherent dual point-source counteracting ARM, attacking target radiant point model without controlling of ARM disturbed by dual point-source is improved, based on decoying principle of ARM decoys system and the limitation of PRS. Simulation is presented to validate the model. The effect of

angle error to the distance choice and decoying error is studied in detail. These conclusions have great significances in improving the campaign efficiency of the active decoying system. [C78]

"Quasi optical circulator X-band scale model utilizing a circular polarization frequency selective surface"

A prototype X-band scale model for a quasi optical 3-port circulator utilizing a double-layer circularly polarizing frequency selective surface is proposed. The operating principles and measured characteristics of the device are discussed. A prototype device operating at 9.9 GHz is built and validated experimentally. The port 1 to port 2 insertion loss of the circulator has been measured to be 2 dB while port 1 to port 3 isolation is 15 dB. It is demonstrated that port 1 to 3 isolation can be increased to 25 dB by embedding the circulator in a feed forward set up. [C79]

"Study and test of rain attenuation time series synthesizers for tropical and equatorial areas"

To develop and test real-time Fade Mitigation Techniques control algorithms, propagation time series are needed. An alternative to using real data collected from propagation experiments is to generate typical fading time-series making use of climatological characteristics as well as geometrical and radio-electrical parameters of the link. The aim of this paper is to present and validate rain attenuation time series synthesizers relying on the Maseng-Bakken principle and 2-state Markov chains for tropical and equatorial areas. Brazilian beacon data at 11.5 GHz are used to parameterize and test the models. The three long-term models are tested with respect to long-term statistics and an "event based" methodology is used to test the isolated events generated by the "event-on-demand" model. [C80]

"Active and passive THz systems for short-range imaging applications"

In this paper three different systems at 94 GHz for short-range imaging applications are presented; both active and passive methodologies are described. An analysis for each case is performed, determining the parameters which satisfy the field of view and resolution requirements. A T-shape interferometric radiometer is first exposed describing the implemented imaging algorithm, the overall system block diagram, and the images obtained from the simulations. The radiometric resolution estimate is calculated, specifying the minimum temperature the system is capable to detect in function of the system parameters. Then, a Mills-Cross based active system is presented; recovered images are shown, as well as the geometry employed in the setup performance. Finally, a reflectarray setup is described; presenting its geometry of exploration and operation principles. In addition a phase discretization analysis is performed for the case of 1 bit. For both active systems the minimum detectable Radar Cross Section, RCS, is computed. [C81]

"Application of D-InSAR Technique for the Bam Earthquake"

The difference synthetic aperture radar interferometer (D-InSAR) is developed based on the synthetic aperture radar (InSAR) technique. It can be used to detect the earth surface deformation, fire hazard, earthquake and etc.. The imaging principle and data process procedure are introduced. The difference interfere process of the SAR data from Bam in Iran where earthquake happened on Dec. 26th, 2003 is implemented. The distinguish between the interferegrams before and after the earthquake is discussed. The phase image reflected the earth surface deformation arise from the earthquake is obtained. Thus the damaged area and the earthquake fracture zone position can be determined. Results show that the D-InSAR technique can be used to study the parameters of the earthquake and supply a new tool to help people to comprehensive the earthquake further. [C82]

"Radar anti-jamming application of solid-state noise source"

Jamming reconnaissance receiver (JRR) is an important anti-jamming equipment of radar. In this paper, we propose a compensation method based on solid-state noise source to against the performance degradation of JRR caused by long-term aging, which can compensate all channels simultaneous and accomplish by JRR itself. First, presented the structure of JRR, analyzed the principle and structure of solid-state noise source. To reduce the influence of ambient temperature on compensation performance, then we given and compared two solutions: constant temperature mode and table lookup mode. At last, advanced a method using attenuator to simulate the influence of long-term aging, and carried on a contrast test. The test results show that, the aging process has no effect on the performance of JRR after the compensation based on solid-state noise source, the long-term stability of JRR has been improved greatly. [C83]

"Sidelobe level reduction in wide-angle scanning array system using pattern-reconfigurable

antennas"

A technique aimed at peak sidelobe level (SLL) reduction for wide-angle scanning arrays is presented in this work, based on the use of a newly designed pattern-reconfigurable antenna (PRA). The proposed antenna consists of a monopole antenna and two parasitic strips, where each strip can be reconfigured into either a reflector or a director via PIN diode switches, leading to the beam deflection. A 2.45 GHz PRA was implemented and the measured results demonstrate three reconfigurable patterns, radiating toward two end-fire and one broadside directions, respectively. When this PRA is used in a 1Ч4 linear array, the SLL is -7.5 dB at end-fire directions and -11.8 dB at broadside. The SLL at end-fire is 7.4 dB enhancement compared to the linear array with the conventional monopole. The design principle was discussed and a Butler-matrix-fed linear array with four PRAs was implemented for demonstration. [C84]

"New detection algorithm for weak target signal embedded in direct path interference using Signal Phase Matching Principle"

A detection method for weak signals embedded in direct-path interference is discussed. This method is based on FM radio signals as the illuminator of passive radar. On the basic of Signal Phase Matching Principle, a new algorithm for suppressing the direct-path interference is proposed in wave-beam domain. To improve the declining performances of the algorithm when the amplitude fluctuates, a compensatory factor is presented. The simulation results show the validity of the algorithm and the compensatory method. [C85]

"Environmental Monitoring System Based on GIS and Wireless Communications"

To solve the problems in environmental monitoring arising from remote data acquisition, real-time transmission and analysis, this paper researched the principle of wireless communications SMS / GPRS and the technology of seamless integration with GIS. The system architecture was designed and key technical solutions were implemented. Based on the SMS / GPRS technology, the wireless real-time transmission of the remote monitoring data was achieved, and GIS visualization technology was carried out to visualize the monitoring data. Geographic affected areas were analyzed by GIS spatial analysis. The system is applicable to the environmental protection departments to realize applications such as monitor data acquisition, communication transmission, GIS management and analysis and decision-making. [C86]

"Quantum-inspired immune clonal clustering algorithm based on watershed"

Based on the concepts and principles of quantum computing, a novel clustering algorithm, called a quantum-inspired immune clonal clustering algorithm based on watershed (QICW), is proposed to deal with the problem of image segmentation. In QICW, antibody is proliferated and divided into a set of subpopulation groups. Antibodies in a subpopulation group are represented by multi-state gene quantum bits. In the antibody's updating, the quantum mutation operator is applied to accelerate convergence. The quantum recombination realizes the information communication between the subpopulation groups so as to avoid premature convergences. In this paper, the segmentation problem is viewed as a combinatorial optimization problem, the original image is partitioned into small blocks by watershed algorithm, and the quantum-inspired immune clonal algorithm is used to search the optimal clustering centre, and make the sequence of maximum affinity function as clustering result, and finally obtain the segmentation result. Experimental results show that the proposed method is effective for texture image and SAR image segmentation, compared with the genetic clustering algorithm based on watershed (W-GAC), and the k-means algorithm based on watershed (W-KM). [C87]

"Evaluation of the self-consistency principle for calibration of the CASA radar network using properties of the observed medium"

The Center for Collaborative and Adaptive Sensing of the Atmosphere (CASA) has deployed a Distributive, Adaptive and Collaborative Sensing (DCAS) network of four radars in central Oklahoma. The radars operate at the X-band frequency and are capable of polarimetric and Doppler measurements. The radar network is being evaluated for Quantitative Precipitation Estimation (QPE). QPE algorithms based on radar power measurements (e.g. ZHand ZDR) require bias correction. The polarimetric self-consistency principle is applied to the CASA radar data to estimate any bias in ZH. Results show a ZHcalibration accuracy of 0.6 dBZ or less for two the analyzed events. ZHbias estimates from the self-consistency principle in rainfall are compared and validated with ZHbias estimated from the comparison of the X-band and the S-band radars' data. Comparison of the two approaches shows a difference in the ZHbias estimation of 0.61 dBZ or less and validates the use of the self-consistency principle in rainfall for the absolute radar calibration of the CASA radars. [C88]

"3D velocity model and ray tracing of antenna array GPR"

Migration is an important signal processing method that can improve signal-clutter ratio and reconstruct subsurface image. Diffraction stacking migration and Kirchhoff migration sum amplitudes along the migration trajectory, which generally is hyperbolic. But when the ground surface varies acutely, the migration trajectory is not hyperbolic. To computer the migration trajectory need the technique of ray tracing. We introduce a method of ray tracing based on 3D velocity model. Firstly, we build the 3D velocity model depending on the estimation of both ground surface topography and velocities. Then we compute the travel time between transmitter, receiver and each subsurface scattering point, and search the propagation ray depending on the Fermat's principle. The method is tested by an experiment data acquired by the stepped-frequency (SF) CMP antenna GPR system. The target is a metal ball that is buried under a sand mound. A nice result of ray tracing is shown in the case. [C89]

"Code sequence selection for SAR radiometric calibration"

It is an important significance for SAR radiometric calibration accuracy to select a proper code sequence about active coded transponder (ACT), in the process of active coding radiometric calibration using synthetic aperture radar (SAR). According to the principle of active coding radiometric calibration, a signal processing model of active coded reflected signals is proposed in this paper. And m sequences, Gold sequences and random sequences are studied. Simulation experiments with the compression of SAR azimuth signals are carried out. [C90]

"High-resolution 3-D radar imaging using pseudo-random noise coded waveform"

In this paper, high-resolution 3-D radar imaging using a 3-step image formation procedure based on the Huggens-Fresnel's principle is analyzed and discussed. To achieve high spatial resolution, large antenna array is required. The array can be implemented with a synthesized antenna array, or a sparse antenna array. To achieve high range resolution, pseudo-random noise (PN) coded signal waveform is used. The ability of generating high-resolution 3-D imaging is verified by computer simulation. Numerical simulation shows the reconstructed 3-D radar image of an object. PN coded signal waveforms also has the advantage of noise immunity. Applications of the high resolution 3-D radar imaging can be in ground penetration radars, microwave medical imaging, and down-looking SARs. [C91]

"KaRIn-the Ka-band radar interferometer on SWOT: Measurement principle, processing and data specificities"

The principal instrument of the SWOT (Surface Water and Ocean Topography) altimetry mission is KaRIn, a Ka-band interferometric SAR system operating on near-nadir swaths on both sides of the satellite track. This article briefly describes the measurement principle, the processing steps and the specificities of the interferometric SAR data of KaRIn as compared to conventional spaceborne SAR systems. [C92]

"Assessment of airborne lidar data for instream flow type classification"

The information of instream biotype, i.e., types, location, distribution, etc, are important for estuary environment management. Field observations carry out by ecology surveyor is the standard procedure to gather that information, which is time consuming and difficult to be applied to a large spatial extend. In this research, we propose using airborne for instream biotype classification. Texture of point clouds is the key to distinguish between flow types, and semi-variogram was employed for texture measurement of different flow types. The principle component analysis is then used for classification and data compression. The results show that the first principle components are closely related to the flow types considered in this study. [C93]

"Data acquisition of vessel ISAR data with assistance of automatic identification system"

In the past, imaging of moving vehicles using the principle of inverse synthetic aperture radar (ISAR) has typically been applied to ground moving vehicles or air and space borne objects. Nowadays, demands to image moving vessels on sea come along for both military applications and coastal surveillance. New processing algorithms have to be developed to focus ISAR data of vessels because of the complicated three-dimensional rotational motion and the sea clutter. Experimental data have to be available for the development process. To be able to acquire these data, the airborne radar sensor PAMIR of Fraunhofer FHR has been extended by integrating a receiver for automatic identification system (AIS) messages, which supports the system with position information of the vessels on sea. The paper shows the hardware integration and software implementation. Benefits of the information gained from the received AIS messages are discussed and results of first acquired data are presented. [C94]

"Multi beam joined estimation for persistent scatterer interferometry"

The persistent scatterer interferometry (PSI) is a powerful technique to monitor the line of sight (LOS) deformation with Millimeter accuracy in urban areas. Nowadays, this technique is well established for the sensors ERS and Envisat/ASAR. Nevertheless, the availability of high resolution SAR sensors enables new applications which require new estimation principles. Application test cases for the sensor TerraSAR-X were demonstrated already. However, the high resolution data are not really fully exploited at the moment. This paper describes a newly developed PSI estimation principle which improves the spatial resolution by the support of distributed scatterers and increases the temporal sampling by the joined estimation of different beams. The prototyped technique needs to cope with the different projections of the horizontal and vertical deformation components onto the line of sight (LOS). Basically, this allows the inversion of the beam's observation equation and finally retrieves the vertical and horizontal deformation components. [C95]

"Target detection based on granularity computing of quotient space theory using SAR image"

Target detection is a hot topic and key technique of SAR image interpretation. There are many detection methods, such as CFAR detector and Extended Fractal (EF) feature detector. In order to overcome their shortcomings and combine their merits at the same time, the combination of some different detection methods need be implemented. Granularity computing is just an approach that solves the problem at different granularity space due to different principles. Therefore, SAR image target detection based on granularity synthetic algorithm of quotient space theory is proposed in this paper. Firstly, CFAR detector and EF feature detection method are performed to generate different detection results as coarse granularity spaces. Then combine the different quotient spaces and construct the fine granularity space by using granularity synthesis algorithm. Finally, obtain the final target detection result. The experimental result of RADARSAT-I C band SAR image proves that the proposed algorithm is effective. [C96]

"Improvement of ship detection accuracy by sar multi-look cross-correlation technique using adaptive CFAR"

This paper describes a novel technique to improve the accuracy of ship detection by synthetic aperture radar (SAR). The methodology is to apply the algorithm of constant false alarm rate (CFAR) to the coherence images produced by multi-look cross-correlation (MLCC) of sub-images. The experiment was carried out in the Tosa bay, Kochi, Japan using three known fishing boats and the simultaneous data acquired by the Phased Array L-band SAR (PALSAR) on board of the Japanese Land Observing Satellite (ALOS) at four different modes. The inter-look coherence images were found to fit best to Gamma distribution, and using this distribution function, CFAR was applied to the coherence image. The results showed substantial improvement in signal to noise ratio and false alarm rate as compared with the coherence image alone. In the followings, the principle of MLCC-CFAR and experimental procedure are summarized, and the results are discussed. [C97]

"A tutorial for applying DMOC to solve optimization control problems"

This paper presents a detailed procedure to apply newly-proposed DMOC (Discrete Mechanics and Optimal Control) methodology to solve optimal control problems. DMOC is based on a direct discretization of Lagrange-d'Alembert principle for a system. First, this tutorial explains the principle of DMOC, and how to formulate the problem in DMOC. Next the steps are shown about how to install and configure nonlinear programming solver IPOPT, and how to use the modeling language AMPL. In particular, the user-defined function is involved with AMPL to solve a more complicated problem. Furthermore, a glider example is provided in this tutorial to solve optimal control problem with the user-defined 2D time-varying B-spline ocean current model. The ocean current original data was collected by HF-Radar stations located around Monterey Bay, CA in August 2000. Practically, this tutorial is shown how to use DMOC to solve optimal control problems with IPOPT and AMPL as the components. The possible users are robotic researchers, control system engineers, operations management researchers, and so on. [C98]

"Damage effectiveness simulation in the smart ammunition design"

The angle of site for smart ammunition terminal trajectory is difficult to be designed and the time of activating the fuse in the fuse-warhead coordination is difficult to be determined. A design for the damage effectiveness simulation able to be quantitatively evaluated was proposed to solve these problems. Based on the model of damage effectiveness, and the principle of maximizing the damage effectiveness, the timing of fuse detonation and angle of site being the variables, the optimal value range of each variable was obtained through comparing the simulation results. The computing simulation was testified, using a certain radar target as the objective. The results prove that the simulation is able to evaluate the design variables in the quantitative way. [C99]

"Cooperative Sensor Networks for VRU eSafety"

Based on the experience from two predecessor projects, a novel architecture for the detection of vulnerable road users (VRU) is developed. It combines communication and localization, following the function principle of a secondary surveillance radar. Challenges are in the accuracy, the scalability, the bandwidth availability and the limited cost and complexity of the devices. This paper describes the objective of the overall project, the architectural approach of the wireless protocol and the design flow, which has been chosen for the development and is still in progress. [C100]

"On exploring SVDSPM algorithm for more accurate DOA estimation of low altitude target"

There exits SVDSPM (Singular Value Decomposition based on Signal Phase Matching Principle) algorithm for direction of arrival (DOA) estimation. Our aim is to present a different SVDSPM algorithm for more accurate estimation of low altitude target. So a void reference sensor is used to explore the possibility of better performance. In the full paper, VRS-SVDSPM (SVDSPM Using a Void Reference Sensor) algorithm and pertinent experimental research are explained in mush detail; here only a briefing is given. The following two topics are discussed: (1) the time delay formula and VRS-SVDSPM algorithm, with the void reference sensor located on the minus of z-axes; (2) analysis of experimental results. The results show preliminarily that: (1) VRS-SVDSPM algorithm can estimate low altitude target when CBF (Conventional Beamforming) and MUSIC (Multiple Signal Classification) can not; (2) the side lobe with VRS-SVDSPM is lower compared with that with CBF; (3) with VRS-SVDSPM algorithm, the bias of azimuth is 0.6 degree and the bias of elevation is 2.4 degree. [C101]

"Research on imaging of SS-BISAR"

Based on the configuration and operating principle of Space-Surface Bistatic SAR (SS-BISAR), the instantaneous range course is analysed and the target's echo model is deduced in this paper. The range-Doppler algorithm fit for SS-BISAR and the effect of receiver on imaging are studied, and in the end this algorithm is validated through simulation. [C102]

"Application of monopulse techniques in angle-measuring of single-beam mechanical scanning radar"

Due to large computation cost and low accuracy of traditional angel measurement in single-beam mechanical scanning radar, a new application of monopulse techniques is proposed. First of all, this paper introduces the principle of monopulse and analyzes the difference in accuracy between monopulse and the traditional methods. Based on that, engineering implementation is then discussed. Finally, experimental data obtained in detection mode for inverse synthetic aperture radar (ISAR) is processed by this method, and results demonstrate effectiveness of the proposed method. [C103]

"Polarimetric sar image visualization and interpretation with covariance matrix invariants"

In this study we give short overview of polarimetric SAR image visualization with colors. By studying the color models and polarization visualization models we propose basic principles which should be followed when presenting polarimetric information in color. We show that for different polarimetric parameters, different color models should be used, and give guidelines for color model selection. We present also two visualization schemes which are suitable for interpretation and browsing of large polarimetric SAR images. [C104]

"A novel method of SAR terrain target scattering signal simulation"

Synthetic Aperture Radar (SAR) raw signal simulation is crucial for SAR system design and processing algorithms. This paper proposes the simulation method of SAR scattering signal of big area terrain target. At first, the SAR imaging principle is analyzed. Then, the space-borne SAR scenario model is constructed. The echoes of point target are calculated, which is impulse response of the SAR signal acquisition system. In tradition, the Radar Cross Section (RCS) simulation parameters of terrain target calculation is based on the scattering model expressions of a random roughness surface and the electromagnetic wave shadow theory. The approach of this communication utilizes the practical SAR SLC (Single Look Complex) or MGD (Multi-Look Ground-range Detected) image as terrain target backscattering coefficient, instead of the traditional method aforementioned. Then, 2D-FFT method is utilized to improve simulation efficiency significantly. The results of simulation prove the validity of the approach. [C105]

"Multiple Sub-Spaces particle filtering for multi-target tracking"

A new multiple target tracking method based on Bayesian filtering and Sequential Monte Carlo approximating

method is proposed in this paper. The key principle of the proposed method is to decompose the multiple target tracking problem into multiple single target tracking problems by allocating Sub-Spaces which are sub-sets of single-target state space to targets. The computational cost of the proposed method is remarkably reduced by avoiding jointly estimating posterior probability distribution used in many conventional multi-target tracking methods. And compared with Finite Set Statistics based methods, the proposed method is more general, moreover, it could supply high level applications with trajectory of moving targets which is not available in Finite Set Statistics based method. The proposed method is tested by tracking pedestrian in video sequence captured from real-world and the tracking result shows that all targets are well tracked in real-time while the number of targets is unknown and varies with time. [C106]

"Power-level surveillance for an FMCW-based local positioning system"

Local positioning systems which are based on the bistatic frequency modulated continuous wave (FMCW) radar principle generally evaluate the time of flight (TOF) of signals. However, the FMCW principle also provides the power level (PL) of the received signal, which is often neglected since various unknown parameters must be considered. In this contribution, we present a method which exploits this additional source of information by predicting its value accurately based on the knowledge of the antenna characteristics, hardware parameters, and the estimated position of the measurement transponder (MT). This information can then be used to determine the quality of each PL measurement and to discard data which are obviously corrupted. [C107]

"On the use of time-frequency domains for the improvement of the Stochastic Matched Filter Pulse Compression scheme with a high speed computing architecture"

In several domains of engineering technologies, such as telecommunication, sonar imaging, positioning systems, radar, medical imaging ..., the main problem is to identify a transmitted useful pulse in a noise-corrupted received signal. A solution to this problem consists in using a modulated pulse for emission and a matched filter for reception. Such a concept is known as pulse-compression. Taking into account the main assumptions of the matched filter theory, the use of the bandpass transmitted pulse as matched filter's impulse response is only available if the useful signal is well known and if the noise is white, which is not the case in practice. For this reason, it has been recently proposed an alternative to the classical pulse-compression scheme taking into account the random nature of the useful signal and the coloration of the noise. This new principle is known as the SMF-PC. Although, this method allows a great improvement in terms of signal to noise ratio compared to the classical pulse-compression technique, the SMF-PC appears under optimal due to stationary assumptions. In this context, the purpose of this paper is to propose an improvement of the SMF-PC by coupling this technique with a time-frequency method. Results obtained on synthetic and real data are proposed and discussed. [C108]

"National Data Buoy Center (NDBC) support of the Integrated Ocean Observing System (IOOS)"

The National Data Buoy Center (NDBC) began implementing Integrated Ocean Observing System (IOOS) principles in 2001, when they partnered with the Gulf of Maine Ocean Observing System (GoMOOS). NDBC and GoMOOS collaborated on a project to transmit meteorological and oceanographic data from the GoMOOS buoys to NDBC in real-time. NDBC's data quality control, data format, and communications services to were then used to transmit the data to the NWS Telecommunications Gateway (NWSTG), which disseminated the data to the Weather Forecast Offices (WFOs) in the region. As IOOS has matured and Regional Associations (RAs) have developed, NDBC has been a partner. NDBC shares ocean observation expertise, develops data management techniques and quality control algorithms, and keeps the RAs and IOOS informed by participating in Regional Association meetings and workshops. Using a scalable system that is able to receive increasing numbers of observations, while maintaining quality control, NDBC has increased the number of partner data providers to more than 40 and the number of partner platforms to more than 600. Many of the providers are members of RAs and Ocean Observing Systems (OOSs). The number of observations handled by NDBC will approach 10 million a year by the end of 2010. As NDBC and partner data are quality controlled at the gateway, any data that do not meet the stringent quality control algorithms are automatically assigned quality flags. The flagged data are transmitted to NDBC, where analysts reexamine the data. NDBC has also been involved in the IOOS effort to establish the technical infrastructure, standards, and protocols needed to improve delivery of ocean data through the Data Integration Format (DIF). NDBC, along with NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) provide these services. Services include the NDBC Sensor Observation Service (SOS), which provides ocean temperatures, salinities, currents, waves, and winds from NDBC Co--astal Buoys, IOOS Regional Coastal Ocean Observing Systems, and TAO moorings. In addition to these data, high Frequency Radar derived coastal surface currents are available through the NDBC THREDDS Data Server. A new partnership between NOAA's National Oceanographic Data Center (NODC) and NDBC will lead to the capability to preserve all of NDBC's marine datasets to meet the standards for climate observation requirements established by NOAA and the Global Climate Observation System (GCOS). Taking advantage of new techniques

using Ocean Geospatial Consortium (OGC) Inc. standards and the SOS described above and funded by NOAA's IOOS Program, will enable a new degree of interoperability within and between NDBC and NODC and properly archive all NDBC Partner observations. [C109]

"Modeling and simulation of sea surface radar observations"

This paper describes a methodology to model and simulate the reflectivity measured by radar observing a maritime environment. The simulation principle consists of reproducing the acquisition of a Real Aperture Radar (RAR) moving along its axis. Pulse after pulse, high range resolution profiles are successively computed by summing the contribution of backscatters comprised in the radar footprint. The scatterer contributions are calculated from typical statistical distribution estimation. The simulation output, called raw data, is the concatenation of time profiles (short time) successively obtained for each radar pulse (long time). A SAR algorithm is then applied in order to form a high resolution image. The generation of the sea surface is achieved by a multi-scale model. This approach takes into account phenomena at different scales (from long wave to small objects), all in interaction in a hydrodynamic environment. It is thus possible to focus locally on contributions considered as more significant. To improve the processing time some contributions can also be retrieved from Look-Up Tables. Hence, our method performs a realistic simulation of electromagnetic interactions in a maritime environment. [C110]

"Research of Indoor Airship Control System Based on AP10"

This paper analyzes the principle and characteristics of the AP10 system, and then presents a solution of controlling indoor airship. AP10 is a kind of autopilot which is proved to be highly stable through market being used on UAV. After restructuring AP10, using the integrated navigation guidance method in it and UWB positioning technique it can be used for indoor airship. The test proved to achieve good results. This program makes up the lack of indoor airship control technique, but also shorten the development cycle. [C111]

"Online Docking Railway Transport Pattern"

In this paper, a new railway transport pattern is provided which only a few carriages will stop at each station and every passenger will reach her terminal immediately without stopping at intermediate stations. Some key technologies of this new railway transport pattern such as operation principle, mobile docking, volume of passengers and the determination of train formation and luggage consigning will be analyzed in this paper. [C112]

"Comparison of pulse and FMCW based radiolocation for indoor tracking systems"

In this paper, pulse and FMCW based radiolocation techniques are compared with respect to their usability for an indoor person tracking system. The basic principles and parameters for pulse and FMCW based distance measurements are derived. To allow the calculation of the signal budget, channel models, noise limits and regulatory aspects in terms of transmit power are considered. The accuracy and the coverage range for the two approaches are estimated for ISM and UWB frequency bands. The shown advantages of FMCW with respect to coverage range, range accuracy and system requirements favour this approach for the target application, where a high path loss due to wave propagation through walls and various obstacles must be expected. [C113]

"Method of reducing antenna RCS using bionics principle"

Bionics principle is applied to antenna radar cross section (RCS) reduction in this paper. Based on a printed circular disc monopole antenna, two novel bionic antennas are proposed by use of two models from animal kingdom and plant kingdom, respectively. Monostatic RCS and ultrawideband related characteristics of the three antennas are simulated, experimentally verified and compared. The results show that compared to the reference antenna, bionic antennas have lower RCS and favorable radiation performances, which demonstrates that the method of applying bionics principle to antenna RCS reduction is valid. [C114]

"Comparison of TEC measurements from DORIS with the NeQuick model"

Doppler Orbitography and Radio positioning Integrated by Satellite(DORIS) is a high precision satellite orbit determination and ranging system based on Doppler shift measurements from dual frequency signals propagated between ground stations and a satellite. The Doppler shift measured on the 2.036GHz signal and an additional 401.25MHz is a very potential means for scientific researches on ionosphere. In this paper, global Total Electron Content(TEC) measuring principle of the DORIS system is analyzed, and an algorithm is presented to derive the space variations of TEC from the DORIS ionospheric correction data. Finally comparison of TEC latitudinal profiles are done to with the NeQuick model. And some advices on the improvement of the DORIS system are

put forward for advantaging ionospheric sounding and tropospheric sounding. [C115]

"Study on a Closed-Loop Fire Correction Algorithm in Vehicle Close-In Weapon System"

This paper forms the integrated structure for the vehicle close-in weapon system and study on closed-loop fire correction algorithm. Through the analysis of different kinds of error factors which lead to miss distance, a mathematical model of miss distance is established to solve the problem of miss distance measuring by using equivalent principle. A feasible closed-loop fire correction model is built and a simulation is made by using the vehicle close-in weapon system. Both the simulation and experiment prove that this algorithm could improve the firing accuracy of the vehicle close-in weapon system effectively. [C116]

"Ground penetating radar imaging algorithm of targets located in unknown subsurface environment based on compressive sensing"

A new GPR(ground penetrating radar) imaging algorithm based on CS(compressive sensing) technique is presented in this paper. It aims at imaging of targets located in unknown subsurface environment. Firstly, a compound objective vector is constructed, including both unknown targets vector and unknown dielectric parameter of background environment. Secondly, the scattering and imaging model is formed based on GPR electromagnetic scattering principle and CS framework. Thirdly, the compound objective vector is obtained by solving a convex optimization problem. Experimental results of GPR simulation data show the effectiveness of this algorithm. [C117]

"Automatic target recognition based on neutral networks"

Several researches published about artificial neural networks are connected with military problems. This research put forward ideas connected with the processing of military information to search and identify targets-automatic target recognition (ATR). A main-purpose automatic target recognition system did not exist. The research put forward here was demonstrated on military data, however it could only be considered as a proof of principle until systems were fielded and proven "under-fire". A TR data could be in the form of non-imaging one-dimensional sensor returns, such as ultra-high range resolution radar returns for air-to-air automatic target recognition and vibration signatures from laser radar for recognition of ground targets. The ATR data could be two-dimensional images. The most common ATR images were infrared, but current systems might also deal with synthetic aperture radar images. Finally, the data could be three-dimensional, such as sequences of multiple exposures taken over time from a no stationary world. [C118]

"Deception jamming method for ISAR based on sub-Nyquist sampling technology"

Fast sampling of wideband RF signal and real time processing of vast data are great difficulties in the engineering implementation of deception jamming to ISAR. This paper proposes a sort of Sub-Nyquist Sampling-Based Method for Jamming ISAR Systems. First introduces the deception jamming technique based on false target for ISAR. Then investigates the jamming principle of sub-Nyquist sampling modulation. Through modulating false target information on radar signals intercepted by sub-Nyquist sampling, the resulting signal can produce a train of vivid false targets. The proposed method can greatly reduce the demands on sampling rate and processing speed, its jamming performance is analyzed in detail and verified by simulation experiments. The conclusions here have certain significance to the manufacture of ISAR jammer in practical engineering. [C119]

"Compressive sensing for high resolution differential SAR tomography-the SL1MMER algorithm"

Differential SAR tomography extends the synthetic aperture principle into the elevation and time directions for 4-D imaging. With modern meter-resolution space-borne SAR systems like TerraSAR-X (TS-X), systematic tomographic imaging of urban infrastructure and its deformations becomes feasible. We demonstrate the potential of TS-X data for this purpose and introduce several novel concepts. Since building deformation in general is nonlinear, e.g. due to thermal dilation, we start from a tomographic system formulation that is general enough to allow for the inclusion of motion models (linear, periodic, etc.). By appropriate warping of the time axis we map the motion model function to become linear and lead to a peak in the spectral domain. For the differential tomographic inversion itself we propose a 2-D compressive sensing (CS) based approach-"SL1MMER". We demonstrate the super-resolution power and the robustness of SL1MMER both with simulated and with real data. We also show that it provides an attractive compromise between parametric and non-parametric methods. A full reconstruction of a building complex and its seasonal deformation from a stack of TS-X spotlight data is finally presented. [C120]

"Polarimetric SAR tomography of natural environments using hybrid spectral estimators"

SAR tomography is the extension of conventional two dimensional SAR imaging principle to three dimensions. In order to improve the vertical resolution with respect to classical Fourier-based methods, high resolution approaches are used in this paper to perform SAR tomography. Both nonparametric spectral estimators, like beamforming and Capon and parametric ones, like MUSIC, maximum likelihood, are applied to real data sets and compared in terms of scatterer location accuracy and resolution. This paper addresses the discrimination of coherent scatterers presented in the natural environment and a joint approach of estimation and detection is proposed. [C121]

"A portable 35 GHZ cross-track interferometer for topographic and surface change measurements"

In the following, we present first results obtained from the design, construction and deployment of a 35 GHz fixed-point radar interferometer, that uses the principles of FMCW for generating a range resolving signal. Using a single transmit antenna and two receive, separated by an interferometric baseline, it is possible to determine phase differences between the two receive channels, and given the viewing geometry, to solve for the target topography. To test the system described in this short paper, it was deployed on a local mountain top, some 270m above the local terrain. With knowledge of the nominal topography (measured by the Shuttle Radar Topography Mission; SRTM), and sufficiently large interferometric height ambiguity, it is possible to solve for the topography, as seen at 35 GHz, and to monitor differences in the observed topography which may be due to differences in volume scattering, surface motion, and surface dielectric change. [C122]

"A mover detection method based on 2-D fuzzy entropy in SAR images"

In this paper, a new technique for the moving targets detection combining incoherent and coherent information of the Synthetic Aperture Radar (SAR) images is proposed based on the measure of a two-dimensional (2-D) fuzzy entropy principle. Firstly, it extracts incoherent and coherent information from images in pixel and builds a 2-D histogram. Secondly, according to 2-D fuzzy function, image pixels are fuzzy classified into two groups: changed and unchanged then 2-D fuzzy entropy is calculated. Finally, Differential Evolution (DE) algorithm is used to maximize the entropy and the optimal parameters of the fuzzy function are obtained, which procures effective moving target detection results. [C123]

"Influence and compensation of target motion on monopulse estimation in PD radar"

Pulse Doppler (PD) radar system with monopulse estimation can effectively acquire the location information of weak target, since it combines the advantages of coherent integration and monopulse technique. However, as it takes some time to realize the coherent integration, target motion will result in the decline of integration efficiency, thus affects the angle measurement precision. This paper investigates the principle of monopulse estimation in PD radar and the influence of target motion on angle measurement. A modified expression for angle measured value is presented when target has tangential motion, which can be interpreted as the midpoint angle of target motion track. Moreover, the target radial motion can be compensated by envelope interpolation method in time domain with the prior information of velocity, or by Keystone transform method in frequency domain without velocity information. Finally, the availability of the modification and compensation is verified by simulation. [C124]

"Compressive sensing MIMO radar imaging based on inverse scattering model"

From the view of inverse scattering imaging, the paper gives basic principle of MIMO radar imaging, then applies compressive sensing (CS) to two methods. The first method is sampling and receiving echoes randomly in both frequencies and channels. The second method is sampling echoes randomly only in frequencies, and controllable space intersection is done in channels to increase the practicability. Both methods can achieve high image resolution using few echo samples. The first method has better imaging quality, but the second method is more controllable. Ulteriorly, the simulation gives detailed analysis of imaging quality and reconstruction successful probability, which is beneficial to applications of CS to MIMO radar imaging. [C125]

"Parameters estimation of target with precession based on combined feature"

It is beneficial for the recognition and classification of targets to obtain geometrical and motional parameters simultaneously. This paper proposes a new method to estimate parameters of target with precession based on combined feature, which is generated by Doppler feature and high range resolution feature of target from a new radar-OFDM radar. Expanded Hough transform (EHT) is employed to establish the combined feature with range and motion information of scatterers. The paper mainly presents the principle to establish the combined feature and the estimation of precession angle, target posture and target length. Finally, the results from simulations and anechoic chamber data prove the validity of the method. [C126]

"The principle of synthesizing HRRP based on a new OFDM phase-coded stepped-frequency radar signal"

Orthogonal Frequency-Division Multiplexing (OFDM) phase-coded pulse is a wideband signal, of which the range resolution is inversely proportional to the bandwidth. However, it is a challenge to synthesize large bandwidth for OFDM phase-coded pulse since wide instantaneous bandwidth and high sampling rate requirements. To solve this problem, this paper proposes a new radar signal called OFDM phase-coded stepped-frequency (OFDM-PCSF) signal, of which the pulse train is stepped frequency, and each pulse is implemented with OFDM phase-coded chips. The property of OFDM-PCSF signal is analyzed at first. And then, the mathematical expressions of the high resolution range profiles (HRRP) are derived, assuming an elementary scenario of point-scattering targets. It mainly presents the influence of velocity on HRRP and investigates the parameter design and velocity compensation, which is helpful for the realization of OFDM imaging radar. Finally, the simulation results demonstrate the validity of the conclusions. [C127]

"A novel adaptive square root recursive least squares filter algorithm of SINS/SAR integrated navigation systems"

In strapdown inertial navigation system (SINS) synthetic aperture radar (SAR) integrated navigation systems, the time-varying parameter estimation is a challenging problem because SAR measurements are fairly few and have unequal interval. In such case, the common Kalman filter algorithm can't be convergent. Furthermore, the traditional recursive least squares (RLS) algorithm is difficult to estimate the time-varying parameter. This paper proposed a novel adaptive square root recursive least squares (ASRRLS) filter algorithm of SINS/SAR integrated navigation systems. The first characteristic of ASRRLS is introducing adaptive fading factors based on the orthogonality principle, which can effectively track the parameters' varying. The second characteristic of ASRRLS is taking covariance square root matrix instead of covariance one in the filter algorithm, which can avoid filtering divergence and improve the filter convergence speed. The ASRRLS filter algorithm is deduced and the performance is rigorously analyzed. Simulation results demonstrate the feasibility and effectiveness of the proposed approach. [C128]

"Dual-sided phase conjugating surface techniques for imaging"

We describe the principle of operation and study the imaging capabilities of a dual sided phase conjugating lens operating as an imaging sensor in free space or in an environment where significant multipath or scattering may be present. The image formation is based on the wavefront reversal properties of the phase conjugating array. By the means of numerical simulation we show that the characteristic resolution of a single dielectric target in free space is about one wavelength, λ, across the range and 3-4λ along the range for CW illumination and about one centre-wavelength λ0when the target is illuminated with a Gaussian packet. For multiple targets in free space resolution across and along the range is ~2λ0when illuminated by a Gaussian packet. It is shown that a weakly scattering object can only be detected behind a lossy dielectric wall using CW or UWB phase conjugation techniques when the backscattered field from the wall is eliminated. A procedure for achieving this is proposed. Numerical simulations for through-the-wall imaging using the phase conjugating lens technique with wall backscatter elimination demonstrates the possibility for small target high-resolution imaging. [C129]

"Interferometric quadrature down-converter for 77 GHz automotive radar: Modeling and analysis"

This paper describes a millimeter wave quadrature down-converter module based on the interferometric principle. The computer model of the six-port interferometer is implemented using S-parameter measurements of a 90° hybrid coupler fabricated on thin alumina substrate. This model is validated by full two-port measurements of the six-port. Down-converter error vector modulation results are analyzed using an envelope simulation. The proposed architecture is suitable for low-cost, high-performance, reconfigurable millimeter wave automotive radar and communication front-ends. [C130]

"A high resolution 2D omnidirectional synthetic aperture radar scanner at K band"

In this paper a K-band 360° 2D imaging radar utilizing a synthetic aperture scanning principle is introduced. A small omnidirectional antenna is mounted on a rotating platform to create a circular synthetic aperture. Based on a broadband holographic reconstruction principle a high resolution 360° 2D image is calculated after each turn of the platform. The size of the synthetic aperture and thus the lateral resolution of the imaging system are determined by the diameter of the resulting circular antenna trajectory. In contrast to common radar scanner-concepts that utilize highly directional and thus bulky antennas, the proposed scanner concept has the advantage that it uses a small and lightweight omnidirectional antenna. This results in a much more compact radar system with notably relaxed requirements for the scanning mechanics. In addition it will be shown that the

use of an omnidirectional antenna allows for very simple options to transfer energy to the radar on the rotation platform. The performance of the proposed SAR radar scanning method is illustrated with a 24 GHz FMCW radar sensor system. [C131]

"Evaluation of a high accuracy range detection algorithm for FMCW/phase radar systems"

The FMCW radar is the most versatile radar principle used today. Depending on the system configuration, it is possible to use an FMCW radar to detect targets in the range from hundreds of kilometers down to a few centimeters. This paper describes an algorithm, which can be applied to improve the FMCW range accuracy down to a few mm. Numerical system simulations are used to evaluate the possibility of using a combination between an FMCW and a phase radar for a line based range detection at 24 GHz. [C132]

"Submillimeter-wave power measurements with commercial infra-red detectors"

In this paper, we present studies of the capability of commercially available infra-red detectors at submillimeter-wavelengths. The detection is based on pyro- and thermoelectric effects. These technologies have been developed to a mature level for applications in infra-red regime. The detectors are low-cost, compact, and robust-qualities that a typical submm-wave power detector does not possess. The IR detectors are not confined to be operated only in infra-red regime. The principle of power detection remains the same also at submm-wavelengths. Results of measurements at 625-814 GHz with commercial IR detectors compared to dedicated submm-wave power detectors are presented. Sensitivity and noise-equivalent power of the pyroelectric detector is estimated to be 600 V/W and 0.6 μW/Hz1/2at 784 GHz at 20-Hz chopper frequency. [C133]

"SAR-like localization of RFID tags for non-uniform trajectory"

In this paper we present a new principle for localization of backscatter RFID tags. A new algorithm comparable to synthetic aperture radar on a non-uniform trajectory is proposed. The performance is verified with measurement data acquired by a multi sensor platform which comprises radar, imaging and RFID. The identified RFID transponder positions are presented with augmented-reality visualization. The new radar approach called SAR-like is shown to have similar performance as SAR at an apparently lower computational cost. [C134]

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"Multistatic, MIMO and networked radar: The future of radar sensors?"

A review is presented of work on multistatic, MIMO and networked radar, explaining the current high degree of interest in these subjects. The enhancement of target signatures in the forward scatter geometry is explained, and some of the principles of Passive Bistatic Radar. The challenge here is to identify applications which offer a clear advantage over conventional radar approaches. Finally, some newer, longer term ideas on networked radar as an intelligent, adaptive distributed sensor system are presented and discussed. [C136]

"3-D calibration of InISAR imaging under a condition of phase ambiguity"

Interferometric inverse synthetic aperture radar (InISAR) imaging is a recently developed powerful radar three-dimensional (3-D) imaging technique, which combines the interferometric technique and the inverse synthetic aperture radar (ISAR). The true 3-D reconstruction of target scattering centers is obtained by interferometric phase processing of different two-dimensional (2-D) ISAR images from the various image planes. However, phase ambiguity is an involved problem in the interferometric process. This paper begins with the discussion on the InISAR imaging principle, followed by the description of three-dimensional calibration technique. By linear fitting phase differences between adjacent scattering centers of the same slant-range cell, the traditional phase ambiguity can be overcame. In the end, simulation results are provided to demonstrate the behavior of the proposed algorithm. [C137]

"Millimeter-wave radar for civil applications"

This contribution gives an overview of civil state-of-the-art and also some novel applications of radar sensors in the millimeter-wave frequency range, together with some general principles and a number of examples of such

radar systems. [C138]

"Radar Multi-Targets Real-Time Communication Based on Software Radio"

According to the modern software radio principle, a programmable general-purpose platform is designed to realize radar multi-targets real-time communication. The receiver is designed based on wideband IF sampling architecture, and cascaded with two digital attenuators. C-band signal is transformed into IF signal through twice conversions. DSP, FPGA, and ARM are used for digital signal processing. Cascaded Integrator-Comb (CIC) filter and polyphase filter are utilized to accelerate processing speed and reduce system resource consumption due to the fast signal processing. Experiment results show that the digital attenuators expand the signal dynamic range 60dB. CIC filter and channelized receiver based on polyphase filter banks can save resource consumption and improve the efficiency of signal processing. [C139]

"A Migrating Target Indicator for wideband radar"

The standard way to suppress clutter in narrowband radar is to use Moving Target Indicator (MTI) cancellation techniques. High Range Resolution (HRR) radars are becoming more and more important because they can detect and track targets more accurately. As for such radars the bandwidth is increased, the resolution is decreased and leads to target range migration over the coherent pulse interval (CPI). Due to this range walk, standard low resolution MTI processing is not adapted anymore to HRR MTI radar data. We propose here to extend the principle of the MTI processing to the wideband case. We refer to this method as the Migrating Target Indicator (MiTI), since it eliminates the non-migrating targets from the received signals. [C140]

"Design of Subsidence Monitoring System Based on Wireless Sensor Networks"

In view of tradition monitoring method for land subsidence existence insufficiency, such as wiring is difficulty and work load is big, and so on. It proposed a new long-distance monitoring method for land subsidence based on the wireless sensor networking (WSN) so as to solve the difficult problem, which the GPS(Global Position System) technology and the InSAR(Interferometer Synthetic Aperture Radar) technology are difficulty to gain various strata micro-deformation characteristic. The micro-data of stratum were wireless long-distance gathered and transmitted by using ZigBee & the GPRS wireless communication technology. It introduced the monitor principle for land subsidence, and discussed hardware architecture and the software realization of Three Gorges Reservoir Region land subsidence observation system based on the ZigBee wireless sensor network. Finally, it introduced with emphasis the observation system terminal node and the wireless gateway node part's software programming realizes. [C141]

"Compressive radar imaging using white stochastic waveforms"

In this paper, we apply the principles of compressive sampling to ultra-wideband (UWB) stochastic waveform radar. The theory of compressive sampling says that it is possible to recover a signal that is parsimonious when represented in a particular basis, by acquiring few projections on to an appropriate basis set. Drawing on literature in compressive sampling, we develop the theory behind stochastic waveform-based compressive imaging. We show that using stochastic waveforms for radar imaging, it is possible to estimate target parameters and detect targets by sampling at a rate that is considerably slower than the Nyquist rate and recovering using compressive sensing algorithms. Thus, it is theoretically possible to increase the bandwidth (and hence the spatial resolution) of an ultra-wideband radar system using stochastic waveforms, without significant additions to the data acquisition system. Further, there is virtually no degradation in the performance of a UWB stochastic waveform radar system that employs compressive sampling. We present numerical simulations to show that the performance guarantees provided by theoretical results are achieved in realistic scenarios. [C142]

"A New Improved Particle Filter Algorithm Based on UKF and GASA"

The degeneracy is the critical problem existed in particle filter (PF). In order to solve this problem, we propose a new algorithm combined PF with unscented Kalman filter algorithm (UKF) and genetic simulated annealing algorithm (GASA) in this paper. In the new algorithm, UKF is used to generate the importance proposal distribution which can match the true posterior distribution more closely, and GASA based on the survival-of-the-fitness principle is applied to enhance the diversity of samples. As a result, the simulation results indicate that the new algorithm can resolve the problem of sample degeneracy successfully and outperform other particle filter algorithms in terms of accuracy and suppression the noise. [C143]

"MIMO radar for sense and avoid for UAV"

UAV are easily deployable platforms. Up to now they carry payloads (surveillance, combat) for military purposes

in crisis or war time. For training, UAV are flown in special areas attributed in a limited space and a limited time slot. In the future, UAV will also be used for civilian tasks. For these reasons, UAV will have to be inserted in the general Air traffic and "Sense and Avoid" systems will be mandatory. Among the possible sensors, the radar is the most pertinent one: it is "all-weather" and provides accurate range, direction and closing speed. In this paper, a low cost solution based on the coherent "MIMO" principles is described. This solution allows the location of the radar within the UAV airframe without any moving parts, hence provides a high reliability level. The rationale of the proposed architecture is explained, then the enabling technologies and related waveforms are described. [C144]

"An implementation of step recovery diode-based UWB pulse generator"

Ultra-wideband (UWB) wireless communications and carrierless UWB radar technology use narrow nanosecond or sub-nanosecond pulse as the transmission medium. This paper presents an implementation of sub-nanosecond level pulse generator. The main principle is using the rapid step recovery characteristics of step recovery diode (SRD) to shape the driving pulse, shorten the rise time, narrow the pulse width, then gain the required UWB pulse. The final actual measured pulse width is about 600 ps, amplitude is about 5 V. It is enough for practical applications, but the ringing is a little too big, the amplitude is relatively low. The paper provides a simple method to design UWB pulse generator. Although there is some room for improvement, it has important reference value for the use of SRD in UWB pulse generating in the future. [C145]

"An experimental 210 GHz radar system for 3D stand-off detection"

A 210 GHz radar system for studies of person scanning at stand-off distances is presented. The radar uses a mechanically scanned RX front-end based on an antenna-integrated MMIC. The TX part is based on an HBV quintupler. Image data formation is made using the FMCW and SAR principles. [C146]

"The device for remote monitoring of human's heartbeat"

This article describes creating principles of the device intended for round-the-clock human breath and heart rate monitoring. This device can be used in intensive care unit's and burns departments, maternity hospitals and also by EMERCOM employees. Heart rate detection is possible because of the Doppler effect. The Doppler frequency selection is based on the homodyne method of signal conversion. [C147]

"A wideband outdoor RCS instrumental radar with high range resolution"

Outdoor static RCS measurement is the principal means to obtain the RCS value of the full-scale targets. This paper firstly presented the imaging principles of the pulse-pulse stepped-frequency radar system. Based on the dominating characteristics of the outdoor RCS measurement, a wide-band (2-18 GHz) and two-channel RCS measurement system was designed and implemented in this paper, which could be applied to backscatter RCS measurement of the full-scale static target, and the high-resolution 2-D imaging of the scatter sources. It could provide the high-precision RCS data of target for the operational frequency range 2-18 GHz. Finally, the technical features of the instrumental radar system were also introduced in detail. This wideband RCS instrumental radar system has been successfully used in an outdoor RCS test range now. [C148]

"Original identification technique of passive EM sensors using loaded transmission delay lines"

This paper presents a proof of concept of an original identification technique of passive EM sensor cells. Previous works published by the authors have shown the feasibility of high sensitivity passive sensor Microsystems based on the electromagnetic transduction principle. More, other works, published by the same authors, have demonstrated the feasibility of a wireless interrogation technique of such passive measurement units. This interrogation technique is based on the measurement of the Radar Cross Section (RCS) level of the system composed of the sensor connected to an antenna. In this communication and for the identification purpose, a smart solution combining the sensor cell and a loaded transmission delay line is proposed. The length of the transmission delay line attributes unique identifier to the EM sensor cell. As it will be shown, the measured Beat signal Level spectrum, obtained by using an FMCW Radar reader, is composed of a two parts: one part related to the structural mode (which gives information about the antenna position) and a second part composed of the antenna mode (which gives us information dealing with the sensor measured value and the sensor identification in case of multiple sensor configuration). [C149]

"A Study on Removal of Radial Interference Echo with Weather Radar"

Electromagnetic disturbance (EMI) is an unpredictable event which often cause abnormal radar echo. EMI enables invariant radial interference echo (features such as sun-strobes) existing in certain directions in radar

echo charts at many radar stations, the interference echo and the precipitation echo overlap in many regions. The paper key research has analyzed removal of interference echo which laps over precipitation echo, and an algorithm has been proposed. The radial interference echo could be distinguished from precipitation echo by analyzing their differences. According to the wave principle of superposition and the weather radar signal processing principle, the effective precipitation echo power was obtained by processing the echo power, thus disturbance was eliminated. The analyses results show that most of interference echo were detected and removed by the algorithm, especially in the overlap regions. It can eliminate radial interference echo and retain precipitation echo well at the same time. [C150]

"Eigen-Decomposition Method for RFI Suppression Applied to SAR Data"

This paper proposes a novel eigen-decomposition method for narrowband radio frequency interference suppression for SAR. This method decomposes the eigenvectors of the RFI contaminated signal into interference subspace and signal-plus-noise subspace. The orthogonality of the two subspaces is used to suppress the RFI signals. Compared with the existing algorithms in previous literatures, the proposed method is more computationally efficient with satisfactory suppression results. Further more, this algorithm will neither estimate nor need the prior knowledge of the parameters of the interference signals. The point-target simulation is used to show the working principle of the proposed algorithm. Experimental results based on SAR real data are also shown to verify the proposed algorithm. [C151]

"A Novel Long-Distance Measurement Method Based on Secondary Radar"

In this paper we present a novel method for high precision long-distance measurement based on secondary radar. In this method, we employ two transceivers unit to work in an acknowledged mode as secondary radar system to achieve the round-trip time-of-flight (RTTOF), and introduce a system group delay (SGD) to estimate the time of the measurement signal through the system circuit. The real RTTOF related to the measured distance is acquired by deducting the SGD in the RTTOF. The prototype operates within the 433MHz ISM-Band. The results show the method has a good preference in long distance measurement at 1 km and the measurement principle is robust towards multi-path effect and target identification. [C152]

"Fast Target Detection for SAR Images Based on Weighted Parzen-Window Clustering Algorithm"

To solve the inefficiencies and high false alarm probability problem of the target detection in synthetic aperture radar (SAR) images and to improve the weakness of the two-parameter CFAR detector, a fast constant false alarm rate(CFAR) algorithm based on Weighted Parzen-window clustering (WPWC) is proposed. The principles and flow of the WPWC algorithm is introduced and a fast two parameter CFAR detector taking WPWC as a preprocessing, which reduced the effect of clutter and eliminated many false target detections from background. According to the theoretical performance analysis and the experiment results of some typical SAR images, the proposed algorithm is shown to be of good performance and strong practicability. Meanwhile, the corresponding fast algorithm greatly reduces the computational load. [C153]

"Application of Low-Frequency Communication System in Smart Plug Based on AVR MCU"

The supervisory information in pipeline such as the temperature and the pressure difference should be transferred by the smart plug, meanwhile the actions such as the plugging, plugging releasing, and safe preparedness starting should be realized according to the outside control instructions. Therefore the special low-frequency modem should be designed to solve the communication problems. According to the working principle of the low-frequency communication system and the low-frequency induction communication theory, the low frequency communication system which suitable for the working environment of the smart plug is designed, and the communication protocol is determined; the stable communication carrier of 20Hz is produced by the AVR MCU, and the method for Manchester coding and decoding based on the AVR MCU is put forward. The low-frequency communication system has good applicability which can be verified by the experiment. [C154]

"Construction approach of integrated remote sensing systems based on the partial channels"

The principles of construction and technical implementation of multichannel integrated remote sensing systems based on the separate channels which work at splitted spectral bands were developed. [C155]

"The robust adaptive signal processing in correlated noise"

A new approach is considered for solving the problem of spatiotemporal signal processing in adaptive antenna arrays in conditions intensive correlated noise processes. The method of synthesis of robust algorithms is based on the game-theoretical principle of searching a minimum of the root-mean-square error that characterizes

quality of received estimations of the existential spectra. The signal processing algorithms, constructed on this principle, relate to the class of minimax algorithms being invariant with respect to the prior uncertainty concerning noise distributions. [C156]

"Study on strapdown decoupling technology for rolling missile using RF interferometer seeker"

Because strapdown seeker is fixed on the missile body, the guidance signal for proportion navigation law can not be directly got. And the outputs of strapdown seeker are not appropriate to be directly used in the control system of the missile, for it couples with the missile body angular motion, Aim at a strapdown seeker using RF interferometer for guidance, this article presents a decoupling method that a dynamic gyro is used to decouple from the body angular motion of the missile, The dynamic gyro is used for tracking line of sight, and at the same time line of sight rate and gimbal angle outputs are available for autopilot command application. The guidance signal for proportion navigation law is derivation from outer gimbal's precessing current of the dynamic gyro. First, the angle-measure principle of phase interferometer is analyzed in the paper; second, the decoupling principle from body angular motion is advanced in the paper. It is proved that the guidance signal, namely line of sight rate in inertial space can follow the input signals well, and the effect of body angular motion can be effectively isolated. [C157]

"An Embedded System of Bridge Stress Monitoring Based on ARM9 and Zigbee"

With the growing number of large-scale bridge construction as well as the increasing complexity of form and function in recent years, the bridge's structural health monitoring technology has become increasingly important. This work presents an ARM9-based embedded bridge stress monitoring system. The system uses the measuring principle of vibrating wire sensors to collect bridge stress change, and the wireless transmission of data will be completed by the Zigbee. The stress acquisition module driver was analyzed and designed under Linux. Depend upon the embedded GUI solutions-QtEmbedded, a highly effective, stable GUI application has been designed. The new design is suitable for the real-time bridge stress monitoring, thus making an important towards low-cost and portable systems. [C158]

"Influence and Analysis of IMU Attitude Measurement Error on Laser Point Accuracy"

The emergence of airborne LIDAR system provides a new technical method for fast acquisition and processing of the spatial three-dimensional data. The limitations of traditional techniques are overcome by LIDRA, using of non-contact scanning data to obtain high-precision 3D data, it be able to work in all-weather, with a quickly scanning speed, strong real-time, all-digital processing and so on. The coordinates of laser pin-point can be abtained by calculating the spatial orientation vector of known points to the unknown point in LIDRA system. The composition of systems is very complex, so the laser point coordinates location will effected by system error and accidental error of the LIADR system. The status quo of airborne laser scanning was briefly introduced in this paper. On the basis of airborne laser scanning system positioning principle, the impact of the pitch angle, roll angle, yaw angle and synthetic attitude error of IMU on laser point positioning accuracy was detailedly analyzed. After simulated calculations using IMU practical measurement accuracy presently, some useful conclusions were obtained, which have certain guiding significance for the understanding of airborne laser positioning accuracy and practical application. [C159]

"Design and realization of a radar simulation system base on CPCI bus"

In this paper, design and implementation of a radar signal simulation system is introduced. It is based on standard CPCI bus and follow the design principle of standardized, modular and extendable in design process. This system is made up of standard hardware and the simulated waveform can be obtained from any algorithms. This system is flexible to extend based on complexity of the algorithms. [C160]

"Design and optimization of radio frequency stealth signal based on SAGA"

A good stealth performance of radio frequency (RF) signals is very important for fighters in order to have high penetration capacity, survivance capacity and combat effectiveness in an electronic warfare. Some design principles of RF stealth signals are proposed in this paper. In the light of design principles, hopping-frequency signals were proved to having the good RF stealth performance. The simulated annealing genetic algorithm (SAGA) was used to design hopping codes based on the maximal sidelobe level criterion. The performance of frequency-hopping signals was verified by experimental simulations. [C161]

"Research on power spectrum estimation based on periodogram and burg algorithm"

With rapid development of modern intelligent traffic management, the measuring speed radar becomes an

important device. Using Doppler principle, speed can be measured by obtaining frequency deviation signal of moving target. Traditional measuring speed method uses analog filter whose measuring accuracy is low and measuring speed is slow, so it's difficult to meet the requirements of modern intelligent traffic management. Signal processing of speed radar generally use power spectrum estimation method. This paper focuses on classical period spectral estimation and modern spectral estimation based on Burg algorithm. By comparing various algorithms in computational complexity and resolution, Burg algorithm was used to signal processing finally. Experimental and simulation results indicated that digital signal processing system would meet system requirements for measurement accuracy. [C162]

"The missile SAR echo signal simulation technology research"

SAR simulation technology is of great significance for the development of synthetic aperture radar. The paper firstly proposes the constituted principles of missile SAR echo simulation system, discusses and establishes mathematical model of the Missile SAR echo signal, and describes the target Scattering model and the geometric model on the distributed targets and described the target Scattering model and the geometric model on the distributed targets, and finally provides a theoretical basis for further study the simulation of missile-borne SAR echo system. [C163]

"A high resolution 2D omnidirectional synthetic aperture radar scanner at K band"

In this paper a K-band 360° 2D imaging radar utilizing a synthetic aperture scanning principle is introduced. A small omnidirectional antenna is mounted on a rotating platform to create a circular synthetic aperture. Based on a broadband holographic reconstruction principle a high resolution 360° 2D image is calculated after each turn of the platform. The size of the synthetic aperture and thus the lateral resolution of the imaging system are determined by the diameter of the resulting circular antenna trajectory. In contrast to common radar scanner-concepts that utilize highly directional and thus bulky antennas, the proposed scanner concept has the advantage that it uses a small and lightweight omnidirectional antenna. This results in a much more compact radar system with notably relaxed requirements for the scanning mechanics. In addition it will be shown that the use of an omnidirectional antenna allows for very simple options to transfer energy to the radar on the rotation platform. The performance of the proposed SAR radar scanning method is illustrated with a 24 GHz FMCW radar sensor system. [C164]

"Target maneuver detection using high resolution Doppler profile"

A novel maneuver detector for radar targets is described. The high resolution Doppler profile is used to detect abrupt variation in attitude as the target maneuvers, which can be extracted within the coherent processing interval. A brief introduction of the detection principle is presented, along with feasibility study results from a back propagation neural network implementation. [C165]

"A low-power wireless remote sensor node design based on GPRS"

For the limitation of transmission distance and power volume of sensor node, a low-power remote data acquisition node which implements long-distance data transmission by combining General Packet Radio Service network with wireless sensor network is designed to acquire data periodically and upload data to remote server through General Packet Radio Service network. This paper expatiate hardware design principles of the node, power management model and software protocol design of the test system. Test results show that nodes can reliably acquire and upload data, the average work current of sensor node is 34mA, the peak current of cluster-head is 260mA when cluster-head uploads data to server, and sleep mode current are both less than 35uA. Performance indicators of node can fulfill the needs of remote monitoring applications in industrial field. [C166]

"Application of particle swarm optimization with stochastic inertia weight and adaptive mutation in target localization"

Target localization based on time difference of arrival (TDOA) measurements has important applications in sonar, radar and sensor networks. This paper simply introduced the target localization principle of moving emitter and the position location algorithm. Further more presented an improved particle swarm optimization with stochastic inertia weight and adaptive mutation, and adopts it to solve the target localization problem according to the batch of continuous TDOA measurements. The experimental results show that the new algorithm has higher localization accuracy, better algorithm stability and faster convergence rate. [C167]

"Application research on intelligent pattern recognition methods in hail identification of weather radar"

Firstly, advantages of the learning ability of intelligent pattern recognition models, which have been used in hail identification of weather radar based on echo parameters, is discussed. Then, structures and working principles of hail identification models which based on fuzzy neural network and support vector machines (SVM) are described respectively. Finally, effect validation of hail identification has been finished by using echo samples from Chengdu and Kuitun to train the hail identification models. The experimental results show that hail identification models based on intelligent pattern recognition have the better effect than which based on the statistical pattern recognition. Besides, in the case of limited training samples, the identification model based on SVM has stronger adaptability than which based on fuzzy neural network. [C168]

"Diouble-channel radio-pulse short-range radar on Gunn diode"

An operation principle and a design of double-channel SRR on the basis of the radio-pulse autodyne on Gunn diode of 8-mm-range are given. The possibilities of simultaneous application both the intro-pulse and inter-pulse modes are realized in this system. [C169]

"Operation principle of intro-pulse autodyne FM SRR"

This paper shows the functional circuit of short-range radar (SRR) with pulse modulation and FM. Time diagrams of such SRR output signals are also presented. The modulation pulse parameters and gating parameters, their interposition in time are defined in the synchronization unit. At the same unit, the synchronization of pulse modulation processes and FM is provided. The radiation reflected from a target inside of each radio pulse causes the amplitude and frequency variations due to the autodyne effect as well as the bias voltage variations after time T later on the beginning of the radio pulse formation. The amplitude variations are usually extracted by means of the additional (external) detector, but the bias voltage variations in the oscillator supply circuit. [C170]

"Multivariate Markovian gamma distributions for multitemporal sequences of SAR images"

This paper introduces a family of multivariate gamma distributions characterized by a Markovian correlation structure. These distributions are interesting for detecting changes between multi-temporal sequences of synthetic aperture radar images. The parameters of these distributions can be estimated by using the maximum likelihood principle. This estimation procedure allows one to obtain a change indicator between each pair of images. A performance comparison with maximum likelihood estimators derived from a bivariate gamma distribution model is conducted. The gain of performance provided by the Markovian multivariate model with respect to a bivariate model is emphasized on synthetic and real images. [C171]

"Summary on weak signal detection methods based on Chaos theory"

Definition, significance and traditional method of weak signal detection (WSD) are introduced. Content of WSD methods based on chaos theory is sorted in detail. Theory base, principle and main content of WSD method based on chaos oscillator are introduced. Its main content contains detection task, detection system, detection condition, chaos criterion, method improvement and method realization. Detection task is to measure parameters of the various periodic signals to be detected. Duffing oscillator is usually used as a chaos detection system and would have different detection performance with different equation form. Detection condition includes noise condition and initial condition. Noise condition means noise type and SNR. Chaos criterion is about identifying and describing state of chaos system. Hardware realization includes design of chaos measurement circuit and sometimes with DSP. This WSD method can be combined with traditional WSD method for lower SNR. [C172]

"High resolution current & bathymetry determined by nautical X-Band radar in shallow waters"

The wave and current monitoring system WaMoS II is a remote sensing system based on a nautical X-Band radar generally used for navigation and ship traffic control. It has been used in recent years to monitor sea state information from moored platforms, coastal sites and moving vessels. A nautical radar can scan the sea surface over a large area (~ 10 km2) with a high spatial (~7.5 m) and temporal resolution (~2s). Directional wave spectra and standard sea state parameters such as significant wave height, peak wave period and direction can be derived by analyzing the sea surface image sequences. Using the temporal and spatial evolution of the sea surface wave images it is also possible to determine high resolution current and bathymetry information. In the paper a brief introduction into the measuring principle of WaMoS II is given and results of a high resolution current and bathymetric mapping technique for shallow water areas (<20 m) are presented. For validation these results are compared with model data and in-situ measurements. [C173]

"Physical bounds and sum rules in scattering and antenna theory"

The objective of this paper is to review some recently developed sum rules and physical bounds in scattering

and antenna theory. The sum rules are based on identities for Herglotz functions that relate the quantity of interest integrated over all wavelengths with its static polarizability dyadics. They are transformed to physical bounds by applying variational principles for the polarizability dyadics together with various estimates of the integrals. The theoretical findings are exemplified by numerical results for several configurations. [C174]

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

This paper mainly discusses how to monitor the land subsidence in Suzhou city using differential interferometric synthetic aperture SAR (D-InSAR) technique. It firstly introduces the principle and data processing flowchart of D-InSAR. Then it carries out test and gets the land subsidence in Suzhou city using two pass D-InSAR technique. At last, it analyzes some problems which influence the application of D-InSAR in monitoring the urban land subsidence in detail. [C175]

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

This paper presents a new error-resistant adaptive filtering algorithm for INS/SAR (Inertial Navigation System / Synthetic Aperture Rader) integrated navigation system. This algorithm adopts the principle of error-resistant estimation to adaptively process measurement information. The experimental results demonstrate that the performance of the proposed error-resistant adaptive filtering algorithm can significantly improve the performance of INS/SAR integrated navigation system. [C176]

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

In this communication, the new and latest results relative to an original passive electromagnetic micro-sensor for wireless pressure monitoring application are presented. This micro-sensor uses the electromagnetic transduction principle. The sensing element is a flexible high resistivity silicon membrane located above a coplanar quarter-wavelength resonator operating in Ka-band. From the measurement of the resonant frequency the pressure applied on the membrane can be derived. This completely passive and wireless pressure telemetry micro-sensor has been designed, fabricated and characterized, thereby eliminating the need for contact, signal processing circuits, or power supplies to be contained within the sensor. Measurement results under real working conditions, obtained from a specific RF/pressure bench are reported and reveal a very good sensitivity of 370 MHz/bar in Ka-band. Moreover, for the first time, we propose to use a frequency-Modulated Continuous-Wave (FMCW) radar system for the remote determination of the pressure data via the electromagnetic micro-sensor. This attractive concept of radar interrogated micro-sensor based on electromagnetic transducer is discussed and illustrated. [C177]

"Constant-phase dual polarization MEMS-based elementary cell for electronic steerable reflectarrays"

A reconfigurable radiating element for beam steering reflectarray is proposed. The elementary cell consists of a square patch slot-coupled to a coplanar transmission line, operating at 76.5 GHz, with 1-bit phase resolution (0°/180°). The control is obtained by activating two pairs of MEMS switches placed on the backside of the radiating element. Such configuration allows dual polarizations and a flat phase shift response over a broad band (theoretically unlimited). Full-wave simulations are presented for 76.5 GHz patch, whereas a demonstrator operating at 10 GHz was simulated, manufactured and tested to confirm the basic principle of operation. [C178]

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

The principle of multiple quadrature waveform synthesis (MQWS) is introduced, which is based on the theory of quadrature modulation. Its adaptability to pulse signals is analyzed. Combined with pre-saved waveform data, this method can be used in radar signal environment simulation and it can simplify the requirement for the hardware implementation with general-purpose and flexibility characters. The realization experiments show that it can fulfill the signal's simulation of various radar types. [C179]

"New approach of imagery generation and target recognition based on 3D LIDAR data"

Light Detection and Ranging (LIDAR) sensor is an advanced technology of 3D-measurement with high accuracy. The processing of 3D point cloud data collected via LIDAR sensor is of topical interest for 3D target recognition. In this paper, a new approach of imagery generation and target recognition based on 3D LIDAR data is presented. The raw 3D point cloud data are transformed and interpolated to be stored in 2D matrix. The target imagery is generated and visualized by means of height-gray mapping principle proposed in paper. For different poses of target, the affine invariable moments of target imagery are selected as features for recognition because of its invariance in rotation, scaling, translation and affine transformation. BP neural network algorithm and

Support Vector Machine (SVM) algorithm are utilized as method of target classification and recognition. The recognition results by two algorithms are compared against and analyzed detailedly. The new method had been applied into target recognition in outdoor experiments. Different types of targets are classified and the rate of correct recognition is greater than 95%. Through outdoor experiments, it can be proven that this new method is applied to the field of 3D target recognition effectively and stability. [C180]

"A Study on Quantitative Radar Rainfall Measurements by the Method of Set-pair Analysis"

This paper introduces the basic principles of Set-pair Analysis, and presents a method of applying Set-pair Analysis in determining the two parameters of Z ~ I relationship of radar rainfall measurement. This method is then applied in the Bailianhe catchment. After a comparative study between the Set-pair Analysis and the traditional method of CTF, a conclusion is made that, compared with the traditional method of CTF, the parameters selected by Set-pair Analysis can produce better rainfall results. It can not only improve the precision of the total accumulated rainfall, but also decrease the bad effect that the irrational radar reflectivity and actual measured rainfall data pairs brought to parametric optimization. At the same time, it improves the fitting precision of the rational data, which consequently improves the rationality of the two parameters. [C181]

"Filter of LIDAR Data Based on Multi-Resolution and Directional Elevation Tolerance"

Based on studying the principle of wavelet multi-resolution analysis, this paper takes Wavelet into the LIDAR filtering, by making use of pyramid-delaminating theory, the fast organization of raw DSM data comes true, while the computing speed increases and the filtering speed improves. At the same time, by considering the directional elevation tolerance of the whole region in the process of filtering threshold selection, judgement makes better accordance with terrain, and the precision of filtering is improved. At last, experiment is carried out on DSM data obtained by LIDAR, the result proves the validity and advantage of the advanced filtering method. [C182]

"Research on Radar Emitters Classification with Fuzzy Support Vector Machines"

In this paper, a novel method based on kernel principle component analysis is proposed to extract features of radar emitter signals image of Choi-Williams distribution. Then these discriminative and low dimensional features obtained were fed to the classifier designed for different radar LFM signals which is based on fuzzy support vector machines (FSVMs). In simulation experiments, the classifier attains over 90% overall average correct classification rate. Experimental results show that the proposed FSVM classifier is efficient for different complex radar signals detection and classification. [C183]

"Space Target Recognition Based on Biomimetic Pattern Recognition"

Biomimetic Pattern Recognition is a new model of Pattern Recognition based on ldquomatter cognitionrdquo instead of ldquomatter classificationrdquo. This new model is much closer to the function of human being, than traditional statistical Pattern Recognition using ldquooptimal separatingrdquo as its main principle.But it has been investigated in 2D sample space, In this paper, we extend to space target Image sample space by Clifford Algebra, and study its property. The experiment result proves the efficiency of our theory. [C184]

"Resolver-to-digital converter based on tangent algorithm"

The paper proposes a solution to digitize the angle information of the two speed resolvers based on tangent algorithm. This solution is simple than the tracking types in common use. The principle is analysed and the configuration of software and hardware is presented. To avoid overflow and improve precision, sampling at the signal peak and two tables are adopted. The experiments show that the solution is steady, reliable, high-accuracy, and low-cost. [C185]

"Design and realization of the vehicle-mounted unit for a remote electronic monitoring and calibration system"

This paper introduced the GPS/GPRS-based remote electronic monitoring and calibration system, as well as its working principle and system framework. Then the hardware structure and software designing of vehicle mounted unit were introduced. Next, we emphasize testing the reliability and speed of communications while refreshing the data of ECU through GPRS. As a conclusion, it quickly implements the functions of vehicle remote supervision and ECU calibration. [C186]

"RCS reduction of missile-borne quasi-traveling wave microstrip antenna"

The reduction of a missile-borne microstrip antenna's radar cross section (RCS) is very important for improving

the stealth performance of the missile. In this paper, the principle of antenna's RCS is firstly analyzed. By taking a kind of missile-borne quasi-traveling wave microstrip antenna as example, a new method is then presented to reduce its RCS significantly and improve its performance as well. The main point of this method is to cut two H-shape slots and install two short-circuit pins in each microstrip unit of the antenna, which reduces the RCS significantly in a wide frequency band, expends the bandwidth, and remains the gain of the antenna unchanged at the same time. [C187]

"Wireless and batteryless surface acoustic wave sensors for high temperature environments"

Surface acoustic wave (SAW) devices are widely used as filter, resonator or delay line in electronic systems in a wide range of applications: mobile communication, TVs, radar, stable resonator for clock generation, etc. The resonance frequency and the delay line of SAW devices are depending on the properties of materials forming the device and could be very sensitive to the physical parameters of the environment. Since SAW devices are more and more used as sensor for a large variety of area: gas, pressure, force, temperature, strain, radiation, etc. The sensors based SAW present the advantage to be passive (batteryless) and/or wireless. These interesting properties combined with a small size, a low cost radio request system and a small antennas when operating at high frequency, offer new and exiting perspectives for wireless measurement processes and IDTAG applications. When the materials constituting the devices are properly selected, it becomes possible to use those sensors without embedded electronic in hostile environments (as high temperature, nuclear site, ...) where no solutions are currently used. General principle of the SAW sensor in wired and wireless configurations will be developed and a review of recent works concerning the field of high temperature applications will be presented with specific attention given to the choice of materials constituting the SAW device. [C188]

"Development of portable integrated signal source for circuit unit test of radar"

Diversification and complication of circuit units of modern radar bring requirement of more functions for signal source used for test. Based on virtual instrument, microprocessor, DDS, CPLD and circuit share technologies, a portable integrated signal source for circuit unit test of radar is developed, which integrates DC power supplies, AC power supplies, low frequency signal source, intermediate frequency signal source and digital signal source into one instrument. The composition of the hardware and the software of the integrated signal source and their design principles are given in the paper. Testing results show that the integrated signal source provides a good test platform for circuit units of radar. [C189]

"Extended Kalman filter based pedestrian localization for collision avoidance"

The practical driving safety assistant system should be able to estimate the possibility of pedestrian-vehicle collision, which includes pedestrian detection and localization as well as collision prediction. Until now, many works concentrated on pedestrian detection and achieved some progress. For collision prediction, it is essential to locate the pedestrian precisely; however, the localization problem still needs to be further studied. At present, most researches adopted expensive equipments (e.g. millimeter wave radar and laser scanner) to run away from the difficulties; and many others used multi-cameras to solve this problem. In our previous work, we proposed a low-cost pedestrian detection system with a single optical camera, which performanced well in pedestrian detection. Basing on the detection system, an extended Kalman filter based pedestrian localization model/methodology is proposed in this paper. The localization model sets up proper relation between state vector and observation vector and chooses proper initial state for the Kalman filter using perspective projection principle, which guarantees the proposed filter to estimate the location of pedestrian quickly and actually. The experimental results have validated that the accuracy of the proposed localization model/methodology may meet the requirements of a practical collision avoidance system. [C190]

"Design on radar signal simulator of automotive ACC"

Radar simulator of automotive adaptive control cruise system (ACC) has been designed with the principle of radar ranging. Based on synthetically considering the relationships between the actual kinematical status of the host vehicle and the virtual kinematical status of the preceding vehicle, the simulator can generate simulated radar data streams inputted into the controller of the real vehicle test platform of the ACC system. In this paper, the basic principle and the hardware and software scheme of the radar simulator of ACC are introduced in detail. Moreover, the cause of the relative distances error of the simulator has been analyzed and it is solved by the integral algorithm correction of the relative vehicle distance that the integral error has been modified and simultaneously the sampling points do not decrease. The results of trial show that the radar signals can meet the ACC controller and accordingly the safety and efficiency of the exploitation of the ACC system and the real vehicle experiment can be ensured. [C191]

"Study of government information construction based on BPR"

The theory of business process reengineering (BPR) is the newest managerial principle. It has archived dramatically as an effective way for the reform of corporations to radically redesign the business processes. BPR is widely used in many other fields due to its remarkable achievements. From the aspect of BPR, this paper proposed e-government planning approach, applied BPR to the government information construction and discussed how to carry out BPR in the e-government. Finally, based on the deep analysis of the characteristics of government work activities, both the fundamental construction and their inter relationship of the new information system in terms of the principle of business process reengineering. In a word, this paper mainly studied the GPR and the value government, which is of some reference significance for actual practice in government information. [C192]

"Compensation Method of Acquisition for High Dynamic DSSS Signal"

According to the problem of acquisition error for high dynamic direct sequence spread spectrum signals, a new compensation method is presented to guarantee acquisition phase accuracy of PN code. In this method, the acquisition result of Doppler frequency is used to compensate acquisition phase of PN code based on processing time of acquisition and start-up time of tracking. Analysis and simulation results indicate that the principle of method is correct and the initialize precision for tracking can be ensured especially for high dynamic environment. [C193]

"Integrated Application of WBAN and WSN"

With the keep growing of the ratio of people over 65, the health care system for elder people is facing challenges. WBAN, being the newest technology, will play an important role in elder people health care system. In this paper, we discussed integrated application of WBAN and WSN in nursing home's health care system, proposed a gradient routing protocol for WSN to satisfy the needs of WBAN data transfer in a limit area, and gave out its principle and implementation. The locating algorithm for moving people in the yard was also discussed in detail, and different algorithms were given out to adopt different situations. [C194]

"A simple method for estimation of maximum spurious radiation level from phased array antennas"

According to the new ITU regulation on unwanted spurious emissions from radar transmit antenna, it has become compulsory to measure transmit antenna patterns at spurious frequencies. However, the complex nature of phased array antennas, involving a large number of antenna elements with element-by-element phase-control for beam-scanning, usually makes it difficult to measure all the radiation patterns at spurious frequencies. This paper introduces our approach to this problem, where, under the principle of pattern multiplication, the spurious radiation maxima are estimated by the multiplication between calculated array-factors and measured element-factors, both at spurious frequencies. Among those antenna element types we have examined, this paper deals with the case for dipole antenna as the most typical array antenna element. [C195]

"A rapid deployment guided radar sensor"

A need has long existed for a rapid deployment, terrain following security sensor for use around portable resources, along an avenue of approach, or for the temporary replacement of a failed sensor. Existing solutions such as portable microwave or passive infra-red (PIR) sensors are relatively inexpensive, but cannot work over uneven terrain, around corners, or in foliage. The cost and installation complexity of these sensors increases rapidly as more units are required. The RepelsregRF sensor provides many of the required features, but uses sensor cables that are overtly mounted above ground. The OmniTraxregtechnology was first introduced at the 2004 Carnahan Conference, applying ultra wide band radar principles to a ranging leaky cable guided radar sensor. In 2007, a program called TFDIDS (terrain following deployable intrusion detection sensor) was initiated in conjunction with the US Air Force, to apply the advancements in this ranging technology to the rapid deployment sensor needs defined by the USAF tactical automated sensor system (TASS). This advancement includes a novel invention employing the processing of dual parallel leaky sensor cables, termed Stereo OmniTrax. This processing dramatically improves the discrimination between human intrusion threats and small nuisance targets or environmental effects. The TFDIDS system provides a complete lightweight sensor kit for the rapid deployment (less than 30 minutes) of a 100 m detection zone, and later, for the sensor's retrieval and reuse. TFDIDS interfaces to standard Government Furnished Equipment (GFE) including USAF powering and communications devices. This paper outlines the key elements of the TFDIDS design, describes its components, and explains how TFDIDS provides reliable detection using a surface sensor cable deployment. Initial performance results are presented, from tests conducted at the Senstar SITE in 2008. The test applications include through-the-woods, on tarmac and o- n typical open field surfaces. [C196]

"A Review on Latest Interferometric Synthetic Aperture Radar Researches"

In recent years, applications of InSAR (interferometric synthetic aperture, radar) to deformation monitoring has become a hotspot in research of geological hazards. This paper introduces the basic principles and data processing procedures of InSAR and summarizes main progresses made in InSAR technology and its application to deformation monitoring. This article figures out existing problems and the future of application of InSAR. [C197]

"Application of DRFM in ECM for pulse type radar"

In this paper, we develop a digital radio frequency memory (DRFM) which samples and quantizes (A/D conversion) an incoming pulse-typed radar signal, stores it and produces (D/A conversion) a jamming signal from the sampled and stored radar signal. Electronic countermeasure (ECM) techniques against radar can be enhanced by using DRFM to simulate the radar signal for subsequent re-transmission to confuse radar at any distance. This paper presents the principle of DRFM and its application in ECM against pulse type radar. [C198]

"High-power millimeter-wave rotary joint for radar applications"

The rotary joint is a useful microwave component that connects a fixed part to a rotatable part. This study analyzes the effect of the discontinuity on the interface of a rotary joint for several waveguide modes. Simulation results indicate that the transmission of the TE01mode is independent of the geometry of the joint, and thus is ideal for such application. A rotary joint consisting of two identical TE01mode converters, clasped each other by a bearing, is designed, fabricated, and tested. Back-to-back transmission measurements exhibit an excellent agreement to the results of computer simulations. The measured optimum transmission is 97% with a 3-dB bandwidth of 8.5 GHz, centered at 35.0 GHz. The cold measurement shows that the results are independent of the angle of rotation. In addition, a high-power experiment is conducted. The just developed rotary joint can operate up to a peak input power of 210 W with a duty of 18%. The working principle, although demonstrated in the millimeter-wave region, can be applied up to the terahertz region where the joint gap is generally critical except for the operating TE01mode. [C199]

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

It is addressed that the anti-jamming efficiency of CSLC coherent sidelobe cancellation could not be only evaluated by C Cancellation ratio, but also by the detection range change between before and after CSLC. According to orthogonal principle, by introducing the correlation coefficient between the main and auxiliary jamming signal, it could be simplified to calculate the C of CSLC. The mathematical models of C of the single and double CSLC are set up considered the receiver noise, and the static simulations are made. The results indicated that the jamming signal could be canceled to the noise level by single CSLC when the jamming signals of main and auxiliary channel are cohered completely, but the jamming signals level will be higher than the noise s level when the channels are not cohered completely and jammer-to-noise ratio is high. The CSLC has a strong anti-jamming performance for cover noise jamming. [C200]

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

First of all, the detection theory of the instantaneous polarization radar is introduced. The overall structure of dual-channel circuit has been designed. The principle part of RF system consists of antenna arrays and the dual-channel receiving and transmitting circuit. Si4133 chip used as the core design of the high stability, fully coherent frequency synthesizer as instantaneous polarization radar's frequency source. Then the structural design of inverters pieces is discussed, clear frequency convert program is reasonable. ADEX-10L devices use to produce high vibration isolation mixers. The dual-channel receiver components focuses on the development of voltage-controlled gain amplifier based on the AD8367 chip, and the amplitude-frequency characteristics, phase frequency characteristics and dual-channel consistency were tested. The introduction of the automatic power balance technology to ensure that the two-channel transmitter power balance. [C201]

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

The principle of the active radar seeker coherent interference was analyzed, and the mathematical expression of orientation error angle under the condition of coherent interference was established. Then the two interference sources phase difference and the signals amplitude ratio which impact the orientation error angle were simulation analyzed, it obtained that when the two interference sources phase difference is at 180Г‚В°, the orientation error angle can reach the maximum. Then the coherent interference signal model was established, and the track performance of active monopulse radar seeker under the condition of coherent interference was

simulation. The simulation result shown that coherent interference can effectively increase the directional error angle and the smallest distance between target and missile, when the two interference sources transmission power ratio non-linear increasing, the orientation error angle and the smallest distance between target and missile increasing greatly, that is the interference effect significantly. [C202]

"Automatic Meter Reading Monitoring System Based on G18 Module"

The G18 module is proposed in this paper, which is used in an automatic meter monitoring system for accessing GPRS traffic from GSM network under control of a micro-controller. The principle of system, design of the hardware circuit, the control method of the single chip computer and GPRS module and the application of G18 module in this system are introduced in detail. [C203]

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

Contract-of-Objectives (CoO) is designed in the context of trajectory-based Air Traffic Management (ATM), using mutually agreed objectives between Air Traffic Control (ATC), airlines and airports. This paper provides an overview of the foreseen validation of CoO and discusses the results of the first Human-in-the-Loop (HIL) evaluation of the concept of operations using CoO between Air Traffic Controllers (ATCos). This HIL real time evaluation is carried out in October 2008 in SkyGuide premises in Geneva, Switzerland. Measurements on system performance (i.e., Safety, Efficiency, and Capacity) as well as Human performances (i.e., workload, Situation Awareness, and acceptability) were collected and analyzed. Results show that ATCos are positive with the concept of operations, and they do agree on the principle of flying what were Г‚Вїplanned, agreed and negotiatedГ‚Вї on the planning phase as opposed to Г‚Вїfirst come, first servedГ‚Вї. Results of the evaluations also show that CoO can be applied to 2008 and 2020 traffic level in Europe without any impact on System Safety. [C204]

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

Within the German Aerospace Center (DLR) project FAGI (Future Air Ground Integration), new operational concepts and automation support systems for fuel- and noise-efficient arrival management are being developed. An essential element of the FAGI concept is a modified airspace and route structure, featuring the late merging of different arrival routes to support user-preferred flight profiles such as Continuous Descent Approaches (CDA). The present paper studies aircraft ghosting solutions on the radar display as a potential means to support controllers with merging different streams of aircraft with sufficient precision. In addition to a technical presentation of different ghosting principles, the results of two human in the loop studies are reported. Using objective and subjective data on performance, workload, situation awareness, and eye-tracking analysis, the benefits, trade-offs and acceptance of the visual assistance functions are discussed. [C205]

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

This paper presents a low cost UWB-pulse-radar operating in the FCC 3.1 GHz-10.6 GHz band designed with standard RF-off-the-shelf components. The radar is based on the sequential sampling principle that will be briefly described. Special attention is paid on the pulse generation, where a coherent pulse oscillator in combination with a high speed switching circuitry is employed to gain pulse durations of 250 ps centered at 6 GHz. To demonstrate the resolution of the radar, a tank level scenario is presented allowing to detect liquid interfaces from 6.5 cm thickness. [C206]

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

This paper deals with the topic of Automatic Target Recognition (ATR) of Non Cooperative Targets. Specifically the focus is on the ATR of ships from multiple ISAR images. An investigation on different techniques for the fusion of the information provided by multiple image frames is presented. The techniques exploit the principles of multi-feature based ATR and apply them to the case of availability of several images. The recognition process makes use of a wire-frame models library which undergoes a step of candidate models selection before feeding the target model declaration step. Both cases of centralized and decentralized data fusion techniques are considered. The performance of the proposed techniques is investigated in depth by means of simulated data. Moreover the paper provides a comparison of the results of the proposed techniques when applied to live ISAR images of ship targets. [C207]

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

During pasture mowing in spring time, every year countless animals such as fawns are killed or severely injured. In addition to animal protection laws, this is a big problem for farmers due to botulism of the livestock. Many

different strategies have been developed to either scar the fawns away or to detect them, for example by searching with a hunting dog. These methods are either ineffective or very time-consuming and therefore less applicable. In this paper, we present a detecting method which is based on microwave signals. This incoherent radar system uses antennas arranged as a matrix and a signal superposition principle. It detects the reflection signature of covered targets of a certain shape-e.g. metals or objects with high water content. The low computing power needed allows a large area to be scanned within a short time. Since this radar system is almost completely insensitive to vertical movement of the extension arm, it can be mounted on a fast driving vehicle. [C208]

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

As a new research scope, blind signal separation (BSS) is attracting more and more interests. Independent component analysis (ICA) is an important solution to the problem of BSS, under the assumption conditions of ICA, a BSS algorithm using oblique projection operators is proposed in this paper. The autocorrelation matrix of mixing matrix is used to construct the objective function while the principle of information maximization is adopted to iterate and extract the component, and the mixing matrix can be obtained in a direct way. The description of the problem is demonstrated, and the detailed flow of the proposed method is listed. Simulation results show the suggested scheme is valid even when the weakest signal is less than -80 dB to others. [C209]

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

The beam pattern of ultrawide-band (UWB) impulse array in the near field is discussed in this paper. The basic principle of beamforming of linear array in the near field for UWB pulse is presented. Computer plots of beam patterns, such as peak amplitude pattern, peak power pattern and energy pattern are presented. The UWB nearfield array beamforming results in a directivity beam pattern having a narrow mainlobe and practically no sidelobes. The influence of every parameters, such as array length, interelement spacing, number of array elements and time duration of the pulse, to the beam patterns of a linear array for UWB Gaussian pulse is analyzed, which is useful to design a practical system. The difference of the beam patterns steering different positions in the near field is analyzed as well. According to the results, improved beam width can be achieved by either increasing the array length or decreasing the time duration of the Gaussian pulse. A reduction of the restlobe level can be achieved by either decreasing the array length or increasing the number of the array elements. However, the restlobe level in the near field beam pattern is higher than that in the far field, and it increases as the range between the source and the array decreases, which is a disadvantage to suppress the noise and interference in the near field. [C210]

"A study on a new hysteresis current sharing controlling strategy for voltage source five-level inverter"

Aiming at the single-phase current five-level inverter, the thesis analyzes the reasons for unbalanced inductor current, introduces some types of present strategies for balancing the inductor current through current sharing, and points out separately the current sharing principles for these strategies, comparing their advantages and shortcomings and then puts forward a new strategy for hysteresis control. Furthermore, the thesis analyzes the principles of this strategy and takes some stimulation with the same parameters as those of traditional hysteresis control strategies and finally comes up with the results to confirm the conclusion. [C211]

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

In this paper we present a multi sensor concept for localization and augmented-reality visualization of backscatter RFID tags. The sensor data of a camera and a RFID FMCW reader system are combined based on a synthetic aperture radar principle. The system enables the localization of tagged goods without the use of any installed infrastructure. We integrate a FMCW RFID reader and a camera system into a handheld device. While the handheld device is moved around, radar measurements as well as images of the surrounding area are taken at a number of locations. Thus, a synthetic aperture is generated and the position of the tags is calculated based on a SAR localization algorithm. Based on the imagery of the camera the user receives an augmented visual impression of where to find the RFID transponders. [C212]

"An ultra wideband positioning system enhanced by a short multipath mitigation technique"

In this paper an approach for high precision local positioning radar using an ultra wideband technique is presented. The concept is based on the standard FMCW (frequency modulated continuous wave) radar principle combined with short pulses to fulfill the emission limits given by the official regulatory authorities. In this way, a

high accuracy in dense multipath indoor environments can be achieved, ideally suited for 1D, 2D and 3D localization. A prototype was built which operates at a center frequency of 7.5 GHz utilizing a bandwidth of 1 GHz. With the setup presented in this paper the distance between two wireless units can be measured achieving a standard deviation down to 6 mm. Additionally, we studied the effects of short multipath propagation and present simulation results for an applicable mitigation technique. [C213]

"Design of a linear non-uniform antenna array for a 77-GHz MIMO FMCW radar"

In this paper the design and the implementation of a linear, non-uniform antenna array for a 77-GHz MIMO FMCW system that allows for the estimation of both the distance and the angular position of a target are presented. The goal is to achieve a good trade-off between the main beam width and the side lobe level. The non-uniform spacing in addition with the MIMO principle offers a superior performance compared to a classical uniform half-wavelength antenna array with an equal number of elements. However the design becomes more complicated and can not be tackled using analytical methods. Starting with elementary array factor considerations the design is approached using brute force, stepwise brute force, and particle swarm optimization. The particle swarm optimized array was also implemented. Simulation results and measurements are presented and discussed. [C214]

"A high sensibility wideband millimeter wave receiver for imaging concealed objects application"

A high sensibility wideband millimeter wave receiver operating in Ka band on the background of imaging concealed objects is presented. The zero-bias direct detecting millimeter receiver achieves an effective bandwidth 9.2 GHz and NF <3.8 dB which can receive like noise signals that are typical for passive mm-wave imaging. The fundamentals of the system are described. The principle of operation, performance of the receiver and supporting measured date are described. Examples of images built with this receiver using a mechanically scanned system are presented proving its applicability for detecting concealed objects needs. [C215]

"STAP developments in Thales"

Space-time adaptive processing (STAP) has been shown to provide significant improvements in many different application areas. Though similar in principle, those applications exhibit specificities, related for example to the characteristics of the antenna arrays and to the statistical properties of the involved signals. In this communication, different examples of applications of space-time adaptive processing (STAP), currently being studied or developed in Thales, are reviewed, and some areas for future research are outlined. The following applications are considered (without exhaustivity): airborne surveillance radars, airborne combat radars, radio communications, satellite navigation, and underwater sonar systems. [C216]

"Hadamard speckle contrast reduction for imaging system: Comprehension and evaluation"

Coherent imaging systems always suffer from speckle phenomenon, which blurs the image, and therefore making the information extraction quite difficult. Hadamard speckle contrast reduction (SCR) is considered to be effective to deal with this problem in optics. In this paper, we explore the working principle and effectiveness of this approach, from mathematical deduction to system simulation, and from optics to millimetre wave frequencies, so as to understand why it works and how well it can perform. We show that the effectiveness of Hadamard SCR is linked to the texture of the objects' surface. The investigated cases are in the region of both millimetre wave frequencies and optics, but it should be clear that it is a wave-oriented discussion and therefore the problem should be considered in terms of electrical size, beyond the limitation of working frequencies. [C217]

"A radar ranging algorithm based on characteristic decomposition power spectrum estimation"

The linear frequency modulation (LFM) signal is the main signal form of the high resolution radar. By analysis for the principle of the LFM radar signal to realize the high range resolution profile and the impact of clutter and noise over target echo signal, we propose the method of using spectrum estimation based on the characteristic decomposition to estimate the frequency and realize the LFM signal range profile. The simulation results prove that this method to the goal 1D range profile is effective under low signal-to-noise ratio conditions. [C218]

"DESDynI adopts hybrid polarity SAR architecture"

DESDynI-Deformation, Ecosystem Structure, and Dynamics of Ice-is one of the first-tier missions recommended in The National Research Council's Earth Science 2007 Decadal Survey. DESDynI's L-band synthetic aperture radar (SAR) is designed to measure terrain surface deformation and forest biomass, hence its quadrature-polarimetric SAR mode. The objective to provide quantitative information on a global scale imposes severe requirements on the radar to maximize coverage and to sustain reliable operational calibration. These

requirements are best served by the hybrid-polarity architecture, in which the radar transmits in circular polarization, and receives on two orthogonal linear polarizations, coherently, retaining their relative phase. This architecture offers many significant advantages over conventional all-linearly-polarized SARs. This paper reviews those advantages, summarizes key attributes of hybrid-polarity dual- and quadrature-polarized SARs including conditions under which the signal-to-noise ratio is conserved, and describes the evolution of this architecture from first principles. [C219]

"On the design of spaceborne polarimetric SARs"

To date, spaceborne polarimetric SARs have predominantly been implemented as experimental add-on modes to existing designs for single-pol or dual-pol systems. As a result, current and planned spaceborne SARs have polarimetric (or quad-pol) modes that are severely limited in swath width, are restricted in the range of look angles, suffer from low SNR and ambiguity problems, and are difficult to calibrate. The consequence of this is that the high potential science return expected from polarimetric SAR data has not and will not be realized. In this paper, the design of polarimetric SAR systems is revisited. Design principles are established, and recent advances will be described that allow wider swath polarimetry over a wide range of incidence angles, and simplified calibration of the final data product. [C220]

"Parallel computation methods for enhanced MOM and MLFMM performance"

The success of present and future intelligence, surveillance and reconnaissance (ISR) systems, in an increasingly electromagnetically complex world, is going to depend directly upon the speed and efficiency of our computational systems. These systems are used for advanced electromagnetic computations such as antenna cosite coupling, intermodulation, and radar cross section (RCS) analyses, among many more applications. Such computations require the use of first principle electromagnetic codes, such as method of moments (MoM) and Multilevel Fast Multipole Method (MLFMM), to perform full wave analyses. Unfortunately, these methods are very time consuming and memory prohibitive due to the inherent complexity of our ISR systems. At present, the models currently being used for analysis of EM computations could take days or even weeks to formulate a solution. Many times, it takes hours to simply determine if there is an error in the problem or if it is unsolvable. Since real-time computation analysis is so important to the defense industry, Northrop Grumman has been working extensively to discover ways in which to make these necessary calculations faster and more efficient. Graphics Processing Unit (GPU) computation offers a unique opportunity for electromagnetic simulation acceleration. GPU technology has been advancing faster than CPU technology due to a consumer fueled gaming industry. GPUs use a unique pixel based system that can not be simulated in an ordinary CPU and therefore allows for unique benefits when running computations. Northrop Grumman has been collaborating with Stony Brook University to explore their research in GPU computation. Northrop Grumman has its own, functioning, 6 node GPU cluster that we hope to use, in parallel with compressive sensing. Our GPU cluster will be able to parallelize the complex computations across the six nodes of the system, which will again decrease computation time. GPU computation has many applications besides electromagnetic- modeling and RCS analysis. These modern adaptations for complex computing can be applied to virtually any large, complex and time-consuming problem. With these modifications, we hope to be able to increase the ability of our systems to handle computations that are more difficult because the complexity of our world will only continue to increase. [C221]

"The application of the principle of chirp scaling in processing stepped chirps in spotlight SAR"

A new approach for processing stepped chirps in spotlight SAR is presented in this manuscript, which is based on exploiting the principle of chirp scaling (PCS). In particular the PCS is integrated in a polar format algorithm (PFA), obtaining a more efficient solution compared with the existing interpolation based technique. The main contribution is the implementation of the azimuth scaling with the bandwidth synthesis embedded in, and it is developed dedicatedly for dealing with stepped chirps. The signal processing flow is investigated in detail, with no interpolations but only FFT's and complex multiplications involved, and point target simulation has validated the new approach based on PCS is feasible and more efficient than the existing interpolation based approach. [C222]

"System architectures and algorithms for radar imaging by MIMO-SAR"

The multi-input / multi-output (MIMO) principle is well known for communication applications, whereas at least the name dasiaMIMOpsila is relatively new for radar applications. Nevertheless, the principle has been analyzed and used in a few examples since the early 80s or even before. A MIMO-radar is characterised by a number N of transmitting and a number M of receiving antennas forming N times M Tx/Rx pairs where each propagation path from the nth transmit antenna to the object to the mth receive antenna is made available to the signal processing. This can be achieved by temporal multiplexing, spatial coding and/or orthogonal waveforms. A

further step is to transfer this technique to the SAR case. Additionally, the whole array is moving, SAR processing can be applied. Possible geometries of MIMO-SAR are along track arrays (reduction of azimuth-ambiguities, moving target indication, super resolution) or across track arrays (reduction of elevation-ambiguities, interferometry, 3D down-looking SAR). In this paper, some aspects of moving MIMO-arrays for SAR will be addressed. [C223]

"Detection of scatterer multiplicity in spaceborne SAR tomography with array errors"

Processing of multibaseline/multitemporal SAR data from complex urban or infrastructure areas is of increasing interest. In this framework, the detection of single and multiple layover scatterers is an important problem, for an extensive and accurate signal interpretation. Recently, an hybrid 3D adaptive tomography-complex data domain model fitting detection method has been proposed. In this work, the basic method is tested with simulated data corrupted by non-idealities, in particular residual atmospheric compensation errors. Afterwards, the analyzed effects specific of the presence of the data non-idealities are taken into account for a more robust design of a detection method based on the same principle. The effectiveness of the algorithm is experimented with real satellite C-band data. [C224]

"Monopulse 77GHz Fresnel Zone Plate reflector"

This paper describes the principle of combining circular or annular patches with C-patches on a Fresnel reflector. The latter can introduce radiation pattern diversity according to the polarization. Patches are designed to perform a 180deg phase difference of the reflection phase between two orthogonal polarizations for a monopulse antenna purpose. Simulations on a small half-wavelength Fresnel zone plate (FZP) reflector have been conducted in order to check the antenna concept. The final antenna will include a (2pilambda/8) Fresnel correction, i.e an 8 zones Fresnel reflector. C-patches have already been designed at 77 GHz and the reflector measurements have been conducted. [C225]

"Efficient multi-aspect RCS simulations based on the Shooting and Bouncing Rays technique"

This paper presents an approach to simulate the monostatic scattering properties of realistic objects in form of their Radar Cross Section (RCS) in the high frequency regime using the well known Shooting and Bouncing Rays technique (SBR) in a very efficient way. It is based on the monostatic bistatic equivalence principle and can be applied well in scenarios where a considerably large number of neighboring aspect angles is of interest (e.g. turn-table scenario). The main idea is to use additional bistatic information for the different required monostatic aspect angles. In many cases, this information can be obtained cheaply during the SBR process and it can be favorably exploited under certain conditions, mainly that the bistatic sector for which the information is collected around the aspect angle is small and the object is rather smooth. The basic principle of the algorithm is presented using the simple example of a faceted sphere, but the proposed approach also works well for typical passenger cars or airplanes using bistatic information in an angular range in the order of a few degrees. The applicability of the presented approach for realistic objects of interest is demonstrated by calculating the monostatic RCS of an aircraft model. A reduction of computational effort by a factor of approximately 38 has been achieved in this case. [C226]

"Planar Circularly Symmetric Electromagnetic Band-Gap antennas for low cost high performance integrated antennas"

The use of planar circularly symmetric (PCS) electromagnetic band-gap (EBG) structures for optimizing the performances of single antenna elements and arrays is been discussed. The key advantage of using this sort of super structures is that they are planar and thus very cheap to manufacture with respect to alternative EBG structures based on vertical pins. In this contribution a review of the design principles and of the antennas based on PCS EBG which have been developed at TNO will be presented. Also a review of the applications that effectively used the benefit associated with them will be discussed. In conclusions, while EBG technology has been promising marvels for phased array applications for quite some time, its PCS implementation eventually turned out to be a one of it most successful examples. In fact it delivered low cost, broad band and efficient integrated antennas which could not have been realized otherwise. [C227]

"Improving principles of construction and development of circuits for HF receiving multi-channel antenna systems"

The results of improving principles of construction and analysis of basic parameters of HF receiving multi-channel antenna systems are considered. [C228]

"Study on roadbed disease recognition algorithm based on support vector machine"

Based on the principle of support vector machines as well as the analysis to the characteristics of roadbed diseases, a new GPR echo signal recognition algorithm is brought up. By using the proposed method to identify the ground-penetrating radar measured data, the test results show that this algorithm is better than the neural network recognition algorithm and overcomes the shortcomings of the local minimum value and over-learning. The algorithm is suitable for ground-penetrating radar signal recognition and is an efficient algorithm. [C229]

"Design and measurement of a wideband aperture-coupled and polarization-agile stacked-patch antenna-array for monopulse radar applications"

A wideband, circularly-polarized antenna array covering the frequency range 1.7 GHz to 2.5 GHz for telemetric monitoring and monopulse application is presented. Using a subarray design, monopulse functionality can be achieved with an external comparator network. The high bandwidth of 38% is realized by using the principle of the aperture-coupled stacked-patch microstrip antenna. By integrating a quadrature coupler, the polarization sense can be selected. Sequential rotation technique is used for enhancing polarization purity. The theoretical analysis is based on the finite-difference time-domain (FDTD) method. A stacked-patch antenna element, a 2times2 antenna quadrant and a 4x4 antenna array have been designed, fabricated and measured. The measured return loss of one quadrant is better than 11 dB in the desired bandwidth for both circular polarization senses. Maximum antenna gain ranges between 7 dB and 18 dB for the sum pattern while the null depth of the difference pattern is always better than 30 dB. Theoretical and measured results of S parameters and radiation patterns are presented and discussed. [C230]

"The use of geometric diversity for spectral dominance in underground imaging"

Underground imaging of dielectric and conductive anomalies performed using ground penetrating radars (GPRs) requires expensive wideband systems to increase the resolution. The advent of tomographic principles in multi-monostatic GPRs dramatically improved the imaging capabilities and suggested the possibility of reducing the bandwidth of the probing waveform. In this work we propose to extend the tomographic principles to the case of below-ground distributed sensing, thus taking advantage of the geometric diversity. We show that, by using geometric diversity, the frequency content required to image below-ground targets is drastically reduced to virtually a single monochromatic signal, thus achieving full spectral dominance in the waveform design. [C231]

"Redesign for Flexibility and Maintainability: A Case Study"

In this paper, we analyze software that we inherited from another party. We analyze its architecture and use common design principles to identify critical changes in order to improve its flexibility with respect to a set of planned extensions. We describe flexibility issues that we encountered and how they were addressed by a redesign and re-implementation. The study shows that basic and well-established design concepts can be used to guide the design and redesign of software. [C232]

"Microwave Mass Flow Meter for Industrial Applications based on a Lefthanded Transmission Line Resonator"

A particulates mass flow meter has been developed using a composite right/left-handed transmission line resonator. The presented sensor principle promises the possibility to design precise particulate solids mass flow meter with moderate costs. The autocorrelation function is applied to the CRLH-resonator in order to detect the velocity information and the material density from a single measurement. The areas of application of these sensors are gas/solids, gas/liquid and liquid/solids flows in various industrial applications. [C233]

"Weak Signal Detection Based on Chaotic Prediction"

In this paper, a weak signal detection method based on radial basis function (RBF) neural networks is discussed. The principle of weak signal detection with a background noise predictor is that the predictor trained by chaotic time series has a small prediction error, and the prediction error becomes relative large when the input contains a source or target. By exploiting the short-term predictability of the input signal, a one-step-ahead prediction model is proposed as the basis of designing an RBF neural network. To enhance the detection performance in noisy background, the extended Kalman filter (EKF) is applied to perform the training and better parameter estimates can be acquired compared to the conventional RBF network training method. The performance of detection for low signal-to-noise ratio (SNR) is analyzed. Computer simulations show that the proposed method is effective for weak signal detection. [C234]

"Simulation of the front-end of a MEMS based ultra narrow band tomographic imaging system"

This paper describes a simulation architecture used to simulate an ultra narrow band radar tomographic imaging (UNBRaTI) system. The work is being performed at Rochester Institute of Technology. The paper lays the groundwork for an effort to develop a systems level approach for the simulation and analysis of an UNBRaTI system using traditional radio frequency (RF) components as well as micro-electro-mechanical systems (MEMS) based components. The utility of the approach is its ability to apply sound systems engineering principles and techniques to compare and contrast traditional RF components with MEMS based components and their effects on system level performance. The simulation has been architected for ease of scalability in order to analyze basic to complex system configurations. [C235]

"Systems Modeling for IP-Based Handoff Using Timed Petri Nets"

The mechanisms and design principles needed for achieving optimized handoff for mobile Internet services are poorly understood and need better analysis. This paper contributes to the general theory of optimized handoff and addresses the need for a formal model that can characterize a mobility event and the associated mobility optimization methodologies. It provides a systematic and formal approach to analyzing a mobility event. After a thorough analysis of the abstract operations associated with several mobility protocols, it determines that these basic handoff operations form a set of discrete events that can be modeled as discrete event dynamic system (DEDS). It then uses deterministic timed Petri nets to model the mobility event and evaluate the performance under different scheduling schemes. This model also helps to validate optimization methodologies that could lead to a set of design principles for any new mobility protocol as well as evaluate its effectiveness. [C236]

"Analysis of Polynomial FM Signal Based on Wavelet-Reassignment Method"

Aiming on the problem of low precision and crossterm in the conventional method of in analyzing polynomial FM signal. The method that based on wavelet transform and time-frequency reassignment is proposed. Not only overcomes the contradiction between the crossterms of polynomial FM signal and the approximate time-frequency centering, but also is good at reducing noise. In this paper, the principle and application of wavelet-reassignment are summarized, and the polynomial FM signal analysis method is made based on the wavelet-reassignment and other methods. The simulation results show that the novel method has compositive advantages. [C237]

"Metal Equivalent Measurement Based on Low-Frequency Electromagnetic Induction Method"

In order to evaluate the detectability of landmine, a new method based on results of metal equivalent measurement is developed. A series of studies are carried out to evaluate the detectability of landmine academically and experimentally, from the aspect of the relation between detection method and induced signal, the impact of metal mass to induced signal, and landmine metal mass equivalent detection method. In addition, by analyzing the relationship between second field signal and metal mass using the principle of low-frequency electromagnetics, it is verified that in the same detection height and the same medium, mine detector's answer output is directly proportional to the quality of metal. Thus a fitting formula of induction signal and detection height, metal mass is concluded. Experimental results prove that using the method of metal equivalent measurement to evaluate detectability of landmine is effective. [C238]

"Technology intercepts for the S-APAS architecture"

The implementation of the S-APAS (Scalable Multifunction Radio Frequency-Active Phased Array System) concept requires the use of autonomous T/R modules connected to a common digital bus. The T/R modules have the functions of radiating energy in the radar space, collecting the relative returns and exchanging data and commands with the processing/control blocks. The technological aspects related to producing a T/R module, that is flexible and cheap enough to be used in different radar systems, at least within the same operating band, have been analyzed in previous papers. Further aspects derived from the S-APAS architectural concept have been considered here, in order to find the right intercepts with available technologies and with new technologies under development. In particular, the transmitter performance, the bus throughput and the performance of the data/ signal processing blocks are among the most critical items, to be analyzed carefully. This paper defines the dimensioning criteria for the proposed architecture in a number of cases related to different applications at different operating frequencies, defines the basic design principles and discusses the results, with respect to the above parameters, in order to find the technological constraints related to the physical implementation of the S-APAS architectural concept. The study is limited to applications with operating frequencies ranging from L band to X band, but the results can be easily extended to other frequencies of interest. [C239]

"Novel Waveform Generation Principle for short-range FMCW-Radars"

The FMCW-radar-principle is widely used for short range radar systems. The basic idea for FMCW-radars is to generate a linear frequency ramp as transmit signal. There are too widely used principles for range-Doppler-processing: generation of ramps with different slopes and generation of a sequence of short ramps processed by a two-dimensional FFT. The developed ramp generation sequence also applies two-dimensional Fourier transforms, but allows to reduce the baseband bandwidth. The principle can be also regarded as an extension of a frequency stepped-CW-radar with intertwined ramps. In the following the method is derived for systems with and without I/Q-demodulator and first measurement results on a 24 GHz-system are presented. The waveform generator has been implemented on a FPGA. [C240]

"A New Control Strategy for Voltage-Type PWM Inverter to Realize Zero Steady-State Control Error"

In this paper, a new simple control strategy for the output voltage of voltage-type pulse width modulation (PWM) inverter which can eliminate the steady-state control error completely is proposed. In the proposed control system, a resonant element implemented by a digital signal processor (DSP) is introduced as a feedback controller. The resonant element exhibits a function similar to an integrator for the fundamental frequency component. Thus, it can eliminate the steady-state control error completely. The principle of the proposed control method is discussed, and its effectiveness is shown theoretically. To confirm the effectiveness of the proposed control method, some simulation testing are shown. [C241]

"Research of Supercapacitor Voltage Equalization Strategy on Rubber-Tyred Gantry Crane Energy Saving System"

A model for supercapacitor voltage equalization strategy is analyzed, and on this basis a supercapacitor voltage equalization method for rubber tyred gantry crane (RTG) energy saving system is proposed, namely active voltage equalization method based on buck-boost converter. The equalizing speed of the proposed method is fast. Firstly, the working principle and process of the voltage equalization circuit is analyzed in detail. In addition, design of active voltage equalization circuit parameters and control strategy are given. Finally, simulation analysis of the series connection of super-capacitors module is performed. Results show that this method for equalizing voltage can avoid over-voltage of each cell and possess practicable and high value for supercapacitor RTG energy saving system. [C242]

"A Method of Same Frequency Interference Elimination Based on Adaptive Notch Filter"

The torpedo active electromagnetic fuze is an active electromagnetic detection system, as the distance between the transmitting and receiving antennas is very short, the direct coupling signal will inevitably appear in the receiving signals. This interference has the same frequency as target signal, and is of great harm to the detection system's normal operation. Traditional methods of same frequency interference elimination were analyzed, and it was found that neither of them were suitable for the object studied in this paper, so a method of same frequency interference elimination was put forward based on adaptive notch filter. Its working principle, working process and performance were analyzed; also its numerical value simulation and engineering test had been carried out. The results indicated that as long as the magnitude and phase of the same frequency remained unchanged, it would be effectively eliminated with this method; moreover, this method could be used in a low SNR situation. [C243]

"Research of Automobile Speed Measuring System Based on Linear CCD"

One automobile speed measuring system based on linear CCD is designed. The linear CCD is the front detecting device, and the MCU processed the CCD output signal using the edge identification arithmetic to achieve automobile accurate localizing on one moment. In this way, the automobile speed can be measured accurately on slope. In this article, the architecture and principle of CCD have been elaborated in detail, one timing sequence driving design method of linear CCD based on the CPLD chip of EPM7128 is described, while the principle and composition of the speed measuring system are introduced as well. Through experiments, the speed measuring range of the system is 5 m/h~160 km/h and the error is less than 0.5 km/h. Right now this system has already been successfully used as an examine system for drivers driving with a ramp. It has been proved that it is accurate with sensitive responsiveness. [C244]

"Combining ICA with LSSVM for Speckle Reduction of SAR Image"

Speckles are inherent defects due to coherent imaging principles in synthetic aperture radar (SAR) systems. An improved polarimetric SAR image filtering method based on ICA (independent component analysis) -LSSVM (least squares support vector machine) was developed to get better results for terrain classification, target

detection and other applications. The first step of this method is to apply ICA to LSSVM for feature extraction. By using ICA, the original higher dimensional inputs will be transformed into other lower dimensional features, the regularized parameter and feature subsets will be geted,These new features are then used as the inputs of LSSVM to process a regularized procedure which defines a cost function to estimate true SAR image.Experiment results using polarimetric SAR data of ERS-1 satellite show that this algorithm attains good despeckling effect and preserves more valuable image details than traditional algorithms. [C245]

"Monitoring Co-seismic Deformation Fields of Bam Earthquake Using D-InSAR Technique"

The Mw=6.5 Bam earthquake, taking place on 26th December 2003 in Iran, caused severe surface deformation. This paper described that it used the differential interferometric SAR (D-InSAR) technique and ENVISAT ASAR data to monitor the Bam co-seismic deformation fields. Firstly, it introduced the principle of D-InSAR and the method to select proper D-InSAR data pairs. Then we used ENVISAT ASAR data to carry out D-InSAR test in the Bam earthquake. We successfully got the Bam co-seismic deformation field. The shape and location of the fault caused by the Bam earthquake was also found in the coherence maps. The test proved that D-InSAR technique is a powerful tool to measure surface deformation and to study earthquake. [C246]

"Optimal Observer Maneuver in Bearings-Only Tracking of Constant Acceleration Target"

This paper deals with the optimization of the observer trajectory when an observer tracks a constant acceleration target. First, optimal control theory is applied to establish the optimal maneuver model of an observer. Second, at range accuracy criterion, necessary conditions for optimal observer course are resolved by analytical means. Finally, the influence of observer speed target acceleration and initial target range on the optimal observer maneuver is discussed by simulation. Simulation results show that the optimal observer trajectory is almost smooth when near target moves at small acceleration and the observer should maneuver at high speed when tracking constant acceleration target accurately. [C247]

"Reconfigurable multi-band scatterers for micro-sensors identification"

For the first time the use of RCS of multi-band scatterers is proposed for the remote identification of micro-sensors in a wireless sensors network. The next step will consist of connecting a specific multi-band scatterer to each micro-sensor and, to achieve simultaneously the remote measurement of a physical quantity (via the electromagnetic transduction principle) and the sensor identification (via the RCS of the associated multi-band scatterer). Part of this work is supported by the Project of ldquopole de competiviterdquo entitled Systeme Autonome Communicant En Reseau (SACER). [C248]

"Variable structure approach power compensation system design of an automatic carrier landing system"

The design problem of approach power compensation system via variable structure control theory is considered. The function of approach power compensation system in automatic carrier landing system is introduced, and its working principle is analyzed. The approach power compensation system is designed via variable structure control theory and the ability of this system that reduces the influence of air disturbance is analyzed. The chattering problem is solved via using a filter. Simulation results indicate that this approach power compensation system enhances the ability of airplane that reduce the influence of air disturbance and validate the reasonability of this method. [C249]

"The Traffic-Flow Detection Based on Pseudo-Random Coded Radar"

A new traffic flow detection system based on pseudo-random coded (PRC) CW radar is studied and developed in this paper. The proposed system can measure the speed of vehicles at a high resolution. The speed can be measured by the Doppler principle, and in the system the good correlation performance of PRC is used to get a high resolution of range and eliminate the interference from nearby lane vehicles. The digital signal processor transforms and processes the signal in time-frequency domain, and gains the vehicle velocity and flow rate rapidly and accurately. [C250]

"Receiver design to harness quantum illumination advantage"

An optical transmitter that uses entangled light generated by spontaneous parametric downconversion (SPDC), in conjunction with an optimal quantum-optical receiver (whose implementation is not yet known) is in principle capable of obtaining up to a 6 dB gain in the error-probability exponent over the optimum-reception un-entangled coherent-state lidar to detect the presence of a far-away target subject to entanglement-breaking loss and noise in the free-space link . We present an explicit design of a structured quantum-illumination receiver,

which in conjunction with the SPDC transmitter is shown to achieve up to a 3 dB error-exponent advantage over the classical sensor. Apart from being fairly feasible for a proof-of-principle demonstration, this is to our knowledge the first structured design of a quantum-optical sensor for target detection that outperforms the comparable best classical lidar sensor appreciably in a low-brightness, lossy and noisy operating regime. [C251]

"Location systems with sensors-Overview and new approach"

A traditional approach to indoor tracking uses non-RF techniques, such as infrared and ultrasound. A disadvantage of these methods is that they do not work unless the sensors have direct connection with the nodes, to which the reference made the estimations of the distance. Another approach for inside buildings location systems uses only RF sensors, a similar principle to the one used by the Global Position System (GPS). The goal of the paper is to highlight the main differences between these systems and to propose a new method for inside buildings location systems. [C252]

"Developments of Interferometric Synthetic Aperture Radar About Monitoring Deformation"

Now, application of InSAR (interferometric synthetic aperture radar) to deformation monitoring has become a hotspot for monitoring deformation. The basic principles and data processing procedures of InSAR are introduced in this paper, at the same time, main progresses made in InSAR technology and its application to deformation monitoring are summarized. Through actual examples of application and research from home and abroad, the article figures out existing problems and future of application of InSAR. [C253]

"Application of the Marine Oil Spill Surveillance by Satellite Remote Sensing"

Oil spill accidents are seen relatively frequent and becomes a severe threat to coastal and marine ecosystems and water quality. Thus, active surveillance and rapid response to marine oil spills is important and essential to environment protection. So, this paper lays emphasis on the research of monitoring the marine oil spills for application by satellite remote sensing especially SAR. Imaging characteristics of satellites and image-forming principle of oil spill information in remote sensing images are analyzed at first. Then how to monitor the marine oil spills by satellite remote sensing and how to identify and detect marine oil spills information in SAR images are discussed mainly. Through the practical applications examples of the marine oil spill surveillance by satellite remote sensing in oil spill accidents of oil tanker ldquoHebei Spiritrdquo, the method this paper proposed is proved to be very effectively and feasibly for the fast response and detection to oil spills especially in the waters near Bohai sea of China. Finally future development of marine oil spill surveillance is suggested with conclusion. [C254]

"A uniform uncertainty principle for Gaussian circulant matrices"

This paper considers the problem of estimating a discrete signal from its convolution with a pulse consisting of a sequence of independent and identically distributed Gaussian random variables. We derive lower bounds on the length of a random pulse needed to stably reconstruct a signal supported on [1, n]. We will show that a general signal can be stably recovered from convolution with a pulse of length m gsim n log5n, and a sparse signal which can be closely approximated using s lsim n/log5n terms can be stably recovered with a pulse of length n. [C255]

"Aircraft pose estimation based on integrated feature matching"

Integrated feature matching algorithm is proposed for aircraft pose estimation based on image sequence. The algorithm chooses posture ratio and correlation coefficient with good distribution as integrated feature, which fuses shape and statistic information. Matching principle is optimization of integrated objective function, which ensures that the ultimate result is global optimal solution. Correlation coefficient is calculated exactly via location and size registration, and applied flexibly in matching. Simulation results show precision and reliability of the algorithm. [C256]

"A simple control arithmetic of step wave cascaded multilevel inverter with different voltage step"

Besides effectively reducing the voltage stress of switches, the cascaded multilevel inverter could also improve the quality of output waveforms by addition of waveforms. The step waveform addition is a usual method. The addition could reduce the loss of switches, but the introduced angle of flow calculating methods of cascade inverters based on step waveform addition are only suitable for cascaded inverters with the same voltage step. To this situation, an angle of flow calculating method of inverters with the different voltage step is proposed in this paper. The method is very suitable for the application of solar battery cascaded inverters and fuel battery cascaded inverters. The method follows the equal area principle, and the online calculation is realized by some

constraint conditions. Finally, the correctness of the method is validated by simulations. [C257]

"Kalman Particle Filter for lane recognition on rural roads"

Despite the availability of lane departure and lane keeping systems for highway assistance, unmarked and winding rural roads still pose challenges to lane recognition systems. To detect an upcoming curve as soon as possible, the viewing range of image-based lane recognition systems has to be extended. This is done by evaluating 3D information obtained from stereo vision or imaging radar in this paper. Both sensors deliver evidence grids as the basis for road course estimation. Besides known Kalman filter approaches, particle filters have recently gained interest since they offer the possibility to employ cues of a road, which can not be described as measurements needed for a Kalman filter approach. We propose to combine both principles and their benefits in a Kalman particle filter. The comparison between the results gained from this recently published filter scheme and the classical approaches using real world data proves the advantages of the Kalman particle filter. [C258]

"Building extraction in urban scenes from high-resolution InSAR data and optical imagery"

Modern space borne SAR sensors provide geometric resolution of one meter, airborne systems even higher. In data of this kind many features of urban objects become visible, which were beyond the scope of radar remote sensing only a few years ago. However, layover and occlusion issues inevitably arise in undulated terrain and urban areas because of the side-looking SAR sensor principle. In order to support interpretation, SAR data are often analyzed using additional complementary information provided by maps or other remote sensing imagery. The focus of this paper is on building extraction in urban scenes by means of combined InSAR data and optical aerial imagery. [C259]

"Fast evaluation for speckle feature in urban SAR images"

Coherent speckle is an important feature in Synthetic Aperture Radar (SAR) image. Testing the property of speckle is effective for urban SAR image performance evaluation. Through correlation analysis for speckle measures, this paper proposes a measurement for speckle feature based on parametric hypothesis test. Firstly selects homogeneous areas in tested SAR image with manual mode and estimates the ENL of each area. In contrast with the speckle feature in sampled image from population, secondly utilizes the u-parametric hypothesis test to measure the quality of speckle. Finally obtains the result that accepts the null hypothesis or rejects it. Experiments of Japan Pi-SAR and East China Research Institute of Electronic Engineering (ECRIEE) SAR images in urban areas show the measurement could distinguish those tested images where speckle property is in accordance with the coherent imaging principle, which is one of the vital requirements for post processing technology of SAR imagery. [C260]

"Surface subsidence and ground fissures activity monitoring based on D-InSAR: A case of Datong city"

The Synthetic Aperture Radar Interferometry technique has become one of geological disaster monitoring tools, for its economical, efficient, high-precision and large-scale surface deformation monitoring capacities. Datong is a well-known historical and cultural city, which is also a major energy bases and known as ldquotown of coal seardquo reputation in China. Since 1980s, with the development of industry and agriculture the amplitude of groundwater withdrawal has increased year by year, which lead to serious surface subsidence and ground fissures hazards in this city, even active up-to-date. Presently, 10 ground fissures with a total length of 34.5 km can be found in Datong region. However, the city-level spirit leveling only carried out during years of 1988-1993 to monitor the surface subsidence, and ceased later on. So in this paper, we collect 8 scenes of Envisat SAR data covering Datong city to minitor the subsidence evolution during Jan. 2005 to Feb. 2008. The interferometric pairs are set according to the principles that temporal and geometric baseline limits. Finally, we obtain the annual and accumulated subsidence amounts. The study shows that the land subsidences in Datong are greatly correlated with the groundwater withdrawal and seasonal variation. And some new sobsidence cones are located at new economic and technological development zones of Datong city. Thirdly, ground fissures deformation in Datong is controlled by the regional tectonic activity and also affects the land subsidence in its surroundings. [C261]

"The low probability of intercept radar systems with spatial feedback"

The radar system with spatial positive feedback throw the target is considered. In this system there are self-oscillations, if the system is closed through a space of the signal radio-path and the target. When the target is absent (system is not closed), transmitter output power of the noise signal is insignificant, and that complicates detection of the radar radiation. In the report principles of such system functioning and results of tests on the real

targets are statedrdquo. [C262]

"Microwave mass flow meter for pneumatic conveyed particulate solids"

A particulates mass flow meter has been developed using a composite right/left-handed transmission line resonator. The presented sensor principle promises the possibility to design precise particulate solids mass flow meter with moderate costs. The Spatial Filter Velocimetry is applied to the sensor in order to detect the velocity information. The simultaneous detection of the velocity and the solids/air concentration from a single measurement, ensure a true mass flow detector. The detector offers good prospects for industrial applications with various scenarios of gas/solids, gas/liquid and liquid/solids flows. [C263]

"Pulse width time walk compensation method for a pulsed time-of-flight laser rangefinder"

A new walk compensation method for a pulsed time-of-flight rangefinder is suggested. The receiver channel operates without gain control using leading edge timing discrimination principle. The generated walk error is compensated for by measuring the pulse length and knowing the relation between the walk error and pulse length. The walk compensation is possible also at the range where the signal is clipped and where the compensation method by amplitude measurement is impossible. Based on the simulations walk error can be compensated within the dynamic range of 1:30 000. [C264]

"Towards a proactive biologically-inspired Advanced Driver Assistance System"

Driver assistance functionalities on the market are getting more and more sophisticated, which will lead to integrated systems that fuse the data of multiple sensors (e.g., camera, Photonic Mixer Device, Radar) and internal system percepts (e.g., detected objects and their states, detected road). One important future challenge will be to find smart solutions in system design that allow an efficient control of said integrated systems. A promising way for achieving this is to get inspiration from known signal-processing principles in the human brain. This paper presents a biologically motivated Advanced Driver Assistance System (ADAS) that uses the generic principle of attention as common front-end of all visual processes. Based on the attention principle an early task-dependent pre-selection of interesting image regions is done, which decreases scene complexity. Furthermore, internal information fusion increases the system performance (e.g., the attention is used to improve the object tracking; road-detection results improve the attention). Based on streams of a challenging traffic scenario it is shown how the system builds up and verifies its environment-related expectations relying on the attention principle. The ADAS is controlled by a central behavior control module that tunes submodules and parameters. The behavior control module has a simple structure, but still allows for robustly performing various tasks, since the complexity is distributed over the system in form of local control loops mimicking human cognition aspects. [C265]

"Integrated Active Pulsed Reflector for FMCW Radar Localization"

This paper presents an integrated active pulsed reflector (APR) functioning as a backscatterer in a power efficient local positioning system using a frequency modulated continuous wave (FMCW) radar in the ISM band at 5.8 GHz. The APR is designed as a switchable, tunable oscillator and is integrated in a 0.18-mum CMOS technology. The operating frequency of the APR can be tuned from 5.45 to 6.69 GHz, the output power is between 2.17 and 6.11 dBm and the matching is better than -9 dB over the complete tuning range. The active reflector including a low-frequency oscillator for modulation draws 46.2 mA from a 3.3 V power supply. The operation principle was verified and a measurement accuracy of 4.9 cm over a measurement range of 1.5 to 7.5 m was achieved neglecting multipath effects. [C266]

"Dual-band branch-line balun for millimeter-wave applications"

This paper presents designs of branch-line type dual-band balun for millimeter-wave applications. The proposed balun is based on different types of dual-band impedance transformers. To understand the working principle of the baluns, closed-form equations are derived, where ABCD-matrix method is applied. It is found that the proposed baluns feature flexible realizable frequency ratio, making it suitable for millimeter-wave systems. To verify the design concept, an experimental prototype working at 20 / 44 GHz is designed, fabricated and characterized. The measurement results match well with the simulation results. [C267]

"A Novel Visual Combining Classifier Based on a Two-dimensional Graphical Representation of the Attribute Data"

A novel visual combining classifier (VCC), which integrates two-dimensional graphical representation of the attribute data, image processing and pattern recognition techniques together, has been proposed. The basic

principle of the VCC is mapping attribute data of a data matrix to the two-dimensional graphs, transforming these graphs to sub classifiers by pixel graphs, and combining the sub classifiers by decision rules. By interactive approaches, the optimum graphs for classification could be chosen and then pattern recognition could be realized automatically. The two experiments of the scatter and pole graphical representations based on Iris database have been made and classification precisions are 98.67% and 97.33% by LOOCV respectively. [C268]

"Downward-looking 3D-SAR with dual-transmit and multiple-receive linear array antennas based on time and waveform diversity"

The dual-transmit and multiple-receive (DTMR) configuration of linear array antennas (LAA) is firstly introduced in downward-looking 3D-SAR imaging in this paper. The geometrical model and the signal model based on the principle of time diversity and waveform diversity are analyzed. The three-dimensional imaging processing algorithm for downward-looking 3D-SAR with DTMR-LAA is given via a stepwise mathematical derivation and the analytic expression of 3D PSF after 3D imaging processing is presented. The simulation results confirm the feasibility of the downward-looking 3D-SAR with DTMR-LAA imaging concept. [C269]

"Undue influence: Mitigating range-intensity coupling in AMCW 'flash' lidar using scene texture"

We present a new algorithm for mitigating range-intensity coupling caused by scattered light in full-field amplitude modulated continuous wave lidar systems using scene texture. Full-field Lidar works using the time-of-flight principle to measure the range to thousands of points in a scene simultaneously. Mixed pixel are erroneous range measurements caused by pixels integrating light from more than one object at a time. Conventional optics suffer from internal reflections and light scattering which can result in every pixel being mixed with scattered light. This causes erroneous range measurements and range-intensity coupling. By measuring how range changes with intensity over local regions it is possible to determine the phase and intensity of the scattered light without the complex calibration inherent in deconvolution based restoration. The new method is shown to produce a substantial improvement in range image quality. An additional range from texture method is demonstrated which is resistant to scattered light. Variations of the algorithms are tested with and without segmentation-the variant without segmentation is faster, but causes erroneous ranges around the edges of objects which are not present in the segmented algorithm. [C270]

"An improved correlation method of phase difference detection between two signals in polarimetric radar signal processing system"

In this paper, an improved correlation method is proposed to detect the phase difference between two signals in high frequency in a polarimetric radar system. The mean value of the correlation of two sampled signals is calculated based on field programmable gate array (FPGA) to give a more accurate result of the detection. The method is simulated in SimulinkГ‚В®, and the blocks are then converted into a Quartus II project and compiled to show the occupied resources. The basic principle of the method is described in detail and the results of the simulation provide some evidences that the method can be applied in the radar system for real time processing. Some notes are also given to improve the performance in practical applications. [C271]

"An improved wavenumber domain algorithm for circular SAR and cylindrical reconstruction areas"

In this paper, an improved wavenumber domain imaging algorithm is proposed for circular synthetic aperture (CSAR) data taken in stripmap mode. The proposed algorithm allows to reconstruct an image on a cylindrical surface. The range trajectory is approximated with the fourth-order terms expansion and the echo signal is transformed to the wavenumber domain by using a principle of stationary phase. Based on the spectrum, the interpolation of the algorithm is deduced, and the residual phase is compensated. The valid aperture length of the proposed algorithm is greatly increased, comparing with the algorithm based on range expanded to quadratic terms. The simulation results validate the high-performance of the improved wavenumber domain imaging algorithm. [C272]

"Maximum likelihood method for time-delay estimation of multiple echoes"

When the ground-penetrating radar (GPR) is used as a non-destructive testing method in the field of civil engineering, the thickness of the mediums can be deduced from radar profiles by echo detection, which provides the time-delay estimation (TDE) associated with each interface. In order to improve the performance of TDE, this paper proposes a new technique based on maximum likelihood principle for estimating the time delays. The proposed method takes into account the multiple echoes phenomena of the propagation of underground wave. [C273]

"Angle and doppier ambiguity mitigation for spaceborne sparse array GMTI radar"

Ground moving target indication (GMTI) using spaceborne sparse array radar is attractive. To mitigate angle and Doppler ambiguities of the moving target detection for sparse array, the paper presented the model of a multi-carrier-frequency radar system and analyzed the basic principle of space time adaptive processing (STAP). Finally, the paper presented preliminary simulations to show that the angle and Doppler ambiguities can be effectively reduced by using multi-carrier-frequency technique. [C274]

"A fast Maximum Likelihood method for improving AMCW lidar precision using waveform shape"

Amplitude Modulated Continuous Wave imaging lidar systems use the time-of-flight principle to determine the range to objects in a scene. Typical systems use modulated illumination of a scene and a modulated sensor or image intensifier. By changing the relative phase of the two modulation signals it is possible to measure the phase shift induced in the illumination signal, thus the range to the scene. In practical systems, the resultant correlation waveform contains harmonics that typically result in a non-linear range response. Nevertheless, these harmonics can be used to improve range precision. We model a waveform continuously variable in phase and intensity as a linear interpolation. By approximating the problem as a Maximum Likelihood problem, an analytic solution for the problem is derived that enables an entire range image to be processed in a few seconds. A substantial improvement in overall RMS error and precision over the standard Fourier phase analysis approach results. [C275]

"A fixed size assumption based data association method for coalescing objects tracking using a laser scanner sensor"

Data association is one of the crucial parts in the reliable objects' tracking system. In this paper, a methodology for data association using an Oriented Bounding Box based object representation is presented. A laser scanner sensor is used for objects perception. A data association algorithm for coalescing objects is described. The algorithm is based on the Nearest Neighbours principle enriched by an Inter-Rays uncertainty paradigm and a Fixed Size assumption, which are introduced to improve the tracking process in terms of objects size and center position estimation. Experimental results are presented to demonstrate the effectiveness of the proposed technique. [C276]

"Cooperation and competition based on free market in swarm system architectures for air defense"

Algorithms to perform distributed command and control functions in ground based air defense systems of systems are presented and analyzed. In previous research we presented the benefits of using swarm architectures for this type of application in terms of no single point of failure, lower detectability and higher scalability. Here we propose some free market distributed algorithms based on the principles of negotiation and competition among the swarm of agents performing air defense missions. In our research, parameter optimization as well as experimental results in tactical scenarios are obtained through simulation. [C277]

"Generation of sub-nanosecond 7V Gaussian pulse using GaAs HBT with 3V battery supply"

A new sub-nanosecond high power impulse generator is presented in this paper for ultra-wideband communication and radar systems using InGaP/GaAs HBT technology. The topology is simple, compact and can be readily integrated into MMIC. It works on two principles: a faster transition can be obtained from a digital logic input into the HBT and a differentiation of the very fast transition current using the inductor to generate a large voltage at the output. Measurement results show the generated Gaussian pulse has a tunable peak voltage between 1 V to 7 V with full-width-half-maximum (FWHM) between 200 ps to 250 ps. The impulse generator is biased at 3 V battery supply and consumes 27 mW to generate a 7 V high 250 ps wide Gaussian impulse at a 1 MHz pulse repetition rate (PRF). [C278]

"Return loss enhancement of surface resistors loaded microwave radar absorber"

In this paper, return loss enhancement of a compact ultra-thin microwave radar absorber is demonstrated, The absorber is designed using textured surface technology comprised of a high impedance surface (HIS) positioned directly behind the anisotropically resistive-elements interconnecting a textured surface of square patches. By the selection of appropriate choice of the required surface resistors based on elementary circuit principles the return loss of absorber can be significantly improved. The properties of absorber are numerically characterized under normal incident using a parallel plate waveguide (PPW) simulator. It is demonstrated for this arrangement 27.09 dB at 3.14 GHz reflection loss can be obtained with an effective working bandwidth of up to 10% at 10 dB reflection loss. In addition it is shown that the bandwidth is insensitive to the small different values of resistive-element. [C279]

"Analysis of a probe-fed bow-tie antenna scattering by using the hybrid FE-BI method"

The hybrid finite element and boundary integral method (FE-BI) for analyzing scattering from an active antenna is presented in this paper. First, the principle and formulas of FE-BI method are detailedly demonstrated, in which the contributions from the antenna feed and incident EM fields are simultaneously considered. Then as an example, the radar cross section (RCS) of a probe-fed plane bow-tie antenna is calculated by using this method. The numerical results show that the RCS of the antenna with the feed is obviously different from the same structure but without the feed. [C280]

"Application of assistant knowledge to detect and recognize target in SAR imagery"

Because of the characteristics of its imaging principle, strong speckle and impacted by background clutter, SAR image is very difficult to be interpreted, especially for the complex military targets. An interactive recognition system framework is proposed in this article which using contextual information, geospatial information and multi-temporal images, etc, as assistant knowledge in the recognition workflow. It can help detecting and recognizing some target which is difficult to be detected and recognized through human vision or automatic target recognition technology alone. [C281]

"Research on deceptive jamming technologies against SAR"

Synthetic aperture radar (SAR) has its own special features different from conventional radar. It has high processing gain, so jamming to SAR is more difficult than that to conventional radar. Jamming to SAR finds its important usage in some military scene. In this paper, the basic principle of the SAR deceptive jamming and the model of the jamming signal are discussed, and the simulations are made. Finally, two criterions used to evaluate jamming effectiveness are provided. The jamming effectiveness is checked up used these criterions by computer simulation. [C282]

"A signal processing method for airborne three-channel SAR-GMTI"

Aiming at airborne three-channel SAR-GMTI system, a signal processing method based on Clutter Suppression Interferometry(CSI) is presented including the processing diagram and the principle of clutter suppression. Channel calibration is proposed to correct the magnitude and phase imbalance between inner channels utilizing the test signal, SAR imaging and clutter cancellation are done successively, finally the accurate target parameters (location and velocity) are obtained. The signal processing approach which has been applied in real data proved its good performance and turned out to be efficient. [C283]

"Omega-k algorithm for bistatic spotlight SAR imaging"

Bistatic spotlight synthetic aperture radar (SAR) which uses a separated transmitter and receiver has been studied intensively due to its flexibility. The paper introduces omega-k algorithm for bistatic spotlight SAR imaging in the parallel track configuration. Using the principle of stationary phase (POSP) and the point scattering response (PSR) of bistatic spotlight SAR, an omega-k algorithm is derived, which is based on the geometry of bistatic spotlight SAR. Lastly, the algorithm is validated through point target simulations. [C284]

"Research on the azimuth ambiguity of phased array sliding spotlight mode SAR"

The azimuth ambiguity is a key character to scale the image quality, but the traditional expression in strip-map SAR does not match the situation in sliding spotlight. This paper firstly introduces the azimuth ambiguity expression of strip-map SAR. Then focusing on the phased array sliding spotlight condition, analyses its working principle, aims at the characteristic that antenna patterns are changed continuously in the process of beams sliding, constructs the azimuth ambiguity calculation function of phased array sliding spotlight SAR, makes corresponding system design and simulation farther, provides effectual reference for SAR system design. [C285]

"SAR image segmentation using quantum clonal selection clustering"

A novel clustering algorithm is proposed, which is derived from physical intuition of quantum mechanics and biological principle based on immune clonal selection. As extension ideas of scale-space clustering and support vector clustering, quantum clustering method deduces the clustering allocation by gradient descent, which is prone to getting stuck in local extremes. By designing a novel and high-efficiency affinity function, we adopt an immune clonal selection algorithm with elite preservation strategy to search the global optimum. The experimental results on texture images and SAR images segmentation we demonstrate show that quantum clonal selection clustering method performs well both in precision and efficiency. [C286]

"Phase imbalance compensation in SAR/ISAR quadrature demodulation"

I/Q channel imbalance in quadrature demodulation is one of the major concerns in the design of synthetic aperture radar (SAR) and inverse SAR (ISAR) receivers. The amplitude and phase mismatches result in the additional mirror signal, which acts as a correlated interference superimposed on the desired signal and, hence, degrades the whole system's performance significantly. In this paper, we first analyze the effects of I/Q channels imbalance in detail, and focus on the relationship between the mirror signal and imbalance effect. Then a new digital method for phase imbalance compensation is proposed. The phase mismatch is adaptively estimated and compensated by optimizing the matched filtering results without requiring any testing signals or measurement circuits. The method is based on the principle that when the phase mismatch is compensated perfectly, the entropy of the range-resolved image will reach the minimum or the contrast will reach the maximum. In addition, the simulation results indicate that the I/Q phase mismatch can be effectively compensated during the normal operation of the SAR/ISAR receivers, even in the rapidly changing case, as long as a linear system model for the imbalance is valid. [C287]

"Research on high resolution SAR based on frequency-stepped chirps"

Since the birth of the synthetic aperture radar, how to enhance the resolution is the very important direction of the SAR research, with the resolution of airborne SAR come to 0.1 m, for the design of the SAR system, the realization of the ultra band signal is a difficult problem, in order to alleviate the press of the A/D acquisition and data store, adopting the technique of the bandwidth synthesis to get the range high resolution, in azimuth applying wavenumber domain method, through the azimuth processing in two-dimension, solving the problem of coupling, attaining the high-resolution of the azimuth. The paper introduced the principle of a high resolution SAR system, the arithmetic of high resolution range imaging, give the simulation result, preliminary flight results and expect the future work. [C288]

"Study on dual-stripmap imaging algorithm for airborne circular-scanning SAR data processing"

The dual stripmap imaging mode for airborne synthetic aperture radar (SAR) is derived from a circular-scanning radar system, which satisfies wide area of imaging scene and high resolution requirements. The working principles, data processing scheme and system parameters design problems resulting from such a novel working mode are analyzed respectively in the text. The point-target simulation and live data implementation results are given to show the validity of the proposed methodology. [C289]

"A new channel equalization method adapted low signal-noise ratio"

This paper proposes a new channel equalization method with the combination of noise reduction with average samples and auto adapted FIR filter. It illustrates the principle and the performance of this method and shows the satisfying GMTI results in low signal-noise ratio. Compared with some other channel equalization methods beyond training, the proposed method in this paper can achieve better results and overcome some defects of theirs. [C290]

"Downward-Looking 3-D linear array SAR imaging based on Chirp Scaling algorithm"

Downward-Looking three dimensional (3D) Linear array SAR (LASAR) has the ability to map a directly overflown scene into a high resolution 3D image by looking perpendicularly downwards. The scope of this paper is to present a Chirp Scaling (CS) algorithm of 3D LASAR. Firstly, the principle of the LASAR system is introduced. Secondly, using the echo model the CS algorithm which focused the 3D SAR imaging in the range direction and the along track direction respectively. Then the beamforming technique is used to focus the 3D SAR data in cross-track direction. Finally the numerical experiments validate the feasibility of this algorithm. [C291]

"A method for CLSAR 3-D imaging based on backprojection and beamforming"

In this paper, a spotlight model curvilinear synthetic aperture radar system is studied and three-dimensional imaging principle of this system model is analyzed. A three-dimensional imaging processing method based on backprojection and beamforming for curvilinear synthetic aperture radar is proposed, and raw data of curvilinear synthetic aperture radar in X-band is simulated and three-dimensional image is achieved. The imaging result is analyzed, and simulation results confirm the validity of the proposed method. [C292]

"QA for satellite sea surface temperatures using the ISAR ship-borne radiometric system"

Satellite measurements of global sea surface temperature (SST) distribution are increasingly recognised to have great importance for understanding changes in the world's climate, as well as for operational forecasting of the

oceans and atmosphere. If satellite-derived SSTs are to provide the basis of an essential climate variable (ECV) it is necessary to establish methods for independently verifying their quality. Previously the validation of satellite SST products has been performed by comparison with sea temperatures measured by contact thermometers on the hulls of moored or drifting buoys or of ships. Such sensors operate below the sea surface, within the top few metres of the water column, recording what is now referred to as SSTdepth. Infrared radiometers on satellites measure the temperature of the surface skin of the ocean, referred to as SSTskin. However, significant uncertainties are introduced when validation is based on comparisons between SSTdepthand SSTskinbecause the sea temperature is not uniform across the skin and the upper few metres, especially but not only because of diurnal variability. Such uncertainties can be eliminated by using in situ SSTskinmeasurements as the basis for a satellite SST validation approach which genuinely compares like with like. This paper describes the principles and results of such a system which has now been in place for five years. It has been used to validate SST measurements from the Advanced Along Track Scanning Radiometer (AATSR) on Envisat. Within the collaborative approach developed by the Group for High Resolution SST (GHRSST) for merging of complementary data from different satellites, the primary role of AATSR data is to provide a reference for bias adjustment of other data. Precise validation of AATSR measurements is therefore essential for maintaining the quality of other GHRSST products. [C293]

"Optimized algorithms for detection of sparse targets in heterogeneous Gaussian noise"

In this paper we propose two adaptive detection algorithms for sparse targets embedded in heterogeneous AR Gaussian noise. The first one solves the problem of estimating the subset of cells containing a scatterer via the GLRT principle, while the latter models the number of scatterers as a random parameter and relies on the use of quantized statistics. A preliminary performance assessment, conducted by Monte Carlo simulation, has shown that both solutions allow to reduce the detrimental effects, in terms of collapsing loss, suffered by conventional solutions. In particular the former algorithm is to be preferred in terms of performance while the latter has a lower computational complexity. [C294]

"A solution of two dimensional spectrum for general bistatic SAR"

The paper derives the two-dimensional point target spectrum for general bistatic SAR configuration. For the kind of configuration the contributions of transmitter and receiver to the overall instantaneous Doppler frequency are unequal due to the different slant range history. In the paper the instantaneous Doppler contribution ratio is proposed to represent the difference of instantaneous Doppler contributions of transmitter and receiver, and the ratio is derived based on its meaning, which varies with instantaneous Doppler frequency. Then the two-dimensional spectrum is approximately obtained using the principle of stationary phase and Taylor series expansion for general bistatic SAR. The derived spectrum is verified with a point target simulation of general bistatic SAR. [C295]

"High resolution mapping of the environment with a ground-based radar imager"

The aim of this paper is to show the potential of the microwave radar as a sensor dedicated to outdoor perception. A new radar sensor named K2PI, based on the principle of Frequency-Modulated Continuous Wave (FM-CW) is presented here. An application in simultaneous localization and mapping using scan matching of radar images (R-SLAM algorithm) has been developed and first results in different environments are presented. Trajectories obtained by the R-Slam algorithm are compared with GPS positioning. The results show the ability of the microwave radar to build maps even in unstructured environment. [C296]

"Simulation for Doppler signal Periodogram Spectral estimation methods"

With the rapid development of modern intelligent traffic, the speed-testing radar becomes a kind of essential equipment, which measures speed through the acquisition of the moving target signal frequency deviation according to Doppler principles. Traditional method uses analog filtering, whose measurement accuracy is low and the measured speed is slow. Obviously, it's difficult to meet the need of the modern intelligent transportation management. Speed radar signal processing generally uses the power spectrum estimation method. Periodogram Spectral estimation (using Hamming window periodogram method) considers for different signal to noise ratio of the data spectral estimation, and finally receives the largest frequency error to meet the system requirements for measurement accuracy. [C297]

"A GPU based real-time SAR simulation for complex scenes"

This paper presents a novel simulator which uses programmable graphics processing units (GPU) to generate Synthetic Aperture Radar (SAR) images. The conventional SAR simulations, based on mere mathematical computation, are usually time-consuming and not intuitionistic. In this paper, a new method which can simulate

real-time SAR images even for complex scenes is developed. The simulator takes the advantage of computer graphics in three-dimensional display and combines it with SAR principle to yield the SAR images. This is implemented on graphics hardware, which offers 3D hardware acceleration and programmable GPU. [C298]

"Defining configurations for bistatic SAR"

This paper provides important principles for the establishment of transmitter/receiver configurations, suitable for the formation of bistatic SAR images. Resolution aspects are presented for generic 2D and 3D cases, and experimental results are provided. Some specific resolution issues that are linked to the bistatic SAR algorithmic process are also raised in this paper. [C299]

"Microwave reflectometry: a sensitive diagnostic for electron density property measurement in Tore-Supra fusion plasmas"

Based on radar principle reflectometry measures the electron density in magnetic fusion plasma. On Tore-Supra, six reflectometers measure the density profiles and the properties of density fluctuations with good temporal and spatial resolution. Four swept reflectometers from 33 to 155 GHz provide reliable and accurate measurements of the whole density profile from the edge on the outer side up to the inner side. The sweeping time was recently decreased from 20 to 4 μs. Fast profile evolution can be followed owing to high repetition rate. Density fluctuations are measured with three different techniques. The classical fixed frequency method looks at large scale density fluctuations. Properties of density fluctuations can also be recovered from consecutive frequency sweeps. Doppler reflectometry is based on wave back scattering on small scale density fluctuations. It measures the poloidal rotation and fluctuations amplitude at different wave numbers. Recent numerical simulation of plasma turbulence have recovered the wave number spectrum obtained from Doppler and fast sweep reflectometry. Reflectometry is also sensitive to the density fluctuations induced by magneto hydrodynamic perturbations. Low frequency modes can be localized by fast sweep profile reflectometry. High frequency modes excited by energetic particles accelerated by the plasma heating system are observed with fixed frequency fluctuation reflectometry. [C300]

"A deceptive jamming method against MMW monopulse radar"

This article focuses on MMW monopulse radar seeker and its deceptive jamming technique. Based on the principle of stepped-frequency High range profile monopulse seeker, a method of jamming against stepped-frequency high range profile monopulse seeker is proposed. The theory of stepped-frequency high range profile monopulse seeker is given in detail. The system architecture, theory foundation and principles of the jamming against stepped-frequency high range profile monopulse seeker are described in detail in this paper. The method shows that the High Range Profile of the Monopulse seeker could be deceived successfully based on the pulling-off of the range track gate with false high range profile. Lastly, the conclusions and future works are demonstrated. [C301]

"High resolution Doppler estimation using highly Doppler tolerant signals"

We propose a new technique for Doppler estimation and also provide details of experimental verification of the same. The proposed method utilizes pulses of a highly Doppler tolerant signal to estimate the Doppler with very high resolution. This method is both analytically tractable and computationally efficient. We have compared various waveforms as candidate signals for this technique and have derived performance bounds for the estimation and the estimate resolution using simple physical insights into the problem. The details of the experimental verification of the theoretical principles is also mentioned. [C302]

"Modular design principles for missile defence early warning radar"

This paper focuses on the innovative architecture of the ground-based UHF Deployable Early Warning (DEW) radar. First, the early warning functions of the radar with the main requirements are presented. Then the surveillance principles and the global radar functional architecture are depicted. The central part of the paper shows how the mission requirements can be met through an innovative modular and digital antenna architecture based on software radar technology, Building Blocks and standard interfaces concepts. The Building Block design principles are described. This approach is demonstrated through examples emphasising the modular design flexibility. Furthermore, the proposed Building Block can be used for creation of other UHF radar products. [C303]

"Study of effect of room window on through wall imaging in UWB range"

In through wall imaging (TWI), detection is possible due to dielectric contrasts between target and room

environment. Complexity increases if room consists of furniture's and other objects beside desired target. Further detection of desired target becomes complex with the presence of window in back wall of room. Thus in this paper, effect of presence of window in back wall of room is investigated on detection and imaging. A detection technique is proposed in which signal processing technique is applied to extract the target information from clutter signal. A back projection imaging technique is applied to image the target. For this purpose, indigenously a TWI system based on step frequency continuous wave (SFCW) principle is developed in ultra wide band (UWB) range of frequency (i.e., 3.95 GHz to 5.85 GHz), plywood considered as wall and metallic plate is considered as target behind the plywood wall. The results are quite encouraging. [C304]

"Efficient SAR Raw Data Simulation of Extended Scenes Using Chirp Scaling Principle"

To simulate Synthetic Aperture Radar (SAR) raw data of extended scenes efficiently, a novel hybrid domain method based on Chirp Scaling (CS) principle is proposed via the analysis of the SAR raw data model. This method first of all provides a signal by stretching the input surface reflectivity of the target in the azimuth and range directions respectively. Then SAR raw data is derived by inversed-equalizing the signal according to CS principle. A simulation scheme and the steps of processing are proposed. Some simulation results are finally presented in order to verify the accuracy and the effectiveness of the proposed simulation scheme. [C305]

"General framework on change detection in a sparse domain"

The paper presents a general framework for change detection in radar images, for an operational purpose and in the context of environmental monitoring. This framework is based on a processing which provides highly sparsifiable representations of data. This processing is called turbo-median and is a combination of the sample median robustness and the turbo principle for iteratively correcting errors. The turbo-median processing of a scene is an homogenized representation based on an iterative median and which consists in spreading the statistically more robust measurements of the scene under consideration over the size of the image representing this scene. It allows for reducing the change detection problem into the problem of detecting a signal, with unknown distribution, in additive noise. [C306]

"Experiences in optical and SAR imagery analysis for damage assessment in the Wuhan, may 2008 earthquake"

The Sichuan Earthquake on the 12th of May 2008, and the extensive rescue operations following this tragic event, proved the value of high-resolution optical and radar remote sensing during the emergency response. Optical data provide a fast and simple way to value Г‚Вїat glanceГ‚Вї damages while radar sensors can deliver images independent of weather conditions, day and night, and thus in principle can represent a mean to obtain a damage map in the immediate aftermath of an event, providing precious information for intervention planning. On the other hand, SAR data is far more difficult to interpret than optical data both to the expert and non-expert. In this paper we present a case study of damage assessment on the Sichuan earthquake experimenting the use of very high resolution data from both worlds, discussing preliminary results and perspectives. [C307]

"Use of neural networks and SAR interferometry for the automatic retrieval of tectonic parameters"

The basic idea of this paper relies on the concurrent exploitation of the capabilities of neural networks and SAR interferometry for the characterization of a seismic source and the estimation of its geometric parameters. When a moderate-to-strong earthquake occurs we can apply SAR Interferometry (InSAR) technique to compute a differential interferogram. The earthquake has been generated by an active, seismogenic, fault having its own specific geometry. Therefore each differential interferogram contains in principle information concerning the geometry of the seismic source the earthquake comes from. To perform the inversion operation an approach based on neural networks can be considered. The paper illustrates such a methodology and its assessment on experimental data. [C308]

"Motion measurement errors analysis for the "one-active" LASAR"

The influences of the motion measurement errors (MMEs) to the 3D SAR imaging are analyzed based on the "one-active" LASAR system in this paper. Firstly, the principle and the spatial ambiguity function (AF) of the "one-active" LASAR are introduced. Then the 3D MMEs are introduced according to three forms: the 3D velocity errors and the 3D acceleration errors, the sine vibration errors and the array vibration errors. The 3D SAR system's maximum allowable MMEs are obtained and the influences of the 3D MMEs to the 3D AF are analyzed by the numerical simulation. Finally, the ground experiments and its results are presented, which validate the feasibility of the "one-active" LASAR. [C309]

"Anti-jamming techniques for synthetic aperture radar"

Excellent performance of SAR has aroused deep study of jamming techniques. This paper first discusses present jamming techniques and their shortcomings, then gives methodology of classifying ECCM of SAR, and at the same time, gives principle and results of signal design method, which combines orthogonal codes and random initial phase at each pulse, the method leads to disability of jamming to finish match filtering of both range and azimuth. Finally this paper points out that beamforming technique is a potential method for the future of ECCM of SAR. [C310]

"Antenna pointing measurement for spaceborne SAR based on sign-MLCC algorithm"

Dual-antenna single-pass synthetic aperture radar interferometry needs alignment of both antenna beams to achieve the best interferometric performance. Meanwhile, geosynchronous synthetic aperture radar, potentially used for global earthquake prediction and many other attractive applications, also requires antenna pointing control system to steer the radar antenna to illuminate desired territory, otherwise, even slight deviation from ideally boresight direction can cause a great variation of footprint position, because of the large slant range from the radar to mapped area. In principle, it is possible to measure antenna pointing information directly; however, measurement uncertainties will limit the accuracy. Thus it is feasible to resort to received radar data to measure the antenna pointing. This paper concentrates on the antenna pointing measurement using onboard Doppler centroid estimator, and furthermore, to drive pitch and yaw angles to steer the antenna pointing. In order to realize real-time onboard processing, a novel Doppler centroid estimation algorithm, called sign-MLCC, is presented here, utilizing the phase information of the received signal and the arcsine law by analyzing the sign alone, then evaluation of the algorithm is discussed. Finally, simulations are shown to prove the validity and reliability of the proposed method. [C311]

"Study on the backscattering characteristic of typical earth substances in northwest of Chaina"

The S-band and C-band FM-CW land-based radar scatterometers were used to measure the backscattering coefficient of a variety of typical earth substances in northwest of China, including: bare soil, frozen soil, bulrush and maize etc. under the different time and different wave band and different polarized condition. First of all, the measurement principle and performance parameters of scatterometer were introduced, the detailed experimental plans and measurements specifications were developed. Based on them, the various units of measurement were completed successfully. The measurement process of scatterometer was briefly introduced in this work. according to different scattering mechanisms, features are divided into two categories: surface scattering and volume scattering, and analyzed these Scattering Characteristics and the reasons for these differences; combining with the corresponding earth substances scattering model, quantitative studying a function between the backscattering coefficient and surface parameters, getting different surface parameters of features by inversion, and analysis of a variety of influencing factors by comparing the measured datas. [C312]

"Differential Reflectivity (ZDR) calibration for CASA radar network using properties of the observed medium"

The Center for Collaborative and Adaptive Sensing of the Atmosphere (CASA) has deployed a Distributive, Adaptive and Collaborative Sensing (DCAS) network of four radars in central Oklahoma working as a closed-loop system since 2006. The radars operate at the X-band frequency and are capable of polarimetric and Doppler measurements. The radar network is being evaluated for Quantitative Precipitation Estimation (QPE). QPE algorithms based on radar power measurements (e.g. ZHand ZDR) require bias correction. ZDRcalibration is required prior to any application of the self-consistency principle. Two different methods were evaluated for ZDRbias correction. The intrinsic properties of dry aggregated snow present above the melting layer and light rain measurements close to the ground are used for the study. Results show a ZDRcalibration accuracy of 0.2 dB or less for both analyzed events when both methods are compared. [C313]

"Distributed RF tomography for tunnel detection: Suitable inversion schemes"

Distributed Radio Frequency (RF) Tomography is a novel approach for detecting underground tunnels and caves, over relatively wide areas. This method requires a set of affordable transmitters and receivers randomly deployed above the ground. Using the principles of inverse scattering, it is possible to develop a simplified theory for imaging below ground, thus revealing and locating voids. In this paper, we introduce inversion schemes suited for ground penetrating radar tomography applied to sensors that are randomly distributed over the area of interest. [C314]

"Multi-baseline POL-inSAR statistical techniques for the characterization of distributed media"

This paper presents principles and robust techniques to estimate physical parameters of natural environments using Multi-Baseline Polarimetric and Interferometric SAR (MB-POL-inSAR) data. The first part of this paper concerns the abstract topic of MB-POL-inSAR coherence optimization The second part is dedicated to the general estimation of the coherence line model parameters [1]. It is demonstrated that the line parameters can be estimated in an analytical and robust way by using the whole available POL-inSAR information. [C315]

"A GPS signal based numeric range migration algorithm of space-surface bistatic SAR"

In this paper, we present a new numeric bistatic range migration algorithm (RMA), specifically designed for GPS signal based space-surface bistatic SAR(SS-BSAR). It can be applied to any arbitrary trajectory BSAR imaging system. Based on the principle of stationary phase and the geometric relationship of the SS-BSAR, a two dimensional (2-D) precise analytic response expression of point targets in frequency domain is deduced first. Then a numeric RMA is proposed which match function and interpolation function are derived numerically. The proposed RMA can process wide SAR scene at once and the shape distortion can be corrected at the same time. Simulation results illustrate the validity of the proposed approach. [C316]

"Analysis of the mean raindrop shape model for dual polarization radar rainfall estimation"

Information about the shape of raindrops is critical for estimating rainfall rate with dual polarization radar. As described in the literature, the relation describing drop oblateness as a function of its equivolumetric diameter is nonlinear. There are several relations that express the shape-size dependence as nonlinear fourth-order polynomials. In fact, there is still no consensus regarding the most appropriate equation to use to describe the shape-size relation. Moreover, while non-linear equations are important for studying raindrop shape, it is not clear that they are needed to estimate an integral quantity such as rainfall rate. The validity of using a simple equivalent linear shape-size model based on the principle of the mean value theorem for estimating rain from dual polarization radar measurements is examined. Proposed rain algorithms based on the estimation of the drop shape are compared with algorithms that assume specific a-priori fixed drop shape-size relations expressed by a fourth order polynomial. Reconstructed rain and radar measurement profiles obtained from real radar observations were used to this purpose. Results show that the proposed rain algorithms perform better or at least equal to the algorithms derived assuming a priori fixed shape-size models, demonstrating that the prevailing model directly derived from data is suitable for rainfall retrieval purposes. [C317]

"Design of a high-speed intermediate frequency radar signal generator"

The design and realization of a universal intermediate frequency radar signal generator system has been brought forward, basing on FPGA technique. The principle and realization of high speed digital up convert (DUC) has been introduced. A novel approach of reducing the phase truncation spurs in numeric control oscillator (NCO) has been proposed as well. Finally, the hardware configuration has been described. The experimentations show that the signal generator is a universal equipment and it can be applied in different radar systems. [C318]

"A research on compensation for UWB ISAR system"

A compensation method for ISAR receiver system using STRETCH processing is presented. The effect of system distortion on radar echo signal is analyzed by using the Phase Stationary Principle and the Paired Echo Principle, and system compensation method is abtained by comparing the difference between ideal echo signal and distorted signal. A series of simulation results demonstrate the efficiency of the method. [C319]

"Compressive sensing in radar imaging"

In a conventional radar system, the sampling rate of images is constrained by Nyquist rate. High sampling rate, fast processing speed, and large capacity of memories could be challenges to this radar system. Radar imaging based on the concept of compressive sensing (CS) is a potential solution. According to CS, sparse or compressible signals can be reconstructed from a small set of their linear measurement. In this paper, we briefly introduce the principle of CS at first. Then we analyse its theoretical scheme in radar imaging and present the numerical simulation results of 1D target detection and 2D radar imaging. This paper concludes with a short discussion and conclusion. [C320]

"Impact on airborne SAR direct geo-location from platform attitude parameters"

Aiming at the direct geo-location application of high-resolution airborne Synthetic Aperture Radar (SAR) images, this paper discussed the theoretical principles and mathematical models for effects on direct geo-location from attitude angles' errors of flight platform, through the phase errors and image pixels' geometric distortion, inputting indirectly into the corresponding geo-location model and influencing the final positioning accuracy. And, the

relative simulation test and quantitative analysis based on true flight trajectories' record data have been executed in the last part of it. The result indicated that the final geo-location error of average horizontal positioning is about 0.53 meters, when the pitch and roll attitude angles' errors are all no more than 0.1 degree. And, it indicates that the measurement errors of no bigger than five thousandth degree will satisfy the accuracy requirement of 1 10000 scale topographical maps, using high-resolution airborne SAR system. [C321]

"Generation of SAR stereo image pair"

Intuitionistic stereo percipience can be got with stereo viewing of stereo image pair, and also three dimension information can be got by using stereo mapping tools. In china, the technique of generation of optical stereo image pair is mature, but the problem of SAR stereo image pair has not been solved, researching the technique of generation of stereo image pair is significative for topographic mapping using SAR image. This paper describes the principle and method of simulation of stereo image pair based on single SAR image. Geo-location model of SAR image is introduce in this paper, so are direct geo-location and indirect geo-location. The simulation of SAR stereo image pair is introduced detailedly. Simulation experiment is done with a TerraSAR image in china. The stereo percipience is well when stereo viewing, and the image pair can be used in stereo measuring. [C322]

"DSP implementation of SPECAN algorithm"

In order to implement the SCANSAR algorithm based on high-speed digital signal processing system, the Space-borne SAR SPECAN imaging algorithm and the geometrical mosaic algorithm are discussed in detail, and a real-time SAR processor, which is based on DSP boards, is introduced. Both the principle of SPECAN and the mosaic algorithm are carefully analyzed in detail and realized. Furthermore, in order to achieve a high processing efficiency, the parallel structure (SIMD software mode) is adopted in this system, the token rule is brought to improve the local DSP bus accessing speed on a board, and the real-time performance of the DSP system is deeply studied. Finally, the image of SPECAN algorithm is given. [C323]

"Research on deceptive target jamming method when the radar platform is moving"

This paper studies the principle of the deceptive target jamming while the radar platform is moving. It puts forward one simplified method for jamming implementation when the target has the motion styles both in uniform straight line and coordinated turn model. This method employs the IMM arithmetic for platform state estimation. It does not need to estimate the speed direction of platform, and it can generate targets with greater precision. Simulation results of some representative scenes have proved the validity of the method. [C324]

"Adaptive statistical model for radar HRRP recognition"

Radar automatic target recognition (RATR) should have a robust recognition performance in different noisy conditions. Most of the algorithms in RATR are based on high signal-to-noise (SNR) condition, not consider the recognition performance in low SNR. In this paper, based on the probabilistic principal component analysis (PPCA) model, we develop an adaptive statistical model for radar target recognition. This algorithm makes the parameters of PPCA model altered by different noisy conditions. Experimental results for measured data show that the average recognition performance of the proposed adaptive statistical model has an obvious improvement in low SNR. [C325]

"A research on synthesis processing of Orthogonal Array Radar based on Non-linear Frequency Modulated signals"

Orthogonal Array Radar OAR is a new radar system. This paper introduces the principles of the OAR. Since the array elements of the OAR transmit orthogonal signals in the omni-direction at the same time, after the signals in different channels are received, the signal synthesis can form the transmitting beam and obtain a narrow pulse. If each transmitting signals are single frequency signals and the multiplied product of the time width T of the transmitted signals and the frequency interval Δf between each signal is larger than 1, the distance grating lobe will occur after the signal synthesis. To reduce sidelobe level, increase the Ratio of Mainlobe and Sidelobe (RMS) and eliminate the distance grating lobe effectively, the method using the Non-linear Frequency Modulated(NLFM) signal as the transmitting signal is presented in this paper. The analysis result shows that this method is effective to solve these problems. [C326]

"WEAK target detection using dynamic programming TBD in CDMA based passive radar"

Long time integration is of great importance in weak target detection in passive radar systems. When an integration time of seconds level is used, a migration of Doppler and range may take place during the process of

matched filtering. This paper presents a novel approach named DPA-TBD to obtain target parameters by taking full advantage of the target migration information. DBT and TBD methods are briefly compared in principle. Then a detailed mathematic description of DPA-TBD is introduced. A model of CDMA based passive radar is established with a slow maneuvering moving target. Two methods, CA-CFAR and DPA-TBD, are applied to target detection, revealing that the latter totally overwhelms the former. Finally, simulation results demonstrate the validity of the theoretical analysis. [C327]

"A 2-D correlated noise depressive jamming technique to synthetic aperture radar"

A new correlated noise depressive jamming (COR-NDJ) technique is proposed to improve the performance of the common noise depressive jamming (COM-NDJ) to synthetic aperture radar (SAR). Based on the false target deceptive jamming(FTDJ)principle, the COR-NDJ signal generation is discussed. Simulation results show that the 2-D COR-NDJ performs much better than COM-NDJ technique. [C328]

"Design of RVD radar if signal simualtor based on FPGA"

Spacecraft rendezvous and docking (RVD) is one of the major tasks in space flight mission. This study discusses an approach for simulating the intermediate frequency (IF) signals which the RVD radar received based on the principle of direct digital synthesizer (DDS). The velocity, distance simulation and noise generator are presented respectively. The whole simulation system was implemented on the platform of field-programmable gate array (FPGA). [C329]

"An focal plane array space variant model for PMMW imaging"

In this paper, based on research the principle of the Focal Plane Array (FPA) in passive millimetre wave (PMMW) imaging, we present a spatial-variant image mathematical model by introducing the focal-image plane transformation operator and spherical projection geometrical relationship and non-uniform Multiple-Beam Antenna (MBA) model. This model can express separately the process of the propagation and the accumulation and receive which are the space variable factors of three different attributes on the effects of the imaging quality. Based on analysis FPA PMMW imaging model and space-variant characteristics analysis, we present a spherical anti-projection transformation method to eliminate space-variant characteristics of the PSF and geometric correction processing. [C330]

"Study of Intelligent Public Transport Monitoring System Based on WebGIS"

At present, most vehicle monitoring systems are based on the client/server structure. According to their disadvantages, an intelligent public transport monitoring system based on WebGIS is constructed. System working principle, design method and main functions are introduced in detail. A fast and practical road match algorithm, is put forward. The system has been used in two domestic cities and has obtained great social and economic benefits. It has better promoting effect on improving the service level of urban public transportation and other transportation trades. [C331]

"Research of three-dimensional imaging processing for airborne forward-looking SAR"

In this paper, an innovative airborne forward-looking SAR system using antenna array mode is studied and three-dimensional imaging principle of this system model is analyzed. A three-dimensional imaging processing method for airborne forward-looking SAR is proposed, and the resolutions in three dimensions are derived. Raw data of forward-looking SAR in L-band is simulated and three-dimensional image is achieved. The imaging result is analyzed, and simulation results show that forward-looking SAR could achieve three-dimensional image, and also confirm the validity of the proposed method. [C332]

"A tri-look detector for single channel SAR-GMTI"

This article studies clutter suppression and detection of moving targets in single channel SAR images. By analysing the most commonly used 3-channel SAR-GMTI principle, a new detector based on tri-look image Cancellation-After-Interferometry (CAI) is proposed where tri-aperture images are constructed by overlapped frequency even-partition of clutter bandwidth. Compared with the single channel SAR detector such as traditional tri-aperture cancellation, simulation results show the proposed algorithm having better robustness against clutter uncertainty especially in strong clutter environments and having capability of detection those with azimuth velocity vector. The simulation and performance comparison with 3-channel detection method also show that the proposed algorithm has no direct capability of parameter estimation resulted from phase randomness in single channel deployment. [C333]

"Monitoring the Coal Mining Subsidence in Jibei Mine Area Using D-InSAR Technique"

This paper mainly discusses the application of DInSAR technique for monitoring the coal mining subsidence in Jibei mine area. Firstly, it introduces the principle and data processing of D-InSAR technique. Then it uses ENVISAT ASAR data and SRTM DEM to carry out 2-pass D-InSAR test. It gets the deformation map and interprets the result. At last, it analyzes some problems to study further in monitoring the mining subsidence using D-InSAR technique. The test proves that DInSAR technique is a powerful and effective tool to measure the mining land subsidence. [C334]

"Fast Scanning LIDAR For Safe Landing On Planets"

Landing on the moon, Mars or other planets safely is of great significance for the success of space exploration. Compared with the previous cameras and human vision to look for a safe landing area, LIDAR can quickly detect the undesired zone with gravels, craters, scarps and other dangerous features. A type of laser scanner, which is designed by Shanghai Institute of Technical Physics of the Chinese Academy of Sciences (SITP) for safe landing on planets, is introduced. The single laser beam is expanded to linear beams through a cylindrical lens and the scanning direction is controlled by two-dimensional tilt mirrors. The reflected laser beams gather at avalanche diode detectors of the focal plane of telescope. The signal of every cell is processed individually and the planetary surface can be achieved by the fast two-dimensional scanning. At present, the designed linear array LIDAR is under prototype development, this paper describes its principle, and detection capability of single cell LIDAR for dangerous terrain. [C335]

"The Design and Solution for the Connection of GPRS Modem"

This paper presents the principle of GPRS (general packet radio service), realization of GPRS modem and how to embed the TCP/IP (transmission control protocol/Internet protocol) protocols. Then we describe the problems happen when the GPRS modem is online; and give some ways to solve them at last. [C336]

"FPGA implementation of SNR estimation for DSSS signal of space borne secondary radar"

According to the problem of SNR estimation for DSSS signal in space borne secondary radar, an efficient approach has been presented. For the implementation of real-time processing of SNR estimation, the efficiency is improved by the redesign of the algorithm flow. Moreover, the SNR estimation is accomplished on a large-scale programmable gate array with the capability of processing high resolution. Simulation results indicate that the principle of the method is correct. Taking into account the space condition, the method performs well. [C337]

"Refined Hybrid Digital Correlation Algorithm for spaceborne SAR"

An improvement of Hybrid Digital Correlation Algorithm for spaceborne synthetic aperture radar is presented. Without affecting the precision of the imaging result, the quantity of computation can be reduced greatly by the improvement. The principle of improvement is dealing with range walk in range frequency domain, to reduce the quantity of computation in the two-dimensional correlation of azimuth dimension. It is suitable for the real-time imaging of spaceborne SAR. [C338]

"A high-performance digital IF receiver and application in ISAR imaging"

In order to obtain high range resolution and long effective detection range simultaneously, high resolution radars usually transmit super wide-band frequency-modulated signals for pulse compression. The pulse compression methods of frequency-modulated signal can be matched filter and strecth. The principle and performance of the two methods is contrasted, and the matched filter method is adopted based on software defined radio theory. General requirements for wideband digital radar receiver are analysed and a universal receiver module is designed and implemented. The receiver module mainly consists of two ADCs with 2Gsps sampling rate and 10bits resolution and two Vertex5 FPGAs. These two ADCs may work as two separate channels or in interleaved mode. A common DDC structure based on poly-phase decimation filter is introduced. The requirements for digital intermediate frequency receiver of the ISAR are analysed. And the implementation parameters and design details of the DDC based on poly-phase decimation filter for super wideband LFM waveform are introduced. The simulation result proves the effectiveness of the high-performance digital receiver. [C339]

"A novel method for ISAR imaging of ship target"

High resolution ISAR (inverse synthetic aperture radar) imaging and recognition of ship target is very important for many applications. Although the principle of ISAR imaging of ship target on the sea is the same as that of

flying target in the sky, the former usually has more complex motion (fluctuation with the oceanic waves) than the latter, which makes the motion compensation very difficult. However, the change of phase chirp rate caused by the complex motion of ships will deteriorate the azimuth focusing quality. In this paper, we first model the complex motion of ship target with cubic phase terms (parameterized on chirp rate and its change rate), then a new ISAR imaging method, referred to as TCD-echirpClean, is proposed, which estimates the chirp rate and the change rate of chirp rate of all scatters in the time-chirp distribution plane. Both numerical and experimental results are provided to demonstrate the performance of the proposed method. [C340]

"Synthetic high resolution radar for target identification"

Target identification presents severe technical complications even with nowadays technical capabilities. At INTA's Detectability Laboratory we have developed a synthetic stepped-frequency high resolution system with optical tracking and generation of frequencies configurable between 6 and 18GHz, which has been developed as part of a research project on non-cooperative target identification. The digital post-processing is based in the superheterodyne principle and provides detailed information on the targets. In particular, it allows to acquire high resolution range profiles (HRRP) and to manipulate them in order to obtain ISAR images. Here we illustrate the methods used in our tests and present various examples of the applications of this radar, e.g. to the identification of small targets (where the radar resolution is shown) and the obtention of ISAR images from measured profiles. [C341]

"Performance analysis and design of radar signal waveforms in modern electronic warfare environment"

In this paper, the modern radar signal waveforms are introduced. For improving the detection capability and reducing the probability of interception, the more complex signal waveforms are applied in the modern radar system. Some basic principles are provided in the design of the LPI signal waveforms. Some novel waveforms with complex modulation are introduced. The WVD-Hough transform are used to analysis the performance of novel radar signals. Experimental results show that the waveforms with combined modulation are efficient for radar anti-reconnaissance design in modern electronic warfare environment. [C342]

"Analysis of regularization based on lk norm in SAR complex-imagery domain"

Synthetic aperture radar (SAR) target recognition needs high quality image. This can be realized by the regularization method, which is beneficial to super-resolution and noise suppression by utilizing prior information. Via analyzing the iterative process of SAR complex imagery domain regularization based on lknorm, the inherent principles of super-resolution is revealed. On the basis of the process, the essential reason of inconsistent resolution of the original algorithm is exposed and a modified method based on weighted amplitude is presented. Experimental results on synthetic scene and real MSTAR data prove the validity of our approach. [C343]

"SAR counter deception jamming based on radiometric calibration"

This paper presents a method of SAR counter deception jamming method based on radiometric calibration. At first, the concept and principle of SAR deception jamming is introduced. Secondly, the principle and method of radiometric calibration is presented. Finally, the method of counter deception jamming with radiometric calibration is researched. The method which uses weak reflector to cover strong reflector, and large area deception jamming, are easily seen through. [C344]

"A HPRF stepped frequency phased array radar system design"

The design for a high PRF, stepped frequency, phased array radar is presented. Phased array radar using stepped frequency waveform brings several benefits. This paper gives design principle for this radar system and key implementation methods. [C345]

"Maneuvering target signal processing algorithm based on improved S-Method for HF OTH radar"

Core steps of S-Method based maneuvering target signal processing for HF(High Frequency) OTH(Over-the-Horizon) radar include the calculation of S-Method Distribution from signal's STFT (Short Time Fourier Transform) and S-Method Distribution based signal decomposition. However, as one of the main parameters of the whole signal processing algorithm, the window function of STFT has a great influence on the results of the signal processing, and this lead to the reducing performance of the algorithm. In this paper, we analyse theoretically the window function's influence on the algorithm for the first time, on the basis of which we propose improved S-Method that meets the principle of optimal signal processing, and consequently obtain a maneuvering multi-target signal processing algorithm based on improved S-Method. Eventually, simulation and

performance analysis are shown in order to verify the validity and advantage of improved algorithm. [C346]

"An efficient imaging algorithm for missile-borne side-looking SAR"

This paper presents an efficient imaging algorithm for missile-borne SAR. In the course of missile's diving flight, it is difficult to use the traditional imaging principle because of the strong coupling between range and azimuth signal. Through the fourth order range model, the echo model is established and the two-dimensional point target spectrum is derived by the method of series reversion. Then, the corresponding range and azimuth match filtering functions are given. Finally, simulation results demonstrate the accuracy and validity of the proposed algorithms. [C347]

"An improved TBD method based on modified Hough transform and Viterbi algorithm for early detection of dim target"

Track-Before-Detect (TBD) Method based on Hough transform (HT) has been presented for radar dim target detection in low SNR environments. In view of the flaws of the conventional algorithm based on HT, a new improved method with the optimization principle is proposed based on the modified HT in this paper. The algorithm procedure can be summarized like this: estimating track of target by the modified HT; then fixing a searching region around the track based on dynamic characteristic of target; finally using reduced-complexity Viterbi algorithm (VA) to make non-coherent optimization accumulation of data and detecting target by a set threshold. The experimental results verify the validity and superiority of the proposed approach. [C348]

"Deployment design and simulation of hybrid bistatic radar"

According to the clutter characteristic of spaceborne bistatic radar, better clutter characteristic can be achieved in the space-airborne bistatic radar after good deployment of satellite-plane flight status. The deployment mode of spaceairborne bistatic radar is presented based on the state of sidelooking receiving antenna array and bistatic baseline in order to get better clutter characteristic. Simulations have been done based on the principle of bistatic deployment mode, the results show that the spaceborne bistatic radar has better bistatic clutter characteristic. [C349]

"The information extraction algorithm for a traffic detection radar using ISAR principle"

As a wireless sensor, the traffic detection radar (TDR) is recently a new application at civilian areas. The system can provide various types of real-time information about the moving entities day-and-night in all weather conditions. However, the price to realize the accurate information extraction from the echo signals is an efficient mathematic algorithm. In this paper, the date acquisition model of the TDR based on ISAR principle is firstly established. Then, the velocity measurement and length estimation algorithm using the minimum entropy criterion is presented. The experimental results of a prototype radar system are given to demonstrate the validity of the proposed methodology. [C350]

"Design of modified spectrum filter based on Mismatched Window for NLFM signal"

In the radar field, Non-Linear Frequency Modulation (NLFM) signals are widely used. The conventional design method of side-lobe suppression filter for NLFM signal is based on the principle of stationary phase with the window functions and the modified spectrum algorithm. A new filtering technique of Modified Spectrum Filter based on Mismatched Window (MSFMW) algorithm is proposed in this paper. This method respectively designs the NLFM signal and the pulse compression filter based on different window functions. So the spectrum magnitude of the filtered waveform is proportional to the window function which is different from the one used for waveform design. The performance of the pulse compression can be modified by the different window functions. The simulation results demonstrate that the Ratio of Main-lobe peak to Side-lobe peak (RMS) can be increased by 0.8 ~ 7.7dB, without changing the main-lobe width. [C351]

"Code sequence synchronisation for SAR radiometric calibration"

Code sequence synchronisation in active coded transponder (ACT) is very important in the process of SAR radiometric calibration. According to the principle of coded SAR radiometric calibration, a signal processing model of active coded reflected signals is proposed in this paper. By means of three cyclic steps, correlation property of pseudorandom code sequence is used for code sequence synchronisation which is divided into two steps: coarse timing synchronization and fine timing synchronization. Simulation experiments with the compression of SAR azimuth signals are carried out. Finally, based on the experimental results, this paper proposes a new method of code sequence synchronisation for SAR radiometric calibration. [C352]

"ICSA based projection pursuit clustering with LDA index and its application in SAR image segmentation"

The performance of the traditional clustering algorithm is not always satisfied with the high-dimensional datasets, which make clustering method limited in many application. To solve this problem, Projection Pursuit with LDA index based on Immune Clonal Selection Algorithm is proposed in this paper. Projection pursuit strategy can maintain consistent Euclidean distances between points in the low-dimensional embeddings where the ICSA is used to search optimal projection direction. In the proposed algorithm, k-mean clustering algorithm is used to partition the reduced data and give labels to LDA index, and iterations have been done for several times can converge quickly to obtain a clustering result. The experimental results on UCI data show that the present method has better clustering accuracy compared with traditional linear dimension reduction method for principle component analysis (PCA). And the experiments on SAR image segmentation also have a good performance. [C353]

"Research on Wireless Positioning System Based on the Principle of Phase Interferometer and its Implementation"

This paper expounded the basic principle of phase interferometer system, established positioning model of one-dimensional double-base line, improved the bearing accuracy and solved the fuzzy problem. The whole circuit of the positioning system was designed, radio signal communication was implemented by RF transceiver chip, low frequency signal was used as signal frequency to modulate it to carrier, the antenna radiated electromagnetic wave to the outside, main station were used to identify whether the corresponding signal were useful signal or not, useful signal received by two slave stations went through filter, amplification and mixing to obtain two ways of IF signal which then were input into phase demodulator respectively, distinguished potential difference of two phase to get a more precise phase according to the proportion of baseline, again using the relationship between phase and azimuth to get the information of target location. According to the plan, control system was designed and a lot of related experiments were made, the experimental results showed that the system was applicable to the direction of elevation which did not exist and had certain applications and development value. [C354]

"Research and Design of Short Message Service System Based on ARM and GPRS"

In recent years, data service has been gaining popularity in embedded system and general packet radio service (GPRS). In this paper, we first analysis the embedded system theory, short message service (SMS), and combine with the latest computer technology, network technology, communication technology and GPRS technology, then propose an method to design the short message service system based on ARM and GPRS. We put forward the system principle block diagram and the hardware circuit of GPRS. At the same time, we give the software process flow and specific algorithm, namely, GPRS initialization module, port 1 receiving interruption module, GPRS communicate with S3C2410's port 1 module and sending message module. This proposed technique is well suited for various applications and has good prospects. [C355]

"Adaptive detectors for MIMO radar with sidelobe signal rejection capabilities"

Antenna beam patterns in MIMO radar systems (as in any radar system) exhibit sidelobes. Naturally it is possible for clutter and other undesirable signals to be detected accidently through these sidelobes. In a MIMO radar system this has the effect of misaligning the mainbeam steering vector and consequently reducing detection performance. In this paper we develop and examine two adaptive processing schemes aimed at reducing unwanted signals entering the system through sidelobes and hence restoring the steering vector to its true position. In this way signal to noise and detection performance are also largely restored. The MIMO version of an adaptive beamformer orthogonal rejection test (MIMO-ABORT) method together an adaptive detector with conic rejection (MIMO-ACR) are developed, that exploit the generalized likelihood ratio principle. Subsequently the constant false alarm rate (CFAR) properties of the two proposed detectors are demonstrated. The performance of the MIMO-ABORT and the MIMO-ACR detectors are numerically evaluated. The results show that the two detectors can reject sidelobe signals with good performance at the cost of a slight reduction in mainlobe signal detection performance, as compared with MIMO version of Kelly's GLRT (MIMO-GLRT). [C356]

"Analysis on the affection of noise in radar super resolution though deconvolution"

Radar angular resolution is constrained by its beam width. Deconvolution is an efficient algorithm for angular super resolution. It has been widely utilized because of 1) easy and simple principle, 2) no requiring of phrase information, 3) its flexibility. This paper introduces two deconvolution algorithms: Wiener filtering deconvolution and fast constrained iterative deconvolution (FCID). The performances of two algorithms with different SNR are compared and evaluated. This paper provides a reference standard to engineering applications in the different

noise environment. [C357]

"Precision inertial navigation system aiding for terminal radar seeker application"

The characteristic of Inertial Navigation System (INS) is discussed roundly at the outset, specially the potential application of information on the precision INS (PINS) in terminal guidance. Based on the gimbaled and strapdown inertial navigation system working principles, the output information of INS and PINS is compared, and the information fusion feasibility of Active radar seeker (ARS) and PINS is elaborated. This paper discussed the application of PINS/ARS fusion information in target-acquisition to enhance the acquisition performance and in terminal guidance to enhancing anti-interference performance. Simulation experiment results and theory analysis proves the validity of the method. [C358]

"Research on Omega-K type algorithms for bistatic SAR"

The bistatic Omega-K algorithm applying to the translational invariant (TI) configuration is discussed. The main difficulty in modifying monostatic Omega-K algorithm to handle the azimuth-invariant bistatic configuration lies in finding a solution for the 2-D target spectrum with linear property that was showed in the monostatic case. A derivation of the 2-D point target spectrum is proposed. The method described makes use of spatial variable transformation, the principle of stationary phase and phase linear approximation. The FGAN version and the ONERA version of bistatic Omega-K algorithm can be regard as different approaches to the procedure. The FGAN version adopts nonlinear transformation of the coordinates of the targets and the fitting by a straight line, while the ONERA version uses a physical reference and Taylor expansions. Both two versions make use of numerical method to solve to the stationary point problem, but the ONERA version involves more analytical elements thus allowing a convenient implementation. Moreover, we presented new expression of the semi-bistatic distance- difference in general TI configuration, and provided simulation results to demonstrate the performance of the approach in the cases of equal and unequal R/T platform altitudes. [C359]

"Imaging simulation of single phase center multiple receiving beams synthetic aperture radar"

The principle of one kind of digital beam forming SAR called single phase center multiple receiving beam synthetic aperture radar (SPC-MB SAR) was analyzed and imaging simulations were executed in this essay. The imaging algorithm was detailed investigated and the processing diagram was given. All simulation results proved that the algorithm is correct and can be greatly used in single phase center multiple receiving beam synthetic aperture radar for high resolution imaging. [C360]

"Query on reciprocity between ARP and ATP"

The conclusion that an antenna's amplitude receiving pattern (ARP) and its amplitude transmitting pattern (ATP) are equal obtained from the electromagnetic field reciprocity principle has premises easily ignored. Analysis on received polarization electromagnetic wave shows that the above conclusion is queried. The antenna under test (AUT) will be faced with different polarization mismatching status of itself and the testing antenna in reception or transmission, so that the form of ARP and ATP are generally not equal. Therefore, the reciprocity between ARP and ATP of AUT is not tenable. Lastly, correct pattern measurement of linear and circular polarization antenna is given. [C361]

"A new fast imaging method of BSLASAR"

A new fast three dimensional (3D) imaging method of 3D SAR is presented in this paper. This method translates the 3D imaging problem into a 2D curve surface imaging problem, achieves a better 3D image quality using the adaptive detection and the sliding window prediction technique. This method is discussed on the BSLASAR system. So the principle of the BSLASAR is introduced and the 3D BP method is given firstly. Then the adaptive sliding window prediction (ASP) based on back projection (BP) method is presented. The numerical experiments validate the feasibility of this method. [C362]

"A study of SAR signal analysis and processing in sliding spotlight mode"

This paper introduces prominently the principle of sliding spotlight mode SAR and analyses its particularities including synthetic aperture time and azimuth resolution based on the difference between the mode and other modes such as strip mode and spotlight mode. The wavenumber algorithm is represented combining with the linear item of Doppler centroid frequency is defined and removed, furthermore, the simulation have been carried through and the results validate the algorithm. [C363]

"Opportunistic Digital Array Radar and its technical characteristic analysis"

Based on the Digital Array Radar (DAR), conformal array, sparse array, Multi-Input Multi-Output (MIMO) system and Ubiquitous radar, a new radar system-the Opportunistic Digital Array Radar (ODAR) has been proposed in recent years. The concept, principle and characteristics of the ODAR are presented in this paper. Furthermore, the challenges are also analyzed from the aspects of the random element distributing, digital beam forming, signal transmission synchronization and adaptively intelligent decision, etc. The Genetic Arithmetic (GA) is exploited to carry out the beam shaping optimization of 3-D randomly distributed elements. The simulation results indicate that the method is feasible. The mathematics models of phase perturbation are preformed to implement the clock synchronization and adaptive beam steering. The adaptive synchronization design of signal transmission is adopted to improve the synchronization precision. The phase perturbation module is built to analyze the influence on ODAR specification by optical fibre or wireless links. [C364]

"A waveform diversity technique for countering RGPO"

In modern battlefield the jammer performing deception jamming of range gate pull off (RGPO) generates a false target and causes the radar to break its track on the target. The use of waveform diversity to remove the false target from the real one is considered. Received signal model under deception jamming is built on the base of the principle of RGPO. A new kind of design method for waveforms orthogonal in frequency domain is proposed and the correspondence signal processing method for removing the false target under RGPO is deduced. Its validity is proved by the simulated experimental results. [C365]

"The effect of polarizing beam splitter in 225GHz"

We demonstrate the working principle of the 225GHz duplexer, and investigate the polarizing beam splitter which is the focus of a quasi-optical duplexer. At last the simulations (made by HFSS) reveal the best size of the polarizing beam splitter. [C366]

"Exploration of new algorithms for airborne collision detection and avoidance to meet NextGen capabilities"

As the aviation community moves toward the next generation air transportation system (NextGen), current airborne collision avoidance technology may become inadequate. The traffic alert and collision avoidance system (TCAS) was developed some time ago, and its ability to accommodate the air-to-air applications and air traffic control (ATC) procedures that are envisioned for NextGen is limited. There is a need to analyze the role of future NextGen technologies such as automatic dependent surveillance-broadcast (ADS-B) in the overall collision avoidance concept and architecture. This paper will describe a MITRE research effort addressing the following three fundamental research questions: What are the desired NextGen operations that are incompatible with current TCAS? What new enabling technologies and design principles could meet the NextGen needs? What are the key functional needs that ensure enhancements and modifications do not detract from safety-the primary function of the collision avoidance system? In this paper we will discuss the technical approach applied to the research, and identify projected TCAS limitations in meeting future air-to-air applications and ATC procedures. [C367]

"A novel method of identifying moving status of bird based on waveform entropy variance"

Surveillance for bird is quite significant for security and development of humanpsilas aviation. ISAR imaging for bird with frequency-stepped chirp high-resolution radar is a novel and vital approach. However, the quality of image could be deteriorated by micro-Doppler effects resulting from birdpsilas flapping wings, and even target can not be identified successfully by radar. It is extraordinarily vital to identify whether bird is gliding or flapping accurately to achieve its clearer image. In this paper, an operated and valid method of identifying moving status of bird with waveform entropy variance is proposed via processing each HRRP(high-resolution range profile) from spectrogram, after the principle of micro-Doppler based on ISAR imaging with frequency-stepped chirp signal is analyzed. The effectiveness of the proposed method is proved by simulation results. [C368]

"Proof of concept for the extensibility attribute of an ISAR simulator for studies in target glint"

The proof of concept of using an interferometric ISAR simulator system in order to form a tool for false target decoy design purposes is presented in this paper. Emphasis is given to the explanation of the involved mathematical principles. The current scenario is the creation of a false target that exhibits corresponding glint effects at different distances to an approaching high resolution seeker sensor. The target is made to expand in its three-dimensional spatial occupation providing leads to the seeker sensor. Finally the novelty of this effort is a proposal attempt for the above mentioned scenario in order to lay the foundations for the optimum behaviour of

the false target decoy. [C369]

"High decoupled antenna for UWB pulse GPR "ODYAG""

A principle of operation and arrangement of UWB antenna system which differs from other with very high frequency independent electromagnetic decoupling are described in the paper. Peculiar design of the antenna makes it possible to use it in two different modes-horizontal scanning mode and accurate definition of local object location mode. The antenna system is designed for the ground penetrating radar ldquoODYAGrdquo monitoring of subsurface structure of asphalted roads. [C370]

"Reconfigurable reflectarrays based on RF MEMS technology"

Innovative and high-performance antenna systems are required by the increasing demand of bandwidth and service quality in modern communication systems, as well as in a number of industrial applications. At the same time, new technologies and devices are emerging to comply with such specifications. Thanks to their inherent low costs and high performance, RF-MEMS can potentially bring in completely new classes of tuneable devices and circuits for RF applications. This paper focuses on the possible use of RF-MEMS in beam scanning antennas and particularly in reconfigurable reflectarrays. After reviewing some of the basic principles of such systems, two projects recently carried out in the framework of the AMICOM Network of Excellence are described. Besides the general features of these antennas, currently under test, the innovative single wafer architecture and the relevant packaging issues are specifically addressed. [C371]

"Design and fabrication of a 100 GHz channel-drop filter"

We have designed and are fabricating a novel passive mm-wave spectrometer based on a photonic band gap (PBG) channel-drop filter (CDF). There is a need for a compact, wide-band, versatile and configurable mm-wave spectrometer for applications in mm-wave communications, radio astronomy, and radar receivers for remote sensing and nonproliferation. The CDF spectrometer was designed to operate in the frequency range of 90-130 GHz. We have manufactured a single proof-of-principle channel-drop filter. The manufacturing process involved etching the rods on a silicon wafer and then bonding them to metallic plates. The initial testing results for the filter will be presented here. Research is also underway to explore alternative configurations of the CDF, including one with metallic rods. [C372]

"Search and control of state of people under avalanches"

In the article principles of design of system for search people under avalanches which is equipped with sensor for determination of heart rhythm of people are discussed. Measuring of heart rhythm of people is possible due to Doppler effect. Detachment of Doppler frequency is based on homodyne method of conversion of signal. [C373]

"Angle estimation with adaptive arrays in strong mainbeam interference fields"

A method of estimating the angle of arrival of a signal at an array antenna in a strong mainbeam interference environment is outline. The development is based on a maximum likelihood estimator and leads naturally to adaptive sum and difference beams which null the strong main beam interference. A measurement of the interference covariance matrix is presented in this paper. And an angle-scan algorithm, which has two principles, is shown to perform well in the presence of main beam interference with the experimentally derived data. [C374]

"Refractivity from sea clutter applied on VAMPIRA and Wallops' 98 data"

For coastal and ship-borne survey radars, coverage prediction is a critical question. In sea environment, the spatial variations in temperature conditions involve refractive index gradients and create atmospheric ducts. These events modify the radar coverage in the lower troposphere. A means to retrieve the refractive index gradients in the low troposphere is to use the Refractivity From Clutter (RFC). The principle of RFC is to compute the propagation factor from the radar received power, thus to process it in order to retrieve the refractive index profiles. In this paper, the RFC is applied on data obtained from VAMPIRA and Wallopspsila98 measurement campaigns. Since refractive index quickly varies, fast inversion methods based on a pre-generated database of propagation factors are used. [C375]

"Study on simulation of signal processing system of space surveillance radar"

This paper simply introduces the structure and working principles of one space surveillance radar simulation system, and analyzes the signal processing (SP) simulation system. In order to improve the radarpsilas ability to detect multiple targets and keep the false alarm probabilities constant, 2D-OS-CFAR and Clutter-Map CFAR are

adopted as the algorithms of CFAR, and the detection threshold coefficient of OS-CFAR is studied and modified. Finally it gives the simulation results. The results show that the signal processing sub-system can detect the targets and their position, velocity exactly. And it can also satisfy the need of detecting far target, high measuring precision, the ability of detecting multi-targets and the false alarm probabilities in heavy clutter background. [C376]

"A new adaptive displaced phase centre antenna processor"

Employing the principle of displaced phase centre antenna (DPCA) and the model of autoregressive (AR) processing, we construct an optimal adaptive DPCA processor for moving target detection in airborne phased array radar data collected under non-DPCA conditions. The proposed processor is fundamentally different from the existing ADPCA which is not optimal. The number of range samples needed to estimate its parameters is only approximately twice the number of antenna elements, significantly less than the number required by the conventional space-time adaptive processing (STAP) and other algorithms. Computationally it only requires 5-10% the cost of STAP. The processor has been tested using both simulated and measured airborne phased array radar data. With ample samples, its performance approaches optimum. In the case of a reduced number of samples, it considerably outperforms STAP and the other algorithms examined. [C377]

"The post-war development of fighter radar in Europe-A British perspective"

This paper, focusing on fighter radar, covers the period of indigenous development that followed the British wartime expedient of reliance on US industry, particularly for airborne equipment. To set the story in context, the wartime history and the U.S. connection has to be sketched, since it provides important support to the theme, though it is not central to it. At each stage of development, the enabling technical principles are discussed in a historical context. It is important that younger people entering the field today have a link with the subject origins and that is the main motive behind the paper. It is intended as a light introduction, not as a definitive history. It is about inspiring enquiry and providing linkage, not about settling historical controversy. One value of history is the projection that it supports. As a basis for this, the importance of the three PRFs in configuring the coherent pulse train for air intercept is illustrated. The European evolution of active array implementation is discussed and quite naturally, the paper ends on prediction of European emphases for the next two decades in the field. [C378]

"Reduced-Rank Detection for Hybrid Direct-Sequence Time- Hopping UWB Systems in Nakagami-m Fading Channels"

This paper investigates and compares the performance of hybrid direct-sequence time-hopping (DS-TH) ultrawide bandwidth (UWB) systems using full-rank and various reduced-rank detections when minimum mean-square error (MMSE) principles are applied, while communicating over Nakagami-m fading channels. In addition to the full- rank MMSE detection, three classes of reduced-rank MMSE techniques are investigated, which are derived based on the principles of principal components (PC), cross-spectral metric (CSM) and Taylor polynomial approximation (TPA), respectively. Our study and simulation results show that the reduced-rank techniques constitute a family of promising detection techniques for UWB systems, which are capable of achieving similar bit error rate (BER) performance as the full-rank detection, while with a detection complexity that is significantly lower than that of the full-rank detection. [C379]

"Validation of rain attenuation time series synthesizers for temperate area-on the enhanced Maseng-Bakken model"

To develop and test real time fade mitigation techniques control algorithms, propagation time series are needed. An alternative to using real data collected from propagation experiments is to generate typical fading time series making use of climatological characteristics as well as geometrical and radio-electrical parameters of the link. The aim of the study presented in this paper is to validate time-series synthesisers relying on an enhanced Maseng-Bakken model for temperate areas. In the first part of this paper, the basic principles of the Maseng-Baken model are recalled and the parameterisation of this channel model is discussed for temperate climates. Then, Ka band beacon data collected in European and in North-American areas are used: on the one hand to retrieve the input parameters of the channel models and on the other hand to test them with respect to long-term statistics. The results of this testing analysis constitute the second part of this paper. [C380]

"Advance visualization of inner concrete structure using micro-wave subsurface radar"

In this report, an improved signal processing procedure with a novel measurement system is considered for advanced visualization of inner concrete structures. In order to visualize the inner concrete structures more exactly in an efficient way, a 2-step search procedure is proposed by developing an antenna scanning system

which can be scanned on an arbitrary route manually and estimate its self-position automatically. In the first step of the procedure, the antenna is scanned arbitrarily on a concrete in order to visualize approximate arrangement of the inner structure by applying the principle of synthesis aperture. Then, in the second step, the antenna is scanned straightly across the buried objects respectively, in order to visualize detailed attributes such as exact positions or materials of the buried objects by an advanced signal processing method. Evaluation of the proposed signal processing procedure has been carried out experimentally by observing a concrete test specimen, which imitates a part of general concrete wall, and finally, fundamental effectiveness has been confirmed. [C381]

"A method of separating target from cluster by polarization in unknown and time-varying circumstance"

This paper discusses a method of recognizing target from unknown and time-varying cluster in polarization domain, by receiving from both vertical and azimuth channel of full polarization radar. First, the principle of the cluster removing algorithm, the determination of original parameter and calculating step are presented. Then, the signal after being removed cluster is simulated, and the result justifies the affectivity of the algorithm. In the end, the polarization characteristic of target is gained from the echo wave, and in further the recursive algorithm is proposed, which is confirmed by simulation. [C382]

"Replacing the pulse compressing by FRFT on imaging processing with real raw data of SAR"

Fractional Fourier Transform (FRFT) has been widely used in chirp signal processing. This paper is based on the former research work and realized a FRFT application on the imaging processing with real raw data of Synthetic Aperture Radar (SAR.) It connected the fast discrete computation of FRFT and explained the principle of pulse compression in FRFT processing. Comparing with the classical pulse compression, FRFT has the similar processing expect a different modulation window, which brings equivalent performance in Signal to Noise Ratio (SNR) and lower sidelobe. Then a linear low pass filter was designed to utilize this character and restrain the great shading effect. This easy but effective method managed to replace the range pulse compression processing by FRFT, which was proved by the result with real raw data. [C383]

"The design and detection of signature sequences in time-frequency selective channel"

In a slot-synchronized wireless communication system, a set of signature sequences can be derived by circularly shifting a base sequence with good auto correlation properties. In a time-dispersive channel, the sequences with different circular time shifts can be uniquely identified as long as their minimum separation in time is greater than the channelpsilas maximum delay spread. In this paper, we extend this approach further to the Doppler domain by introducing an additional circular frequency offset to the delay shifted sequences. When the base sequence is carefully designed through applying some delay-Doppler radar signal design principles, the results of this two-dimensional generalization are a much larger set of sequences with better correlation properties than some existing designs. Moreover, the new design is also suitable in channels that are both time and frequency selective as long as the minimum Doppler separation of the sequences is greater than the channelpsilas maximum Doppler spread. The detection of the sequences essentially consists of correlating the received signal with all valid hypotheses, and can be carried out efficiently if the base sequence is properly designed. Simulation results show that given a sequence length that is large enough, exact number of multiple devices can be accurately detected in very challenging conditions with a single threshold test. [C384]

"Narrowband MIMO radar imaging with two orthogonal linear T/R arrays"

Based on the spatial convolution principle of multi-input multi-output (MIMO) radar, the distribution of two orthogonal linear transmit/receive (T/R) arrays is designed. With this array structure, a two-dimensional (2-D) imaging method for narrowband MIMO radar is proposed. The simulation shows that this array can provide about the same imaging resolution but uses fewer antennas compared with a planar receive-only array. [C385]

"Study on range window in HPRF Stepped Frequency radar system"

High pulse repetition frequency (HPRF) Stepped Frequency radar can achieve both unambiguous velocity and high resolution ranging in a single dwell, but it need the range window to detect the different interval. This paper presents the principle of range window for Stepped Frequency radars working in the mode of HPRF. The influence of range window on the high range resolution (HRR) profile is analyzed in detail and we have found that the range window may cause a coupling time shift in HRR profile of the target, which may lead to range aliasing. As a solution to this problem, several constraints on the system parameters are proposed. The effectiveness of the proposed method is verified by simulations. [C386]

"Double-IF quadrature demodulation of super-heterodyne radar receiver"

In radar, sonar and communication applications, and especially in all-digital receivers and software radio systems, baseband in-phase and quadrature (denoted by I and Q) components are usually needed. In a super-heterodyne radar receiver, the conventional method to obtain quadrature components of signals is to multiply the original signal with a complex exponential. In this paper, the fundamental principles of obtain digital quadrature components of the super-heterodyne radar receiver are introduced. Double-IF quadrature demodulation topology is synthesized and fully analyzed in this paper. [C387]

"The hardware platform design for DRFM system"

The hardware platform design for digital radio frequency memory (DRFM) is the analogue-digital combined circuit with high speed data transfer speed, and the design quantities of the hardware platform significantly affect the overall performance of the whole system. The hardware requirement for general purpose DRFM system is analyzed and the hardware architecture based on FPGA and DSP techniques is proposed. The general principle for high-performance hardware design is withdrawn based on the engineering implementation experience. The entire design example with high speed data sample rate and real-time modulation ability is illustrated, and several important circuits example is given. The ideal performance of the example board guarantee the correctness of the design idea, and the concept stated in the article is valuable for implementation reference. [C388]

"Improved RMA based on Nonuniform Fast Fourier Transforms(NUFFT's)"

Range Migration Algorithm (RMA) can perfectly fulfill the focusing of the whole scene under the condition of wide aperture and large squint angles. However, Stolt interpolation is needed in regular RMA and is time-consuming. In this paper, an improved RMA algorithm based on Nonuniform FFT (NUFFT) is developed for SAR imaging. NUFFT is substituted for the Stolt interpolation and range IFFT in the improved RMA. In this work, the principle of NUFFT and its implemented steps are analyzed in detail first. Then SAR echo signal model is introduced including the geometric model and the expression of echo signal in both time and frequency domain. Besides, algorithm flow of Regular RMA and the improved RMA based on NUFFT are given. Simulation based on SAR echo model is performed and imaging effects are compared in different squint angles. Numerical simulations illustrate the performance of the improved method. The improved RMA based on NUFFT can satisfy both the imaging precision and computation efficiency. [C389]

"Asymptotic theory of local maximum of back scattering from thin conducting polygon with large dimensions"

Let plane electromagnetic wave is incident on thin conductive polygon with large, in compare with wavelength, dimensions. The problem is to determine the back scattering from this polygon. A possible asymptotic solution is suggested by the problem geometry-in the context of geometry diffraction theory (GDT). A field scattered by polygon may be considered as a superposition of ray fields of three types. First, in accordance with geometry optics principle, the incidence ray is reflected from plane surface of polygon. Second, diffraction rays arise from rectilinear edges of polygon. Both types of the rays are well known. Finally, it should be added the rays from the tops of polygon. [C390]

"Providing basic data for the wood segment of GEOUA-information service system "leskosmos" (Forest-UA)"

On the stage of elaboration of Forest-UA system, as a wood segment of GEOUA national program, the following remote sensing principles should be realized: synchronous remote and necessary field measurements of the surface and meteorological parameters; repeated observations in order to estimate changeability of the surface reflective properties and increase detection reliability; using aprioriinformation about the surface reflective properties from contrasting schemes. [C391]

"Coherent multilateration systems"

Passive coherent location systems using ldquotransmitters of opportunityrdquo like radio or TV broadcasters, GSM base stations, satellite communication and GNSS signals has reached a substantial attention in the last years. In this paper the coherent location system, based on bistatic radar principle with multiple non-cooperative transmitters is described and various aspects of signal processing and signal parameters are discussed. [C392]

"Remote sensing of urban areas from polarimetric SAR data using Time-Frequency and spectral

analysis methods"

This article presents two complementary approaches for the study of urban areas using polarimetric and interferometric SAR (POL-inSAR) data. A multidimensional linear Time-Frequency (TF) decomposition is used to analyze the intrinsic polarimetric behavior of different components of an urban area. A TF signal model, adapted to the case of urban areas, is proposed and studied using relevant statistical descriptors. A TF classification procedure is introduced to retrieve building location and characterize their polarimetric response, and applied to fully polarimetric SAR data acquired by the E-SAR sensor at L-band. Multiple POL-inSAR signals, acquired from different positions, are used to estimate the height of buildings using the interferometry principle. High-performance array signal processing techniques are adapted to the case multi-baseline POL-InSAR (MBPI) observations, in order to enhance the height estimation of scatterers by calculating optimal polarization combinations and determining their scattering characteristics. These multidimensional spectral estimation methods are shown to resolve the building layover problem by extracting and analyzing two components within one azimuth-range resolution cell. [C393]

"Thermo-mechanical pre-optimisation of radar sensor design by means of FEA and microDAC measurements"

More and more dense packaging is one of the most important challenges in advanced electronics and micro technology, driven by requirements like low cost and high reliability. One way to meet these demands is to follow the so-called ldquochip in duromerrdquo approach, which allows an extremely dense integration and very short interconnects. Already in the very first design phase of advanced products, numerical studies by means of finite element analyses (FEA) are very efficient to check the desired properties regarding functionality as well as reliability aspects. This has been carried out with a new generation of active distance control (ADC) devices for automobiles, based on a radar principle. In order to obtain sufficiently flat modules for subsequent manufacturing steps, thermally induced deformations were measured at suitable specimens by means of the microDAC technique, developed by CWM GmbH Chemnitz and Fraunhofer IZM. Combining FE analyses and measured deformations, a methodology was developed which can be generalised and applied to many design procedures before any real parts are available [1]. It is helpful to reduce cost and time-to-market for future products by minimising real tests and an expensive redesign. [C394]

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"An Oblique Projection Polarization Filter"

Based on the oblique projection operators, a novel method for interference suppressing named oblique projection polarization filter (OPPF) in the polarization domain is proposed, which is valid for nonorthogonal polarization filtering or projecting. After discussing the fundamental principle of the proposed OPPF in detail, simulation results are given to illustrate the suggested scheme is suitable for canceling the interference in radar and other systems even if the polarizations between the target signal and interference are not exactly orthogonal. [C396]

"Human Resource Development Based on Wuli-Shili-Renli Systems Approach"

The Chinese terms, Wuli, Shili and Renli emerged in the end of 1970s in some papers on organizational management and systems engineering. And the combination of three lis into WSR systems approach was in the end of 1994. After a brief introduction of the origin and basic ideas of WSR approach, based on the analysis of its application in human resource development, this paper builds three-dimension model including Wuli, Shili, and Renli and performance functional model. Furthermore, with regard to polyphyly of developers, this paper has a selective analysis of Renli related factors such as developers and their relations, and provides theoretical basis

and guiding principles for human resource development. [C397]

"Contact-less capacitive tuner for microwave comb-line mechanically-tuned filter"

The paper presents an approach to avoiding the problem of obtaining the electrical contact in typical tuners for stripline-based combline filters. The tuner structure shown here does not require any electrical contact and is based on the concept of the cylindrical capacitor with a sliding inner part. The idea of the construction and working principle are shown together with a simulation and measurement results for a manufactured model of 5thorder combline L-band filter. [C398]

"A technique of stabilizing FDTD-subgridding algorithm using reciprocity principle"

This paper shows the application of reciprocity principle in stabilization procedure for finite difference time domain (FDTD) schemes containing locally refined meshes. The method, originally proposed only for verification of stability of FDTD-subgridding algorithms, allows one to change coupling factors between boundary field samples in such a way, that the resulting scheme will be stable. The presented methodology is verified by numerical tests confirm the stability of a modified subgridding algorithm. [C399]

"Analysis of Luneburg lenses using domain decomposition method"

In this paper a method of electromagnetic analysis of Luneburg lenses is presented. The method combines three techniques, namely volume-integral equation/method-of-moments (VIE/MoM), the domain decomposition method (DDM) based on the surface equivalence principle, and the body-of-revolution (BoR) scheme. It is shown that application of DDM allows the user to pre-compute, or partially solve the computationally expansive sub-problem, involving volume formulation, and then put it into an external configuration of excitations, where only a relatively small linear set resulting from surface formulation has to be solved. [C400]

"1.5 kW S Band Transmit Module"

The paper describes S-band transmit modules designed for use in an active phased array and solid state radar transmitter. Brief principles of its operation are described and electrical and mechanical information are presented. Main parameters of transmit module are shown in the form of characteristics. Results of measurements in wide range of the ambient temperature are presented as well. Basing on the obtained results, conditions of transmit module operation are defined. [C401]

"Tapered PIFA antenna for handsets terminals"

A new compact PIFA applicable to PCS system is described. The principle aim in design is to broaden the bandwidth within limited body thickness of mobile phones. To overcome the narrow bandwidth characteristics that is typical of a patch antenna a type of tapered patch is employed. The antenna is designed using Zeland Software Ltd and its characteristics are compared with a basic PIFA with similar volume. For WLAN lower 1.8 GHz-band, bandwidth of about 14 to 16%, and gain 2.2 dBi were achieved. [C402]

"Frequency domain measurements for an UWB imaging system"

Paper presents the evaluation of the frequency domain measurements applied to an ultra-wideband (UWB) imaging system. Principle of the system operation consist in revolving the object under test and recording reflected signals for subsequent angles of rotation. Approach discussed herein is based on the frequency domain measurements. After transformation to time domain, the approach becomes almost equivalent to a time domain one. [C403]

"Identification of frequencies and amplitudes of microwave simultaneous signals by means of IFM methods"

The basic specification and principle of operation of instantaneous frequency measurement IFM receiver based on microwave frequency discriminator MFD utilizes interferometric techniques is presented. Simultaneous signals measurement error was calculated. The method of measurement of parameters of signals coincident in time was proposed. This method uses only two parallel MFDs aided by digital processor. The processor evaluates two pair of IQ components, which the next build the digital image in form of the constellation diagram. The analysis of this constellation gives correct information about frequencies of each of simultaneous signals and about their amplitudes as well. The image processing or database techniques can be used for this analysis. [C404]

"Circular array of triangular patches as filter"

This paper proposed a microstrip circular array antenna consist of 8 triangular patches work as a filter for weak signals (noise) and undesired signals in L-band of microwave frequency. This array has been designed on YIG substrate which works on the principle of inverse dynamic nonlinearity of magnetostatic waves in ferrite substrates. The proposed antenna structure is suitable for mobile communication system. [C405]

"Optimization of the end-fire beam pattern of two-dimensional dipole array"

We have laid down the optimization guidelines for the scanning of the beam-pattern in the azimuth direction. The procedure of selecting the initial values by using the principle of reciprocity followed by the local optimization is more suited to this application as it gives an accurate value with less iteration. We also show that phase-only technique which is relatively easier to implement is applicable within the two ends of the scan range which provides almost the same quality of beam-pattern compared to the both phase and amplitude technique. [C406]

"High-resolution 3-D imaging algorithm without derivative operations for UWB through-the-wall radars"

We proposed a modified envelope as high-resolution 3D imaging algorithm for through-the-wall UWB radars. This algorithm utilizes the principle that the target boundary behind the wall can be expressed as an envelope of modified spheres, which are determined from the electric permittivity and thickness of the wall. In numerical simulation, we confirmed that the proposed method achieves higher-resolution 3-D imaging for advanced through-the-wall applications. It is our future task to develop the imaging algorithm with the wall permittivity and thickness estimation. [C407]

"Investigation of radar propagation in buildings: A 10 billion element Cartesian-mesh FETD simulation"

In this paper large scale full-wave simulations are performed to investigate radar wave propagation inside buildings. In principle, a radar system combined with sophisticated numerical methods for inverse problems can be used to determine the internal structure of a building. The composition of the walls (cinder block, re-bar) may effect the propagation of the radar waves in a complicated manner. In order to provide a benchmark solution of radar propagation in buildings, including the effects of cinder block and re-bar, we performed large scale full wave simulations using a finite element time domain (FETD) method. This particular FETD implementation is tuned for the special case of an orthogonal Cartesian mesh and hence resembles FDTD in accuracy and efficiency. The method was implemented on a general-purpose massively parallel computer. In this paper we briefly describe the radar propagation problem, the FETD implementation, and we present results of simulations that used over 10 billion elements. [C408]

"Mapping of the environment with a high resolution ground-based radar imager"

The aim of this paper is to present the potential of microwave radar as a high resolution ground-based imager, in order to build radar maps in environmental applications. A new radar sensor named K2Pi, based on the principle of frequency-modulated continuous wave (FM-CW) is described. In order to build the radar maps, the R-SLAM algorithm has been developed. It is based on simultaneous localization and mapping (SLAM) principles. The global radar map is constructed through a data merging process, using scan matching of radar image sequences. First results obtained in different environments are presented, which show the ability of the microwave radar to deal with unstructured and extended environments, and to build consistent maps. [C409]

"A new anti-collision method for SAW tags using linear block codes"

In this paper a new separation/anti-collision method for simultaneous interrogation of multiple surface acoustic wave identification (SAW-ID) tags is presented. The tags are encoded by means of a linear block code . This approach allows to retrieve lost data caused by destructive superposition of the response signals of multiple tags. Another advantage of this principle is that the IDs of the tags result directly without scanning all possible combinations of tags. A typical application is multi-object tagging in an industrial environment. [C410]

"Detecting ground deformation with Permanent scatterer of Suzhou region"

Permanent scatterer interferometry is one of the latest developments in radar interferometric processing. It is achieved by the analysis of the interferometric phase of the individual point targets that are discrete and temporarily stable natural reflectors or permanent scatterers in long temporal series of interferometric SAR images with one master image. The wrapped phase of a point in differential interferogram can be decomposed to uncompensated topography, target motion in the time between the acquisitions, object scattering phase related

to the path length traveled in the resolution cell, the atmospheric phase accounting for signal delays, the phase caused by imprecise orbit data and additive noise term. Based on this principle, it could bypass the problem of geometrical and temporal decorrelation. Furthermore, by using a large amount of data, atmospheric signal is estimated and corrected for. This paper addresses the how we use the PS-InSAR technology and Differential Interferogram procedure to estimate the velocity of deformation of Suzhou region in the time span 1992-2002. The main processing is done with the GAMMA software. [C411]

"Signal enhancement in a near-field MIMO environment through adaptivity on transmit and polarization diversity"

In this paper a technique is presented on how to enhance the received signals in a near field multi-input multi-output (MIMO) environment where beam forming is not possible. This is done through the use of adaptivity on transmit. Polarization diversity can also be implemented. This technique is based on the principle of reciprocity, is independent of the material medium in which it is transmitting, and incorporates near-field environments and multipath. The objective here is to select a set of weights adapted to each receiver to be applied to each transmitting antenna array, which is a function of the user location, so that the transmitted signal at the carrier frequency may be directed to a particular receiver location while simultaneously minimizing the received signal strengths at other receiver locations. Numerical simulations have been made to illustrate the novelty of the proposed approach. [C412]

"Multilayer time domain transmission line model"

The multilayer time domain transmission line model of ground penetrating radar (GPR) has been described in the paper. It is comprehensive and helpful in understanding basic principles of GPR and its main limitations. What is more one can use the model to simulate effectiveness of the radar in specific situations, as long as it can estimate the layer characteristics for the model. [C413]

"Wearable system-on-a-chip UWB radar for contact-less cardiopulmonary monitoring: Present status"

The present status of the project aimed at the realization of an innovative wearable system-on-chip UWB radar for the cardiopulmonary monitoring is presented. The overall system consists of a wearable wireless interface including a fully integrated UWB radar for the detection of the heart beat and breath rates, and a IEEE 802.15.4 ZigBee low-power radio interface. The principle of operation of the UWB radar for the monitoring of the heart wall is summarized. With respect to the prior art, this paper reports the results of the experimental characterization of the intra-body channel loss, which has been carried out successfully in order to validate the theoretical model employed for the radar system analysis. Moreover, the main building blocks of the radar have been manufactured in 90 nm CMOS technology by ST-Microelectronics and the relevant performance are resulted in excellent agreement with those expected by post-layout simulations. [C414]

"Coherent Ka-band radar with a semiconductor transmitter for airport surface movement monitoring"

The paper outlines the operation principles, technical characteristics and the field tests results of the innovative Ka-band radar for airport surface monitoring. Advantages and disadvantages of operation in the Ka-band with respect to a shorter one, i.e. the W-band, are discussed. It is shown that in the Ka-band the coherent operation regime can be realized. This regime enables one not only to essentially reduce the radiation power to the level provided by the available semiconductor devices, but also to perform moving target detection on a interference created by reflections from surface objects and rain as well as to perform automatic classification of targets according to their radial velocity of movement. Main performance specifications, principle of operation, and design of the innovative antenna developed for the radar are described in details. The results of the field tests confirm the predicted radar operation characteristics. The radars of the proposed type can find use as radar-sensors for systems of airport surface monitoring. [C415]

"Secondary Surveillance Radar: Sparsity-based sources separation in a real environment"

Secondary surveillance radar (SSR) based on multilateration principle and omni-directional antennae are operational today [1], [2]. We proposed several new algorithms to separate a mixture of overlapping SSR replies on a M-elements antenna in previous works [3], [4], [5], [6], other solutions were also proposed in the literature [7], [8], [9]. Unfortunately, a rare event, but important, has not yet been resolved: the impinging of more sources than sensors with an approximate similar time of arrival. This preliminary work studies the use of the SSR sources sparsity property, as in [10], [11], [12]. Real recorded signals in a live environment will be used to

demonstrate the effectiveness of the proposed techniques. [C416]

"Vehicle dynamics estimation for camera-based visibility distance estimation"

The presence of an area with low visibility conditions is a relevant information for autonomous vehicle as far as environment sensing is important regarding safety. In this aim, we develop a generic sensor of visibility using an onboard camera in a vehicle. Our approach consists in estimating the range to the most distant object belonging to the plane of the road having at least 5% of contrast. The originality of this approach lies in the fact that the depth map of the vehicle environment is obtained by aligning the road plane in successive images. This algorithm exploits the dynamics of the vehicle which is given or observed from proprioceptive sensors classically available on public vehicles. In this paper, we present the principle of our approach in terms of image processing and explain how the vehicle dynamics takes part in it with a sensitivity study. [C417]

"High resolution non-destructive testing in civil engineering by ultra-wideband pseudo-noise approaches"

Ultra-wideband sensing provides new and interesting options for testing and inspection in many different fields. The article will deal with some applications for civil engineering. The advantage of UWB-sensing is the good penetration of the sounding waves through the material under test and its high spatial resolution. A flexible UWB-sensor conception will be discussed. Its working principle is based on pseudo-random sounding waves. The examples considered shall indicate the device performance for quite different sensor tasks. [C418]

"Pulsed frequency modulation techniques for high-precision ultra wideband ranging and positioning"

In this paper a novel approach for a high precision local positioning radar using an ultra wideband technique is presented. The concept is based on the standard FMCW (frequency modulated continuous wave) radar principle combined with short pulses to fulfill the emission limits given by the official regulatory authorities. The system combines the advantages of FMCW radar systems and the advantages of the use of a wide bandwidth. With this concept, a high accuracy in dense multipath indoor environments can be achieved, ideally suited for 1D, 2D, and 3D localization. A prototype was fabricated which operates around the center frequency of 7.5 GHz utilizing a bandwidth of 1 GHz. With the setup presented in this paper the distance between two wireless units can be measured achieving a low standard deviation. [C419]

"Delay-doppler ambiguity function of ultrawideband-throb signals"

The performance of ultrawideband (UWB) radar in target detection, resolution, and recognition depends on the structure of the radar waveform. In this paper, the principles of waveform diversity and design (WDD) for generating periodic and orthogonal UWB-impulse signals are described. A mathematical model for a UWB-throb signal that yields the practical advantages of the widely used linear frequency-modulation (FM) ldquochirprdquo signal is presented. The structure of the UWB-throb signal is designed based on a pulse-time modulation scheme. The delay-Doppler ambiguity function of the UWB-throb signal is derived for performance analysis. Computer plots of the UWB-throb signal, its autocorrelation function, and ambiguity function are generated to illustrate its characteristics and advantages for high-resolution impulse radar. [C420]

"Design and implementation of Intelligent Transportation System based on GPRS and Bluetooth hybrid model"

With the development of communication technology, recently, a lot of attempts related to Intelligent Transport System have come forth at home and abroad. Based on the exploration of wireless communication in the intelligent public transport system, a hybrid model of GPRS and Bluetooth is provided which is fast, stable and secure and a new model of intelligent public transportation system is established on the existing transportation model. It introduces the system of composition and working principle, and completes the design and implementation of system. This model of communication has been used in the actual project and has achieved certain results. [C421]

"Advanced multiple objects tracking by fusing radar and image sensor data-Application on a case study."

The aim of this paper is to present a multiple object tracking data fusion technique, which fuses radar, image, and ego vehicle odometry. The data are fused at a high level, which leads to reliable and stable tracking results providing also additional features as width estimation and the detection of stationary objects. A ldquorealrdquo

application of these algorithms is illustrated on a specific use-case: the SASPENCE system, developed inside the Integrated Project PReVENT. The principle results show that such a data-fusion technique is actually able to improve the SASPENCE performances, especially in terms of extension of operative scenarios, a basic issue for the system functionality. [C422]

"Epigenetic sensorimotor pathways and its application to developmental object learning"

A pathway in the central nervous system (CNS) is a path through which nervous signals are processed in an orderly fashion. A sensorimotor pathway starts from a sensory input and ends at a motor output, although almost all pathways are not simply unidirectional. In this paper, we introduce a simple, biologically inspired, unified computational model-Multi-layer In-place Learning Network (MILN), with a design goal to develop a recurrent network, as a function of sensorimotor signals, for open-ended learning of multiple sensorimotor tasks. The biologically motivated MILN provides automatic feature derivation and pathway refinement from the temporally real-time inputs. The work presented here is applied in the challenging application field of developing reactive behaviors from a video camera and a (noisy) radar range sensor for a vehicle-based robot in open, natural driving environments. An internal model of the agentpsilas experience of the environments is created and refined from the ground-up using a cell-centered model, based on the genomic equivalence principle. The outputs can be imposed by a teacher, at the same time as the learning is active. At any time instant, sensory information from the radar allows the system to focus its visual analysis on relatively small areas within the image plane (attention selection), in a computationally efficient way, suitable for real-time training. This system was trained with data from 10 different city and highway road environments, and cross validation shows that MILN was able to correctly recognize above 95% of the radar-extracted images from the multiple environments. The in-place learning mechanism compares with other learning algorithms favorably, as results of a comparison indicate that in-place learning is the only one to fit all the specified criteria of development of a general-purpose sensorimotor pathway. [C423]

"Wideband VNA design with bandwidth 1:53 by multisixport principle"

The paper presents multisixport principle and its benefits above classical sixport. The novel multisixport design is presented in practical example with its parameters as obtained bandwidth and standard deviation of measurement. [C424]

"Performance comparison of target tracking algortihms in underwater environment"

Target tracking is one the most fundamental elements of a radar system. The aim of target tracking is the reliable estimation of a targetpsilas true state based on a time history of noisy sensor observations. In real life, the sensor data may include substantial noise. This noise can render the raw sensor data unsuitable to be used directly. Instead, we must filter the noise, preferably in an optimal manner. For land, air and surface marine vehicles, very successful filtering methods are developed. However, because of the significant differences in the underwater propagation environment and the associated differences in the corresponding sensors, the successful use of similar principles and techniques in an underwater scenario is still an active topic of research. A comparative study of the effects of the underwater environment on a number of tracking algorithms is the focus of the present thesis. The tracking algorithms inspected are: the Kalman filter, the extended Kalman filter and the particle filter. We also investigate in particular the IMM extension to these filters. These algorithms are tested under two representative scenarios. [C425]

"Resolution improvement for UWB wallscanning radar applications"

An important quality criterion of radar systems is the maximum obtainable resolution. This limit is reached when echoes coming from adjacent objects overlap and it is no longer possible to distinguish between them. This paper presents an algorithm formulating the echo separation as an optimization algorithm. The basic idea is to model each received signal as a linear superposition of reference signals. The parameters of the model are obtained by using evolutionary optimization strategies. An example of imaging two pipes placed in a concrete wall verifies the proposed principle experimentally. [C426]

"A four channel 24-GHz FMCW radar sensor with two-dimensional target localization capabilities"

The measurement of different target parameters using radar systems has been an active research area for the last decades. Particularly target angle measurement is a very demanding topic, because obtaining good measurement results often goes hand in hand with extensive hardware effort. Especially for sensors used in the mass market, e.g. in automotive applications like adaptive cruise control this may be prohibitive. Therefore we address target localization using a compact frequency-modulated continuous-wave (FMCW) radar sensor. The angular measurement results are improved compared to standard beamforming methods using an adaptive

beamforming approach. This approach will be applied to the FMCW principle in a way that allows the use of well known methods for the determination of other target parameters like range or velocity. The applicability of the developed theory will be shown on different measurement scenarios using a 24-GHz prototype radar system. [C427]

"Method for high precision local positioning radar using an ultra wideband technique"

In this paper, a novel approach for a high precision local positioning radar using an ultra wideband technique is presented. The concept is based on the standard FMCW (frequency modulated continuous wave) radar principle combined with short pulses to fulfill the emission limits given by the official regulatory authorities. With this concept, a high accuracy in dense multipath indoor environments can be achieved, ideally suited for 1D, 2D, and 3D localization. A prototype was built which operates around the center frequency of 7.5 GHz utilizing a bandwidth of 1 GHz. With the setup presented in this paper the distance between two wireless units can be measured achieving a low standard deviation. [C428]

"An incoherent simulator for the SHARAD experiment"

SHARAD (shallow radar) is a sounder and altimeter with synthetic aperture radar (SAR) capability provided by the Italian Space Agency (ASI) as a Facility Instrument to NASApsilas 2005 Mars Reconnaissance Orbiter. Primary objective of this nadir-looking sounder is to map Martian surface and subsurface down to several hundred meters depth with vertical resolution of 15 m and horizontal resolution of a few hundred meters (300 m-1 Km). In this paper we are going to present an incoherent simulator for the surface echoes received from SHARAD that utilizes only geometrical projections and the operating principle of the synthetic aperture radar. Making use of a convenient model of the Martian surface, our simulator is an important instrument for discriminating subsurface echoes from clutter artifacts. [C429]

"A Public Database of Simulated Multidimensional SAR Data for Techniques Validation"

This paper presents a new benchmark for techniques validation based on a multidimensional database of simulated data. By exploiting a SAR simulator of complex targets, series of numerical simulations may be run for specific sets of observation conditions and the results made public. Targets are in principle focused on urban structures, despite any other type of man-made targets may be considered. User interaction has allowed to fix the range of values for some design parameters according to the experience gained with real data. Multi-baseline polarimetric SAR interferometry and SAR tomography are the techniques for which this benchmark has been initially conceived, despite other research areas may also benefit, as multi-temporal or multi-frequency analysis. With the resulting amount of images, an adequate testing set can become available for multidimensional methods, which validation with real imagery is difficult. [C430]

"Research of system of energy recycling on Rubber-Tyred Gantry crane"

In order to solve the problem that the existing rubber-tyred gantry (RTG) crane consumes massive generating/braking energy through resistance, produces plenty of heat, causes excessive fuel consumption and exhaust emission during working, the relation of energy flows of the existing system is analyzed and the value of the improvement of energy-saving is confirmed in the paper. The constitution and principle of the RTG energy recycling system are proposed. The topology and principle of the bi-directional DC/DC converter are anatomized. The method of voltage balance and the result of simulation of storing-energy supercapacitors are given in the end. [C431]

"Kernel bandwidth estimation in methods based on probability density function modelling"

In kernel density estimation methods, an approximation of the data probability density function is achieved by locating a kernel function at each data location. The smoothness of the functional approximation and the modelling ability are controlled by the kernel bandwidth. In this paper we propose a Bayesian estimation method for finding the kernel bandwidth. The distribution corresponding to the bandwidth is estimated from distributions characterizing the second order statistics estimates calculated from local neighbourhoods. The proposed bandwidth estimation method is applied in three different kernel density estimation based approaches: scale space, mean shift and quantum clustering. The third method is a novel pattern recognition approach using the principles of quantum mechanics. [C432]

"A Real-Aperture Radar for Ground-Based Differential Interferometry"

Satellite interferometry has been used extensively for ground-motion monitoring with good success. In the case of landslides, for example, space-borne SAR interferometry has a good potential to get an overview on the slope

stability. The role of a space-borne INSAR as an element in a landslide or rock fall warning system is constrained by the specific space-borne SAR imaging geometry, the typical multiple-week repeat-interval, and uncertainties in the data availability. Most of these limitations can be overcome with an in-situ radar imaging system. GAMMA has developed a portable radar interferometer that utilizes real-aperture antennas to obtain high azimuth resolution. Images are acquired line by line while rotating the transmitting and receiving antennas about a vertical axis. Phase differences between successive images acquired from the same location are used to determine line-of-sight displacements. The instrument operates at 17.2 GHz and has measurement sensitivity better than 1 mm. The instrument uses two receiving antennas with a short baseline to form an interferometer. Phase differences between simultaneous acquisitions by these antennas are used to calculate the precise look angle relative to the baseline, permitting derivation of the surface topography. Expected statistical noise in the height measurements is on the order of 1 meter. In this contribution the design, measurement principles and characteristics of GAMMA's Portable Radar Interferometer (GPRI) are presented. [C433]

"Doppler Parameter Estimation for Single-Channel SAR Moving Target based on a Novel Model in Complex Image Domain"

In order to characterize the signal of moving target in complex image domain (CID) of synthetic aperture radar (SAR), this paper deduces the model of moving target based on Range-Doppler imaging algorithm and stationary phase principle (SPP). In CID, the target approximately modeled as a linear frequency modulated signal (LFM), which has a great improvement in signal-clutter ratio (SCR), and distributes as mis-located segment in the 2D image. The center and slope of the segment is determined by the Doppler center and Doppler ambiguity integer. Meanwhile, the spreading length is jointly determined by the azimuth velocity and Doppler ambiguity integer. Furthermore, this paper derives the Cramer-Rao Bound (CRB) of parameter estimation in CID. At last, numeric experiments is made to approve the conclusion. [C434]

"Application of Spatial Spectrum Estimation Technique in Multibaseline SAR for Layover Solution"

Spatial spectrum estimation technique is applied to resolve layover effect with multi-baseline synthetic aperture radar (SAR) in the paper. Based on the signal model of multi-baseline SAR, the mathematical principle of layover solution with spectrum estimation is derived. The main steps of spatial spectrum estimation technique for layover solution in multi-baseline SAR are obtained. In order to deal with the spectrum ambiguity problem generated by FFT method under limited multi-baseline SAR data, we introduce the Yule-Walker method for spectrum estimation to resolve layover effect. We analyze the principle of Yule-Walker method for performance improvement, and give the processing steps using Yule-Walker method for layover solution in detail. The simulation results for layover solution with FFT method and Yule-Walker method are realized and compared. [C435]

"A new bistatic-based sparse linear array 3D imaging SAR model"

A bistatic-based sparse linear array three dimensional (3D) imaging SAR (BSLASAR) is demonstrated and its resolution characteristic are analyzed in this paper. First, the principle of the BSLASAR is presented, the echo model is build and the imaging condition of BSLASAR is derived. The 3D BP (back projection) algorithm is introduced to focus the 3D SAR data. Then 3D PSF is analyzed, and the 3D spatial resolution expressions of BSLASAR are obtained. It is proved that the 2D horizontal PSF can be decomposed into two independent 1D PSF, the along track (AT) PSF and the cross track (CT) PSF, when the linear array direction is perpendicular to the AT direction. Compared to other configurations, this system inherits the advantages of conventional bistatic SAR and has these additional advantages: the receiver antenna phase center (APC) control precise is more flexibility than the curved SAR (CSAR), the hardware expenditure is saved and the couples between the elements are avoided. [C436]

"79GHz automotive short range radar sensor based on single-chip SiGe-transceivers"

Today automotive short range radar sensors are only available for the 24 GHz band. But in the EU the production of ultra-wideband sensors is limited to 2013 for the 24 GHz band, after 2013 the 79 GHz range must be used. This was the impact to develop a single-chip SiGe RF-transceiver for the 79 GHz-band on InfineonГ‚Вїs B7HF200-Process with transition frequencies above 200 GHz. The power spectral density limit of -9 dBm/MHz for the 79 GHz-band is much higher than the -41.3 dBm/MHz limit for 24 GHz. Therefore the built prototype is a FMCW radar and no pulse radar in order to achieve a higher Signal-to-Noise Ratio. The required frequency ramp generation according to the FMCW-Principle is realized without a Phase Locked Loop(PLL), but by controlling digitally the tuning voltage of the VCO with help of a D/A-converter. The non-linearity of the VCO tuning law is compensated by measuring the frequency of the divider signal. Two bistatic transceiver variants have been realized: ATRX2 has one transmit and three receive channels, while ATRX3 has two switchable

transmitters and two receivers. An RF-board has been designed for each chip, where low-cost patch antennas have been applied, optimized for a short range system. In the following the configuration for both chips is explained and measurement results are presented in order to demonstrate the angle detection capabilities. [C437]

"An approach for passive radar using a smart antenna system"

An antenna without phase center system used for DOA estimation and beam steering was introduced in. In the radar problem, the antenna can receive the signals scattered from a moving target. In this paper, an approach for passive radar using a smart antenna system is introduced. We assume that the primary transmitted signal comes from a known fix voice broadcasting station. The principle of the passive radar are presented. [C438]

"Edge Detection in Speckled SAR Images with Improved ROEWA"

Automatic detection of sustained intensity changes (edges) in SAR images for applications requiring localization and identification of objects is complicated by the nature of the speckle. The speckle is characterized by a high degree of correlation and multiplicative signal dependence. Ratio based detectors like MRoA and RGoA edge detector use predefined thresholds. The modified RGoA detector defines an automatic threshold determining method. But all these edge detectors, apart from detecting the object edges, detect a number of false edges. In this paper, a new ROEWA based algorithm that automatically discriminates the object boundaries and the false edges is proposed. Otsupsilas nonparametric and unsupervised principle for automatic threshold selection is introduced in this classification process. An optimal threshold is selected by maximizing the seperability of the classes in gray level. Real SAR images are used to verify our method and the results are compared with the existing methods for edge detection. Experimental results show that the proposed method is robust and efficient. [C439]

"79GHz Automotive Short Range Radar Sensor based on Single-Chip SiGe-Transceivers"

Today automotive short range radar sensors are only available for the 24 GHz band. But in the EU the production of ultra-wideband sensors is limited to 2013 for the 24 GHz band, after 2013 the 79 GHz range must be used. This was the impact to develop a single-chip SiGe RF-transceiver for the 79 GHz-band on Infineon's B7HF200-Process with transition frequencies above 200 GHz. The power spectral density limit of -9 dBm/MHz for the 79 GHz-band is much higher than the -41.3 dBm/MHz limit for 24 GHz. Therefore the built prototype is a FMCW radar and no pulse radar in order to achieve a higher signal-to-noise ratio. The required frequency ramp generation according to the FMCW-principle is realized without a phase locked loop(PLL), but by controlling digitally the tuning voltage of the VCO with help of a D/A-converter. The non-linearity of the VCO tuning law is compensated by measuring the frequency of the divider signal. Two bistatic transceiver variants have been realized: ATRX2 has one transmit and three receive channels, while ATRX3 has two switchable transmitters and two receivers. An RF-board has been designed for each chip, where low-cost patch antennas have been applied, optimized for a short range system. In the following the configuration for both chips is explained and measurement results are presented in order to demonstrate the angle detection capabilities. [C440]

"Millimeter-wave imaging of dielectric objects using first order scattering models"

For the reconstruction of scattering centers using the synthetic aperture radar principle the radiating reflector model is assumed. This means that a scattering object can be described by a number of discrete scattering centers. For the case of a penetrable object the assumption is not necessarily fulfilled. A comparison of simple metallic and dielectric bodies using a numerical field simulator to generate the scattered field of them can help to point out the different scattering behaviour and the consequences for the applied reconstruction techniques. Furthermore a validation of these observations with a MMW-sensor measuring objects of different permittivities is shown. [C441]

"K-band/S -band satellite transponder system for on-orbit evaluation of LTCC technology"

A satellite transponder for on-orbit verification of LTCC packaging technology at K-band/S -band is presented. The system up-converts a received signal at 2 GHz to 22 GHz and down-converts to the transmit frequency of 2.2 GHz. We discuss the system concept needed to evaluate K-band LTCC components by means of S -Band signaling. As a proof-of-principle a basic transponder system including some housekeeping electronics is analyzed in terms of conversion characteristic and spectral output. [C442]

"Position finding based on multiple doppler sensors"

Nowadays knowledge about the position of persons indoors is relevant for a huge number of problems. An

increasing number of modern applications and services is based on information referring to the users actual position and in some cases also on its velocity. In addition to these location based services also safety and security relevant tasks require these informations, e.g. critical infrastructure (CI) or small area surveillance. In outdoor scenarios the GPS-System is often used, but not all of the already existing wireless infrastructure is capable of providing the position information needed, especially in indoor environments. For this case several approaches can be found in the literature. Most of them adopt the GPS-principle thus needing additional infrastructure and objects actively participating in the position finding task. We will present a system that is based on doppler measurement and only analyses a relative distance information between the object to be detected and four very basic sensors. Therefore no cooperation of the object is needed which is very important for the mentioned security relevant applications. The design of a 4-channel demonstration system will be shown and practical results obtained with this demonstration system will be given. [C443]

"System modeling for active MM-wave imaging systems using an enhanced calculation method"

This paper describes an enhanced calculation method based on the Huygenspsilas principle for characterizing and optimizing system behavior for millimeter-wave imaging systems. The method will be described in mathematical details and the results will be illustrated with images. To further illustrate the scopes of the modeling approach, some images will be presented to show aberration changes in opposition to the lens size. [C444]

"Turbo Speckle Filtering applied to PolSAR Data"

A new approach for speckle reduction in polarimetric synthetic aperture radar (PolSAR) images based on the turbo iterative principle is proposed. The turbo iterative algorithm shows high performances due to the propagation of the information between two complementary filters. One filter can boost up the results of the other by processing its residue image and retrieving valuable information in the noise subspace. [C445]

"Some results of radar signal processing in time microscale"

The process of radar signals recognition is mainly based on deinterleaving process of signal time parameters. Signal spectrum recently has became a very distinctive radar signal feature. Within this subject frequency modulation on pulse (FMOP) is a very good descriptor of signal. The most popular and obvious method is application of digitising technique and specialized software performing fast Fourier transform. Such an approach of signal spectrum evaluation is relatively easy when signal is not limited in time. The problem is when short pulsed radar signals are discussed. Facing with that problem the paper presents a wideband signals compression principle using surface acoustic (SAW) dispersive delay lines (DDL), to measure instantaneous spectrum of short pulsed radar signals. Compressive receiver concept has been introduced and its relation to time frequency analysis has been presented. Basic theory of problem is described and experimental results are presented. [C446]

"Characterization of microwave anisotropic thin radar absorber using artificial magnetic ground plane"

In this paper, the characterization of a low profile thin radar absorber based on the high impedance surface (HIS) principle is demonstrated. The absorber consists of an artificial magnetic ground plane placed 0.03 lambdaobehind the anisotropically resistive-elements interconnecting a textured surface of square patches. [C447]

"Pressure sensing approach based on electromagnetic transduction principle"

In this paper a new type of low cost, smart and high sensitivity pressure micro-sensor is designed based on electromagnetic transduction principle, which can be used for long distance covering measurement. As it will be shown in this paper, the resulting pressure cell presents a high sensitivity to the applied pressure, is compatible with fully passive wireless sensor unit and does not require electronic circuits for eventual signal conditioning and processing. [C448]

"The use of complementary sets in MIMO radar"

In multstatic radar it is desirable to transmit waveforms which are completely mutually orthogonal in order to minimise cross-transmitter interference. Perfect orthogonality is impossible to achieve, and in reality adaptive processing is necessary to remove interference, with some mismatch loss in main lobe size. This study proposes a method of composing waveforms from mutually-orthogonal complementary sets. Each transmitter is assigned a set of complementary waveforms to be separated in frequency. Nonlinear processing of matched filter outputs

can completely remove cross-transmitter interference and suppress autocorrelation sidelobes without cost. Cross terms introduced by the nonlinear operation are handled via frequency agility and Doppler processing. The principle is demonstrated by simulation. [C449]

"Achieving EMC in high frequency and high power switching environment on Radar Imaging Satellite"

Satellite deck provides a challenging electro magnetic (EM) environment as the overall volume available is limited and a number of DC-DC converters and clocks are present. Add to this high frequency and high power switching the electro magnetic interference (EMI) scenario couldn't be worse. Radar imaging satellite (RISAT) India's first satellite with day night imaging capability, slated for launch by the third quarter of 2009 carries a synthetic aperture radar (SAR) as payload. SAR operating in c-band and radiating a whopping 2880 watts of peak power boasts of a 6mts times 2mts patch array antenna. The RF power is switched at 3.3 kHz rate. In transmit mode a clock of 5.35 GHz, occupies an ldquoONrdquo pulse duration of 20 mus. The ldquoOFFrdquo duration of about 0.3 ms is used to receive the reflected signal. This large power switching is an open invitation for EMI. Achieving electro magnetic compatibility (EMC) in such a scenario is a challenging task and needs innovative techniques. This paper describes the SAR payload, its operating principle, the various functional modes, and the challenges in achieving EMC onboard. The intricacies involved in drawing up a Test / qualification program for the pay load on ground is part and parcel of the paper. Even the test site selection and human safety issues occupy centre stage while handling such high powers. [C450]

"Study of High-Precision Altimetry Arithmetic in LFMCW Radar System"

Introducing a LFMCW (linear frequency modulated continuous wave) radar altimeter system, which is modulating by the triangular wave, is a continuous wave modulation system of access to distance information through modulating the continuous wave. Comparing with the pulse radar, LFMCW radar has many advantages. It is based on the principle of electromagnetic wave propagation delay time in space to determine the height of the Earth's surface craft. a new arithmetic of processing the echo signal is put forward, in order to achieve the high precision altimetry and target detection and ensure the steady false alarm. The arithmetic adopts the manner of accumulating average through the sliding window, making use of the Doppler frequency shift. Through the echo signal is demodulated and collected and processed, the information of speed and distance is picked up and the false and lose alarm are eliminated when the altitude and the speed are measured in the radar altimetry system. [C451]

"Frequency Estimation for Weak Signals Based on Chaos Theory"

The method of the weak signal detection using the Duffing oscillator's initial conditions sensitivity was analyzed, and the Melnikov method of determining chaotic threshold of Duffing oscillators is discussed. The principle of weak signal detection based on the change of phase trace is described, and the influence of noise to the system status in the chaos detection process is also studied. Simulation experiments show that the oscillator is sensitive to the small signal having the tiny frequency difference with the referential signal and immune against the random noise and interference signal having larger frequency difference with the referential signal. Through analyzing the intermittent chaos mechanism of Duffing oscillator, it was found that the system output is a intermittent chaotic signal when input frequency deviates the compulsory drive frequency slightly, and the deviation can be estimated by the statistic characteristic of output chaotic signal. Simulation results show that the signal with low SNR can be detected by the method. [C452]

"The noise immunity of Invariant relative amplitude modulation"

The Invariant system of information transmission can be based on the know principle of relative amplitude modulation. By calculating the noise immunity of such kind of system the ratio of information modulated parameter to the reference modulated parameter is used. In the given article the analysis of the noise immunity of such system is carried out and it is compared with the nose immunity of know kinds of modulation. [C453]

"Digital Beamforming for a 3D MIMO SAR-Improvements through Frequency and Waveform Diversity"

The 3D imaging and nadir looking ARTINO (Airborne Radar for Three-dimensional Imaging and Nadir Observation) principle uses a sparse MIMO antenna array distributed over the whole wings of an airplane. The adaption of the ARTINO principle to high and fast flying airplanes with large wings requires new concepts to deal with PRF limitations. In this paper, an extension of the ARTINO principle is presented based on two different strategies namely the frequency diversity and the waveform diversity. Both concepts allow the implementation of

the ARTINO principle to arbitrary airborne platforms. [C454]

"Analysis of 3D-SAR based on Angle Compression Principle"

This paper presented the 3D-SAR based on angle compression principle which could, in contrast to conventional single-channel 2D-SAR, create the real 3D resolution cells to avoid geometric distortions. Except for conventional side-looking mode, 3D-SAR system herein can be operated in downward-looking mode which can avoid shadowing effects. The angle compression principle and the angular ambiguity problem are analyzed in this paper. The analytic expression of angle compression and the condition which should be satisfied to avoid angular ambiguity are also derived in this part. The demonstration of the feasibility of the 3D-SAR based on angle compression principle and the angular ambiguity problem are given by simulation in the last part of this paper. [C455]

"Networked Waveform System for Range Velocity Ambiguity Mitigation"

A networked waveform system is developed to overcome the fundamental limitation of a single pulsed Doppler radar in resolving ambiguities. The networked radar system uses the principle that the underlying intrinsic properties of the precipitation medium remain consistent in a network. The ambiguity in range and velocity is resolved by jointly processing the measurements from all the radars in the network. In this paper results for networked waveform system are shown for simulated data as well as data collected with first generation CASA (The Center for Collaborative Adaptive Sensing of the Atmosphere, an engineering research center established by the National Science Foundation) radars deployed in Oklahoma. [C456]

"Small Perturbation Method for Scattering From Rough Multilayers"

In this paper, we present an elegant closed form solution obtained applying perturbation theory to three-dimensional layered structures with an arbitrary number of rough interfaces. A general method has been developed to treat layered structures that can be described by small changes with respect to an idealized (unperturbed) structure, whose associated problem is exactly solvable. The final expression, beyond the compactness, allows us to directly prove that our formulation satisfies the reciprocity principle. [C457]

"Range measurement using ultrasound FMCW signals"

Low peak power frequency-modulated continuous wave (FMCW) radar is used in various fields, such as vehicle collision warning systems, airborne radio altimeters, and other applications. The authors proposed an ultrasound FMCW range measurement system based on the same principle as the FMCW radar. In the proposed system, the transmitter and receiver operate at very low voltage. This advantage suggests the possibility of designing a small and simple transmitter/receiver using low power ICs. Although pulsed ultrasound imaging is safe to patients, it's always a good idea to find a method that can use a minimum ultrasound power for diagnosis. The sawtooth and isosceles sawtooth functions are selected as the frequency modulation signals for the ultrasound FMCW range measurement system to achieve sufficient range resolution in human body. An ultrasound FMCW signal is transmitted into human tissue and the reflection signal is received after the two- way propagation time in human body. Instantaneous frequency difference between the transmitted and received signals is proportional to the propagation time in the system. Therefore, the range information may be obtained from the frequency spectrum of the baseband signal which is generated by multiplying the transmitted signal by the received signal. The spectrum and range resolution were calculated based on the basband signal analysis. The calculation results suggest that the system has similar range resolution to conventional ultrasound pulse diagnosis systems. We verified the calculated results by the experiments using electrical delay line and an ultrasound phantom. We measured the baseband frequency spectrum versus electrical delay time with the sawtooth and isosceles sawtooth frequency modulation signals and observed that harmonics peak frequency moved to a higher frequency band as the delay time increased. The relationship between the harmonics peak frequency spectrum and the delay time agreed with the calculated results.-- Next, we measured the frequency spectrum in the baseband signal using an ultrasound phantom. We confirmed a linear relationship between the harmonics peak frequency and the delay time in a range of 0-170 micro seconds. These experimental data agreed well with calculated results. The 3 dB bandwidth of the baseband frequency spectrum was 1-3 kHz with the sawtooth modulation signal and it was equivalent to the range resolution of 0.5 mm 1.5 mm in human body. The measured frequency spectrum and its bandwidth satisfied the range resolution required in a medical diagnostic ultrasound system. We conclude that the proposed system has a possibility of decreasing ultrasound peak power to less than 1/100 of that of conventional pulse ultrasound diagnostic systems. [C458]

"ROEWA based detector for SAR automatic target recognition"

Edge detection is a fundamental issue in automatic target detection using synthetic aperture radar (SAR)

images. Edges are associated with intensity changes in the image and are efficient descriptors of the image structure. Due to the presence of speckle, edge detection in SAR images is extremely difficult. Several detectors have been developed for the detection of isolated step edges in speckled images like MRoA and RGoA edge detectors which use predefined thresholds. The modified RGoA detector defines an automatic threshold determining method. But all these edge detectors, apart from detecting the target edges, detect a number of false edges. In this paper we have proposed a new ROEWA based algorithm that automatically discriminates the object boundaries and the false edges. The principle of entropy is introduced in this classification process. Real SAR images are used to verify our method and the results are compared with the modified RGoA and entropy based MRGoA edge detectors. Experimental results show that the proposed method is robust and efficient. [C459]

"Extraction of building polygons from SAR images: Grouping and decision-level in the GESTALT System"

The GESTALT-system is a stratified architecture for challenging computer vision tasks. This contribution focuses on the 3rd and 4th layer of it-the grouping and decision layers. As example application building recognition from high resolution SAR-data is presented. The 3rd layer contains an assessment driven perceptual grouping process with any-time capability and flexible control. Important grouping principles such as good continuation and symmetry are utilized. A dynamic programming optimization is used in the final decision and post-processing layer to find closed polygons that describe the outlines of buildings. Further post processing includes polygon editing and consistency enforcement. [C460]

"Null phase-shift polarization filter for high frequency radar radio interference suppressing"

Radio interference suppressing is a main problem to be solved in high frequency (HF) radar system. To effectively cancel the interference, the parameters of the polarization filter should timely adapt to the variation of the polarization of the interference, which may impact the amplitude and phase of the desired signal passing through the same polarization filter during the coherent integration time (CIT) and render the enhancement of the signal integration a failure. To avoid this, a null phase-shift polarization (NPSP) filter is proposed in recent years. Based on the principle of the NPSP filter, a simplified NPSP is proposed in this paper. The interference can be suppressed completely while the target signal remains without distortion. Some applications of HF radars for suppressing the radio interference are introduced. Simulation results from the experimentally derived data indicate that the proposed NPSP filter is effective in HF radar or other coherent systems. [C461]

"Adaptive radar detection of distributed targets under conic constraints"

In this paper we deal with the problem of adaptive detection of mismatched mainlobe targets and/or sidelobe interfering signals that are distributed in range. More precisely, in order to improve the robustness of the decision rule in presence of mainlobe targets we investigate the impact of modeling the actual useful signal as a vector belonging to a proper cone with axis the nominal steering vector; similarly, in order to improve the rejection capabilities of the decision rule in presence of sidelobe targets we study the effects of replacing the usual noise only hypothesis with a noise plus interferers hypothesis where interferers belong to the complement of a cone with axis the nominal steering vector. Mixed solutions are also studied. At the design stage we adopt the GLRT principle to derive CFAR detectors under the assumption that training data are available and the noise vectors share one and the same Gaussian distribution (with unknown covariance matrix). The performance assessment, conducted also in comparison to other approaches, proves the effectiveness of the proposed strategies. [C462]

"Compressed sensing radar"

A stylized compressed sensing radar is proposed in which the time-frequency plane is discretized into an N by N grid. Assuming that the number of targets K is small (i.e. KLtN2), then we can transmit a sufficiently ldquoincoherentrdquo pulse and employ the techniques of compressed sensing to reconstruct the target scene. A theoretical upper bound on the sparsity K is presented. Numerical simulations verify that even better performance can be achieved in practice. By comparing traditional uncertainty principles with those of compressed sensing, this novel approach reveals great potential for better resolution over classical radar. [C463]

"An integrated procedure for rainfall estimation using C-band dual-polarization weather radars"

Weather radar polarimetric techniques have been widely studied due to their potential to improve radar rainfall estimation and to infer on the microphysical characteristics of clouds and precipitation. Nowadays, polarimetric techniques are receiving an increasing attention from meteorological services. In fact, programs aiming at upgrading national weather radar networks with polarimetry are ongoing in both in Europe and in USA. Therefore, there is growing a demand for properly designed products that capitalizes research results in order to

obtain improved and reliable meteorological products, such as rainfall estimates, based on polarimetric measurements. This paper presents an integrated methodology which, starting from C-band polarimetric radar measurements, allows to obtain the best rainfall estimation. The procedure takes into account radar meteorology key issues such as: real time calibration check, ground clutter identification, and C-band attenuation correction. The methodology takes advantage of the synergy among radar measurements of reflectivity factor, differential reflectivity, and specific differential phase, as expressed by the self-consistency principle of polarimetric radar measurements in rain. The procedure is evaluated with a case study observed by the ISAC-CNR Polar 55C radar during an intense rainfall event which occurred on 25 September 2006 over the Lazio region (central Italy). A comparison analysis of the method is also performed using rainfall data collected by the hydrographic regional office telemetered network. [C464]

"STAP I-Architectures and algorithms"

Space-Time-Adaptive Processing (STAP) is becoming an integral part of modern airborne and space-based radars for performing Airborne Moving Target Indicator (AMTI) and Ground Moving Target Indicator (GMTI) functions. STAP is an application of optimum and adaptive array processing algorithms to the radar problem of target detection in ground clutter and interference with pulse-Doppler waveforms and multi-channel antennas and receivers. Coupled space-time processing is required to optimally mitigate the Doppler spreading of ground clutter induced by radar platform motion. This tutorial will begin with the fundamentals of adaptive beamforming and radar pulse-Doppler processing, move through principles and application of STAP, and conclude with a brief overview of some advanced current research topics. Optimum STAP and a taxonomy of practical STAP architectures and algorithms will be described in depth. Key aspects of a practical STAP algorithm include the methods for estimating the background interference, proper subspace selection, and the technique for computing STAP filter weights. Algorithms for providing rapid convergence, robustness to clutter inhomogeneities, robustness to steering vector calibration errors, and reduced computational complexity will be described. The effect of STAP on subsequent detection and target parameter estimation algorithms will be discussed, with some emphasis placed on adaptive monopulse approaches for STAP radars. Simulation and experimental data will be used to illustrate STAP concepts and algorithmic issues. [C465]

"Radar interferometry"

Since its inception 30 years ago perhaps no innovation in radar technology has made such a tremendous impact on the field as that of radar interferometry. Radar interferometry uses two or more observations separated in either time or space to measure fraction of a wavelength scale range differences between the two observations. Radar interferometry is used by scientific, commercial and government institutions for numerous applications including topographic map generation, surface deformation mapping, landslide monitoring, current velocity measurement, vegetation structure determination and change detection. Radar interferometers can be flown on either spaceborne or airborne platforms or be fixed observing systems. This course is designed to provide an overview of the basic concepts of radar interferometry and an introduction to some of its applications. The course will cover basic radar imaging principles, a geometric and imaging signal perspective of the interferometric phase, interferometric correlation, basic sensitivity equations, phase unwrapping, topographic mapping and repeat pass interferometry for deformation measurements. The principles will be illustrated with examples from both spaceborne and airborne interferometric data sets. An overview of some of the major applications of radar interferometry will be presented with an emphasis on topographic and deformation mapping. The course will also briefly touch upon permanent scatter methods and polarimetric interferometry. [C466]

"Basic radar systems"

This course provides even relative newcomers to radar an appreciation of radarpsilas uses today, and a true understanding of the nature of radar and its subsystems and of the underlying principles of the fascinating advances being made today and so widely reported in our conferences and other technical media. The course is an excellent ldquowarm-uprdquo for RadarCon-08! [C467]

"Estimation of rotation in ISAR imaging based on local sharpness measure"

The geometry of inverse synthetic aperture radar (ISAR) imaging suggests in principle a tomographic approach to the reconstruction of a 2D projection of an object illuminated by a radar signal. In theory this is straight forward, but the computational load of such reconstructions have in stead led to the use of fast Fourier transforms (FFTs) on a Cartesian grid. Using FFTs directly in ISAR imaging requires a small rotational motion to avoid blurring and defocusing. Alternatively, interpolation and polar reformatting can be applied prior to the reconstruction step. Also, time-frequency methods have been proposed to reduce the effects of blurring and defocusing of the reconstructed ISAR images. By applying tomographic reconstruction, the polar reformatting is

the last stage of the ISAR imaging process, meaning that phase problems involved in interpolating complex data points are reduced. The objectives of this paper are; 1) To propose a method for estimating the rotational motion of an object based on maximizing the sharpness of a small region of the reconstructed image, and 2) To describe an efficient implementation of a tomographic ISAR image reconstruction in the case of non uniform rotation. [C468]

"Design of a ridged waveguide feed network for a wideband Rotman lens antenna array"

Planar electromagnetic lenses like the Rotman lens are attractive candidates for beambeam forming networks forming networks because of their high bandwidth of operation and their capability to form multiple beams at lower cost as comparable electronic phase shifting networks. The principles of Rotman lenses have been studied for several decades and examples have been successfully built using different technologies, including parallel plate cavities fed by rectangular waveguides or microstrip lines on dielectric substrate. Due to the true time delay nature of Rotman lenses they theoretically exhibit extremely large bandwidth. However, lenses with rectangular waveguides as ports suffer from propagation of higher order modes inside the waveguide which limits the bandwidth to less than one octave in practical applications. Higher order waveguides, e.g. single or double ridged waveguides, allow for the propagation of a transversal electromagnetic (EM) mode and thus incorporate a larger bandwidth. But the symmetric nature of the TEM mode and the presence of the ridge complicate integration in the lens. The proposed paper outlines the design of a novel feed network based on higher order waveguides suited for multi- octave operation in Radar or Electronic Support Measures (ESM) applications. Each port includes coaxial feeding, a step transformer and a tapered section leading into the parallel plate section of the lens. An overview over the system will be given and numerical as well as experimental results on matching, insertion loss, mutual coupling and expected bandwidth obtained for a laboratory sample will be shown. [C469]

"Development of a high resolution MMW radar employing an antenna with combined frequency and mechanical scanning"

Electronically steerable antennas are expensive, whilst mechanically scanned antennas are of complex construction and hence are prone to failure. Based on the leaky-wave frequency-scanning principle, the spinning grating antenna (SGA) provides beam steering without the need of hinges. Whilst pulsed or stepped frequency waveforms may be implemented with this antenna, a frequency modulated continuous wave (FMCW) waveform allows close range operation at high speed, the possibility of excellent range-resolution, and low-cost signal processing. However, to implement FMCW with the SGA, the inherent scan-angle variation with frequency must first be overcome. Following on from an effort to develop a highly accurate radar system employing closed-loop linearisation to achieve 4 GHz of bandwidth centred at 94 GHz, this paper focuses on simultaneously achieving high angular resolution over a 20 degree scan range with good results. [C470]

"PodSAR: A versatile real-time SAR GMTI surveillance and targeting system"

Synthetic aperture radar (SAR) and ground moving target indication (GMTI) systems from an airborne platform are in principle based on very simple concepts. The latter combines radar pulses over a short interval to extract Doppler information in order to detect ground moving targets against a clutter background. The former combines pulses over much longer intervals in a coherent manner to achieve very fine azimuth resolution. However, the many demands that are placed on such systems in terms of resolution, geolocation accuracy and coverage have led to the development of highly sophisticated algorithms. The ability to perform such complex processing in real-time on board the airborne radar platform presents significant computational challenges. This paper describes how a successful implementation of a real-time SAR GMTI system has been achieved with the QinetiQ PodSAR system. It describes the radar system that is mounted on a wide-bodied Andover aircraft. It discusses the design challenges that had to be overcome in order to achieve real-time processing for SAR and GMTI along with showing a number of examples of image exploitation techniques being developed using data from the PodSAR system. [C471]

"ERS Differential SAR Interferometry: A powerful tool for surface deformation analysis"

We investigate the key role played by the European Remote Sensing satellites ERS-1 and ERS-2 to demonstrate the revolutionary nature of the Differential Synthetic Aperture Radar Interferometry (DInSAR) technique to investigate surface displacements over large temporal and spatial scales. The presented analysis starts with a short overview of the basic principles of DInSAR, followed by the presentation of a number of successful applications based on exploiting ERS data; in particular, several results focused on seismic deformations, volcanic activities and land subsidence, are shown. Subsequently, the analysis is dedicated to introduce the recently developed advanced DInSAR algorithms. In this case the emphasis is given on discussing the approaches that allows analyzing time sequences of ERS SAR data to produce deformation time series. The

main aspects related to these advanced DInSAR algorithms are discussed first, followed by the presentation of key results obtained by processing long time series of ERS data. [C472]

"Preliminary performance analysis and design for a distributed P-band synthetic aperture radar"

This paper focuses on a new concept for spaceborne P-band radar implementation, that is distributed SAR based on formation flying. This approach can in principle allow to overcome physical constraints that limit the performance of monolithic SARs, leading in the P-band case to huge antennas and hard swath/resolution trade-offs. The proposed SAR is based on a larger transmitting satellite and a set of light-weight receiving-only platforms. This architecture also allows for multi-mission capabilities. In particular, in the P-band case forests observation and biomass estimation can be in theory combined with interferometric ice sounding. Payload concept is clarified, and a preliminary performance analysis in terms of ambiguity and coverage is proposed. [C473]

"Investigations on signatures of projectiles for sniper detection applications"

In a world, where terrorism is threatening human life in particular that of those forces and civilian personnel who are involved in peace keeping and peace enforcing missions, the defence against snipers is a necessary safety demand. For this purpose sensor systems based upon various principles are in use and still under development. Among those acoustic and electro optical sensors are the most common ones; however their performance is very often limited with respect to their ability to cope with dust, fog and haze, especially in urban terrain. Notably here the millimeter wave radar could offer the additional advantage of small, light weight miniature sensors with the capability to fulfill the demands of an urban environment. As a first step to develop a millimeter wave radar system as a part a multi sensor approach, the signature characteristics of typical sniper projectiles have been investigated. RCS simulations have been conducted, which were validated by measurements under well controlled conditions. The paper gives results from this work and discusses the implications on the design of a respective sniper detection approach. [C474]

"Signal model and statistical analysis for the sequential sampling pulse radar technique"

For high-accuracy radar-based range measurement two commonly applied radar principles are frequency-modulated continuous-wave (FMCW) and pulse radars. In many applications, e.g. liquid level gauging or short-range automotive applications, the latter radar principle is based on sequential sampling together with a cross correlation technique to alleviate the high demands on the sampling stage as well as the high power consumption of a standard pulse radar. The systempsilas mode of operation is well-known. In this paper we present a detailed derivation and discussion of the resulting intermediate frequency (IF) signal model. Furthermore, a derivation and comparison of the best possible round-trip delay time (RTDT) respectively range estimation variances using FMCW, standard pulse, and the advanced pulse radar concept is given by means of the corresponding Cramer-Rao lower bounds (CRLBs). Asymptotically optimal and suboptimal estimators are derived and compared regarding their range estimation variance, threshold level, and computational complexity. Simulation and measurement results show the applicability of the derived bounds and estimators in practice. [C475]

"STAP II-Advanced concepts"

Space-time adaptive processing (STAP) is an advanced signal processing methodology for the Ground Moving Target Indication (GMTI) mode of airborne and space borne surveillance radar systems. It is used to mitigate motion-induced spread-Doppler clutter that interferes with the echo from ground targets. The course will develop and clearly illustrate the GMTI problem from first principles, showing the need for STAP processing. Traditional STAP processing solutions will be derived from a detection probabilistic perspective-the most pertinent metric for radar. Additionally, the course covers state-of-the-art STAP techniques that address many of the limitations of traditional (ideal) STAP solutions, offering insight into future research trends. [C476]

"Study on bistatic (multi) radar system using navigation satellites"

The operational principle of passive detection radar based on outer radiation source is introduced. Based on the in-depth research study on operational principle of non-cooperation bistatic(multi) radar and the requirement for air target detection especially stealth target detection, a space-ground bistatic(multi) radar system based on navigation satellite signal is presented. The paper has analyzed the feasibility of target detection using navigation satellite signal and the problems for system function realization. The system operational principle and detection performance has also been studied. [C477]

"A novel direct-conversion structure for non-contact vital sign detection system"

In this paper, an analysis on non-contact vital sign detection system is presented. It is concluded that the null point and dc-offset are related, so that the associated problems can be solved. Based on this principle, a novel structure of direct-conversion transceiver, which contains a tuneable phase shifter, is proposed to achieve a better performance. Two sets of simulations are employed to demonstrate the new structure. With this structure, dc-offset and null point can be eliminated and it is very easy to reach the optimal detection. [C478]

"Principle and experiment of air target detection based on Signal Power Disturbance"

This paper introduces an allocation method for air target detection based on GPS satellites 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 called SPD (Signal Power Disturbance) which is different from the typical bistatic radar system. A series of experiments have been done to verify the SPD method. [C479]

"PSO algorithm for amending the "minus beam" pointing error after phase defocusing"

The ldquominus beamrdquo steering of the phased arrays deviates from the given direction because of the quantization phase in the digital phased shifter. This paper studied the theory of wide-beam and ldquominus beamrdquo and investigated the model of the particle swarm optimization method on the arrayspsila beam steering, and modified the range of the position and speed factor by the principle of random phase quantization. The simulating results show the effectiveness and correctness of the method. [C480]

"A Polarization Coherence Notion at the Coherent Scattering by Complex Radar Objects"

The given paper is devoted to a "polarization coherence" notion at electromagnetic waves scattering by random complex radar objects. The system analysis methods, emergence principle and generalized interference laws are used for this notion substantiation. [C481]

"Current profile measurement using moored acoustic Doppler current profiler"

Permanent monitoring of currents in the Adriatic coastal region is of great interest both scientifically and to the general public, because of their role in coastline sea life and their impact on economy and tourist activities. Moored ADCP is a convenient instrument for long time current studies. Itpsilas relatively cheep, but effective solution that could do the job of a full string of single point current meters. This paper describes some basic principles of operation, technical description and setup parameters of an ADCP. Deployment configurations together with example data of moored ADCP are also shown. [C482]

"Weak Signal Detection Based on Duffing Oscillator"

The capability of conventional detection method such as power spectral density is limited while detecting periodic signals buried in the noise and deciding accurate frequency, the chaotic oscillator can increase the detection ability of weak periodic signals and improve frequency precision. In this paper, a new method based on duffing oscillator is proposed to detect weak signals. The chaos characteristic and detection principle for weak periodic signals of duffing equation are analyzed. This paper researched on the chaos property of duffing oscillator equation with Melnikov criteria. Through analyzing the intermittent chaos mechanism of Duffing oscillator, it was found that the system output is a intermittent chaotic signal when input frequency deviates the compulsory drive frequency slightly, and the deviation can be estimated by the statistic characteristic of output chaotic signal. Simulation results show that this method can detect weak signals with extremely low signal to noise ratio. [C483]

"A new method of camouflage jamming against ISAR based on compensating modulation"

It is quite significant in the military field that an effective jamming can be executed against inverse synthetic aperture radar (ISAR) successfully. However, ISAR has a well anti-jamming capability, which is stronger than that of conventional radar due to its special imaging approach. Camouflage jamming with many particular advantages becomes a very effective and important jamming approach nowadays. However, it is a novel and important technologic approach that an effective camouflage jamming can be carried out against ISAR. A new method of camouflage jamming is proposed in the paper, based on principle of ISAR imaging. The compensating modulation can be employed for the ISAR signals received by jamming device to achieve camouflage jamming, based on the phase relationship between ISAR signals received by jamming device and the real returned signals of targets. The feasibility and effectiveness of the methods are verified by simulation results. [C484]

"Research on the Acquisition Terminal for Intelligent Instrument"

The terminal design of a data acquisition system based on GPRS is designed in this paper. It works out the hardware design of GPRS terminal equipment, including the minimum system design based on the Samsung ARM7-core microcontroller S3C44B0X, and the hardware design adding the GPRS engine MC35i produced by Siemens and RS485 interface to the minimum system. According to dial-up procedure, describes how to design the MC35i dial-up program. Here introduces some important subsets of AT command sets, and also describes how to use them to dial up MC35i; analyzes the principle of the point-to-point protocol, and also demonstrates how to establish the wireless link to GPRS by practical example. [C485]

"Intelligent multi-mission radar resources management"

Summary form only given. The capabilities of modern military multifunction/multi-mission/multi-role radars cannot be fully realised by using older sensor control strategies, due to the advance in radar technology and the complexity of the tactical environment. The most obvious radar management imperative is the real-time optimisation of radar functionality & radar resource management to meet the changing operational mission, according to an assessment of the current environment conditions and tactical requests from an external centre. The objective of the tutorial is to present: main principles of intelligent radar resources management; strategies for radar time budget regulation; algorithms for: threat assessment, dynamic dwell priority allocation, real-time dwell planning/scheduling, load handling/control,... new advanced tools for radar management simulation on complex scenarios. The tutorial will be illustrated with simulation and campaign results of advanced Thales Multi-function/Mission Radars (e.g. MASTER A radar). [C486]

"Over the horizon radar"

The tutorial provides an introduction to the fundamental principles of high frequency over-the-horizon (OTH) radar, including sky-wave and surface-wave systems as well as other bi-static HF radar architectures. The main challenges of operating in the HF environment are described and connected to motivate and explain the architecture and design of existing OTH radar systems. From this viewpoint, the most influential characteristics of the HF propagation medium, and those of different HF signals received by OTH radar, are described in detail. The essential properties of various radar sub-systems, including antenna, transmitter, and receiver, are also explained. This is followed by a description of the central features of conventional and adaptive signal processing methods in OTH radar. In addition to the theoretical aspects, the tutorial also contains numerous examples of practical results obtained from actual HF radar systems, new insights for the way ahead, and a comprehensive list of references. For this reason, it is expected to benefit scientists and engineers, either starting out in this field, or those wishing to gain a more complete understanding of the most critical OTH radar concepts. [C487]

"Frequency-Domain Extracted IFFT Method for Synthetic Aperture Radar Imaging with Frequency Coded Waveform"

Study of frequency coded synthetic aperture radar was concerned in this paper. A new frequency-domain extracted IFFT approach (FDE-IFFT) to obtain high range resolution profile was proposed, and the mathematical principle of this new method was detailed analyzed. Simulation results and series of radar images using time domain back-projection method were given in the end. All results proved that the FDE-IFFT method has better capability of anti-jamming. It is more effective than conventional IFFT method and can be widely used in frequency coded synthetic aperture radar. [C488]

"Analysis of EM scattering from electrically large target over 2-D sea surface"

The mechanism of composite scattering from complex electrically large target over the two-dimensional (2-D) randomly rough sea surface is researched based on the modified ldquofour-path modelrdquo. Kirchhoff approximation and the method of equivalent edge currents are applied to analyze the backscattering of the sea model generated with the Monte Carlo method and the electrically large target respectively. The issue of the coupling field between the target and the sea surface is solved with the principle of image. A model of the composite scattering from the complex target over the sea surface is proposed to analyze the affects of sea background to the scattering characteristics of the target. The EM scattering characteristics of the electrically large target in the sea clutter background is discussed with the numerical results. [C489]

"Near range MMW synthetic aperture radiometer 3D passive imaging"

Millimeter wave synthetic aperture radiometer (MMW-SAR) technology can use phase information of electromagnetic wave radiating from target, and will be real-time imaging with less receiver elements. However MMW-SAR is limited to 2D imaging due to passive regime nowadays, lack of range information of target, which

is very unfavorable for target detection and identification, thus this paper presents novel principle and algorithm for MMW-SAR 3D passive imaging under near range conditions. In near range, it is spherical wave radiation and wave front curvature of spherical wave is inversely proportional to propagation distance, synthetic aperture technology can get the curvature of the wave front. Thus there is quadratic phase factor in imaging formula primarily. Regarding the factor as LFM, the 3D imaging algorithm calculates the slope of LFM so as to get wave front curvature, then calculated range distribution. MMW-SAR 3D passive imaging can get both range distribution and brightness temperature distribution, which could effectively overcome fuzzy problem caused by defocus. [C490]

"A Novel Method for Background Suppression in Millimeter-Wave Traffic Radar Sensor"

The millimeter-wave traffic flow detection radars have been widely used in traffic information collection systems during these years in China. To improve the detection accuracy of the traffic radar sensor, background suppression is of great necessity and importance. In this paper, after analyzing the principles of the millimeter-wave traffic radar sensor and the properties of the echo power, we propose a novel method for background suppression. The proposed algorithm is on the basis of order statistics and coherent averaging. Moreover, we present the field test results in different road conditions, and additionally compare the algorithm with previous approaches. Consistency of the test results with the theory proves the feasibility of the proposed algorithm. And the capacity for background suppression of the traffic radar sensor has been noticeably improved. [C491]

"Study on the detection of coating stealth ground target by millimeter-wave radiometer"

The demand to detect coating stealth targets has presented serious challenges to the design of conventional detectors illuminating targets with electromagnetic waves, since the objective of the coating stealth technology is to reduce the radar cross section (RCS) of targets by absorbing the incident energy and reducing the reflected energy. The research of detecting coating stealth metal target on the ground by means of millimeter-wave (MMW) radiometer is carried out in this paper. The methodology is described in detail based on both the analysis to the operation principles of radiometer and the interpretation to radiation characteristics of coating stealth metal target which is under various conditions. And at the same time, some theoretical results are also given. Furthermore, a series of simulative detection experiments are conducted on the basis of the fabrication of a total-power radiometer operating at 3 mm band. Ultimately, the experiment results are presented and analyzed to demonstrate the significance of this methodology. [C492]

"Calibration of the mono-static stepped-frequency GPR with a Vivaldi UWB antenna"

The mono-static stepped-frequency ground penetrating radar (GPR) with a Vivaldi ultra-wide band (UWB) antenna was used to non-destructive estimate the parameters (permittivity, conductivity and thickness) of each layer of a stratified subsurface medium. In this realization, a calibration procedure is necessary. This paper introduces the principle and the implementation of this calibration. The non-directive property of the Vivaldi antenna makes a challenge of the calibration of the system, because the measurement results are heavily disturbed by reflections from surrounding objects in air. However, after a suitable calibration, it can be used successfully in this radar configuration, and this was validated by the experiment. [C493]

"Combination-optimization method for ultra-wide band TEM horn antenna array using micro-genetic algorithm"

Finite-difference time-domain method (FDTD) and micro-genetic algorithm (MGA) are combined to optimize time-domain ultra-wide band (UWB) transverse electromagnetic (TEM) horn antenna array. Firstly, FDTD was applied to obtain the time-domain information of elementary antenna. According to principle of superposition, the antenna array could be primarily optimized using MGA without regard to mutual coupling effect. Secondly, the whole antenna array was simulated by FDTD. The first optimal results then acted as the known knowledge to reduce the searching range of MGA and the antenna array was optimized for the second time. Hence, the optimization speed can be greatly accelerated by using combination-optimization method described above while mutual coupling effect is taken into account. As an example, a 4-element UWB planar TEM horn antenna array was optimized to show the validity. The results confirmed it and the computational time decreased by 48.6%. [C494]

"Visualization of 3D spatial data sets applied in radar imaging"

Radar imaging technology is a vigorous research field at present. The method of SAR imaging is often used in radar imaging. But it is a quite complex process. In this paper, visualization of 3D spatial data sets technology is applied in radar imaging. The principle of creating iso-surfaces in 3D regular data sets and the optimization to MC algorithm are introduced. The way of building programming circumstance for OpenGL to render iso-surfaces is presented in detail. Real data get from radar scanning is used to implement 3D re-building. The result is quite

satisfactory because the configuration of spatial object and the reflective intensity to electromagnetic wave are reflected well. [C495]

"On End-to-End Mobility Management in 4G Heterogeneous Wireless Networks"

With the advent of modern technology, mobile devices with multi homed capabilities are proliferating. Existence of different network interfaces in multi homed devices enables them to seamlessly roam across heterogeneous networks. These vertical handovers however, causes to affect the TCP connections. Many solutions exist that handle this problem caused by mobility of the nodes. However, current mobility management solutions either require support of additional entities in the network or require changes in current implementation of TCP. This paper argues that mobility management service can effectively be provided without requiring the support of additional entities in the network and without changing the current implementation of TCP. On the basis of this principle, we present an end-to-end mobility management framework (EMF) that overcomes the limitations of current mobility management solutions and provides a richer set of mobility services such as location updates, soft handover, willful handover, etc. [C496]

"Research and Design of GIS in Vehicle Monitoring System"

With the development of satellite positioning technology and Global Positioning System (GPS), vehicle monitoring and navigation system has begun to appear. And it is a great technology revolution in vehicle monitoring field. In this task, using general packet radio service (GPRS) wireless communication technology, combined with the GPS global positioning technology and Geographic Information System (GIS) geographic information application technology, we raise component GIS secondary develop pattern based on MapX, and provide a realization of vehicle monitoring system. In this paper, application of MapX component in vehicle monitoring system is discussed. On the basis of analysis of composition and work principle of vehicle monitoring system, using Visual C++ and integrating MapX component, we realize functions of vehicles positioning, tracks replay, navigation map, objects query, and the design of digital map module of vehicle monitoring system. [C497]

"Research on Pulse Radiation of Planar Equiangular Spiral Antennas"

Planar Equiangular Spiral Antennas (PESA) are modeled by the RGWedge element models in this study. The surface current of the antenna is solved by the Method of Moment (MoM), and input impedance, transfer function and radiated pulse waveform of it are presented. The research indicated that, in the interesting frequency band, its input impedance is in good agreement with the theoretical value of that of Self-Compensated antennas (as defined by Babinet' principle). Its transfer function has a flat amplitude response and a linear phase response over very wide band. PESA can be used as a ultra-wide band (UWB) pulse antenna. Radiating electric field waveform is similar to that of second derivative Gaussian pulse. [C498]

"A feed-forward compensation strategy of SPWM Matrix Converter under abnormal input voltage conditions"

The feed-forward control scheme based on SPWM matrix converter is proposed. As a device without DC line, the AC line side abnormal inputs can deteriorate its output characteristics. Tri-carrier is prior modulated by measured envelop of line voltages, to let the pulse width of SPWM get different compensation in each pulse. This paper analyzes compensation principle, introduces realization method, and compares output behaviors of without compensation with compensation by Matlab/Simulink. Analyses and simulations show that the scheme modifies effectively output characteristics of MC (Matrix Converter) under abnormal input conditions. It is simple not only easy to realize through hardware but also to digital, and simple algorithm. [C499]

"Precise distance measurement with cooperative FMCW radar units"

In many applications the precise distance between different units has to be measured. The proposed measurement system operates with frequency modulated continuous wave (FMCW) radar sensors for distance measurement in a cooperative but unsynchronized way. Due to the missing synchronization a data transfer between the units is performed by means of the radar hardware. On the other hand, this principle could be easily implemented in communication systems. A prototype system in the 5.8-GHz ISM band has been built, and measurement results up to about 780 meters distance with accuracies of few centimeters are shown. Furthermore, the distance can be calculated at both transponder units. [C500]

"2.45 GHZ Saw-based passive binary transponder for wireless interfaces of integrated sensors"

This paper describes the development of a MEMS tunable surface acoustic wave (SAW) device that allows an integrated sensor to be interrogated wirelessly in a range of several meters. The component itself requires no

power for the wireless communication, as the principle is based on evaluating the reflected signal similar to a radar echo. The structure is similar to a one port reflective SAW delay line device. A MEMS switch is used to modulate the SAW according to the binary sensor output. The encoding solely requires an electrostatic tuning voltage of as low as 3 V for the MEMS switch. We successfully demonstrated that the device assembled on a microstrip antenna wirelessly transmitted ASCII characters over a distance of up to 2 m. [C501]

"The Design and Construction of an Airborne High Spectral Resolution Lidar"

A high spectral resolution lidar designed for operation in the NSF/NCAR Gulfstream V research aircraft is described. The operational principles of the instrument are described and examples of data are presented. Special design features required for aircraft operation are described. [C502]

"On the Leakage of FMCW Radar Front-End Receiver"

As an accurate range measurement sensor, frequency-modulation continuous-wave (FMCW) radar receives wide research attention throughout years. One well-known challenges of the design of a high-performance FMCW radar is the well-recognized leakage problems associated with a homodyne receiver. In this study, the actual effect of free space leakage for a FMCW radar system-on-substrate is measured. The experiment principles and results are discussed in detail. Other sources of leakage within a FMCW radar receiver are also explained. The appropriate methods to reduce or remove these negative effects on the receiver performance are discussed as well. [C503]

"Using Airborne Hydrographic LiDAR To Support Mapping of California's Waters"

A specialist team comprising academic, industry and government members is underway in a program that will ultimately lead to mapping of all 14,500 km2of California's state waters from MHHW out to the three-nautical-mile boundary. The technical and scientific team is lead by California State Coastal Conservancy through a contract with California State University Monterey Bay (CSUMB), and includes principle investigators from the seafloor mapping Lab of CSUMB, Fugro Pelagos, Inc; the US geological survey's coastal and marine geology program; and moss landing marine Labs' center for habitat studies. The data acquisition program includes a seafloor mapping component that incorporates the latest multibeam echosounding and airborne LiDAR bathymetry technologies and a ground truth component that includes video transects and sampling. This presentation describes the comprehensive and high-resolution seafloor-mapping program, with a focus on integrating the airborne LIDAR component with the multibeam data. The airborne bathymetric LiDAR sensor is capable of providing beach and bluff topography, digital aerial imagery, nearshore bathymetry and nearshore seabed laser reflectance imagery. All LiDAR data will be integrated with deeper water acoustic data and ground truth data to ultimately support a three-tier level of data processing and analyses. The Tier 1 and Tier 2 products specified as requirements include a minimum of nine GIS data layers (ESRI compatible) with FGDC compliant metadata files. Two tier 3 interpretation example products are also being created: 1) an updated 1:100,000 essential fish habitat (EFH) interpretation map, and 2) a 1:24,000 geological quad map. The first portion of the California coast to be mapped extends from Punta Arena north of the golden gate, southward to Punta del Aflo Nuevo. This area was identified as a high priority during a workshop attended by statewide stakeholders. This ground-breaking program is funded by the California- Ocean Protection Council through the California State Coastal Conservancy. The program manager was the Monterey Bay Sanctuary Foundation, working in collaboration with NOAA's National Marine Sanctuary Program. This presentation includes sections on the various technologies used, examples of results obtained to date, notes on planning the statewide mapping program, and a report on current program status. This major integrated mapping program along 1800 km of shoreline is establishing standards that can be applied to new regional coastal and offshore mapping for the management of marine resources. [C504]

"Image Quality Measures for Predicting Automatic Target Recognition Performance"

One important issue for Automatic Target Recognition (ATR) systems is to learn how robust the performance is under different scenarios. The quality of the input image sequence is a major factor affecting the ATR algorithm's ability to detect and recognize an object. If one can correlate the algorithm performance with different image quality measures, the recognition confidence can be predicted before applying ATR by predetermining the input image quality. In this paper, we address the utility of image quality measures and their correlations with performance failures of a principle component analysis (PCA) based ATR algorithm. Various image fusion approaches are examined to illustrate their abilities to improve ATR performance. Results show that the Shift Invariant Discrete Wavelet Transform (SiDWT) and Laplacian pyramid fusion schemes outperform other methods for improving the detection rate with the considered SAR images. Regression analysis is conducted to show that linear combinations of the selected image quality measures could explain about 60% of the variability in the non-

detections of the ATR algorithm. [C505]

"The Design and Research of Remote Terminal Unit Based on Radio Technology"

This paper describes the design and research of RTU based on GPRS. The function of instrument includes field information sampling, analysis and transmission. In hardware design, the MSP430 microcontroller and GR64 is adopted to improve systemic reliability. In software design, the software development environment of the instrument is a cross compiler (IAR Embedded Workbench) which is design for MSP430 micro-controller by IAR Company. The basic principle, the system composition, and the researches on key technological problems are presented in the paper. The practical results showed the system is stable and reliable. Compared with similar products, this design is characterized with simple hardware structure, powerful software functions, high reliability and low costs. This design can work at a temperature as low as -30 degC, and has a strong anti-jamming capability. Both theoretical and experimental results show that the RTU based on GPRS has favorable performance with low power consumption and high accuracy. [C506]

"Rough set theory based on genetic algorithm in radar equipment damage evaluation method"

Damage evaluation is a very important work to effect-based operation. In the paper, a damage evaluation method for radar equipment by using rough set theory is presented, the principle of rough set theory is introduced, a damage evaluation procedure based on reduction at tributes with discrimination matrix is given, and applying the approach, an example is also given to realize the evaluation of radar equipment damage. The result fits to practice. It shows that the approach is practical and useful in the damage evaluation research. [C507]

"A scheme of telemetering and preventing electric larceny system based on GPRS communication system"

For the power supply department, the key problem is hard to find a suitable and cheap way to not only collect huge number of the vastly distributed meters, but also calculate the balance of electric quantity and detect the nontechnical loss (such as electric larceny) automatically. This paper analyzes the structure and principle of the telemetering and preventing electric larceny system based on the public mobile data communication network GPRS. This system realizes the real time and accuracy of reading meter. Meanwhile, for the unique addressing mode, the monitoring software of this system can monitor the process of power provision and consumption, compare and analyze the data in real-time to find the nontechnical loss and measure the power or water supply system weak points; The power supply department can calculate the line loss according to the real-time data; The strong monitoring software also provides some analytic information about the real-time measurements of electrical energy quantities and alarms of electric larceny. The application shows that this system has the character of cheapness, high efficiency, practicability and so on. [C508]

"Modified stepped-frequency train of LFM pulses"

A new modified signal-the stepped-frequency train of LFM pulses with modulation of MPS (minimum peak sidelobe) biphasic coding and Costas frequency coding is proposed, whose spectrum function and ambiguity function are deduced respectively. Then the processing measure of the ranging system is illustrated in detail and the principle of the measure is analyzed. Range and velocity estimation of the target are resolved and how to form HRRP (high-resolution range profile) is exhibited. Finally, the resolution and ambiguity characteristics are studied. Research shows that the new modified ranging system is feasible and has advantageous performance. [C509]

"SMS Receiving and Dispatching System Based on Embedded Linux"

The SMS receiving and dispatching system is designed in this paper, which consisting of embedded Linux system and GPRS module. The principle of work and frame of system are given. How to encode the message in PDU mode, decode the message from PDU and the SMS receive/send flow under the control of AT commands, is the technical difficulty in SMS terminal developing. based on the embedded Linux system, Several solutions are given. [C510]

"Real time implementation of reconfigurable correlation radar for road anticollision system"

Car anti-collision systems are becoming very popular in automotive industry as well as in research. Furthermore, this device could become mandatory aboard vehicle in the next years. The principle of this system is to avoid collision between the equipped vehicle and the one in front, or other kind of obstacles (pedestrians, animals, etc.). As a consequence, this will reduce accidents and enhance road safety. Such systems are studied by the

INRETS-LEOST* within the framework of the GRRT, Regional Group for Transportation Research. Those systems use radar detection to measure distance to obstacle and the obstaclepsilas relative speed. Many radar antennas were developed in the INRETS-LEOST* in collaboration with the IEMN**. Most of the microwave sensors were carried out by the IEMN-DHS**. Correlation radar is the most recent radar developed in the LEOST. This paper concerns real time implementation of this radar. We will give the principle of distance measurement using this sensor as well as the implementation of the correlation function on an FPGA. The main contributions of this paper concern the reconfigurable aspect of the correlator, using a VHDL code generator, and enhancements in the correlator architecture. [C511]

"The target location study of multistatic radar base on non-cooperative emitter illuminating"

In this paper, a passive detection system composed by multistatic stations is studied. According to the basic principle of time difference location technology, an indirect measurement way of time difference of arrival (TDOA) is provided to avoid the difficulty of direct measurement. The theory derivation and simulation analysis show that the indirect way can achieve certain location precision to meet the requirement of target-tracking. [C512]

"Dual polarized traveling wave antenna for Ultra Wideband radar application"

This paper introduces a development of a compact dual polarized traveling wave antenna for Ultra Wideband technique. A principle of the antenna is introduced as well as its development. Subsequently the measurements results are shown including the time domain analysis of the antenna behavior. [C513]

"Colorization for Polarimetric SAR Image Based on Scattering Mechanisms"

Polarimetric synthetic aperture radar (POLSAR) images are widely used for aerial and spatial image applications, such as terrain classification, target detection, etc. However, only monochrome gray images can be derived from SAR data due to the imaging mechanisms of SAR, which limits image presentation and visual appeal. In this paper, we proposed a new approach to colorization for POLSAR images. The basic principle is that pixels with the same scattering characteristics should have similar colors. To achieve this, the algorithm first utilizes the Cloude and Pottier's decomposition to separate pixels into eight scattering categories, and then unsupervised classification is applied for further iteration. Colorization is performed in Lab color space using the classification result, which assigns a color to each class according to the self-defined entropy-alpha color map. In this semiautomatic method, an operator only needs to define a color map, and then the indicated colors are automatically transferred to produce a fully colorized image. The effectiveness of this algorithm is demonstrated by a JPL/AIRSAR POLSAR image. [C514]

"Estimation of Direction-of-Arrival by an Active Array"

Recently, MIMO techniques have been using in active radars,and become a hot topic in radar field, where they improve the performance of detection and parameters estimation greatly. On estimates of direction-of-arrival (DOA) in active radars, generally elements of the receive array were closely spaced to enable direction finding measurements. However, in order to obtain angular diversity, all elements of active radars need to be sufficiently separated, and so targets are in the near field of the array. Therefore, estimates of DOA in the active radars are near-field problems in fact. This paper tries to study direction finding of active radars from near-field principle, and establishes near-field estimates of DOA model of active array systems. The near-field model needs only 1-D searches, and decreases the burden of calculation in comparison with the traditional near-field estimates of DOA, which generally need 2-D searches. From the Cramer Rao bound (CRB) analysis, we find that there is great improvement on the performance of DOA estimates. [C515]

"General power transmission line on-line monitoring software system based on wireless public network"

Through analyzing problems in aspects of multi-version coexistence, data integration, system expansion and capacity expansion for the power transmission line on-line monitoring software system, a set of decentralized remote monitoring software system based on wireless public network (GPRS/CDMA) was researched and developed. It consists of six subsystems and can expand with the scale of monitored objects. In detail discussed the design concept of key subsystems: the data acquisition service subsystem divided three logic processes of data acquisition, data parsing and data saving into three expandable and isolated software units; the surveillance and maintenance subsystem adopted multicast communication method to acquire status information from each node, so as to form different surveillance data queues interiorly; the expert subsystem designed the data management container by time scale and created a uniform plug-in interface according to analysis in different fields; the hardware debugging subsystem realized a general mechanism that can carry on local and remote hardware debugging, by using of the data stream adapter principle. Compared with traditional system, this

system has been improved in availability, expandability, reliability and economical efficiency. [C516]

"Simple building reconstruction from LIDAR point cloud"

This paper presents a method for simple regular building reconstruction from LIDAR point cloud. At First, TIN model of the extracted building point from discrete LIDAR point cloud is built. Those points in triangle facet which having the similar normal vector value are clustered into the same plane point set. Then, every plane point set is fitted into plane using the least square method which boundary is decided by convex hull theory. The boundary of building top plane can be optimized based on regular building principle. From the optimized building top boundary and the height of ground, we can calculate the 3D coordinate of every corner point on building. The building model can be constructed based on 3D coordinates of these corner points. The experimental result shows that this method is able to construct effectively simple regular building. [C517]

"Principles of polarization parameters statistical theory for coherent images of random complex radar objects"

It is demonstrated in the given paper that the scattered field polarization-energetically speckles formation at the scattering from multi-point random complex radar object (RCRO) is the interference process. In this case the polarization-energetic response function of a RCRO can be considered as space harmonics collection. Every space harmonic of this collection will be initiated by one from a great many scattered interference pair, which can be formed by multi-point RCRO scatterers. In this connection every space harmonic will have an amplitude, which will be defined by a value of this pair scatterers polarization states proximity (or distance). As far as the RCRO elementary scatterers positions are stochastic, at the positional angle change and a random number of interference pairs, having the same space diversity under the condition of these pair scatterers polarization states proximity stochastic difference, we have the classical stochastic problem. This setting of a problem has been formulated in the first time. [C518]

"Waveform design and modulation schemes for impulse communications and radar"

Ultrawideband impulse radio communication is based on the classical principles of pulse time modulation conveniently used for baseband transmission. In this paper, we present the principles of impulse waveform design, impulse time modulation for information transmission process, period-staggering modulation scheme for multiple access applications, and M-ary impulse modulation. Periodic and orthogonal non-sinusoidal impulse waveforms are generated in terms of the periodic and orthogonal sinusoidal waveforms. The conventional analog and digital modulation schemes that are based on the use of sinusoidal carrier waveforms are applied to nonsinusoidal impulse waveforms. As illustrative examples, M-ary impulse modulation schemes are described, i.e., M-ary phase shift keying (M-PSK) and M-ary frequency shift keying (M-FSK). The design of a linear FM "chirp" impulse waveform for radar applications is presented too. [C519]

"The Design of Vehicle Emergent Calling System Based on GPRS"

Combining with the working principle of Intelligent Transport System, and with the purpose of enhancing the security of modern traffic, this paper brings forward a project of building a kind of automobile emergent calling system which starts-up with the starting of airbag, the wireless date transport modem, which is droved by serial interface, transmitted the acquired data to the remote monitoring center. The design of the hardware circuit implement, the design of software and the design of building monitor and control center are demonstrated. And finally, the key technique of the system is also discussed. [C520]

"Investigation of Real-Time Wave Height Measurement Using X-Band Navigation Radar"

In order to meet the warship's needs of real-time wave height measurement, a method using X-band navigation radar to measure wave height is presented. In this paper, the principle of wave height measurement based on X-band navigation radar is also introduced, the mathematical model of wave height measurement using X-band navigation radar is given. According to the X-band radar-image sequences collected from East Sea in China, the wave heights are retrieved based on mathematical model. The retrieved wave heights are validated by comparison of the radar-derived significant wave heights with the significant wave heights acquired from in-situ buoy sensors. It is shown that the accuracy of the radar-retrieved significant wave height is consistent with the accuracy of the in-situ buoy sensors. Therefore, to some extent, the reliability of the mathematical model is verified, to measure the wave height using X-band navigation radar is available in warship. [C521]

"Study of Detection Technique Simulation of High Resolution Radar Based on BP Neural Network"

Technology applying neural network to detection of high resolution radar is advised. Firstly, it analyses the

principle of detection technique of high resolution radar and the conception of "distance corridor". Secondly, it introduces the basal principle of BP algorithm. The principle and structure of three layers BP neural network is analysed. Thirdly, the detection technology and algorithm of high resolution radar based on BP neural network is researched. The result of research of target detection technology based on BP neural network possesses superperformance, which is in view of four distance corridor and ten distance corridor, which are the neural network that possesses four input neurons and ten input neurons. At last, the research is carried out by Matlab, the result are visible and understandable. [C522]

"A New Method for Generator Polynomial Estimation of Period (ql-1)/n LFSR Sequence"

A finite field discrete Fourier transform is used for studying the properties of linear feedback shift register (LFSR) sequence with period (ql-1)/n, and the relation of sequence's linear complexity and the nonzero-points in frequency-domain is given in this paper. Then a new algorithm is introduced to estimate the generator polynomial and initial state of m-sequence and gold-sequence. Based on the principle of FFT, a fast algorithm is also explored. [C523]

"A New Short Pulse Generator for Ground Penetrating Radar"

By analyzing the feature of short pulse used in short-pulse ground penetrating radar, the method of pulse generating is presented. The basic structure of pulse generating circuit involves avalanche transistor, step recovery diode and transmissions line. In order to analysis and operate the circuit, some methods and principle are given in the paper, Measured results confirm the design is versatile and may be used in the ground penetrating radar system. Some traits have been demonstrated by experiment, as follows: high amplitude, short pulse duration time, good symmetry and low distortion. [C524]

"A combination of NLOS radar technology and LOS optical technology for Defence & Security"

This paper describes a new system specifically designed for Defence & Security applications combining Non-Line-Of-Sight radar technology and camera technology. After a description of the new challenges caused by limited regional conflicts and terrorism, an innovative ground-based solution built with an UHF radar, called Ground-Alerter-One, and an IR camera is presented. Details on the frequency band choice are given. The design principles are explained and some results of operational trials conducted during the last few months are presented. [C525]

"A novel segmentation-based mutual information image registration for SAR images"

In this paper, a segmentation-based mutual information image registration algorithm is proposed. Because of noise-like speckle, mutual information is calculated on segmented results instead of original images. Instead of using pixel-based MRF segmentation, region-based RAG-MRF is applied on oversegmentation formed by Watershed transformation on the gradient of SAR images. The extrema of mutual information indicate the desired registration parameters. The conception of mutual information image registration is introduced followed by the principle of RAG-MRF segmentation and watershed transformation. Experiment results showed it is an efficient approach for registration of SAR image. [C526]

"Downward continuation and geoid determination in Mongolia from airborne and surface gravimetry and SRTM topography"

In this paper we outline the principles of downward continuation and geoid determination in Mongolia, based on the 2004-5 airborne gravity survey, surface gravimetry from various sources, and detailed digital terrain models from satellite radar interferometry (SRTM). A remove-restore method is used for terrain and global spherical harmonic reference models, with the residual gravity field signal downward continued by least-squares collocation, and the geoid and quasi-geoid computed by spherical Fourier methods. For reference field a GRACE and EGM96 combination field is used, and the geoid assessed using a subset of available GPS-leveling data, indicating that recent GRACE fields still have detectable problems in the harmonic wavelength band 50-100. The gravimetric geoid model computed refers to a global vertical datum; the Kronstadt Baltic Sea level data used in Mongolia shows a difference of more than one meter to the global datum, and therefore it is essential to fit the gravimetric geoid to local height data to obtain an operational geoid model for GPS use. [C527]

"Simulation of ISAR Imaging of Ships with Multipath Effects"

Multipath effects are investigated on inverse synthetic aperture radar (ISAR) image reconstruction of ships with rectilinear motion in different sea state. First, the generalized problems of multipath propagation in radar application are formulated. After a brief review of ISAR imaging principles, multipath propagation effects on ISAR

imaging are theoretically analyzed and the point spread function (PSF) is defined, two artifacts with different intensities and shifts in ISAR generated images are introduced by multipath effects, moreover, range-Doppler imaging algorithms are used to give a more clear and direct explanation to the range and cross-range shift of these two artifacts. Finally, the theoretical analyses are validated by simulation of ISAR imaging of ships with rectilinear motion in different sea state, indistinct and distinct multipath influenced ship images are generated and compared to corresponding ones without multipath effects. [C528]

"Constrained adaptive detection of range spread targets"

In this paper we consider the problem of detecting range spread targets in the presence of steering vector mismatches and Gaussian disturbance with unknown covariance matrix. To this end we resort to the Generalized Likelihood Ratio (GLR) principle and devise several detectors accounting for possible mismatches between the actual and the nominal steering vector. At the analysis stage, we assess the performance of the new algorithms, both in the matched and mismatched signal cases, also in comparison with a previously proposed GLR Test (GLRT) designed assuming that the nominal and the actual steering vectors coincide. The results show that the new tests may achieve performance improvements over the previously proposed GLRT when the mismatch is present. Moreover they exhibit an acceptable performance loss in the matched signal case. [C529]

"Target detection using orthogonal netted radar system (ONRS)"

An Orthogonal Netted Radar System (ONRS) is a networked system consisting of multiple radars, each of which uses an orthogonal set of coding waveforms, and operating at the same carrier frequency. ONRS can simultaneously operate in a monostatic and a multistatic mode, and thus possesses the advantages offered by both a monostatic and a multistatic radar system. The principles and structure of ONRS are described in this paper. The detection schemes using ONRS and an initial performance analysis is carried out. [C530]

"System level modelling of space based MTI performance"

Moving target indication (MTI) has been performed from airborne platforms for many years over both the land and sea. Multi-phase centre space based radars offer the potential to perform the same functions from space. This paper describes, from first principles, a simple monostatic system level performance model of the area coverage rate that could be achieved by a space based radar. This is then used to identify the important system performance drivers for further work. [C531]

"SAR active-decoys jamming based on DRFM"

The problem of how to realize the SAR active-decoys jamming is studied. Principles of the SAR active-decoys jamming are presented through analyzing range deception and azimuth deception, respectively. Thereby, two novel realization schemes are proposed. They can both realize active-decoys jamming effectively and only need measuring the angle between the radar and the jammer. The two realization schemes can be realized conveniently based on DRFM but they content the different deceptive demands respectively. Generally, we recommend the second one because it generates more decoys and it's easier to realize. Their validities are proved by the simulated results. [C532]

"Polarization Selectors"

Considered in this paper are design principles of polarization selectors providing signal decomposition in orthogonal base and heterodyne signal injection having equal phase relationships. [C533]

"Toward Optimal Sensor Density for Improved Freeway Travel Time Estimation and Traveler Information"

Accurate freeway travel time estimates are critical for transportation management and traveler information-both infrastructure-based and in-vehicle. Infrastructure managers are interested in estimating optimal freeway sensor density for new construction and retrofits. This paper describes a concept developed from first principles of traffic flow for establishing optimal sensor density based on the magnitude of under-and over-prediction of travel time during shock passages when using the midpoint method. A suggested aggregate measure developed from vehicle hours traveled (VHT) is described for a reasonable range of detector densities. Extensions of the method to account for both recurring and nonrecurring congestion are included. Finally some suggestions for future research are described. [C534]

"Antenna Arrays for RF-MEMS based 77 GHz On-Board Wake Vortex Detection Sensor"

In this paper the first generation of transmit and receive antennas for an on-board wake vortex detection front end module at 76.5 GHz is presented. The antennas are realized with serially fed patch antenna arrays connected in parallel by a corporate feed network. The use of RF-MEMS phase shifters between the feed network and the 2D patch antenna arrays will, in a future integration step, allow for steering the receive antenna beam in discrete steps in the horizontal plane. The principle of operation of the front end module and the design of both antennas are described. Simulated and measured results are presented to validate the design. [C535]

"Application and Simulation of Kalman Filtering with Anti-Jamming"

Classifying the jamming of guidance system and inducing its characteristics; and the importance of jamming and anti-jamming in the missile guidance are analyzed. In order to make the missile dive target with higher speed and attack it in the limited time, designing Kalman filter based on missile and target relative movement modeling; researching the anti-jamming abilities and techniques. The result of simulation shows that it can obtain the anticipative effect under the certain of parameter selection and adjustment and this method has good value of theory and application. [C536]

"Evaluation of SAR Jamming Performance"

The basic principles of SAR jamming performance evaluation (JPE) are discussed firstly. A novel evaluation method of SAR jamming performance by combining the subjective evaluation and objective evaluation is proposed. Namely, based on the objective evaluation parameters, a nominal value of SAR jamming performance can be obtained by weighting the objective evaluation parameters, where the weighted factors come from expert's judgments. Detailed derivations are given as well as the simulation experiments. [C537]

"Airspace design process for dynamic sectorisation"

Air traffic control in core Europe reaches the limits of available airspace capacities. Therefore new roles are introduced to shift workload away from the executive (radar) controller, who operates at the limit and is the capacity bottleneck, towards a more planning oriented but yet adaptive control function, the multi sector planner. This multi sector planner will be responsible for the expeditious flow through several sectors. The new role will execute a set of actions on both, airspace and traffic flows to reduce workload for the sector team or balance workload between sectors, so that overall centre capacity is increased. One of the central support tools is fine-grained, tactical, dynamic airspace management in conjunction with tactical flow measures. The study presents the airspace design process and tools that have been applied for the development of the future airspace of the Maastricht Upper Area Control Centre, based on the principles of dynamic airspace management. [C538]

"Interferometric Synthetic Aperture Microscopy: Physics-Based Image Reconstruction from Optical Coherence Tomography Data"

Optical coherence tomography (OCT) is an optical ranging technique analogous to radar-detection of back-scattered light produces a signal that is temporally localized at times-of-flight corresponding to the location of scatterers in the object. However the interferometric collection technique used in OCT allows, in principle, the coherent collection of data, i.e. amplitude and phase information can be extracted. Interferometric synthetic aperture microscopy (ISAM) adds phase-stable data collection to OCT instrumentation and employs physics-based processing analogous to that used in synthetic aperture radar (SAR). That is, the complex nature of the coherent data is exploited to give gains in image quality. Specifically, diffraction-limited resolution is achieved throughout the sample, not just within focal volume of the illuminating field. Simulated and experimental verifications of this effect are presented. ISAM's computational focusing obviates the trade-off between lateral resolution and depth-of-focus seen in traditional OCT. [C539]

"Design of LXIbus Interface Circuit for HF Ground Wave Radar"

According to the requirements of modularization and standardization, this paper presents the design principle of general purpose LXI bus interface for high frequency ground wave radar (HF GWR) based on LXI bus using DSP ADSP-21062, Ethernet controller DM9000A and dual-ported RAM (DPRAM). It describes the hardware design and data transmission mode in detail. With the advantages of high flexibility, integrity and speed, this interface circuit has been verified in practice. [C540]

"Wide-Band High Resolution Homing Sonar Echo Detect Based On Spread Spectrum Technology"

This paper propose and analyze high resolution auto-navigation sonar system based on DS/SS technology.

Compare to traditional auto-navigation sonar system, the system have big time and frequency range, can provide high distance and speed resolution and good anti-interference capability. Paper discuss the principle of waveform design and enduce ambiguity function of DS/SS modulation signals. In the case of high-speed target, paper provided and proved a algorithm using CZT which can estimate Doppler frequency offset and target speed in very low SNR condition. [C541]

"Study about Test Ammunition Terminal Effectiveness with the Velocity Radar"

The paper analyzes the fragment movement rule when the ammunition exploded. The mathematics model of the fragment radar echo signal is established on the basis of the principle of the movement targets modulating Doppler signal. The simulation data processing was achieved in using FFT method for the fragment echo signal. Quantitative analysis was realized about the influence for the signal processing precision by the fragment amount, the velocity difference value between the fragments and SNR. [C542]

"Development of Intelligent Digital Circuit Test Module Based on VXI Bus"

In this paper, an intelligent digital circuit test module based on VXI bus is developed using universal bus simulation technology. Composition and design principle of the hardware and the software are given in the paper. To reduce the area of the circuit board, the logic circuit of the hardware is realized using CPLD devices, the design of which makes the delay time between two test sequences be zero. The module can be operated by the softpanel directly or programmed by calling the given drive functions. Experiment shows that the module can well accomplish simulation test function for microprocessor-based and other bus-structured intelligent digital circuit boards. [C543]

"Wearable System-on-a-Chip UWB Radar for Health Care and its Application to the Safety Improvement of Emergency Operators"

A new wearable system-on-a-chip UWB radar for health care systems is presented. The idea and its applications to the safety improvement of emergency operators are discussed. The system consists of a wearable wireless interface including a fully integrated UWB radar for the detection of the heart beat and breath rates, and a IEEE 802.15.4 ZigBee radio interface. The principle of operation of the UWB radar for the monitoring of the heart wall is explained hereinafter. The results obtained by the feasibility study regarding its implementation on a modern standard silicon technology (CMOS 90 nm) are reported, demonstrating (at simulation level) the effectiveness of such an approach and enabling the standard silicon technology for new generations of wireless sensors for heath care and safeguard wearable systems. [C544]

"ET Gravimeter Data Collecting System Based on GPRS"

To meet the needs of researches in earth tides, polar motion, free oscillation of the earth, etc., we design an long-distance data collecting system for the ET gravimeter. The system collectes the data of the ET gravimeter and the temperature, humidity, atmospheric pressure etc., to which the ET gravimeter is exposed, and then saves them to multimedia card. The system can receive the command from and transfer data to an observation center by wireless. The rapid development of modern wireless communication technology has brought great convenience to long-distance data collecting systems. In the research of geophysics, the ET gravimeters are often placed in the observation stations far away from cities for long-term observation. In these places, not only the observers' lives are inconvenient, but also the observation costs are greatly boosted. Therefore, we have developed the ET gravimeter data collecting system based on GPRS. GPRS is the short name for general packet radio service, which is a kind of packet exchange data load and transmission mode developed on the basis of GSM, has the merits of high data transmission speed, high communication quality, 'always on-line', charging according to flow, etc., and is widely used. This article is divided into 5 parts: in the first part, the motivation and the purpose of this job are introduced; in the second part, the constitution and working principles of the system are described; in the third part, introduction are made for the implementation approaches of GPRS in the system, as well as the hardware design of communication modules; in the fourth part, the program design of system is stated, including the communication program of data collecting systems and observation center; in the last part, it's the conclusion for this job. [C545]

"Research and Implementation of Hydrology Telemetric System Based On GPRS Technology"

It is very important to remotely measure and monitor hydrology information real-time so as to improve modern management of water resource. In this paper, a new hydrology telemetric system is introduced. The system mainly consists of remote terminal units (RTUs) and monitoring center. The RTU based on ARM is mainly designed to collect, store and transmit the water information to the host computer in the monitoring center. The host computer receives the data from the RTUs and makes correct decision after analyzing, which provides the

water conservancy with immediate and exact water information. The remote communication between RTUs and the monitoring center is realized over GPRS. The basic principle, the system composition, and the researches on key technological problems are presented in the paper. And the main idea about improving information security in remote monitoring would also be given. The practical results showed the system is stable and reliable. [C546]

"Harold A. Wheeler's Antenna Design Legacy"

Harold A. Wheeler had a distinguished career in the field of radio-electronics. He had a unique talent for reducing complex scientific principles to simple forms that were universally helpful to theoreticians and practitioners. Of his many contributions, those related to antenna design are the subject of this paper. The three principal antenna topics in Dr. Wheeler's experience were impedance matching to a transmission line, electrically small antennas, and planar arrays. This paper concentrates on the first two topics and presents two examples of how he developed simple forms that were very helpful and useful to the antenna community. His solutions, although simple in form, were in exact agreement with those based on more rigorous theory. [C547]

"SAR with Two-Dimensional Aperture Synthesis"

The omega-k algorithm follows from the Leith-Upatnieks hologram and the holography based SAR mathematical problem is solved using Fourier analysis. Holography stems from Huygens-Fresnel principle describing the scalar diffraction theory subservient to Maxwell's equations of electromagnetic theory. It is the Huygens-Fresnel principle that renders SAR imaging phenomenon and Optical imaging phenomenon mathematically analogous. In this paper we have used SAR2, the two dimensional variant of the contemporary one dimensional slant plane SAR. SAR2involves two dimensional rectangular aperture synthesis. Detailed simulations of SAR2are presented. Matched filtering in SAR2with incorrect altitude is demonstrated that bears striking resemblance to image plane that is ahead or behind the focal plane in Fourier optics. Optimum circular aperture shape is predicted from the knowledge of the mathematical condition encountered in the analytic formulation of SAR2. Finally, Fourier optics model of Circular SAR (CSAR) algorithm is devised. Fourier optics analogy makes CSAR algorithm a predictable development in SAR imaging. [C548]

"Hitchhiking bistatic radar: principles, processing and experimental findings"

An experimental low cost bistatic hitchhiking radar has been developed at FFI utilizing the transmission of a civilian ATC radar. It uses off-the-shelf components in the receiver to produce close to real time traces of targets of opportunity. The processing enables positioning in 2D with good suppression of nearby clutter by continuously monitoring the clutter variation. [C549]

"An Experimental Study on Using Electronically Scanning Microwave Radar Systems on Surface Mining Machines"

Using a series-model of an automotive short range radar sensor (SRR) and a recently completed experimental radar system, field tests have been performed in a surface mine. It was examined, to what extent low-cost electronically scanning radar sensors can provide useful data for assistance systems in large scale mining machines. The series SRR sensor using mono-pulse principles for cross range measurement, proved to be useful to supervise the safety zone of a bucket wheel excavator. The more complex and sophisticated experimental radar system using digital beam-forming for cross range processing, can clearly detect and map the contours of trenches and escarpments. The overall promising results refer to many more potential applications for electronically scanning radar in surface mining and motivate to adapt the experimental sensor for such applications. [C550]

"Solution to Linear Inverse Problem with MMV having Linearly Varying Sparsity Structure"

In this paper, an extension to current algorithms dealing with inverse problem is considered. In stead of that invariant sparse profile of the solution vectors is concerned, we mainly focus on the problem with linearly varying sparse structures. Two methods are proposed to solve the linear inverse problem with the unknown linearly varying sparse structure by using MMV. In order to adapt to the linearly varying sparse profile of the solutions, one method, named LMMV (Linearly-MMV), introduces a new parameter and makes use of circular shift matrix to convert the new problem to the one with invariant sparse profile and new iterative algorithm is derived in principle of existing methods. Another method, named WMMV (Wide-MMV), attributes the change of the sparse structure of the solution vectors to the inaccuracy caused by the chosen dictionary and combines several rows of the dictionary together, which is equivalent to find a lower dimensional sparse solution and in turn gives a more robust algorithm. Numerical experiments with random dictionaries and applications to direction-of-arrival (DOA)

estimation verify the validation of the proposed two methods and their superiority to some existing methods is illustrated. [C551]

"Method for High Precision Radar Distance Measurement and Synchronization of Wireless Units"

In this paper we present a novel approach for high precision synchronization of wireless units. A concept similar to the standard FMCW (frequency-modulated continuous wave) radar principle is used to estimate the offset in time and in frequency between two radar units. It allows for a synchronization of both offsets significantly below 100 ps and 10 Hz, respectively. This highly accurate synchronization is used in a prototype system to measure the distance between wireless units similar to a secondary radar. The prototype operates within the 5.8 GHz ISM-Band and uses a bandwidth of 150 MHz. With the setup presented the distance between two radar units is measured with a standard deviation of less than 4 cm over a range of 250 m. The broadband measurement principle is robust towards multipath interference. It can be extended to other frequency bands and is well-suited for direct integration into communication channels. [C552]

"A Low-Cost Ultra-Wideband Indoor Ranging Technique"

This paper presents the development of a low-cost indoor ranging technique based on time-of-arrival (TOA) estimation, using short-pulse ultra-wideband (UWB) signals. The realized system includes two identical UWB transceiver devices, in which the receiver section is based on a tunnel diode detector and the pulse generation is performed by a common bipolar transistor driven in avalanche mode. An indirect measurement of the distance between the devices is obtained by measuring the frequency of the generated pulse train. A theoretical model of the system is described and a statistical analysis is presented, including the evaluation of the Cramer-Rao lower bound (CRLB) on the distance estimation. Furthermore the principle of operation of the realized system prototypes is described, along with some implementation issues. Finally experimental results are shown and discussed. [C553]

"Development problems of large area, web accessible, environmental pollution monitoring system"

The main purpose of the paper is to present the www hydrocarbon pollution monitoring system which is under development at the Warsaw University of Technology (WUT). The dedicated system server collects data from mobile GSM/GPRS accessed observation points, and delivers information on potential pollution to the authorized www clients. The emergency alarm information is planned to be send directly to palmtop/mobile phone equipped emergency teams to assure short response time to environment contamination. The moving observation points property and country wide GSM operator coverage makes the system flexible and universal. The principles of system realization are presented. The structure of the system and some problems concerning its development are discussed. Two realizations of system software are presented and compared: one with the use of Microsoft .NET IDE, and the other with LAMP/WAMP approach. [C554]

"Joint Model Selection and Parameter Estimation of GTD Model using RJ-MCMC Algorithm"

The Bayes principle is applied to the joint model selection and parameter estimation of GTD model to explore the prior information. An algorithm using RJ-MCMC is designed. It not only has better model selection and parameter estimation performance than the non-Bayes algorithms, but also solves the mixed parameter estimation problem in GTD model effectively. The advantage of this algorithm is especially evident at low SNR, for short data and with closely-spaced components. Simulations verify the effectiveness of this algorithm. [C555]

"Method for High Precision Clock Synchronization in Wireless Systems with Application to Radio Navigation"

In this paper we present a novel approach for high precision clock synchronization in wireless systems. A concept similar to the standard FMCW (frequency-modulated continuous wave) radar principle is used to estimate the offset in time and in frequency between two wireless communication units. The novel approach allows for a synchronization of both offsets significantly below 100 ps and 10 Hz, respectively. This highly accurate synchronization is used in a prototype system to measure the distance between wireless units similar to a secondary radar. The prototype works within the 5.8 GHz ISM-band and uses a bandwidth of 150 MHz. With the setup presented we can measure the distance between two radio units with a standard deviation of 4 to 5 cm over a range of 200 m. This distance deviation implies a clock and center frequency synchronization of both communication modules significantly below 100 ps and 1 ppb, respectively. The broadband measurement principle is robust towards multi-path interference. It can be extended to other frequency bands and is well-suited for direct integration into communication channels and novel modulation principles such as OFDM (orthogonal frequency division multiplexing) or SC/FDE (single carrier transmission with frequency domain equalization), e.g. for locatable WLAN (wireless local area network) devices or wireless sensor networks [C556]

"A Novel Algorithm for Estimating Vehicle Speed from Two Consecutive Images"

In this paper, we present a new algorithm for estimating individual vehicle speed based on two consecutive images captured from a traffic safety camera system. Its principles are first, both images are transformed from the image plane to the 3D world coordinates based on the calibrated camera parameters. Second, the difference of the two transformed images is calculated, resulting in the background being eliminated and vehicles in the two images are mapped onto one image. Finally, a block feature of the vehicle closest to the ground is matched to estimate vehicle travel distance and speed. Experimental results show that the proposed method exhibits good and consistent performance. When compared with speed measurements obtained from speed radar, averaged estimation errors are 3.27% and 8.51% for day-time and night-time test examples respectively, which are better than other previously published results. The proposed algorithm can be easily extended to work on image sequences [C557]

"Wearable System-on-a-Chip Pulse Radar Sensors for the Health Care: System Overview"

A new system-on-a-chip radar sensor for next generation wearable wireless interface applied to the human health-care and safeguard is presented. The system overview is provided and a summary of the feasibility study of the radar sensor is presented. In detail, the overall system consists of a radar sensor for detecting the heart and breath rates and a low-power IEEE 802.15.4 ZigBee radio interface, which provides a wireless data link with remote data acquisition and control units. Particularly, the pulse radar exploits 3.1-10.6 GHz ultra wide band signals, which allow a significant reduction of the transceiver complexity and, then, of its power consumption. The operating principle is highlighted and the results of the system analysis are summarized. Such a novel system-on-a-chip wireless wearable interface enables low-cost silicon technologies for contactless measuring of the primary vital signs and extends the capability in terms of applications for the emerging wireless body area networks. [C558]

"Adaptive Regularized FOCUSS Algorithm"

The sparse solutions obtained via the regularized version of FOCUSS (focal underdetermined system solver) are governed by the choice of a proper regularization parameter. Based on the principle of adaptive regularization algorithm (ARA) and regularized FOCUSS (R-FOCUSS) algorithm, this paper proposes an adaptive regularized FOCUSS (AR-FOCUSS) algorithm for solving an underdetermined linear system. Simulation results show that AR-FOCUSS is less sensitive to the choice of regularization parameter than R-FOCUSS, and the former outperforms the latter under the same conditions. [C559]

"Extraction of Bridge Features from high-resolution InSAR Data and optical Images"

Modern airborne SAR sensor systems provide geometric resolution in the order well below half a meter. By SAR interferometry from pairs of such images DEM of the same grid size can be obtained. In data of this kind many features of urban objects become visible, which were beyond the scope of radar remote sensing only a few years ago. However, because of the side-looking SAR sensor principle, layover and occlusion issues inevitably arise in undulated terrain or urban areas. Therefore, SAR data are difficult to interpret even for senior human interpreters. Furthermore, the quality of the InSAR DEM may vary significantly depending on the local topography. In order to support interpretation SAR data are often analyzed using additional complementary information provided by maps or other remote sensing imagery. In this paper a fusion of high-resolution InSAR data and one aerial image is discussed for the example of a scene containing bridges that are core elements of infrastructure. The aims are improvement of the 3D visualization of the scene and the extraction of the main parameters of the bridges' geometry. [C560]

"Multisource Data Processing for Semi-Automated Radiometrically-Correct Scene Simulation"

The digital imaging and remote sensing image generation (DIRSIG) model is an established, first-principles based scene simulation tool that produces synthetic multi-spectral and hyperspectral images from the visible to long wave infrared (0.4 to 20 microns). Significant enhancements such as spectral polarimetric and active light detection and ranging (lidar) models have also been incorporated into the software, providing an extremely powerful tool for algorithm testing and sensor evaluation. However, the extensive time required to create large-scale scenes has limited DIRSIG's ability to generate scenes "on demand." To date, scene generation has been a laborious, time-intensive process, as the terrain model, CAD objects and background maps have to be created and attributed manually. To shorten the time required for this process, we have initiated a research effort that aims to reduce the man-in-the-loop requirements for several aspects of synthetic hyperspectral scene construction. Through a fusion of 3D lidar data with passive imagery, we are working to semi-automate several of the required tasks in the creation of high-resolution urban DIRSIG scenes. This paper reports on the progress

made thus far in achieving these objectives. [C561]

"A Holographic Approach to Image Processing"

In this document, a distributed image processing based on the mathematics of holographic storage is presented. This work was inspired by the distributed principles between wave propagation and subsequent interference patterns seen in holograms. We then analyzed the mathematics to produce a general mathematical description of the holographic process. From a generalized case of this analysis we are able to propose this way for works in some engineering fields such as radar, control and neural networks. [C562]

"Conception of Scaling, Fractional Dimension and Deterministic Chaos in Radio Physics and Radio Electronics"

It has been briefly reported how the new synergetic approach on the basis of fractional measuring, fractal dimension, scaling, fractals and deterministic chaos has been developing in IRE RAS as applied to problems of modern non-linear radio physics and radio engineering.New challenging information technologies development and introduction on the basis of fractal radio physics and fractal radio electronics principles relates with training of specialists for these scientific fields. [C563]

"Cross-band Inverse Synthetic Aperture Radar (ISAR) Image Fusion"

Research on image fusion is making rapid progress recently, because multiple looks of the same target from different aspects will increase the available knowledge and allow more useful target information to be extracted. Studying on the physical principle of constructing radar images, especially inverse synthetic aperture radar (ISAR) images, make the fusion from multiple individual images generated by radars at multiple locations becomes possible. However, it is a challenge for image fusion if the source images are of different geometric resolutions, which are determined by radar system parameters, for example, the bandwidth of transmitted signals. This paper analyzes the influences caused by the different image resolutions, modifies the data fusion method proposed by previous research, and applies the modified method to an actually measured database. The performance of the modified image fusion algorithm is evaluated by the image attribute rating (iar) curves. The results show that the data collected by radars working at X-band and Ka-band can be fused successfully, and the information contained in the signals at these two frequency bands are complementary to each other. Therefore, the fusion improves target feature detection and thereby enhances target recognition. [C564]

"RESOLUTION: Reconfigurable Systems for Mobile Local Communication and Positioning"

RESOLUTION aims at developing a wireless three-dimensional (3-D) local positioning system with measurement accuracy in the centimetre regime and real-time ability. A novel frequency modulated continuous wave (FMCW) radar principle with pulsed active reflector is employed. This High-Precision-Localisation-System (HPLS) will be implemented together with common WLAN systems that are used for data communication purposes. Due to its high data rate capabilities and large potential bandwidth, the 802.11a/n standard allocated bandwidth around 5.5 GHz is applied. Special emphasis is given to the system's reconfigurability by efficiently using inherent synergies between the WLAN system and the HPLS approach. To allow multifunctional tasks, highly integrated system on chip (SoC) frontends will be designed on advanced CMOS or BiCMOS technology. Smart power and adaptive performance control will be applied to minimise the power consumption according to application needs. In order to enhance performance and coverage range, the transceiver features adaptive antenna combining (AAC) in the radio frequency (RF) receiver. AAC significantly decreases the power consumption, size and costs, since the number of multiple components is reduced to a minimum. Because of the high 3-D resolution and real-time ability, which can be achieved in indoor environments with strong multipath effects and fading, novel local positioning applications, e.g. for smart factories, robotics, interactive guiding, object tracking and augmented reality are presumably leading to a large economic potential. [C565]

"Electromagnetic Diversity and EMI Implications for Multiple Co-sited Radars and Targeting Applications"

Real-time fusion of data collected from a variety of co-located radars that acquire information in a cooperative manner from multiple perspectives and/or different frequencies, is being shown to provide a more accurate and effective way of tracking complex targets in a multi-target scenario. This is more advantageous than employing a single radar or a group of radars operating independently. This paper describes a cooperative multi-sensor approach in which multiple radars operate together in a non-interference limited manner. A three-fold approach is presented: (i) applying multiobjective joint optimization algorithms to set limits on the operational parameters of the radars to preclude electromagnetic interference; (ii) measuring and processing radar returns in a shared

manner for target feature extraction based on electromagnetic diversity principles in conjunction with target scattering cross sections; and (iii) employing feature-aided track/fusion algorithms to detect, discriminate, and follow real targets from clutter noise. The results of computer simulations are provided that demonstrate the advantages of this approach. [C566]

"Satellite Data Visualization on the Ocean Motion Website"

The NASA-sponsored OceanMotion Web site (http://www.oceanmotion.org) documents humankind's experiences, observations and investigations of ocean surface currents. In addition to the information resources posted on the website, there are also investigations that lead students to explore patterns and relationships through data products (color-coded images, time series graphs and data tables). These investigations are done through an interactive browser interface that provides access to a wealth of data. This paper focuses on use of surface current data and models in student investigations to illustrate application of basic science principles. Skills developed using data to discover patterns and relationships will serve students in other courses as well as empower them to become stewards of the Earths environment. [C567]

"Millimetre Wave 3D Imaging for Industrial Applications"

Within the next few years, improvements in graphic rendering and the application of millimetre wave radar technology will, together, allow operators of industrial processes in poor visibility environments to control their machines remotely. At the ACFR, we have been developing the 3D radar systems and displays to make this a reality in the mining industry. This paper discusses the principles involved in generating such images, and gives a number of examples of systems that have been implemented in the field. [C568]

"Principle of a direction sensitive borehole antenna with advanced technology and data examples"

Underground, in mines it is important to get spatial information about the geology on limited profiles. In low conductive material, like salt, ground penetrating radar (GPR) is a valuable method to find structures in the environment. For radar measurements in boreholes a direction sensitive antenna can solve the problem of getting spatial information. A new development of a direction sensitive antenna with an advanced technology to calculate the direction increases the resolution of this method. The idea of this technique will be illustrated and examples of measurements are shown. [C569]

"Mobile Terminal Device Architecture: Present and Future"

This tutorial presents a comprehensive coverage of software & hardware architecture of 2G/3G/B3G mobile terminals. The tutorial includes a brief overview on mobile handset architecture covering the major blocks and the software layers, detailed functionalities of the Software layers like MMI Framework, middleware components like BREW, J2ME and their importance in terms of developing Mobile applications. It explains how to develop personalized services like messaging, video and push-to-X services for 3G and GPRS mobile handhelds. The various operating systems are used in the mobile handset (Symbian, Windows Mobile 5.0 and Montavista Linux). Functional block diagram on the handset hardware and its functionalities (RF front-end transceiver, baseband, power management unit, power amplifier) are discussed as well as wireless protocol stack architecture and its working principles (GSM / GPRS / UMTS / WLAN / CDMA2K / Wi-MAX), Call establishment scenarios like voice call, packet call & SMS. NEXT GEN mobile terminal software architecture and its new protocols/layers such as IMS client framework, handover layer, cross-layer design, 4G MAC layer, common data link layer, and unified hardware abstraction layer are explained. Ensuring seamless mobility for continuous data transfer while the subscriber moves across various cellular networks during on-line service and provision of smooth data transfer switching between various cellular networks based on user preferences and the available network resources are core problems to be solved. The tutorial also tackles the new emerging trends like reconfiguration technology, NFC, DVB-H etc.. [C570]

"Adaptive Frequency Sweep Linearization based on Phase Accumulator Principle"

A novel approach to in-system monitoring of frequency sweep linearity is presented. Phase error measurement is carried out using a phase accumulator such as known from direct digital synthesizers (DDS). The successful application of this monitoring concept in an adaptive frequency sweep linearization system is shown by measurements of a 77-GHz linear frequency modulated continuous wave (LFMCW) radar transmitter. [C571]

"A prototype for the WISDOM GPR on the ExoMars mission"

This paper will describe a GPR prototype for the WISDOM-(Water Ice and Subsurface Deposit Observations on Mars) experiment on the ExoMars mission. The operation principle as well as the instrument design is explained.

Simulations of the radar response to realistic geologic models of the Martian sub-surface are presented. Measurements with a commercial GPR system in Mars analog geology on earth are shown. [C572]

"Sub-wavelength Microwave Radar Imaging for Detection of Breast Cancer Tumors"

This paper presents a novel approach to the detection of tumors of size well below a centimeter using a sub-wavelength ultrawide band (UWB) microwave radar imaging technique. Our approach exploits the principle of phase-shifting mask (PSM) and is implemented using a time-reversal (TR) algorithm based on the transmission-line matrix (TLM) method. A 0.5-mm diameter tumor was detected and located using a 200-ps UWB pulse in a realistic inhomogeneous two dimensional breast model. The breast model was derived from magnetic resonance imaging data and simulated using the TLM method. [C573]

"Robust Satellite Techniques (RST) for Oil Spill Detection and Monitoring"

Satellite remote sensing is an useful tool supporting the management of marine technological hazards, especially for what concern oil discharge. Nowadays, the most reliable satellite techniques are based on SAR (Synthetic Aperture Radar) active sensors operating in the microwave region of the electromagnetic (EM) spectrum. Such methods (even if not in whatever wind condition), assure good sensitivity for oil spill detection and high spatial resolution for a detailed description of the polluted area. Unfortunately, they cannot be used for real-time monitoring at all latitudes because of a revisiting cycles which ranges from few days up to 5 weeks moving from polar to equatorial zones respectively. Passive optical sensors on board meteorological satellites could be, in principle, also used for oil spill monitoring provided that suitable data analysis techniques (still lacking) are developed. In fact, thanks to a time resolution which is better than of few hours (up to few minutes) and despite their lower spatial resolution (not better than 250 m in the visible spectral range) they could represent the unique possibility when a timely detection is crucial in order to mitigate the damages. In this paper a new satellite technique for oil spill detection and monitoring is discussed. It is based on the general RST (Robust Satellite Techniques) approach applied to AVHRR1 observations in the Thermal Infrared (TIR) region of the EM spectrum. The proposed approach, which exploits the analysis of multi-temporal satellite records, seems able to detect the anomalous signals on the sea due to the oil polluted areas with excellent reliability (0% of false alarms) and good sensitivity in different observational conditions. It is applied in this paper to the "San George" Argentina -Uruguay oil spill event occurred in February 1997. Preliminary results so far achieved confirm the reliability of the proposed approach which promises to offer new (economically sustainable too) opportuniti- es for building a real-time monitoring system for oil spill at the global scale. [C574]

"Earth Observation Remote Sensing and GIS Services for Monitoring of Integration Systems"

Today availability of using the high resolution of space imagery creates a positive environment on application of space technology for monitoring of integrated systems in different areas of industry and commercial purposes. They are an airborne, unmanned aerial vehicles (UAV) and satellite Synthetic Aperture Radar and LIDAR multi-spectral and hyper-spectral sensors. One of the advance methods of feasibility study of appropriate services for monitoring of integration systems is based on remote sensing data and GIS developments. Objective of this approach is to improve safety, security aspects of integration systems, reduce survey costs and improve transportation and transmission efficiency through an increased monitoring frequency. Conceptually monitoring the integration system is structured into four main system components: (1) the Pipeline Operator System (POS), which is the part of the monitoring system which is used by the pipeline operator for delivery and handling of alarms and for specifying the monitoring characteristics for different parts of the pipeline network. (2) the Pipeline Information Management System (PEMS), which stores all relevant information on the pipeline network, the environment around it, and the integrity monitoring and which provides analyses and scheduling functionalities for the pipeline operator. The PIMS also includes an alarm production system, which decides what hazards should be considered as alarms. (3) the Hazard Extraction System (HES), which extracts the hazard report information out of the basic remote sensing imagery layers, using advanced image interpretation techniques. (4) the imagery Collection System (ICS), which collects the required remote sensing imagery with a suit of both spaceborne and airborne platforms and different types of sensors, conform the monitoring priorities. In the ICS all these means are scheduled optimally conform the specified priorities of the pipeline operators and the weather and season conditions- . Here also the data are pre-processed to remote sensing basic imagery layers. The four components in principle can be independent of each other so that maximal flexibility exists. Also each system component in itself is set up as much as possible in a modular and flexible way. By implementation of this above mentioned issues, new technologies on sensors, platforms, data processing, data storage and transfer can be integrated and the system easily can be extended to other operators or areas. The future integration systems monitoring scenarios can only be turned into reality if sufficient supply from spaceborne data will be available for reasonable economic conditions and with certain technical performance. Earth observation for appropriate investigation requires very high resolution optical and in most cases radar sensors. Very high resolution is here

defined as a resolution of 1 meter and better. This scale is required to allow the detection of targets. Very high resolution satellite observation, formerly limited to national and strictly classified reconnaissance tasks, has become a commercial business in the recent years. However, national security users are still the basis for the commercial viability of that business. Affected by satellites losses and pioneered with Space Imaging's IKONOS satellite, better than 1 meter resolution optical data is now available for science and commercial use. [C575]

"Design and realization of intermediate down-sampling for SAR based on FPGA"

Under the condition of meeting resolution, the SAR real-time image can satisfy the demands of the processing band by pre-filter and down-sample. Due to being in a special position in the signal processor, the ranger pre-filter needs very high operating speed and quick frequency response. The pre-filter principles and the methods are analyzed in this paper and the study is focused on the realization of range down-sampling using FPGA. This paper pay more attention to the range down-sampling which following the digital orthogonal mixing. After analyzing the polyphase arithmetic, a new method of down-sampling which is implemented in FPGA is put forward in this paper. Validated by simulation, circuit operates reliability and fulfils design demand. [C576]

"High Speed Downlink Packet Access Principles"

Data services are expected to have significant growth over the next few years and will likelly become the dominant source of 3G traffic. High speed downlink access (HSDPA) provides large enhancements over wideband code division multiple access (WCDMA) for the downlink. HSDPA was standardized as part of third generartion partnership project (3GPP) Relase 5 and Relase 6. The HSDPA peak date rate avaible in the terminals is initally 1.8 Mbps, and it is increasing to 3.6 and 7.2 Mbps with potentially beyond 10 Mbps. HSDPA has been designed to increase downlink packet data throughput by means of fast physical layer retransmission and transmission combining as well fast link adaptation controlled by the Node B -i.e. base transmission station (BTS). The paper covers HSDPA principles for WCDMA -the key new feature included in Relase 5 and enhanced further in Relase 6 specification. [C577]

"Two-dimensional PCA for SAR automatic target recognition"

In this paper, a new technique for synthetic aperture radar (SAR) automatic target recognition (ATR) is developed, which is builded upon two-dimensional principle component analysis (2DPCA). First, 2DPCA is applied to extract features in frequency domain, which is based on image matrix directly. Then support vector machine (SVM) is used for classification. Experimental results on MSTAR dataset show that the 2DPCA method both gives higher recognition rate, and are computationally more efficient than PCA. [C578]

"Research on the three-dimensional ISAR imaging for spin target"

In this work a three-dimensional ISAR imaging for spin target by back projection algorithm is presented. The space-time feature of ISAR signal is described. The principle of back projection algorithm is analysed, and a three-dimensional ISAR image reconstruction procedure using the back projection (BP) algorithm is developed. Otherwise, we introduce the point-spread function (PSF) to analyze the space resolving power of the back projection algorithm. The calculated results of the 3-D point spread function of nonlinear motion 3D ISAR is presented. [C579]

"SHARAD design and operation"

This paper describes the operating principles and the design of the Mars shallow radar sounder (SHARAD), an HF sounding radar devoted to the mapping of sub-surface features of Mars and currently operational on board the NASA/JPL's Mars reconnaissance orbiter spacecraft. Compared to its predecessor MARSIS, currently operating from ESA's Mars Express, SHARAD is characterised by an higher carrier frequency (20 MHz vs a max of 5 MHz for MARSIS) and a much wider signal bandwidth (10 MHz vs 1 MHz of MARSIS). This allows SHARAD to achieve a finer range resolution (15 metres unweighted in free space) at the expenses of ground penetration, which makes the instrument ideal to probe the shallow subsurface layers (to depths of hundreds of meters) which cannot be resolved from the surface by the much far- reaching MARSIS. SHARAD uses a 85 usec chirp signal with a PRF of 700 Hz and a peak power of 10 W, and radiates by means of a 10 meters fiber foldable tube (FFT) dipole antenna, with a wide-band matching network in charge of impedance matching with the transceiver. The most challenging requirement(especially considering the large fractional bandwidth of the system) is the level of the range sidelobes, which shall be below -55 dBc after the 6th lobe, to allow proper detection of the weak subsurface echoes in presence of strong surface returns. On this side, the design takes advantage from the wide download bandwidth made available by the MRO Spacecraft to keep the on-board processing to a minimum level (basically, only a programmable coherent presuming), and leave most of the processing (range compression and synthetic aperture) on ground. In this way it is easy to use Tx chirps and Rx

transfer functions characterised on- ground as reference for range correlation, with the range sidelobes limited, basically, only by the stability of the RF hardware. The limited amount of on-board processing also helped in limiting the complexity of the instrument design and, therefore, its mas- s and power consumption. SHARAD uses a very simple architecture, with the transmit chirp generated directly on the RF frequency (using a digital chirp generator) before being amplified to the transmit level by a class C amplifier. The receiver is even more essential, providing direct amplification of the received signal (with programmable gain and band filtering) to an A-to-D converter operated in downsampling mode by digitising the signal at 26.6 MHz rate. In this way, the complete 10 MHz signal bandwidth can be represented unambiguously with only an acceptable amount of oversampling (30%) minimising the required hardware. Instrument control and processing tasks are performed by the same AD-21020 DSP (with the help of a couple of FPGAs). The presuming can be varied from 1 to 32 in powers of two steps, and the resolution of science data can be selected to be 4, 6 or 8 bits, to allow optimisation of the data rate vs the operating scenarios. The receive window position can either be controlled in open loop, using an a priori knowledge of S/C orbit and surface topography (which demonstrated to be a very robust approach) or in closed loop. [C580]

"Comparison between MARSIS & SHARAD results"

MARSIS (Mars advanced Radar for subsurface and ionosphere sounding) is a low frequency nadir looking sounding radar selected by ESA as a payload of the Mars Express mission, whose primary Scientific Objective is to map the distribution of water both solid and liquid, at global scale on the Martin crust. MARSIS is the first instrument to be able to detect what lies beneath the surface of Mars (up to about 5 km). MARSIS operates with a very high fractional bandwidth: 1 MHz bandwidth allows a vertical resolution of 150 m in vacuum which corresponds to 50-100 m in the subsurface, depending on the electromagnetic wave propagation speed in the crust. The center frequency of the pulses transmitted by MARSIS can be set to 1.8 MHz, 3 MHz, 4 MHz and 5 MHz. On day side operations, it operates only in 4 MHz and 5 MHz due to the ionosphere plasma frequencies of Mars cutting of all frequencies lower than 3 MHz. All the four carrier frequencies are available for subsurface sounding on night side. The Mars Shallow Radar Sounder (SHARAD), a facility instrument provided by the Italian Space Agency (ASI), is embarked on board the NASA Mars Reconnaissance Orbiter spacecraft. SHARAD began science operations on October 3rd 2006: it has been collected data from surface and subsurface. This instrument penetrates to roughly half a kilometer below Mars' to search for information about underground layers of ice, rock and, perhaps, melted water. SHARAD operates with a center frequency of 20 MHz and 10 MHz bandwidth. These parameters allow vertical resolution on the order of 10-20 m. The carrier frequency of 20 MHz guarantees the capability of SHARAD to operate in day side as well as in night side. Both MARSIS and SHARAD use the principle of a Synthetic Aperture Radar (SAR) to achieve a fine along-track resolution. In particular,MARSIS is an un-focused SAR with best along-track resolution of 2 km; data coming from SHARAD can be processed with focusing algorithm (Chirp Scaling Algorithm), risi- ng a best horizontal resolution of 300 m. This paper provides a comparison between MARSIS and SHARAD images in different zones of the Mars' surface. From the preliminary analysis it has been evident that MARSIS detects signals from subsurface interfaces at 3 km of depth, while the signals received by SHARAD in the same zone and at the same depth are much weaker compared with the background noise. However,SHARAD radar-grams show subsurface interfaces at 100-200 m of depth: these interesting targets can not be discriminated by MARSIS because of its coarse vertical resolution. At the same time,SHARAD data add to MARSIS data scientific information about the upper portions of the crust of Mars. [C581]

"Radar emitter signals classification using kernel principle component analysis and fuzzy support vector machines"

Field=03 In this paper, a novel approach based on QTFDs and kernel principle component analysis (KPCA) is proposed to extract features of radar emitter signals. Then, these discriminative and low dimensional features achieved were fed to a Support Vector Machines (SVMs) based on FCM (fuzzy c-means) clustering for multi-class pattern recognition. Experimental results show that the proposed methodology was efficient for the different complex radar emitter signals detection and classification. [C582]

"Investigation into key technologies of 12-bit DA converter"

In this paper, a 12-bit voltage output D/A converter developed in linear compatible CMOS (LC2MOS) were described. The schematic diagram of the converter is provided to show the converter's operational principle. In developing the 12-bit D/A converter, the optimization of two unit circuits is focused. The 12-bit voltage-output DA converter finds wide use in the data acquisition and feedback control system in the fields of communication and radar. [C583]

"The analysis of permanent scatterers and its application in urban surface deformation monitoring

of Tianjin"

In this paper, the basic principle of PS technique has been illustrated at first, and then the mathematic model of PS has been analyzed in detail. The flow of SAR processing with PS technique is also introduced in this paper, then also the application examples of PS in the urban area of Tianjin city. Seventeen images of the same area have been used forming the interferograms. Finally, we get the surface deformations of Tianjin urban area, which is consistent with field measurement. [C584]

"Circular SAR experiment for human body imaging"

In this paper, the CSAR (circular synthetic aperture radar) technique is introduced firstly. The principle of CSAR 3D (three dimensional) imaging and the spatial wavenumber support are analyzed and the 3D resolution is discussed secondly. Secondly, Ku band fully-polarimetric CSAR human body imaging experiments are performed, and the experimental data is processed by a fast 3D backprojection algorithm, the corresponding amplitude images are shown. Finally, the future experiments for human body imaging are discussed. [C585]

"Simulation research of parametric methods for multi-baseline SAR tomography"

Multi-baseline SAR tomography is an extension of SAR interferometry. It uses multi-baseline data to obtain the distribution of scatterers along the height direction and realize three-dimensional imaging of the investigated scene. The parametric method can be used to realize SAR tomography. Super-resolution method based on modern spectrum analysis and inverse processing with singular values decomposition (SVD) are the main algorithms of parametric method. We analyze the principle of multi-baseline SAR tomography. The steps of the two algorithms are introduced, and the imaging results and efficiencies of the two algorithms are compared. We simulate the two algorithms with spaceborne SAR parameters, and get the tomographic images of the investigated targets. [C586]

"A 1.3GHz wideband successive detection logarithmic amplifier"

The basic principle design methodology, circuit structure and simulated results of a successive detection logarithmic amplifier (SDLA) which was developed in dielectric isolation Complementary Bipolar Process (CBIP) is presented in this paper. First of all, the principle of SDLA base on the transfer function of logarithmic amplifier is analyzed. Then, the design of circuit structure is optimized based on conclusion drawn by formula derivation. Finally, on the basis of mathematical analysis and with mathematical software MATLAB, the simulated results are analyzed, and the performance parameters of the circuits are evaluated effectively. Using the AC coupling and the typical structure which cascades amplitude-limiting amplifiers, we develop an SDLA whose bandwidth is much wider than 1.3GHz and whose logarithmic accuracy is less than plusmn1.0 dB. This logarithmic amplifier can be widely used in electronic equipment such as telecommunication, radar, electronic countermeasure. [C587]

"Research on jamming effect evaluation method of ISAR"

The inverse synthetic aperture radar (ISAR) is a high resolution imaging radar. Some methods used to evaluate the jamming effect of general radar are unsuitable to ISAR. Considering the principle of radar jamming and the theory of image disposal, the paper gives new evaluation methods of barrage jamming effect on ISAR, These methods can reflect clearly distortion degree of the jammed target during the whole jamming process. The results of simulation prove the methods are correct and effective. [C588]

"A kind of improved clutter-suppression interference method"

CSI is a STAP technology like displaced phase center antenna(DPCA).Its virtue is that it couldn't be confined by DPCA conditions. This paper briefly analyses the principle and shortage of conventional CSI firstly. Then making dual-channel GMTI as an example, puts forward an improved CSI processing method. Lastly, we compare channel-cancellation result of simulated date and real dual-channel echo data, The results proved this improved CSI method is reliable and effectual. [C589]

"Modified doppler centroid tracking for ISAR based on image equilibrium"

Phase correction is a key step of inverse synthetic aperture radar (ISAR) motion compensation, which seriously affects the ISAR focusing and imaging quality. As a typical phase correction method, Doppler centroid tracking (DCT) method has clear principle and small computation amount. However, the performance of DCT is normally unsatisfactory when the target has strong scattering centers. Based on the analysis and comparison of existing methods, the image-domain equilibrium is proposed in this paper to improve the performance of DCT method. By using the simple operators of equilibrium and feedback, the proposed method may dramatically reduce the

effect of prominent scattering centers and improve the robustness and the ultimate imaging quality. Finally, the effectiveness of the proposed method is verified via the performance analysis and imaging results of real airplane target. [C590]

"A Real-time signal processing method for air-born three-channels GMTI"

In this paper, we briefly introduced the performance of several GMTI systems at first. After that, we prompted a method based on CSI algorithm for air-born three-channels GMTI signal processing, gave out the processing diagram of this method, analyzed the principle of cluster suppress, present an adaptive phase compensation method for each channel based on the minimum power criterion and analyzed the locating and velocity-estimation problem of moving targets. The presented method, which has been applied in actual furnishment, turned out to be efficient. [C591]

"A novel ground moving target detector in dual-channel SAR images based on the covariance matrix"

Concerning the detection of ground moving targets in dual-channel SAR images, a novel detector based on sample covariance matrix is proposed. The method makes use of the principle of orthogonal projection, for obtaining the component of the sample covariance matrix energy vector that is perpendicular to the clutter covariance matrix energy vector, then construct effective metric by this orthogonal component. Compared with traditional DPCA, this new metric can achieve better clutter rejection, eliminate influences from moving targets' sidelobes, set threshold more easily and get lower false alarm probability. The simulated results prove the effectiveness of this metric. [C592]

"Demonstration of a Novel Man-Portable Magnetic STAR Technology for Real Time Localization of Unexploded Ordnance"

We report results of field tests of the first prototype of a novel man-portable Magnetic Scalar Triangulation and Ranging (STAR) technology. The new magnetic sensor system technology is being developed with support from the Strategic Environmental Research and Development Program (SERDP) to provide an easily deployable magnetic sensor system for real-time, point-by-point Detection, Localization and Classification (DLC) of magnetic targets such as Unexploded Ordnance (UXO) and buried mines. The STAR technology is based on a multi tensor gradiometer approach that uses magnetic gradient tensor magnitudes, i.e., "gradient- contraction-type" parameters to perform DLC of magnetic targets. The magnetic STAR sensor uses the scalar functions to triangulate a magnetic UXO-type target's position vector and to calculate the target's magnetic signature vector. The vector components of an object's magnetic signature provide a basis for real time classification of its type, i.e. UXO-like or not. In order to provide proof of principle of the STAR concept and demonstrate its advantages for high mobility magnetic sensing applications, we designed, constructed and field-tested a prototype man-portable STAR Gradiometer. The portable gradiometer's hardware and software are completely self- contained and provide a practical and user friendly capability for real time DLC of magnetic targets. Target DLC parameters: e.g., range, bearing, elevation and magnetic signature are correlated with Global Positioning System time and position data and displayed in near real time (total delay < 3 seconds) on a heads-up display that clips onto the operator's safety glasses. Interactive software controls data acquisition, performs signal processing to remove residual motion noise effects and runs the STAR Algorithm to generate and display the target's DLC parameters. Field tests have demonstrated proof-of-principle of the STAR concept and conclusively demonstrated that the technology has uniqu- e advantages for DLC by highly mobile sensing platforms. While being carried and operated by a single individual, the portable sensor has demonstrated very robust, motion noise resistant performance even while undergoing rotational motion of more than 40 degrees per second. The field test results very strongly indicate that the man-portable STAR technology can provide a wide variety of highly maneuverable sensing platforms (including Autonomous Underwater Vehicles) with uniquely effective, motion-noise-resistant magnetic sensing modalities for DLC of magnetic targets such as UXO and underwater mines. [C593]

"A robust method to determine relevant target vehicle using vehicular radar"

In order to solve the problem of the instability in the selection of relevant target, caused by the complexity of the measurement environment of vehicular radar, a robust method to determine the relevant target using vehicular radar is proposed. Based on analyzing the measurement environment, the method uses the principle of the nearest object in the same lane for target pre-selection. The Kalman filter is applied to predict the target information and the relevance verification of the pre-selected target is done by the consistence checking. The target decisions are made through a "relevant target life cycle" method. The verification tests show that by efficiently eliminating the effects of ghost objects, other disturbances and the bumping and swinging of vehicle,

the proposed method can accomplish the determination of relevant target under different conditions. [C594]

"Local Positioning for Wireless Sensor Networks"

This workshop paper gives an overview of local positioning and tracking principles for wireless sensor networks including recent results of the European project RESOLUTION (reconfigurable systems for mobile local communication and positioning). Measurements of a first demonstrator applying a frequency modulated continuous wave (FMCW) radar principle are presented. The unlicensed ISM band around 5.8 GHz, 150 MHz bandwidth and less than 25 mW effective isotropic radiated transmit power are used. Excellent 3-D positioning accuracies in the order of 4 cm in an anechoic chamber and 18 cm in a conference hall with strong multipath and area of 800 m2are measured. Furthermore, the results of optimized radio frequency integrated circuits and a suitable compact flash card are outlined. [C595]

"About the Speaker"

• The principles of UWB radar • The state of the art in UWB radar performance • Examples of applications of UWB radar [C596]

"On the Swept-threshold Sampling in UWB Medical Radar"

The non-invasive techniques to measure vital signs have received much attention lately. They exhibit several advantages compared to the traditional invasive techniques. One such technique can be based on radar principles. In this paper we scrutinize the statistical properties of a medical radar developed on a single CMOS chip, which operates in the ultra wideband from 3.1 GHz to 10.6 GHz. A key part of the chip is based on a new technique for sampling at very high frequencies called swept- threshold sampling. This is based on multiple pulse emissions, accumulation and range-gating. We derive expressions for the bias and variance of swept-threshold sampling and show that the bias is a strong function of noise power and input value, but independent of the swept-threshold parameters for a fixed input range. The variance is shown to be proportional to the quantization step size and standard deviation of the noise process. Finally, simulation results are provided as proof of concept, and they show that the derived theoretical equations for bias and mean square error are valid. [C597]

"SAFIRE: A close range real time millimetre wave radar for public education"

Millimetre wave (MMW) imaging is a fast moving technological area which has seen major advances in the last few years and is now offering practical solutions across a wide spectrum of imaging applications. Despite this, the technology is largely unknown and poorly understood by the general public. Under a UK EPSRC partnership for public engagement grant, the millimetre wave group at the University of St Andrews has partnered with exhibit development company FifeX Ltd to construct a touring exhibition designed to showcase the alternative view of the world provided by MMW remote sensing, illustrating the science principles behind the technology. The group is providing the centrepiece of the programme, a 94 GHz FMCW radar named SAFIRE (St Andrews fast imaging radar equipment). SAFIRE uses a frequency multiplied 7G Hz source to provide a low power (+2.5 dBm) 94 GHz carrier with a 750 MHz modulation bandwidth (i.e. a radar range resolution of 0.2 m). SAFIRE has a single zenith-pointing antenna scanned in azimuth via a rotating mirror angled at 45 degrees to the antenna axis to generate a PPI display of the immediate scene surrounding the radar (the maximum range is 25 m). Since real time imagery is essential for a project of this type the PPI is refreshed at minimum rate of 4 Hz. We present an outline of the motivation for the radar design and the expected system performance. [C598]

"Study on the Division Tactics of Top Swimming Athletes Home and Abroad in the 400m Freestyle Swimming Race"

In swimming competition, a rational disposition of physical strength is seen as a major factor in deciding the final outcome. Among various items in swimming competition, the issue of physical distribution over the 400 m race has aroused the most extensive controversy. In this paper, concerning the achievements of elite athletes home and abroad in 400 m freestyle swimming race, the principle of variation coefficient in statistics has been adopted and calculation is conducted in regard to the newly-defined speed coefficient. The features and disciplines in the tactics application of those top athletes are analyzed from a new angle about the adoption of phase speed pattern. It is hopeful that this paper could provide some valuable suggestions about the puzzle of physical distribution over the swimming competitions for swimming coaches in the process of their instruction. [C599]

"Diakoptic Surface Integral-Equation Formulation Applied to Large 2-D Scattering Problems"

A diakoptic surface integral-equation formulation is applied to 2-D transversal magnetic (TM) scattering

problems. The diakoptic formulation is based on the equivalence (Huygens') principle. The aim of the diakoptic formulation is to reduce the CPU time needed for the electromagnetic analysis and the memory needed for the data storage without compromising the final results. The proposed diakoptic formulation is illustrated on two examples of 2-D TM scatterers. The calculated radar cross-section (RCS), CPU time, and storage requirements are compared to those of the classic method of moments (MoM). [C600]

"Experimental consideration on the synthetic range-profile processing by stepped-frequency radar"

In radar system, separation of the target from the background clutters requires high range and cross-range resolution. To improve the range resolution, shorter pulses and wideband-FM pulses are utilized. However, they tend to complicate system architecture and to increase implementation cost due to the necessity of a wideband receiver. The synthetic range-profile (SRP) processing has been proposed to realize high range resolution without using the wideband receiver. The principle of the processing is that the echoes of stepped-frequency pulses are synthesized by IDFT in the frequency domain. This enables us to obtain short pulses in the time domain. This paper proposes the SRP radar composed of high-speed wideband exciter, which generates the stepped-frequency pulses. Through experiments, effectiveness of the proposed system is verified. [C601]

"Reflectivity retrieval in a networked radar environment: Demonstration from the CASA IP1 radar network"

A network-based reflectivity retrieval technique has been developed within the Center for Collaborative Adaptive Sensing of the Atmosphere (CASA). The concept of a networked- radar system is simultaneous observations of the same precipitation event by multiple radars operating at the attenuating frequency such as X-band and scanning in a low elevation plane. This paper presents the preliminary demonstration of the network-based retrieval using data from the first Integration Project (IP1) radar network in Oklahoma. Electromagnetic waves backscattered from a common volume in a networked radar system are attenuated differently along the different paths. The CASA networked-retrieval method is based on a set of governing integral equations describing the backscatter and propagation of common volume with constraints of total path attenuation. The method has been implemented in a multiprocessor environment, which operate simultaneously and collaboratively to meet the real time requirement of CASA. The performance of the implemented retrieval algorithm such as computation requirement will be presented. Comparison of the CASA networked retrieval is made against the conventional attenuation correction based on the principle of coupling the specific attenuation, differential propagation phase and reflectivity. The preliminary results show good agreement with conventional differential phase base attenuation correction. [C602]

"Rain microphysics estimation using X-band dual polarization radar measurements"

Rain microphisycs retrieval has been proposed and demonstrated mainly at S-band where attenuation effects are usually negligible. Recent advances in attenuation correction techniques enable rain microphisycs retrieval also using attenuating frequencies, such as X- and C-band. Most up to date attenuation correction methodologies are based on the use of a constraint represented by the total amount of the attenuation encountered along the path, which is distributed over each range bin contained in the path. The inner self-consistency of radar measurements can be exploited to improve the attenuation estimate obtained using those techniques. In fact, based on the self-consistency principle, an optimization procedure can be devised to obtain the best estimate of specific and cumulative attenuation as well as of specific and cumulative differential attenuation. The main goal of the study is the examination of the drop size distribution retrieval from X-band radar measurements after attenuation correction. The study is based both on simulated and measured data. Simulations based on the use of profiles of gamma drop size distribution parameters obtained from S-band observations are used for quantitative analysis. Examples of the DSD parameter retrievals using radar measurements corrected for attenuation and differential attenuation are also shown. [C603]

"Lidar education at Georgia Tech"

The lidar research team at the Georgia Tech Research Institute (GTRI) is developing an educational program with many components including academic classes, short courses, classroom teaching materials, hands-on laboratory demonstrations, and web-based resources. We are currently developing a textbook for introductory instruction on the basic principles of lidar systems. [C604]

"Estimation of the bidirectional reflectance distribution function of subarctic boreal forest using C-band SAR"

Surface albedo is acknowledged as an important variable in climate research. Monitoring of Earth's surface

albedo in a global scale is practical only with satellite observations. However, satellite-based albedo research in the boreal regions is hampered by continual cloud contamination in the optical wavelengths, as well as long periods of low sun elevation. As the surface albedo can be calculated from the Bidirectional Reflectance Distribution Function (BRDF) of an area, new methods to improve the accuracy of BRDF calculation and remove cloud contamination effects are needed to enhance the accuracy of future climate studies. This study explores the possibility of estimating the BRDF of boreal forest using C-band synthetic aperture radar (SAR) data. The principle of the estimation is based on the knowledge that the BRDF of boreal forests depends on structural parameters such as NDVI or LAI, and that similar structural information can be derived from SAR imagery. The results of the study show that the estimation of BRDF from C-band SAR is possible at least under certain conditions, the proposed estimation method yielded a coefficient of determination of 0.68 for the small-scale study area in Northern Finland. [C605]

"Calibration of SMOS geolocation biases"

The Soil Moisture and Ocean Salinity (SMOS) mission aims at observing two variables critical for a large scientific community, from biosphere dynamics to climate monitoring. The mission should also provide information on root zone soil moisture and vegetation and contribute to significant research in the field of the cryosphere. The original design, 2D interferometric radiometer at L-band, and principle of measurement makes SMOS a challenge at various technical levels. Moreover, stringent requirements on the estimated variables make the complete processing of SMOS data even more challenging. One of these requirements is concerned with the ability to accurately localize all the footprints of the instrument on the surface of the earth. Based on simulation and sensitivity studies with respect to the final retrieval of soil moisture, this accuracy requirement has been established so that the localization error on each footprint presents a zero mean and a standard deviation of 400 m. This high accuracy is mainly due to the need for knowledge of open water within a footprint, not to bias soil moisture estimation. This accuracy is highly challenging and unprecedented for sensors of this class and resolution. The on board devices that will help characterize the geolocation of the SMOS products include stellar sensor and gyroscopes, which can achieve an accuracy consistent with the requirements in terms of standard deviation. But the overall localization budget is also contaminated by an important bias, due to the mechanical deployment of the instrument antenna arms after launch, and to the launch shift that impacts all the alignments on the satellite (mechanical shift of stellar sensor due to shocks and vibrations, moisture desorption in mechanical brackets...). The purpose of this study is to characterize these biases, obviously inaccessible to on ground measurement and expected not to evolve once in orbit, so that they can be accounted for in the ground processing prior t- o initiate the soil moisture retrieval. [C606]

"Enclosed coaxial waveguide antenna array for a ground-penetrating radar"

In this paper the phased array of enclosed coaxial waveguides has been theoretically considered as antenna for ground-penetrating radar. The reflected and transmitted signals were obtained using the inverse Fourier transform. The reflection and transmission coefficients for the elements of array with monochromatic excitation can be founded using the variational principle in single-mode approximation. Some numerical results for array of two enclosed coaxial waveguides with a pulse excitation are presented. [C607]

"A new tracker for ocean-land compatible radar altimeter"

Satellite radar altimeter is an active microwave remote sensor for obtaining ocean topography, as well as the marine and land ice mass fluxes at a global scale. Because the echo properties of ocean, land and pole ice are very different, the on-board tracker of radar altimeter should have the ability to handle the distinct signals automatically. In this paper, a new tracker for ocean land compatible, the model compatible tracker (MCT), is proposed. In MCT, two track algorithms, MLE (Maximum likelihood Estimate) and OCOG (off center of gravity), cooperate in parallel. Therefore, not only the good accuracy but also the robustness can be realized in real time on board. So MCT is very suitable for the ocean-land compatible radar altimeter. The principle of MCT, the cooperation strategy for the two algorithms, the adaptive bandwidth technique, and the realization of MCT are discussed in this paper. [C608]

"Theoretic error analysis of split-gate tracker in satellite radar altimetry"

A theoretical analysis of the altimeter split-gate height tracker error is carried out in this paper. The principles of altimeter split-gate tracker are reviewed, and the discriminative curve of the tracker is derived. It is shown that the antenna parameters have little influence on the slope of discriminative curve. The height noise of the tracker is analyzed, assuming there is no other noise in the instrument. It shows that the AGC gate noise contributes much in the overall tracker noise in high sea state condition, so a long AGC gate is preferable. Finally, the 1s-averaged height noise level in a typical sea state (SWH=4 m) is calculated, and the error specification (<2 cm) is

proved to be met. [C609]

"Recognition Method of Radar Signal Based on Rough Set and Support Vector Machine"

A hybrid algorithm based on attributes reduction of rough set and classification principles of support vector machine (SVM) is presented in this paper. Firstly, the attributes reduction of rough set has been applied as preprocessor so that we can delete the redundant attributes and conflicting objects from decision making table but remain efficient information lossless. Then, the classification modeling and forecasting test based on SVM are realized. By this method, the dimension of data is reduced greatly, the complexity in the process of SVM classification is decreased highly, the occupied memory is cut down and the over-fit of training model is prevented at some extent, also the good classification performance is obtained. Finally, the simulation experiment of radar signal recognition and its results show this hybrid method is effective. [C610]

"Automotive 24 GHz pulse radar extended by a DQPSK communication channel"

An increasing number of cars are equipped with radar sensors for different applications observing the car environment. In order to improve the reliability of a single sensor and to gain additional information e.g. by triangulation, data from different sensors can be combined. One step further is to exchange sensor data between neighbouring cars by a data link to continuously transmit vehicle safety relevant sensor information. For this purpose it is necessary to establish an intervehicle communication (IVC) link. This task can be realized by independent communications links. A different attractive approach would be to partially use the hardware and the frequency spectrum of the existing radar sensors. This was the impulse to extend a pulse radar at a center frequency of 24.125 GHz by a communication transceiver in the same frequency band. The communication band, which is small compared to the radar spectrum, is placed in a range with low radar power spectral density. The pulse radar principle was chosen, because it is most common and key components, respectively RF-Frontends, are already available. The principle also provides short measurement times and high dynamic range. In the following the basic concept of the built prototypes and the signal processing of the radar and transceiver on FPGAs are described. The suitability of the system concept is discussed based on measurements and simulations. [C611]

"Coherent millimeter-wave imaging for security applications"

Homeland security today presents a major field for technology improvement and systems development. For instance body scanners, commonly operated at airports, are basically metal detectors and therefore are not able to detect other potential hazards like ceramics or explosives as well. In this context millimeter-wave (MMW) radar systems are a promising approach, because the radiation does not present a health hazard to people under surveillance and readily passes through many optically opaque materials such as clothing fabrics. For indoor systems we propose to apply active and coherent sensors. Based on the principles of Synthetic Aperture Radar small physical apertures can be used in order to get very good resolved images providing all the image features necessary for localizing relevant objects. In order to get a view of the person from all sides either the person has to be rotated standing on a turntable or a sensor is moved on a circular path around the person. Additionally interferometric principles can be applied firstly in order to obtain a geometrically improved mapping of the reconstructed scene and secondly to reduce ambiguities related to numerical reconstruction. [C612]

"European project RESOLUTION-local positioning systems based on novel FMCW radar"

This paper gives an overview of the European (EU) project RESOLUTION (reconfigurable systems for mobile local communication and positioning). RESOLUTION aims at developing a wireless three-dimensional (3-D) local positioning system with accuracy in the centimeter regime. A novel frequency modulated continuous wave (FMCW) radar principle is employed and co-designed together with common WLAN systems operating around 5 GHz. At 140 MHz bandwidth, measurements demonstrate excellent positioning accuracies of better than 4 cm in an anechoic chamber, and 18 cm in a conference hall with strong multipath and area of 800 m". Because of the high positioning accuracy, real-time ability, and robustness against multipath effects and fading, the system is very well suited for smart factories, robotics, interactive guiding, object tracking and augmented reality. [C613]

"Range Doppler detection for automotive FMCW radars"

The FMCW-Radar-Principle is widely used for automotive radar systems. The basic idea for FMCW-Radars is to generate a linear frequency ramp as transmit signal. The difference frequency between the transmitted and received signal is determined after downconversion. In order to detect range and velocity together, the information, extracted from one frequency ramp, is not enough, because it is ambiguous. Several subsequent ramps have to be generated to remove the ambiguity between the frequency portion produced by range and the doppler frequency. In this paper two methods are presented to perform this basic signal processing step. The

two methods have the Fast Fourier Transform as basic calculation step in common, but the number of FFTs and their length are different. The requirements on bandwidth for the IF-Hardware and A/D-Converters are also determined by the algorithm for Range-Doppler-Detection. The CFAR (Constant False Alarm Rate)-Algorithm for target detection must also be adapted to the chosen method. Both methods have been verified with a 24 GHz radar prototype. The Radar-Frontend has been built with a newly developed SiGe-Radar-Chipset on Infineon's B7HF200-Process with a transition frequency of 200 GHz. [C614]

"Four-square phased array for multi-beam applications using novel matrix feed"

Modern communications systems use multi-beam antennas for the sectorization of 360deg azimuthal coverage or diversity and MIMO concepts. One suitable antenna realization is based on the phased array principle, where four elements placed at the edges of a square are required in order to form four overlapping beams in azimuth. In its basic form, excitation phases of 0deg, 90deg and 180deg are required for beam forming. The paper presents a novel multi-beam matrix network created by four 90deg-hybrid couplers which realizes the required excitation for four beams spaced by 90deg in the azimuth plane. A proof-of-concept antenna was designed which employs miniature surface-mount couplers in a microstrip feed network and uses vertical monopole radiators. [C615]

"Novel secondary radar for precise distance and velocity measurement in multipath environments"

The performance of wireless systems strongly depends on the characteristics of the radio channel. Multipath propagation and Doppler effect are two phenomena to be considered. We present a frequency-modulated continuous wave (FMCW) secondary radar concept to estimate the offset in time and in frequency of two wireless units and to measure their distance to each other. The distance can be measured with a standard deviation as low as 1 cm. However, the accuracy of the system is degraded in multipath environments or if the stations are moving relative to each other. In this paper we show a novel extension of the algorithm to cope with multipath propagation and the Doppler effect. The broadband measurement principle at hand is robust towards multipath interference. Additionally the Doppler effect is compensated for. By evaluating the Doppler frequency shift the relative velocity of the mobile units is measured directly. Measurement results prove the significant improvement in system performance if the extended algorithms are used. [C616]

"W-band substrate integrated waveguide radar sensor based on multi-port technology"

A 94 GHz collision avoidance radar sensor based on multi-port technology is proposed. This sensor makes use of substrate integrated waveguide (SIW) multi-port circuit fabricated on alumina substrate. The use of integrated waveguide allows for a full integration of the radar sensor front-ends. A specific base-band circuit generates in-phase and in-quadrature signals used to obtain the relative speed of target (including the moving direction) and the distance by elementary signal processing. Simulation and measurement results validate the operating principle of the proposed sensor and also indicate excellent results for relative velocity measurement together with good accuracy of distance measurement. [C617]

"A high-resolution imaging algorithm without derivatives based on waveform estimation for UWB pulse radars"

UWB pulse radars are promising as high-resolution imaging techniques, which are required for target positioning systems of rescue robots moving in a dark smoke, for example. It can be also applied to a non-destructive measurement for industrial products (e.g. antennas and vehicles), in order to detect small surface defects. These applications require a fast, robust, and high-resolution imaging algorithm. We have already proposed a robust and fast imaging algorithm with an envelope of circles. This method utilizes the principle that the target boundaries are expressed as the envelopes of circles with the radius corresponding to the time delays. Our method can realize robust imaging even in a noisy environment. However, the error of the estimated image is at least about 1/10 of the center wavelength of the pulse because the image is distorted especially around sharp edges. This is because we assume that the scattered waveform is the same as the transmitted one. In this paper, we utilize the shape estimation method together with a waveform estimation in order to enhance the resolution of the image. An imaging algorithm based on this idea has been published. However, the earlier study utilizes a parametric approach and can be applied only to a simple polygon. In this paper, we extend this idea to general convex targets including smooth curves and edges. Numerical simulations and experiments show that the proposed method accomplishes a high-resolution imaging. [C618]

"Ultra-thin absorbers by using high impedance surfaces with resistive frequency selective surfaces"

This paper presents a novel procedure for the synthesis of thin radar absorbers composed by a lossy Frequency Selective Surface (FSS) in the viinity of a PEC plane. The aim of this work is to obtain the same properties of

the Salisbury and Jaumann screen for both TE and TM incidence polarizations, using a thinner structure. The new-style RAM relies on the operating principle of the Salisbury screen, but its ultra-thin design is based on the Artificial Magnetic Conductor (AMC) properties of the FSS configuration. [C619]

"Simulation of Beam-Wave Interaction for Millimeter Wave Coupled-Cavity Traveling Wave Tube Using PIC"

A method of particle-in-cell (PIC) has been introduced to simulate beam-wave interaction of millimeter wave coupled-cavity traveling wave tube (TWT). The principle of PIC was analyzed theoretically. Both the move track of particles of electron beam and the change of electric field were simulated before and after beam-wave interaction with our self-designed PIC software. The simulation results show that dynamic beam-wave interaction of millimeter wave TWT can be expressed accurately using PIC, which may provide guidance for the research of beam-wave interaction of TWT. [C620]

"Performance Analysis of FMCW Synchronization Techniques for Indoor Radiolocation"

A high precision localization system (HPLS) operating in the 5.8 GHz ISM band is presented. The system principle is based on the sequential exchange of frequency modulated continuous wave (FMCW) signals between identical radar stations. The round-trip time-of-flight (RToF) localization method requires exact synchronization of all involved stations. Consequently, accurate compensation of clock frequency drift is indispensible. We analyze the impact of clock deviation on synchronization accuracy and present a precise compensation method. The synchronization technique has been tested on a prototype system. Measurements showed a 3D-position accuracy of 2.8 cm under laboratory conditions. [C621]

"Implementation of an active noise suppression system in C-band indoor RCS measurements"

The present article shows the results of ongoing works at AMR/IAE/CTA in the configuration of an experimental setting necessary to determine the error sources in radar cross section (RCS) measurements and hence minimize them by means of a system developed to measure targets in C- Band (6.0 GHz), in a closed environment, using an anechoic chamber. Microwave circuit techniques were employed aiming at an active noise suppressing system, by use of the principle of phase canceling. By means of this work it was possible to perform comparison of the RCS measurements, with and without the developed system, and observe its influence in such measurements. Given the accuracy obtained, it can be asserted that implementation of this system in future measurements will be very useful and necessary for the determination of RCS of complex objects, such as missiles, aircrafts and helicopters. [C622]

"The validation of models in an imaging infrared simulation"

Simulation models must be validated to ensure that the simulation reflects reality. The approach taken here is based on a well accepted framework that considers reality, the conceptual model and the computer model. The paper shows how these principles are applied to models in the infrared simulation and how the results are interpreted. The concepts discussed here are not bound to infrared systems, and can be applied to radar, in the environmental sciences and even in the human sciences. [C623]

"Design of a [CDC-20 GHz] Buffered Track and Hold Circuit in InP DHBT Technology"

This paper describes the design and realization of a buffered track and hold (BTH) circuit fabricated in InP-InGaAs-InP double heterojunction bipolar transistor (DHBT) technology (FT= 180 GHz). This BTH is intended for a single shot, 20 GHz bandwidth and 40 GS/s sampling frequency digitizer based on the non simultaneous spatial sampling principle. Based on a high speed switched emitter follower (SEF), the BTH can ensure 20 GHz bandwidth signal compatible with the targeted objectives. First experimental results in the frequency domain and a novel optimized architecture leading to a combination between the SEF and the Cherry Hooper design based buffer are also presented. [C624]

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"Novel robotic spacecraft simulator with mini-control moment gyroscopes and rotating thrusters"

A novel hardware-in-the-loop spacecraft simulator is introduced for the laboratory validation of guidance, navigation and control algorithms. This three-degrees-of-freedom robotic vehicle uses the principle of air-floating along a flat floor in order to reproduce in two dimensions the frictionless and weightlessness conditions of the orbital flight. For the first time in its class, to the authors' knowledge, the new spacecraft simulator uses miniature control moment gyroscopes for the attitude control and rotating thrusters for both attitude and translational control. A pseudo-GPS, a LIDAR and a fiber optic gyroscope are used as navigation sensors. The paper presents in details the design of the robotic vehicle and the results of preliminary experiments. [C629]

"Multi-source semantic integration-revisiting the theory of signs and ontology alignment principles"

Current conceptual models for information fusion, including the JDL model do not consider the fact that their information sources are often based on different ontological bases. We therefore suggest that the Alignment functional process of the JDL model, which caters for space and time common referencing, be augmented with the notional aspect of common ontological alignment We illustrate this with the semiotic triangle and show how symbols relate to conceptualizations which in turn refer to objects of interest within domains of discourse. We then discuss on the notion of ontology alignment and how it is substantiated in a perspective of communication between a source (an addresser) and a fusion node (an addressee. Finally, we discuss on the semantic distance as a result of aligning similar (but not congruent) concepts. [C630]

"Weighted Laguerre Polynomials and its Applications in Transient RCS Analysis"

Weighted Laguerre polynomial is a set of self-contained orthogonal causal functions. In this paper, the properties

of weighted Laguerre polynomials are summarized. As a set of temporal basis functions, the influence and choice of the time scaling factor are discussed in detail. And then the choice principle for the time scaling factor is obtained. The application of weighted Laguerre polynomials, which are the temporal basis of transient scattering analysis for arbitrary shaped structures, is illustrated for transient RCS calculation. The examples show that the choice principle proposed here is effective. [C631]

"A low cost millimeterwave antenna with smart tapering active feed network"

The purpose of this paper is to report on a microstrip reconfigurable antenna in millimeter wave range. This antenna has directivity diversity and is based on a four- element array. An original method is outlined to guarantee matching for each configuration without changing circuit. A smart tapering active (STA) feed network has been simulated to demonstrate the principles and capabilities of this antenna in millimeter wave. Great results have been achieved with two passive prototypes at 24 and 77 GHz and active models are under consideration. [C632]

"A Novel Multiplexing Method for High Data Rate Communication Systems"

In order to improve exploitation in guided transport networks, many approaches have been investigated for the development of tools or systems able to provide needed information. Ours laboratories designed an original radar system that allows inter-vehicle communication. This system called CODIREP-communication detection and identification of broken-down trains-is based on the principle of a co-operative radar using a transponder inside targets. It is made of a transmitter/receiver couple, which equips respectively the front and the rear of two successive vehicles. It uses a numerical correlation receiver and has a broad band of about 100MHz which could be exploited to establish high data flow communications. A preliminary prototype was realized using a technical solution to multiplex communication data and localization code. The tests in free space and tunnel show that a range of 800 m in free space and 700 m in tunnel with a location precision of 1.5 m and a data rate of about 1.6 Mbps could be reached. This remains insufficient for some applications that require more resources. With the system, we intend to reach more than 5 Mbps. The aim of this work is to improve this system by proposing another original coding technique developed in order to increase the data flow rate. Simulations will be executed to evaluate the system's performances in terms of data flow, bit error rate (BER), computing time and complexity. [C633]

"Research of State Monitoring and Pre-warning System of Cable Joint in Distribution power grids"

The failure caused by the cable joint seriously threatens the safe running of distribution power grids. In this article, we have proposed a supervising system using wireless communication technique in order to realize a real-time monitoring and pre-warning of cable joint in distribution power grids. In this paper, we mainly introduce the framework of the system, principles as well as the software designing. [C634]

"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 [C635]

"Image Formation Algorithm for the Implementation of Circular Scanning SAR"

This paper presented circular scanning synthetic aperture radar (SAR) based on circular scanning antenna. The work principle of this scanning radar was described. The variations of synthetic, aperture time, azimuth resolution and time-bandwidth product were analyzed. Also a focused imaging algorithm instead of DBS was used to form high resolution image. This algorithm based on extended chirp scaling (ECS) could compensate phase errors with high precision. The versatile image formation flow was composed of burst imaging, geometric correction and mosaicking. The computer simulation results confirmed that the versatile image formation flow could be used to image precisely for circular scanning SAR [C636]

"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 [C637]

"Topographic Effect on Multistatic Spotlight SAR Azimuth Spectrum Combination"

Based on wave-front reconstruction theory, this paper analyzes the principle of improving azimuth resolution in spotlight mode by multiple SAR surveys, and the approach to implement it. Meanwhile, topographic effect on the approach is investigated. And the way to eliminate topographic effect is presented. The numerical simulation examples are given in the end to illustrate the results [C638]

"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 [C639]

"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 [C640]

"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 [C641]

"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 LI 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. [C642]

"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 [C643]

"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 [C644]

"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 [C645]

"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 [C646]

"An Iterative Filter for a Class of Multi-Channel Nonlinear Systems with Multiplicative Noise"

An iterative state filtering algorithm was proposed for a class of multi-channel nonlinear systems in the presence of multiplicative noise. The system is under the condition that the multiplicative noise sequence of observation model is in the form of diagonal stochastic matrix, and the multiplicative noises of all observation channels are correlated with each other at the same time. Based on linearization, iterative idea and the principle of linear minimum-variance, the algorithm is optimal for the linearized system in the sense of linear minimum-variance, and is suboptimal with respect to the original nonlinear system. A simulation example of two channels was given to demonstrate the effectiveness of the proposed algorithm [C647]

"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 [C648]

"Vision-based path-planning in unstructured environments"

Autonomous driving in unstructured environments has attracted an unprecedented level of attention when the DARPA announced the Grand Challenge Competitions in 2004 and 2005. Autonomous driving involves (at least) three major subtasks: perception of the environment, path planning and subsequent vehicle control. Whereas the latter has proven a solved problem, the first two constituted, apart from hardware failures, the most prominent source of errors in both Grand Challenges. This paper presents a system for real-time feature detection and subsequent path planning based on multiple stereoscopic and monoscopic vision cues. The algorithm is, in principle, suitable for arbitrary environments as the features are not tailored to a particular application. A slightly modified version of the system described here has been successfully used in the Qualifications and the Final Race of the Grand Challenge 2005 within the Desert Buckeyes' autonomous vehicle [C649]

"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 [C650]

"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. [C651]

"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. [C652]

"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, an 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 [C653]

"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 [C654]

"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 Pfaand Pd(detecting probability) are proved independent of the probability distribution of white noise by Monte Carlo simulation, although the performance of Pdis shown to deteriorate less than 4 dB compared with optimal parametric detector as far as samples length of 256 and Pfaof 1e-4 is concerned [C655]

"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 M2times M2into the (2M-1) times (2M 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 [C656]

"A Method to Remove Rebound Jamming against Bistatic Synthetic Aperture Radar"

Rebound jamming, a kind of main-beam jamming, is effective to resist BiSAR. Due to simultaneous coherence between interferences and target echoes in both down-range and cross-range, it is difficult to remove the interference from received signal. Based on the principle of two-channel cancellation using for moving target detection, the paper proposes a method to remove rebound jamming against BiSAR, which can give satisfactory interference cancellation when interference parameters are known either completely or partially. The estimation of interference parameters is presented, too. Validation is confirmed by simulations [C657]

"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). [C658]

"Research on the Technology of RFSS in Large-scale Universal Missile ATE"

This paper addressed the application technology of radio frequency simulation system (RFSS). The realization was applied to a large-scale universal missile automatic test equipment (ATE). Mathematic model and operating principle of two most important kinds of final guidance radar RF simulation system were described, including pseudo-coherent frequency agile radar and pulse Doppler (PD) radar. We developed an integrated system with modularization configuration, which was characterized by its versatility and expandability [C659]

"Chirp-Pulse Stepped-Frequency Radar Based on Decorrelation Processing"

This paper introduces a novel method based on decorrelation processing to solve the energy-spillover problem in conventional chirp-pulse stepped-frequency radar processing in order to achieve high range resolution. Compared with previously proposed methods, this method is much simpler to be realized in engineering. Its principle is analyzed in this paper, and its performance is confirmed by simulation results [C660]

"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 [C661]

"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 situtechniques. 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 [C662]

"A novel tiered sensor fusion approach for terrain characterization and safe landing assessment"

This paper presents a novel, tiered sensor fusion methodology for real-time terrain safety assessment. A combination of active and passive sensors, specifically, radar, lidar, and camera, operate in three tiers according to their inherent ranges of operation. Low-level terrain features (e.g. slope, roughness) and high-level terrain features (e.g. hills, craters) are integrated using principles of reasoning under uncertainty. Three methodologies are used to infer landing safety: fuzzy reasoning, probabilistic reasoning, and evidential reasoning. The safe landing predictions from the three fusion engines are consolidated in a subsequent decision fusion stage aimed at combining the strengths of each fusion methodology. Results from simulated spacecraft descents are presented and discussed [C663]

"On the impact of unwanted traffic onto a 3G network"

The presence of "unwanted" (or background) traffic in the Internet is a well-known fact. In principle any network that has been engineered without taking into account the presence of unwanted traffic might experience troubles during periods of massive exposure to it, e.g. large-scale infections. A concrete example was provided by the spreading of Code-Red-II in 2001, which caused several routers crashes worldwide. Similar events might take place in 3G networks as well, with further potential complications due to the functional complexity and the scarcity of radio resources. In this explorative paper, we show that unwanted traffic is present also in GPRS/UMTS, mainly due to the widespread use of 3G connect cards for laptops. Based on a mixture of real-world measurements and theoretical speculations, we investigate the potential impact of such traffic onto the

underlying network. We show that under certain hypothetical network configuration settings unwanted traffic, and specifically scanning traffic from infected mobile stations, can cause large-scale wastage of logical resources, and in extreme cases starvation. We urge the research community and network operators to consider the issue of 3G robustness to unwanted traffic as a prominent research area. The goal of this paper is to trigger interest and at the same time move a first pioneering step in this direction [C664]

"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 naffowband antennas, will be presented in next part [C665]

"Narrow band high resolution radar imaging"

We present a technique for generating imagery with high spatial resolution but from low bandwidth radar transmissions. The high spatial resolution is obtained by applying the principles of tomography to a multi-site monochromatic continuous wave (CW) radar system that can illuminate the target over a complete angular range of 360 degrees. A simulation has been developed to investigate the technique. Further, full-scale imagery of corner reflector and vehicle targets derived from an ISAR data collection has been modified to emulate and examine the performance of a multi-static monochromatic CW system. The approach also provides valuable insight into the fundamental resolution limits possible in microwave imaging. It is shown how resolution can be improved beyond the limits normally attributed to the SAR and ISAR forms of imaging. In fact, there is no theoretical limit of the resolution of the sensor. [C666]

"A novel transmit-receive module based on coupled oscillators"

A novel kind of T/R module is introduced in the article. Basic principle of receiving beam scanning is reviewed and the method of using coupled oscillators to realize the receiving beam-scanning is detailed. Then a kind of more realistic scanning system possessing transmitting and receiving functionality is introduced. The T/R module based on the new beam-scanning system has the merits of low profile, low cost and high efficiency [C667]

"Direction of arrival (DOA) estimation using electrically small resonant dipole antennas"

In this paper we present a methodology for the direction of arrival (DOA) estimation using the induced voltages that are measured at the feed points of electrically small resonant dipole antenna arrays illuminated by the signal of interest. The matrix pencil method is applied directly to the induced voltages to estimate the DOA of the various signals. Using electrically small resonant antennas can be advantageous if they are spaced half a wavelength apart as it will significantly reduce the mutual coupling between the various antenna elements. However, the electrically small antennas can also be placed in close proximity of each other saving the real estate and thus making it possible to deploy phased arrays on small footprints. For the latter case it may be necessary to use the transformation matrix to compensate for the strong mutual coupling that may exist between the antenna elements. The transformation matrix converts the voltages that are induced at the loads corresponding to the feed point of the array operating in the presence of mutual coupling and other near field scatterers to an equivalent set (ULVA) consisting of omni-directional isotropic point radiators equally spaced and operating in free space. Three different scenarios are presented to illustrate the methodology. First we consider resonant dipole elements spaced half wavelength apart, electrically small resonant antenna elements spaced half wavelength apart and electrically small resonant antenna elements placed in close proximity of each other to reduce the footprint without affecting the performance of the phase array. Numerical examples are presented to illustrate the principle of this methodology. [C668]

"ISAR processing results from forward scatter radar measurements of ships"

Forward scattering radar system concepts have been the object of extensive research both for military and civilian applications since the 1930s. Forward scattering systems are in principle easy to construct. This paper shows a realization of a forward and back scattering radar system carried out by Forsvarets forskningsinstitutt for the purpose of generating both ISAR signatures of ships simultaneously. Forward scattering can give significant enhancement due to Babinet's principle. The processed results show that both forward and backscattering configuration were able to see a small open fiber glass test boat passing through the radar beams. Forward and

back scattering ISAR give different ship signatures, and can, when combined, give increased ability for ship classification, recognition and identification. [C669]

"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 [C670]

"IWRAP: the Imaging Wind and Rain Airborne Profiler for remote sensing of the ocean and the atmospheric boundary layer within tropical cyclones"

IWRAP, the Imaging Wind and Rain Airborne Profiler, is the first high-resolution dual-band airborne Doppler radar designed to study the inner core of tropical cyclones (TCs). IWRAP is currently operated from a National Oceanic and Atmospheric Administration (NOAA) WP-3D aircraft during missions through TCs and severe ocean storms. The system is designed to provide high-resolution, dual-polarized, multi-beam C- and Ku-band reflectivity and Doppler velocity profiles of the atmospheric boundary layer within the inner core precipitation bands of TCs and to study the effects precipitation has on ocean wind scatterometry as it applies to TCs. This dual-wavelength system also provides for the use of differential attenuation techniques to derive the rainfall rate and to characterize the dropsize distribution (DSD) within TCs. This prototype has demonstrated its capability to measure the wind field and the rainfall rate over the range of winds and rain rates usually present in this kind of scenario, and has served as a proof of concept for the design of similar instruments aboard other platforms such as unmanned aerial vehicles (UAV) flying at high altitudes, as well as for spaceborne applications. IWRAP implements a very unique measurement strategy, it profiles simultaneously at four separate incidence angles (approximately 30, 35, 40 and 50 degrees) while conically scanning at 60 RPM. A summary of the principles of operation and the system design of the instrument is given, and examples of IWRAP's unique imaging capabilities are presented and compared against high density sequencies of GPS dropsondes and other radars aboard the aircraft. To our knowledge, the examples that will be presented include the highest-resolution measurements of the boundary layer winds in a hurricane ever obtained [C671]

"Invited Paper: Advances in Millimeter Wave Imaging and Radar Systems for Civil Applications"

Recent developments in the field of millimeter wavelength imagers intended for security and other applications are described. Passive mm-wave systems are now available that exploit high performance MMIC based sensors combined with mechanically scanned optics to provide highly cost effective industrial security cameras. The paper will describe the general principles inherent in the approach, describe the supporting technology and provide performance examples. Additionally the potential for the development of longer range sensor systems intended for surveillance and other applications is discussed [C672]

"Research on 2-Channel Outdoor Radar Target Scattering Measurement System"

A 2-channel system based on pulse-to-pulse frequency shifting technique was designed and realized for outdoor radar target scattering measurement. The system can perform radar-cross section (RCS) measurement simultaneously on two fixed frequency bands, and test 2-dimension imaging cooperated with a rotation platform. The principle of the pulse-to-pulse frequency shifting is summarized, the design is presented and an actual result is given [C673]

"Investigation and Development of a Time-Domain Chamber for Antenna and RCS Measurement"

Principles of time-domain measurement in chamber was studied. Developing procedures of a test system for antenna and RCS were introduced. sampling oscilloscope was used for measuring in compact range chamber for the first time. Idea of virtual instrument was used. Finally, curves achieved from the system were offered [C674]

"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 [C675]

"Design and Implementation of Intelligent Vehicle Monitoring and Management System Based on the Multi-Net"

In this paper, an intelligent vehicle monitoring and management system (IVMMS) based on the multi-net is designed. First, its architecture and functions are introduced. It uses many technologies fusing GPS, GPRS/CDMA, GIS, RS and Internet, and is composed mainly by two major parts: the Mobile Terminal and the Monitoring Center. Especially, GPRS/CDMA technology is the reliable technical support for wireless communication smooth transition from the 2.5G to the 3G; then, the principles and the key technologies of Mobile Terminal and Monitoring Center are discussed respectively in detail, and figures of their structures are also shown below; finally, a novel vehicle scheduling model based on ant algorithms are proposed and the course of scheduling tasks is also introduced. It is indicated that, the vehicles scheduling efficiency is enhanced greatly. The system not only can be used in the vehicles scheduling, but also in the vessel and other fields, and the solid technical support will be provided for the ITS research [C676]

"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 [C677]

"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 [C678]

"Enhancement and implementation of a localization and communication system dedicated to guided transports"

Nowadays, in maritime and airway domains, many intelligent systems are used for the localization and to exchange data information. However, in guided transports domain, no system is able to ensure these two functionalities. This paper presents a new system called CODIBT (communication, detection and identification of broken-down trains) allowing multi-user access and combining the two main functionalities: localization and high data flow rate communication. Such systems are developed in order to improve exploitation inside guided transport networks. Our laboratories designed an original radar system that allows inter-vehicle communication. This system is based on the principle of a co-operative radar using a transponder inside targets. It is made of a couple of transmitter/receiver which equips respectively the front and the rear of two successive vehicles. It uses a numerical correlation receiver and has a broad band of about 100 MHz which could be exploited to establish high data flow rate communications. The aim of this paper is to describe the mock-up realized and present some improvements of the coding methods developed using spreading spectrum techniques. Some simulations aimed to evaluate system performance in terms of BER together with main experimental results will be reported [C679]

"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 it's 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 [C680]

"A New Method of Distance Measuring Based on Frame Synchronization Code for Airborne Target Drone"

For the application of airborne target drone, a distance measuring algorithm based on frame synchronizing code is presented. Taking the wireless data link of a airborne target drone for example, this paper elaborates the method that takes the synchronizing code of the data link frame in wireless telecontrol (TC) and telemetering (TM) as the measuring code, and gives out the principle of the measurement, the design of the circuit and the analysis of the error. Regarding the ground control station as the zero distance benchmark, comparing the radar identified flight data and the airborne target drone measured data, these two are well fitting in plot. Besides, the mean square error of the distance that airborne target drone measured is in range of 20 m, which meets the demanded error in range of 30 m. Many types of airborne target drones and many flight experimentations show that this method is simple, good-precision, low channel energy spent and low system cost. This method can also be applied to other wireless system that needs measuring continuously in range of 300 km [C681]

"Time Synchronization for Wierless 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 [C682]

"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 [C683]

"Effective Testing Principles for the Mobile Data Services Applications"

Wireless communication technologies like GPRS, UMTS and WLAN, combined with the availability of high-end, affordable mobile devices enable the development of advanced and innovative mobile services. Devices such as mobile phones and personal digital assistants let the users access a wide range of new offerings whenever and wherever they happen to be. A strategic approach for the quality assurance of these mobile data services should take into account a number of characteristics unique to the mobile paradigm such as the increased complexity of emerging handheld devices, the greater sensitivity to security and load related problems in wireless infrastructure and increased complexities of scale. This paper identifies the major factors influencing the development and testing strategies for these applications and works out effective quality assurance principles to ensure productive and scalable mobile data services [C684]

"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 *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). [C685]

"Handoff Protocol for Heterogeneous All-IP-based Wireless Networks"

Next generation wireless networks (NGWN) or 4G are envisioned to be a combination of different architectures and wireless technologies. This brings several design and deployment challenges, such as mobility management, quality of service (QoS) provision and networks interworking. Mobile IPv6 (MIPv6) and its extensions, like HMIPv6 and FMIPv6, have been proposed for IP layer mobility management in NGWN. However, these protocols are hindered by several shortcomings; they fail to ensure seamless communications and support of real-time applications. This paper proposes a new and efficient mobility management protocol namely, handoff protocol for integrated networks (HPIN), based on score function, fast handover and anticipated resources reservation principles, to alleviate service disruption during users roaming by allowing selection of the best available network. The implementation of HPIN has been subject to extensive tests and results obtained show its benefit in terms of QoS than traditional and existing handoff protocols [C686]

"Design and Realization of Embedded Image Transmission System Based on GPRS"

The embedded image transmission system introduced in this paper is realized in advanced RISC machines (ARM9) platform and embedded Linux system which has excellent network function, and it is connected to net through the general packet radio service (GPRS) module. Image is transmitted by multimedia messaging service (MMS). MMSprotocol stack, the design principle, the hardware structure and main software process to transmission image are introduced in detail, and put the system into wireless intellectual home safeguard control system, also it can be used in other watch field. [C687]

"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 [C688]

"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 [C689]

"The Design of the Microwave T/R Module Automation Test System Based on the Embedded System"

This paper describes the design principles of the automated test system for microwave T/R module, with the embedded system achieving the function control of the whole system. The system could implement automatic measurement of all the time domain and frequency domain parameters in the sixteen 32-channel modules using the single-connection multiple-measurement (SCMM) technique, and conduct automatic S-parameter test and error correction under both continuous wave and pulse according to presetted test programs. With the application of the embedded system, the system ranks a high flexibility, high reliability, open infrastructure and good scalability, and the performance specification has made it among the advanced products worldwide. [C690]

"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 [C691]

"Stealth Consideration for Passive Millimetre-wave Detection and Guidance"

Under actual threat of passive millimetre-wave (MMW) detection and guidance, to enhance survivability of ground target in future battlefield, MMW passive stealth technology research is conducted. Its necessity is analyzed and certified, and MMW passive detection distance is analyzed on the base of target radiation characteristic testing principle. The main direction for MMW passive stealth, the shape and the materials behavior control, are pointed out and the actual control methods are analyzed [C692]

"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 [C693]

"A High Repetition Rate Battery-Powered 0.5 MV Pulser for Ultrawideband Radiation"

High power electromagnetic pulses are of importance in a variety of applications such as transient radar, when investigating the effect of strong radio-frequency impulses on electronic systems and modern bio-medical technology. The paper presents details for a compact, battery powered, repetitive pulser, which is capable of producing nanosecond rise-time pulses at voltages exceeding 0.5 MV. The system is based on a Tesla transformer operating in a dual-resonance mode, with a high energy transfer efficiency between the primary and secondary circuits. To obtain a high pulse repetition frequency of at least 1 kHz, the key component is a closing switch in the primary circuit working on the principle of corona stabilization [C694]

"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 [C695]

"Motion Planning in an Uncertain Environment: Application to an Unmanned Helicopter"

In this work we present a methodology for intelligent motion planning in an uncertain environment using a non-local sensor, such as radar. This methodology is applied to an unmanned helicopter navigating a cluttered urban environment. We show that the problem of motion planning in a uncertain environment, under certain assumptions, can be posed as the adaptive optimal control of an uncertain Markov decision process, characterized by a known, control dependent system, and an unknown, control independent environment. The strategy for motion planning then reduces to computing the control policy based on the current estimate of the environment, also known as the "certainty equivalence principle" in the adaptive control literature. Our methodology allows the inclusion of a non-local sensor into the problem formulation, which significantly accelerates the convergence of the estimation and planning algorithms. Further we show that the motion planning and estimation problems, as formulated in this paper possess special structure which can be exploited to significantly reduce the computational burden of the associated algorithms. We apply this methodology to the problem of motion planning for an unmanned helicopter in a partially known model of the Texas A&M campus [C696]

"Microwave Reflectometry Based On Amplitude Modulation"

Reflectometry is a technique, based on the radar principle, with a response mainly sensitive to the plasma regions where the microwaves are reflected. The reflectometry technique used in plasma devices measures the phase of a wave reflected by a plasma cut-off layer at a given electron density. It has become a promising experimental technique for the measurement of the electron density profile in plasma devices, due to its good spatial and temporal resolution, together with the moderate access requirements and its ability to perform profile inversion along a single line of sight. Since its first implementation on a plasma device for electron density profile measurement, the high cut-off X-mode polarization has convinced many scientists to use this technique on most of the main devices, such as ASDEX, DIII-D, Gamma 10, TJII, TFTR, W7AS etc, and it is planned for edge and scrape of layer profile determination on ITER. [C697]

"Scattering and Propagation of Polarimetric Radar Signals in Storms and Clouds"

The introduction of differential reflectivity (Zdr) and propagation differential phase (Phidp) was originally intended for improving radar estimates of rainfall rate. These parameters together with the effective reflectivity factor (Zh) 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 Zhand Zdrwith X-band Zhand specific attenuation Ah). [C698]

"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. [C699]

"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. [C700]

"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. [C701]

"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 [C702]

"WLC28-4: An Evaluation of Ultra Wideband Technology for Indoor Ranging"

Ultra wideband technology shows promise for precision ranging due to its fine time resolution to resolve multipath fading and the presence of lower frequencies in the baseband to penetrate walls. While a concerted effort has been conducted in the extensive modeling of the indoor UWB channel in recent years, to our knowledge only two papers have reported ranging performance, but for limited range and fixed bandwidth and center frequency. In principle boosting power can guarantee connectivity between transmitter and receiver, but not precision due to the distorting effects of walls and other objects in the direct path. In order to gauge the limits of UWB ranging, we carry out 5000 measurements up to an unprecedented 45 m in non line-of- sight conditions in four separate buildings with dominant wall material varying from sheet rock to steel. In addition, we report performance for varying bandwidth and center frequency of the system. [C703]

"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 [C704]

"Study and Simulation on Bistatic SAR"

After introduction of system configuration of a multi-static SAR, essential principle and system performance is analyzed. By utilizing the Versatile SAR Simulation Model (VSARSM) simulation results are given, which sustained the theory. [C705]

"Analysis of Scattering and Radiation of Mixed Conducting/Dielectric Objects Using MLFMA"

A scheme is presented to apply multilevel fast multipole algorithm (MLFMA) to analyze the scattering and radiation for three dimensional (3D) objects comprising conducting and dielectric bodies. Applying equivalence principle, PMCHW formulations are used on the surface of the 3D dielectric bodies and EFIE is used on conducting surface. The far-field matrix-vector multiplication and the near-singular problems are analyzed. Application of MLFMA reduces the memory requirement and computational complexity of the MOM solution significantly, which renders us to analyze the electrically large objects. Numerical examples are presented to demonstrate the accuracy and high efficiency. [C706]

"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. [C707]

"Impulse Generator Using UWB Pulse Forming Network"

Development of a new nanosecond monocycle pulse generator with pulse forming network is presented along with detailed design and analysis. The developed pulse forming network is simple, compact, and can be realized using planar circuit. Formation of the impulse is a classical technique using the delay-line principle and

implemented on microstrip structures. The pulse-shaping network employs a microstrip short-circuited stub. An impulse generation circuit using an SRD was made and the monocycle pulse was produced using the microstrip pulse forming network. The measured pulses have good symmetry and low ringing level. [C708]

"The Use of the Emergence Principle as a New Step in the Electromagnetic Waves Polarization Theory at the Scattering by Complex Random Radar Objects"

In the given paper the use of the emergence principle is considered as a new step for investigation of electromagnetic waves polarization properties at the scattering by complex radar object, include random complex objects. Unexpected for the existing polarization theory results have been found as the consequence of relations between a distributed radar object elements polarization properties. [C709]

"Wideband Vector Network Analyzer Design by Multisixport Principle"

Paper presents simple sixport principle and its frequency bandwidth. The novel multisixport approach is presented with its possibilities, typical parameters and frequency bandwidth more than 1:100 if necessary. [C710]

"Multibit Microwave Frequency Discriminators"

The broadband microwave phase detector with diode ring discussed in the paper can be also used as a frequency detector. Operation principle for frequency detectors of the sine and cosine type are presented. Structures of multichannel frequency discriminators including sine and cosine type detectors and their features are also shown. [C711]

"Digital-Analog Phase Shifters with Ferroelectric Varactors for 2D Phased Array Antenna"

The advantages of the new digital-analog principle of operation for phase shifters using ferroelectric (FE) film varactors are considered. The results of the theoretical investigation are confirmed by testing of a 1.8GHz device with a figure of merit F=120 deg/dB and a phase error < plusmn2deg in bandwidth Deltaf/f~ 5%. The response time of the phase shifter to control pulse corresponds to units of nanoseconds. On the base of analysis of properties of ferroelectric varactors the theoretical estimation of nonlinear behavior of digital-analog phase-shifter in two-tone input signal regime is executed. Expected parameters of a multilayer microstrip phased array antenna based on phase shifters with ferroelectric varactors are presented. [C712]

"RF-CMOS Integrated Circuits for Wireless Communications"

This paper reviews state of the art CMOS-RFICs for wireless transceivers. It discusses principles and trends in the development of wireless platforms in the context of CMOS technology evolution. Some examples of achievements and commercial implementations are presented. Finally, some perspectives on future directions in RF-CMOS integration will be given. [C713]

"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. [C714]

"Planar version of Collinear Microstrip Patch Antenna"

The paper presents a planar version of collinear microstrip patch antenna that exhibits further gain enhancement compared to collinear microstrip patch antenna due to the lateral extension of in-phase source current area of radiation element. The principle of operation is similar as in case of collinear wire antennas. The basic idea consists in the use of TM0xmode with geometrical perturbation of radiation motif by inner slot(s) and lateral notches introduced in such a way that they eliminate radiation from even half current wavelengths. Detailed principle of an antenna operation explained via vector surface current distribution, determination of initial antenna dimensions and final optimization in planar simulator IE3D are presented. The prototype of the antenna operating in 2.4 GHz ISM band has been realized and measured. [C715]

"Project Resolution; Reconfigurable Systems for Mobile Local Communication and Positioning"

The aim of RESOLUTION project is developing of a wireless three-dimensional (3D) local positioning system with resolution in the centimetre regime and real-time ability. The system is intended to work in environment with strong multipath effects and fading. The solution will be implemented in advanced CMOS technology. Main project goals are: development of a wireless 3D high accuracy local positioning system, a novel frequency modulated continuous wave (FMCW) radar principle with pulsed active reflector will be employed, positioning system will be implemented on basis of common WLAN systems, to allow multifunctional tasks, highly integrated system on chip (SoC) frontends will be designed on advanced CMOS technology, smart power and adaptive performance control will be applied to minimize the power consumption according to application needs, in order to enhance the performance and coverage range, the transceiver features adaptive antenna combining in the radio frequency (RF) receiver. [C716]

"UWB Radar for Human Being Detection Behind the Wall"

In this paper is described UWB radar for detection and positioning of human beings presented behind the wall or any nonmetallic obstacles. Radar was developed and manufactured in "GEOZONDAS" JSC. Experiments showed good results for detection of person respiratory movements and week observation of heart beating. Novelty of the radar lies in its large operational bandwidth (11.7 GHz) combined with high time stability. Novel principle of human being detection is proposed and verified experimentally. [C717]

"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. [C718]

"Adaptive Radar Detection with Conic Rejection"

In this paper we deal with the problem of adaptive signal detection in colored Gaussian disturbance. Since the classical receivers may exhibit severe performance degradations in the presence of steering vector mismatches and sidelobe interfering signals, we try to account for the quoted drawbacks, very usual in realistic radar scenarios, at the design stage. To this end we first characterize the set where the useful received signal may lie and its complement, i.e. the set which may contain the signals to be rejected. Then we resort to the generalized likelihood ratio (GLR) principle and devise detectors capable of operating in the presence of array response mismatches and sidelobe interfering signals. [C719]

"Numerical Analysis of the effects by scattering from objects on ATC-radar and various methods for its reduction-Theory, results"

The necessity of the reduction of the reflections from objects is outlines for ATC radar, in particular for the secondary radar. Principal measures and real measures are discussed. Some of these do not work as proposed and others are effective and consistent with physical principles. [C720]

"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. [C721]

"TDRSS: The System Simulation Software for Three-Dimensional Radar"

Based on the analysis of the principles of frequency-phase scanning 3-D (Three-Dimensional) radar and the scaattering mechanism of 3-D radar, the target and cllutter IF(intermediate frequency) signals model of frequency-phase scanning 3-D radar is brought forward in this paper, then TDRSS (Three-Dimensional Radar Simulation System), as one general radar system simulation software, is proposed in this paper. At last and its results obtained during tests are introduced as well. [C722]

"LPI Radar Systems with Spatial Feedback"

The radar system with spatial feedback is considered. In this system there are self-oscillations, if the system is closed through a space of the signal radio-path and the target. When the target is absent (system is not closed), transmitter output power of the noise signal is insignificant, and that complicates detection of the radar radiation. In the report principles of such system functioning and results of tests on the real targets are stated. [C723]

"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 [C724]

"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 [C725]

"An Image Regulation Technique for Passive Millimeter Wave Focal Plane Array Imaging Radar System"

Passive millimeter wave imaging radar systems provide advantages over the optical and infra-red (IR) systems, especially under the poor weather with fog, clouds and light drizzle which are effectively transparent at millimeter wavelength. Due to the higher diffraction in millimeter wave range, the images are often acquired with poor resolution. In order to enhance these images and recover the spatial resolution, super resolution algorithms are often applied. In this paper, we presented and calculated the ideal imaging process of millimeter wave focal plane array imaging radar systems and developed an image regulation technique. Examples of applying our technique will be given and the results seem to be promising [C726]

"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 [C727]

"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 every 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 [C728]

"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 [C729]

"PNPM-LFM Combined Radar Signal Analysis"

A new combined radar signal-pseudo-random binary-phase code phase modulation and LFM combined radar signal is proposed, and the frequency spectrum function, the ambiguity function and the range correlation function are deduced. The working principle of combined radar is illustrated in detail and the formula of signals in each stage is deduced and the Doppler signal and it's effect on the correlation output of radar system is analyzed. Finally, the resolution, ambiguity characteristics and the range cut-off characteristic are studied. Research shows that the new combined radar system is feasible and has advantageous performance [C730]

"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 [C731]

"Research on 2-Channel Outdoor Instrumentation Radar"

To meet the requirements of the outdoor radar target scattering measurement, a 2-channel instrumentation radar based on pulse-to-pulse frequency shifting technique was designed and realized. The radar can perform radar-cross section (RCS) measurement simultaneously on two fixed frequency band, and test 2-dimension imaging cooperated with a rotation platform. The pulse-to-pulse frequency shifting technique avoids the problems causing by the nonlinear error of the linear frequency modulation. To farthest eliminate the errors causing by the outdoor phantom signals and the background clutters, a series of range gate pulses generated by FPGA were set and the high resolution imaging technique was used. The quadrature errors can be corrected by a real time calibration branch. The principles of the pulse-to-pulse frequency shifting are summarized, the design and realization are presented, the hardware in the loop simulation method is introduced and the test result is given and analyzed [C732]

"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 [C733]

"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 it's 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 [C734]

"Simultaneously Velocity Measuring and HRR Profiling with a Novel CSF Sequence"

High radial velocity of radar targets is an important reason of HRRP (high range resolution profile) distortion in synthetic HRR pulse radar and it can be measured by transmitting high PRF sequences. Therefore, high PRF synthetic HRR sequence has the potential to acquire accurate radial velocity besides of accurate range and undistorted HRRP. In this paper, a new waveform called CSF (cross stepped frequency) sequence is proposed. The carrier frequencies of the first half pulses and the second half pulses in one CSF sequence are stepped with two opposite stepping slopes, making the CSF sequence achieve much higher range-Doppler 2D resolution than normal SF sequence. The principle of velocity estimation in high PRF mode is derived based on phase

compensating and profile correlating process. After that, twice bandwidth of each half is synthesized by echo sequence re-ordering, which makes CSF sequence much more attractive than TSF (triangle stepped frequency) sequence. Simulation results show that much less velocity estimation error exists by utilizing CSF sequence than SF sequence in high PRF mode, and that HRRP after twice-bandwidth-synthesis has great correlation coefficient with ideal HRRP of twice bandwidth. Thus, high PRF CSF sequence has a good perspective in utilization [C735]

"A Modified Ranging Algorithm Based on Multiple Frequencies CW Radar"

Quadric difference frequency (QDF) has high range resolution, but it needs a pair of antennae to transmit two channels of frequencies, which complexes the hardware design and subsequent data processing. Based on the principle of phase comparison, a modified ranging algorithm-once difference frequency (ODF) is proposed. Under the same condition, the performance of ODF is slightly poorer than that of QDF, but ODF only needs to transmit one channel of frequencies, so it lowers the hardware design complexity and production cost, and it can improve the range performance by increasing transmitted frequencies. Finally, simulation results verify the validity of the method [C736]

"Principles of UWB Multisite Radar Devicesfor 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 [C737]

"Design and Implementation of Optical True Time Delay in Optically Controlled Phased Array Antennas"

The applications and the advantages of the optical electronic techniques in wideband and wide-angle phased array radar are introduced. Based on the physical model of optically controlled phased array, this paper analyses the working principle of optically controlled phased array antennas (OCPAA) in detail. Then a design example is given. According to the different pulse compression results of a linear phased array with 32 antenna elements, the optimization of OTTD number can be chosen. A design of 4-bit OTTD based on binary delay fiber lines and optical switches is given. The main performances of OTTD which affect the array antennas system are discussed [C738]

"Contrast Optimized PGA Algorithm for P-band UWB SAR"

The phase gradient autofocus (PGA) technique has been proved to be a superior method for higher order autofocus. However, given the different nature of P-band ultra-wideband synthetic aperture radar (UWB SAR) imagery and very low signal-to-clutter ratio in the data, conventional PGA algorithm usually fail to yield robust focusing result on raw data without distortion. We proposed the modified PGA algorithm that combines the traditional PGA with contrast optimization principle and reference scatterer coregistration. Our method is successfully applied on raw P-band UWB SAR image and excellent results are attained [C739]

"Research on Target Auto-tracking Initiation Based on Plot Fusion Processing of Multi-radar"

According to principle of target auto-tracking initiation, the track automatic initiation speed algorithm of multi-radar plot fusion system is compared with that of single radar plot system, and an algorithm for improving the track initiation speed of the system is presented by means of averaging data updated time. To meet the need of real application, the track initiation averaging time is also quantitatively analyzed for multi-radar plot fusion system [C740]

"Double Mode X-band T/R Module Based on LTCC"

LTCC is usually applied as basic PCB for high-density and high-reliability integrating in MCM. The structure and operating principle of a double mode X-band T/R module based on LTCC are discussed in this paper, and the performance analysis in theory is performed. Finally, the test results and conclusion are given [C741]

"Estimation of Refractivity Profile from Radar Sea Clutter and Key Problems"

The estimation of atmospheric refractivity profile from radar sea clutter is called RFC. RFC can really get atmospheric refractivity profile from radar sea clutter. Compared with the traditional numerical prediction models

based on meteorological parameters, it has a better performance. This paper introduces basic principle and research state of RFC. Key problems of RFC are also discussed [C742]

"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 [C743]

"Theoretical analysis of direct-finding targets with rolling-airframe passive radar by phase interference technique"

From the point of positioning principle regard to the passive with rolling-airframe, this article derives a new testing formula for the angle between aim line of target and axis of missile, introduces a measurement method of time-difference by using true time delay with optical fiber. Authors analyze the reason of angle ambiguity phase interferometer with single baseline, and also compare the advantage of measuring time-difference method with phase-difference. We simulate the process of the phase interferometer of the rolling-airframe missile. This approach provides a new access to develop and manufacture phase interferometer with rolling-airframe [C744]

"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 [C745]

"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 [C746]

"An Auto-adaptive Accumulation ISAR Imaging Algorithm Based on Time-frequency Analysis"

Based on time-frequency analysis, an auto-adaptive accumulation ISAR imaging algorithm is proposed in this paper, which is especially suitable for complex motion target imaging. This new algorithm adaptively adjusts its accumulating scope by means of the echo correlation coefficient threshold and eliminates the strong interference cross-term by means of entropy principle. Validity of the proposed algorithm is verified by real ISAR data imaging [C747]

"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 [C748]

"Back Projection Algorithm for Spotlight Bistatic SAR Imaging"

Bistatic radar, spatially separated between the transmitter and receiver, has recently been an interesting research hotspot. As geometry configurations of bistatic SAR can be flexible, its slant range is more complicated than the monostatic SAR case. Furthermore, in the spotlight-mode, the angle between the transmitter/receiver platform and the scenes center is higher than the strip-mode case. Hence, range migration in spotlight-mode BiSAR is more severe than the strip-mode BiSAR case. Solving Range migration problem is key step to develop the spotlight-mode BiSAR imaging formation. In this paper, we derive the dechirp formula of bistatic SAR, as range compression is usually implemented by dechirped method in spotlight SAR. Then we establish the BiSAR echoes model and analyze the principle of back projection algorithm. By analyzing the principle of back projection algorithm, we can see that back projection algorithm is adapt to general aperture configure, and compensating for range migration easily in the time domain. Under the condition of the different bistatic angles, we give the simulation results to validate that impulse response of point target is compressed well by the back projection algorithm [C749]

"Effect of Noise FM Jamming against ISAR Imaging"

The imaging principle of inverse synthetic aperture radar are analyzed, jamming means against ISAR are discussed, and the noise FM jamming method is proposed. Also, the effect of noise FM jamming against ISAR one or two-dimensional imaging is described in detail, and the power requirement of noise FM jamming is compared with that of RF noise jamming. It is proved by theoretic analysis and computer simulation that the noise FM jamming can destroy the one or two-dimensional image of ISAR and is an effective jamming method [C750]

"A New Method of Resolving Velocity Ambiguities in Multi-Channel Interferometric SAR/GMTI"

Along-track interferometry is an effective technique of the land clutter suppression for ground moving target indication (GMTI). Based on the principle of clutter cancellation in dual channels along-track interferometric synthetic aperture radar (SAR), the performance of relocation and radial velocity estimation in the three channels SAR/GMTI is analyzed, and a set of analytical formulas is derived. To solve velocity ambiguities resulted from interferometeric phase, unequal separation four channels along-track interferometric SAR/GMTI scheme is proposed, and the method of resolving velocity ambiguities is presented in detail. In addition, irregular spacing of sub-aperture help to exclude blind velocities and improve detection probability. Theoretical analysis and simulation results show the validity of this scheme [C751]

"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. [C752]

"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 canwork successfully. [C753]

"Passive Location Using TDOA Measurements In Four Sites"

This paper simply introduced the 3-D TDOA (time difference of arrival) position location principle of moving emitter and the position location algorithm which based on the one time measurement of TDOA. Further more

this paper presented a batch processing algorithm which uses a batch of continuous TDOA measurements to compute the target position. Considering three different sites deployments, we fundamentally show the correlation between location precision and radar arrangement The simulation results show that the location precision of batch processing is much better than that of the proposed algorithm [C754]

"Effective 3D GPR survey and its application to the exploration of old remains"

Since the buried cultural relics are three-dimensional (3D) objects in nature, 3D survey is more preferable in archeological exploration. 3D ground penetrating radar (GPR) survey based on very dense data in principle, however, might need much higher cost and longer time of exploration than other geophysical methods. We developed a small-scale continuous data acquisition system which consists of two sets of GPR antennas and the precise positioning device tracking the moving-path of GPR antenna automatically and continuously. Besides this hardware system, we adopted a concept of data acquisition at arbitrary locations not along the pre-established profile lines, since the high cost of field work may be partly attributed to establishing many profile lines. Using the developed system, we performed 3D GPR survey to investigate the possible historical remains of Baekje Kingdom at Buyeo city, South Korea, prior to the excavation. Owing to the newly devised system, we could obtain 3D GPR data of this survey area having a real extent over about 17,000 m2within only six-hours field work. Although the GPR data were obtained at random locations not along the pre-established profile lines, we could obtain high-resolution 3D images showing many distinctive anomalies, which could be interpreted as old agricultural lands, waterways, and artificial structures or remains. This case history led us to the conclusion that 3D GPR method is very useful not only to examine a small anomalous area but also to investigate the wider region of the archeological interests. [C755]

"One-dimensional model-based approach for ISAR imaging"

In this paper, we extend the estimation of scattering centre parameters to the case of ISAR imaging. The representation of a target by a set of individual scattering centres has shown promising results for applications where high resolution is needed (high-resolution imaging, classification, NCTR). In practice, methods extract time-delay and amplitude parameters associated with strong scattering sources from complex-valued reflectivity samples in the frequency domain. The principle has been successfully applied with samples from one or several segments. We show that a one-dimensional model can be used to create a two-dimensional ISAR image. After presenting the principle of ISAR matrix data collection and processing, we propose two methods for building the ISAR model matrix. We show that the technique processing the Doppler information first is more suitable for building ISAR-Model. As an example, we consider the case of a corrupted data matrix, which can be restored by coherently processing sparse sub-bands. Samples from a simulated Mig25 are used to illustrate the technique. [C756]

"A new parameter estimator based on the Helmholtz principle"

In this paper we present a novel parameter estimator that follows a general perception law as an objective function, the Helmoltz principle. We present an interpretation of this postulate in statistical terms and apply it along with low order statistics in order to obtain a flexible parameter estimator with a high breakdown point, capable of suiting the specific needs of each problem. The performance of the algorithm is tested applying the estimator to find lines in synthetic data with up to 90% of noise and real LADAR images. [C757]

"Principles and design considerations for short-range energy balanced radar networks"

{no data available} [C758]

"Enhancing bottom tracking for AUVs by using sound diffraction"

In this paper, we present a method of seabed detection based on the use of a single electro-acoustic transducer (sounder). This method uses both acoustic diffraction and bottom backscattering coefficients. Firstly, we present the acoustic sensor and its geometry. When dimensions of the aperture of the transducer are not very large in comparison with the sound wavelength, diffraction must be taken into account in the estimation of beam geometry. We determine the beam geometry by application of the Huygens-Fresnel principle. We explain how the shape and dimensions of its aperture will influence the diffraction of the acoustic beam (diffraction patterns are presented). We also detail the bottom backscattering properties and their influence on the backscattered acoustic energy of main and secondary beams. In the second part, we introduce a new method aiming to extract seabed features from the received acoustic echo. This method is based on the shape of the received acoustic echo and aims to work out the seabed slope. In the last part, we present results obtained during simulations and during experimentations conducted in the open sea. [C759]

"A Methodology for Intelligent Path Planning"

In this work we present a methodology for intelligent path planning in an uncertain environment. Examples would include a mobile robot exploring an unknown terrain or a UAV navigating enemy territory while avoiding radar detection. We show that the problem of path planning in an uncertain environment, under certain assumptions, can be posed as the adaptive optimal control of an uncertain Markov decision process. The strategy for path planning then reduces to computing the control policy based on the current estimate of the environment, also known as the "certainty equivalence" principle in the adaptive control literature. Further we show that the path planning problem, as formulated in this paper, possesses special structure which can be used to significantly reduce the dimensionality of the problem. Finally we apply this methodology to the problem of path planning of a mobile rover in an unknown, unstructured terrain [C760]

"Principles of systems that enable autonomous driving of vehicles"

This document describes technologies that enable an autonomous control of a vehicle. A basic explanation of the approach to designing a lateral controller is given as well as a description of several systems that are used for the orientation of a vehicle. Systems for lateral control (guide wire, magnetic, GPS) as well as for longitudinal and/or lateral control (picture processing, radar systems, electronic drawbar) are described. [C761]

"A sensor management protocol for tracking with diverse sensors"

We develop a sensor management protocol that a vehicle may use to track other vehicles and objects in its neighborhood using a sensor-suite, an individual element of which gives either periodic cluttered updates or a periodic uncluttered updates. We outline how to combine the joint probabilistic data association filter with stochastic Kalman filters for the state estimation process. However, since such an algorithm is sensitive to modeling errors, we discuss the use of data-driven optimization algorithms to increase robustness. Finally, we discuss extensions of previously developed covariance control sensor management algorithms. [C762]

"Low profile, low cost and high efficiency phased array for automobile radar and communication systems"

Large profile, high price, low efficiency in realization prevent phased array from being broadly used in automobile radar and communication systems, though phased array has high performance. The article puts forward a new kind of shifterless phased array based on coupled oscillators. The article studies the dynamics of nearest-neighbor coupled oscillators after reviewing the principles of electrical beam-scanning. According to the need of beam-scanning the desired solutions of phase dynamics are established. From that, we determine how the accessible parameters of coupled oscillators can be adjusted. The article also determines conditions under which those solutions are stable, i.e., physically realizable. Computer simulations are used to testify the usefulness of the method. Then in the last part of the article a complete transmit-receive scheme for vehicle radar and communication systems is given out. [C763]

"Impact of RNAV terminal procedures on controller workload"

Human factors studies have identified message frequency, message complexity (amount of information transmitted), and specific types of information as determinants of operational errors resulting from high workload. Miscommunications, at the very least, have the potential of narrowing the margin of safety. Reducing the number of routine controller-pilot communications, the amount of routine information transmitted, and the need for communicating information that is susceptible to errors helps foster a safe airspace environment and may also minimize workload incurred by the controller. This goal is supported by area navigation (RNAV) terminal procedures which capitalize on the enhanced navigation capabilities of current avionics technology. RNAV reduces the vectoring of aircraft from the terminal radar approach control (TRACON) boundary to the final approach for arrivals and from the runway to the TRACON boundary for departures through the design of fixed flight routes. A voice communication analysis was conducted for the terminal departure, terminal approach, and local tower controller positions at Hartsfield-Jackson Atlanta International airport. The analysis is comprised of three principle areas: 1) the amount of required communications; 2) the amount of information conveyed; 3) and the type of information conveyed. Voice data analysis results show up to 40% reduction in the amount of two-way communications and up to 50% reduction in the amount of information required. [C764]

"Perspectives principles of creation advantages and characteristics of multiposition radiolocation system with synthetic aperture"

Recently interest in bistatic and multiposition synthetic aperture radar is increasing rapidly. Potential of the

multiposition SAR for surveillance was discussed and a portion of the possible constellation configuration was analysed. In this paper, a number of possible spatial configurations of the multi-position SAR are presented. This paper represents analysis of potential of these configurations in comparison with monostatic SAR [C765]

"Transmitter for extra-accuracy radar"

Proposed in this paper is the principle for design of continuous 76...77 GHz radar. Radar output signal has a complicated shape which is a combination of discrete LFM signal with DeltaF=500 MHz and fdis =1 MHz, and time of frequency change 2 ns or lower, time of holding each frequency thold=50 mus, and additional phase-code modulation (M-sequence) with 0deg and 180deg phase. Length of M-sequence element-4 ns, phase switching time-2 ns. Output power is 20 mW [C766]

"Low-angle reflectivity modeling of sea clutter using LS method"

Radar sea clutter (SC) reflectivity is important for predicting the performance of radar engaged against a low-angle target at sea. Existing techniques to resolve the reflectivity estimate are mainly based on radar clutter theory and the LS approximation method. A more practical reflectivity model for SC is presented through data (Nathanson, F.E. et al., "Radar design principles: signal processing and the environment", McGraw-Hill, 1991). Throughout the reflectivity modeling, the idea of inductive reasoning is used. By using it, the functional relations between radar parameters and radar surface clutter backscattering are analyzed. In calculating the unknown parameters in the presented models, simplification of limit conditions are used so properly that the LS method can be employed. From the comparisons analysis, we can obtain that, generally, the presented SC model approximates that of Nathanson et al. better than others. Considering the accuracy and complexity for a more complex prediction of radar performance, the presented SC reflectivity model is preferable. [C767]

"A waveform generate unit suitable for software defined HFSWR"

A new radio frequency waveform generate unit is presented for software-defined high frequency surface wave radar (HFSWR). Since HFSWR operates in congested band, to suppress interference and clutters, together obtain the optimal combined sequence of waveform parameters, the radar system should be designed based on software radio principle. In this paper we discuss a software defined HF radar system-OSMAR2003, and focus on design and implementation of waveform generate unit for it. The proposed waveform generation unit integrates a frequency synthesizer with low phase noise and high signal to noise rate and a re-configurable synchronization control unit. The design is started with examination of requirements of the waveform and then optimize architecture of the combination of the synthesizer technology to satisfy the system requirements. Followed is the FPGA (field programmable logic array) based synchro unit controlled by VXI-bus. The measurement shows that the transmitted signal can be synthesized quickly with phase noise less than -109 dBc/Hz at 1-kHz off carrier and spur suppression greater than 65 dBc, While the waveform parameters can be set by VXI-bus. The signal generate unit becomes an important part of the software defined HFSWR and field experiments provide the validity. [C768]

"Unwired SAW sensors systems"

Surface acoustic wave (SAW) devices can be used as identification and sensor elements (SAW transponders) for measuring physical, chemical and biological quantities such as temperature, pressure, torque, acceleration, humidity, etc. that do not need additional power supply for the sensor elements and may be accessed wirelessly. The complete wireless sensor system includes a transponder, consisting of an antenna wired to a SAW device, and a local reader unit, consisting of a radar transceiver linked to a signal processing and controlling unit. An RF burst transmitted by the radar transceiver is received by the passive SAW transponder. The passive transponder responses with an RF signal-like a radar echo, which can be received by the front-end of the local transceiver. Amplitude, frequency, phase, and time of arrival of this RF response signal carry information about the SAW reflection and propagation mechanisms which in many cases can be directly attributed to the sensor effect for a certain measurand. Due to the high delay time of the SAW transponder in the order of a few us, usually no intersymbol interferences (ISI) due to environmental reflections occur when the system operates in typical, i.e. harsh indoor/outdoor environments. The present work reviews the operating principle of such sensor systems and their state-of-the-art performance by way of a few examples which include the wireless measurement of temperature, pressure, torque, acceleration, tire-road friction, magnetic field, and water content of soil [C769]

"Wave-oriented data-processing of fields scattered by one-dimensional aperiodically-ordered structures"

Wave-oriented data-processing techniques, successfully applied in the past to the analysis of periodicity-induced wave phenomenologies, have been applied in the present paper to more general aperiodically ordered

configurations based on two-letter substitution rules. For a representative canonical example, it has been shown that GWT configuration-spectrum phase-space processing is still capable of extracting the relevant phenomenology-matched footprints. Results also suggest that peculiar phase-space signatures can be obtained, in principle, via judicious exploitation of available geometrical and/or constitutive degrees of freedom, with interesting potential applications (e.g., radar countermeasures). [C770]

"A beamforming method in UWB pulse array based on neural network"

In this paper, the principles and algorithm of array beamforming based on a realistic ultrawide-band (carrier free) pulse signal model is discussed firstly. Then, a UWB pulse array beamforming method, based on a radial basis function (RBF) neural network, is presented. It can compensate the propagation delays accurately in each channel and form a narrow directivity beam in a desired direction. Compared with the method of employing FIR filters for delay steering in wideband beamforming, the RBF approach has the advantage in achieving arbitrary array response. The simulation results show that the beam formed by RBF has high main gain and very low sidelobe, in addition to rapid and accurate processing due to the high parallelism and mapping ability of the neural network. [C771]

"Geometrical and signal processing aspects using a bistatic hitchhiking radar system"

Bistatic hitchhiking radar system concepts have been object for extensive research both for military and civilian applications. Hitchhiking systems are in principle easy to construct and can be used without introducing any interference, or being seen by a possible enemy. This paper addresses how to handle the geometry such systems are faced together with using proper signal analysis strategies for obtaining optimum target detection. The main motivation for doing bistatic measurements is to be able to see signals from the target that are scattered in other directions than backwards, due to target shape. For large bistatic angles the target forward scattering region can give serious enhancement due to the Babinet principle. Experimental results from bistatic hitchhiking radar are shown for the purpose of aircraft detection. The data presented has been processed non-coherently. For suppression of device noise and scan-to-scan stationary clutter a signal analysis method called "target back propagation technique" has been used. Sampled radar data containing 6 aircrafts is presented. The technique is used on an image with bistatic geometry averaged over 3 scans and with target back propagation locally applied for each aircraft. All aircrafts are sharpened in the image and this illustrates the usefulness of the "target back propagation technique" for suppression of device noise and stationary clutter, even if just three scans are integrated. [C772]

"The "len-tenna" physical optics and beam former design as converging disciplines"

We are witnessing an astonishing growth in technologies related to the expansion of beam former hardware to higher frequencies, larger apertures, and wider fractional bandwidths. At the same time we are seeing, as a result of MEMS and nanotechnology, the development of optical systems that are looking curiously like phased arrays. In this paper we explore the similarities between optics and antenna design as employed in radar systems. We will see that many principles of optics can be viewed using beam-forming concepts familiar to radar engineers. We will discuss Fresnel lenses, subspace, and near field beam formers. [C773]

"Scan scheduling of multi-function phased array radars using heuristic techniques"

This paper describes a scan scheduler based on heuristic principles for MPRF airborne fire control radar. The design of the heuristic scheduler is based around a set of simple rules which work in conjunction with a priority framework to provide the required outputs to the system, in this case the next beam azimuth and elevation. A new heuristic scheduling algorithm has been produced that incorporates the elements of the best published algorithms. The heuristic rule set incorporates a hierarchy of function priorities and an overload strategy that provides graceful degradation of surveillance tasks to service target tracking. Simulations were designed and executed to stress the full capabilities of the scheduler. Superior performance was demonstrated in all but the most extreme of overload conditions. In common with all priority-based systems the scheduler surveillance performance degraded under heavy load conditions. This scheduler mitigated this degradation by altering the surveillance volume under load. A novel approach to prioritising beam position updates in heavy loading conditions was implemented such that the beam scanned from the boresight position first. This approach optimises search time by ensuring that the areas with high beam dilation compensation factors were updated at a lower rate. Realistic parameters were used, based on an existing fighter radar system (AN/APG-63) and showed improvements when compared with that radar's existing mechanical system. The chosen PRFs and dwell times gave initial acceptable performance but the adaptability of the MFR allowed the variation of dwell time and data rate to show further performance gains. The set of heuristics used in the scheduler showed emergent behaviour that took account of track loading and the search time available in an overload situation to

cope automatically with loading and shedding of tasks. This non-programmed behaviour resulted in graceful degradation of system performance under overload conditions. Although the graceful degradation is emergent behaviour, it can be deduced by formal reasoning and shown to be implied by the heuristic rules. [C774]

"A multifrequency HF-VHF radar system for aircraft identification"

MOSAR is a multifrequency and multipolarization radar system used for analysis of aircraft radar cross section by means of measurements in the low VHF frequency band (20-80 MHz). At first, basic principles of this project are presented and technical choices are explained. After extraction of radar cross sections (RCS) from the MOSAR data, a target identification algorithm, based on a comparison with a numerical database containing RCS of commercial aircraft, is applied to measurements. The influence of signal to noise ratio (SNR) and flight level is evaluated. [C775]

"Automatic Target Classification — Experiments on the MSTAR SAR Images"

SAR (Synthetic Aperture Radar) can produce target images in range and cross-range with sufficient resolution for recognition. In this paper, we did an experimental test on three different feature extraction techniques (Principle Components Analysis PCA, Independent Components Analysis ICA, and Hu moments) by using different target SAR images taken from the MSTAR database. The performance of these techniques is analyzed. A number of classification techniques, such as Linear (LDC), Quadratic (QDC), K-nearest Neighbor (K-NN), and Support Vector Machine (SVM) are tested and compared for their performance on the target classification. Our experimental results provide a guideline for selecting feature extracting techniques and classifiers in automatic target recognition using SAR image data. [C776]

"Current trends and challenges towards wireless Internet"

The wireless Internet, which was a dream just a few years ago, is now progressing so fast that it could revolutionize the whole framework of the telecommunications industry. In this paper we firstly review the main related network technologies and then note some of the current trends and challenges toward wireless Internet. These trends include those within the telecommunications technology as principles and those within the Internet applications. By 'network technologies' we refer to either the cellular or wireless networks being able to provide Internet access (such as 3G or WLANs), while by using the terms "challenges" we refer to those issues that will play the most important role in coupling Internet services with network architectures (such as mobility management or QoS). [C777]

"Adaptive change detection in coherent and noncoherent SAR imagery"

This paper is concerned with change detection in averaged multi-look SAR imagery. Averaged multi-look SAR images are preferable to full aperture SAR reconstructions when the imaging algorithm is approximation based (e.g., polar format processing), or motion data are not accurate over a long full aperture. We study the application of a SAR change detection method, known as signal subspace processing, that is based on the principles of 2D adaptive filtering (M. Soumekh, January 1999) and we use it to recognize the addition of surface landmines to a particular area under surveillance. We identify the change detection problem as a trinary hypotheses testing problem, and identify a change signal and its normalized version to determine whether there is i) no change in the imaged scene; ii) a target has entered the imaged scene; or iii) a target has exited the imaged scene. A statistical analysis of the error signal is provided to show its properties and merits. Results are provided with a realistic X band SAR platform using averaged noncoherent multi-look and coherent single-look SAR imagery. [C778]

"The physics and modelling of discrete spikes in radar sea clutter"

This paper first examines the physical source of sea clutter spikes from considerations of oceanographic principles and electromagnetic scattering; it is shown how electromagnetic scattering theory can be used to predict the characteristics of discrete spikes in backscatter from the sea. The spikes can also be modelled statistically as extensions to the standard K-distribution model for sea clutter, as proposed by K.D. Ward et al. (1990). In this paper, the work in K.D. Ward et al. (1990) is extended to include the addition of thermal noise and it is also shown how the parameters of this model can be matched to real data. Results are presented for recorded airborne radar data, showing how the model can accurately match the characteristics of real clutter-plus-spikes-plus-noise, including the effects of pulse-to-pulse integration with frequency agility. [C779]

"Spaceborne synthetic aperture radar quick-look processing with ECS+FIR algorithm"

This paper presents a new spaceborne synthetic aperture radar quick-look algorithm: ECS+FIR, which is based

on a sub-aperture approach. The ECS+FIR algorithm uses the sub-aperture approach in azimuth direction instead of FIR filtering and down-sampling approaches as in other quick-look algorithms. The computing amount is reduced greatly compared with other quick-look algorithms. The principle and processing course of the algorithm are discussed in details, and the comparison between the new algorithm and other quick-look algorithms has been carried out, and the advantages of the new algorithm are obvious. Several simulation and processing results are given to demonstrate the feasibility of the algorithm. [C780]

"A time domain beamforming method of UWB pulse array"

The principle of space-time processing is discussed here after a realistic UWB pulse model introduced in the paper. The problem of realization of variable delay circuits is addressed. Delay line is not enough for accurately beam steering. A digital filter method by compensating channel dispersed delay for time domain beamforming is presented here. An ideal system with fractional sample delay hat occurs in insufficient sample of UWB pulse signal is not realizable. The two filter approaches involving FIR and allpass filter are given to approximate casual and stable system with the fractional delay. The Lagrange interpolation for FIR filter and complex cepstral computation for allpass filter are examined. A comparison of UWB pulse array directivity versus conventional phased array directivity has been done. The effect of different sampling rate and noise level is discussed. In the experiment, the FIR and allpass filter with a capability of accurate propagation delay compensation improved the beamforming performance remarkably. The results indicate the feasibility and effectiveness of the method. [C781]

"Scattering centers association and radar imaging based on multi-aspect measures"

Radar imaging is an important way to obtain the structural information of target. Based on the geometrical projection of scattering center on the line of radar sight, the principle of reconstructing scattering centers' 3-D distribution based on multi-aspect measures is provided in this paper. After analyzing the characteristic differences between true and false scattering centers, the multiple elastic modules (MEM) is introduced to perform scattering centers association and radar target imaging. The experiments are developed with simulated and experimental data, and experimental results show the feasibility and validity of proposed approach. [C782]

"On possibility to measure the sea surface wind vector by the Doppler navigation system of flying apparatus"

A possibility of recovering the wind vector over sea using the Doppler navigation system of flying apparatus, which operates in the mode of a multi-beam scatterometer, is discussed, and a measuring algorithm of the sea surface wind speed and direction is proposed. The analysis of the Doppler navigation system, the backscatter model function and the geometry of wind vector measurements have shown that the wind vector over sea can be measured by an airborne Doppler navigation system employed as a multi-beam scatterometer. The principle considered and algorithm proposed in the paper can be used for the creation an airborne radar system for operational measurement of the sea roughness characteristics and for safe landing of an amphibious airplane on water, in particular under search and rescue missions. [C783]

"3-D short-range localization device by low-cost CW-Doppler radar"

Low cost and short range detection/localisation devices arouse a growing interest for civil and military applications such as automotive anti-collision radars or target detection devices used in active shielding. This field of application is principally devoted to FMCW radars, which allow a direct range measurement like pulsed radars, but are less expensive. In this paper we show that it is also possible, under some conditions, to perform a real time localisation based on CW radars only, by means of an adequate signal processing. The targeted application deals with short range localisation of very fast moving targets in order to engage an instantaneous riposte. In the second section of this paper, a principle for extracting the information of the position of a target from a Doppler signal is presented. Some algorithms that perform an estimation of the position within the time restrictions of our application is given in the third section. The following section focuses on the information theory, and gives some useful indications about the optimal configuration of such a detection device and the maximal theoretical performance achievable for it. Sections 5 and 6 are devoted respectively to some realisation aspects and to a few simulation results. Finally, some concluding remarks are provided in the last section. [C784]

"PCA and kernel PCA for radar high range resolution profiles recognition"

Radar high range resolution profile (HRRP) contains target structure information. It is shown to be a promising signature for radar automatic target recognition. As a method for data dimension reduction and feature extraction, principle component analysis (PCA) and kernel PCA have found wide applications in pattern recognition field. According to the characteristics of target pose sensitivity and shift sensitivity, a localized PCA and a modified KPCA are proposed for radar HRRP recognition. Also the methods for selecting the kernel basis

vectors and handling the range-shift alignment are carefully addressed. Finally, support vector machine (SVM) classifier is used to evaluate the classification performance based on measured data. Experimental results show the proposed methods are effective and KPCA outperforms PCA. [C785]

"MATLAB-based toolkit for an introductory course in SAR image processing"

This paper documents the continuation of the work that started with a student paper presented at Radar04. The earlier paper was a description of a graphic user interface (GUI) for SAR data processing that was developed for classroom use, based on a previously published algorithm. This GUI and associated MATLAB toolbox has now been extended to include several other capabilities and has grown into a toolkit that can be used in an introductory course in SAR image processing. Besides the processing of raw SAR data, the GUI and toolbox now include additional teaching and research capabilities, to include additional types of speckle filters and image compression capability. Apart from this the user can choose from two different algorithms that help to extract the single look image from the raw SAR data. These algorithms were implemented in MATLAB, because of its wide availability, and "self documenting" capability. Thus, the resulting package is suitable for classroom use to illustrate the principles of SAR data processing. Results of the project is made available to the radar community for use by the other schools and institutions that desire a simple SAR processing capability. The MATLAB code has been extensively commented, so that it provides useful baseline for other class projects. Although the material presented is not cutting edge research, it does provide a much-needed tutorial introduction to SAR processing in the classroom. We have also begun developing C and Python based versions of this package so that users can make comparative performance measurements and understand how various implementations of the algorithms affect the end results. We would like to acknowledge the help received from Alaska Satellite Facility (ASF) and the Space Dynamics Laboratory (SDL) at Utah State University for this project. [C786]

"Cylindrical array beamforming based on ultra-wideband signals"

Conformal array antennas are very attractive for many applications interest, especially in space-born radar, navigation, and radio communications, where the allowable space for antenna platform is very limited. One type of conformal array antennas is the cylindrical array which can provide wide angular coverage in both the azimuth plane as well as the elevation plane. In this paper, the principle of cylindrical array beamforming based on ultra-wideband impulse (UWBI) waveforms is introduced. Antenna patterns, such as amplitude pattern and energy pattern, are derived for the cylindrical array as functions of array dimensions and signal bandwidth. [C787]

"Multi-target detection in FMCW radar based on six-port technology"

The traditional FMCW radar has its own limitation in multitarget detection. Six-port radar is proposed as a new way to solve this problem because of its phase measurement capability. The structure of six-port radar is given and the operating principle of the six-port as direct conversion receiver in FMCW radar is discussed. How six-port radar suppresses false alarm is analyzed in this paper. Computer simulations prove that the analysis is correct and the method is practical. [C788]

"Deception jamming against stepped-frequency ISAR using image synthesis technology"

Based on the principle of stepped-frequency inverse synthetic aperture radar (stepped-frequency ISAR), a method of producing false targets for countering stepped-frequency ISAR is proposed. Also, the image synthesis method proposed has an advantage that false target motion states including position, velocity, and direction can be controlled or adjusted. The principle, system architecture and theory foundation of the image synthesizer against stepped frequency ISAR are described in detail in this paper. Furthermore, how false-target signals are synthesized is given in theory, and the image processing to reconstruct the false target is presented. Lastly, the simulations have been done, and the deceiving jamming against stepped-frequency ISAR is accomplished. The simulation results show that the target-false signal is synthesized successfully and the false target can be visually displayed on ISAR 2D imaging screen, thereby the effectiveness and feasibility of the method are demonstrated. [C789]

"A simple measuring method of reflectivity for radar absorbing material"

The basic principle of measuring reflectivity for radar absorbing material (RAM) is analyzed. And a simple method for measuring reflectivity of radar absorbing material using vector network analyzer HP8722ET and APC-7mm coaxial line is presented. The results indicate that the reflectivity of the radar absorbing material can be measured in 0.05-18 GHz using this method. Under the ordinary laboratory condition, the reflectivity of the RAM can be measured accurately without microwave darkroom and other strict terms. Measurement results of reflectivity for single-layer RAM indicate that the measured reflectivity accords with the theoretical calculation of the reflectivity. The measured reflectivity using coaxial method is consistent with the reflectivity using arch

method. Some errors exit between the measured results using arch method and theoretical calculation results because the sample's size is large and the thickness of the two-layer RAM can hardly be prepared homogeneously. The coaxial sample under test is small and the thickness can be controlled accurately, so the measured reflectivity is consistent with the theoretical calculation of the reflectivity. [C790]

"Sampling in three-dimension microwave near-field imaging"

Three-dimension imaging is a hot topic. And the near-field imaging is a new kind of measurement technique, which has been widely used in radar measurement. Based on Nyquist criterion, the spatial and frequency sampling criterion is established in near-field microwave imaging. First, the principle of the experiment was introduced, particular analyses on simple point-target were given, and the method to improve working frequency had been received, through changing the geometry relation of the sampling spatial. A statistics on one typical experiment condition was presented, and an analysis of multi-target and three-dimension target was implemented, compared with point-target, and get the method to predigest the complex target to the point-target by changing the geometry. This will make the experiment easier and more efficient. [C791]

"Sophisticated numerical hybrid scattering analysis integrated into system simulations for navigation and radar applications"

Classical and modern navigation, landing and radar systems rely on the radio transmission and reception. Relevant objects in the radiation field can harm the intended characteristics of these systems. Modern state-of-the-art simulations can predict in an increasing number of complicated cases the electrical performance in the presence of these objects. Countermeasures can be designed from this knowledge. This paper deals mainly with the "threat" (potentially in-acceptable distortions) by the forthcoming new large aircraft A380 on the widely spread ILS (instrument landing system; operating at 110/330MHz) installed on every major airport. The related system simulations and the mathematical and numerical analyses are outlined and some results for different numerical cases are presented. It is in particular emphasized to apply 3D and sophisticated state-of-the-art methods which are adapted to the 3D characteristics of the objects in contrast to inadequately simple methods. For the case of the new Airbus A380 some principle results are presented using simple physical optics based methods, trials to improve the simple PO by creating "fudge factors" by measurements and in contrast results for rigorous and quasi-rigorous numerical methods. Large errors for a simple physical optics PO treatment in contrast to the rigorous method-of-moments MoM and improved physical optics IPO solution are presented and explained. The practical consequences for airports illustrate the necessity of reliable state-of-the-art system simulations and the application of advanced electromagnetic scattering analysis. [C792]

"Repeat-track SAS interferometry: feasibility study"

Repeat track interferometry is a commonly used technology in Radar. It permits to obtain topography and elevation variation of ground. This technology is not used with sonar system, even though this configuration could provide interesting applications for underwater environnement knowledge. This paper presents a study on repeat-track interferometry feasibility with sonar system, and especially for synthetic aperture sonar (SAS). We shortly expose the SAS and interferometry principle in the first part. Then we present the multi-track interferometry and discuss on limitation. In a third part, experimental results based on data acquired with the experimental low frequency SAS (LFSAS) of GESMA (France), are detailed and we expose methods to circumvent problems induced by repeat-track interferometry. Finally we discuss on future strategies to improve the encouraging results we obtained. [C793]

"L-S band module for phase/amplitude processing"

1.5 GHz module for the phase/amplitude processing is considered. The new principle of operation based on the combination of digital and analog regimes for different cascades of module allows to increase the figure of merit of device and to provide the effectively suppression of phase and amplitude errors. Device is based on GaAs hyperabrupt tuning varactors and consists of 360deg digital-analog phase shifter with figure of merit F=240 deg/dB in 13% bandwidth and (0.25divide4) dB tunable attenuator, which are integrated in one module using the printed circuit board (PCB) technology. Possibility to improve the device parameters due to the use of LTCC technology considered also [C794]

"Elimination of Multipath Fading in Point-to-Point Communication"

We describe a technique to eliminate multipath fading in point to point communications. The technique exploits our ability to control relative phase between desired signals arriving in the antenna beam and of undesired multipath signals coming from outside of the beam direction. Using out ability to control relative phase, we can in principle reduce the destructive interference know as multipath fading to arbitrarily small values. [C795]

"Phased array performance characteristics and compliance with SATCOM military standards"

The initiative to reduce military platform signature has encouraged the consideration of phased arrays as viable alternatives to traditional reflector-based communication antennas. Phased arrays enhance a military platform's mission effectiveness not only by providing reduced radar cross section (RCS) relative to reflector-based implementations, but also by adding increased flexibility via simultaneous multi-beam operation, increased mean time between failure (MTBF), and increased operational availability resulting from graceful degradation. This paper discusses phased array antenna principles with respect to military communication system applications. Specifically, consideration of phased array antenna performance parameters as they relate to existing governing standards for satellite communications is explored. These standards implicitly assume a scan invariant reflector-based implementation. Examples of scan dependent phased array antenna performance parameters include antenna gain, sidelobes, cross-polarization isolation and instantaneous bandwidth. Performance versus implementation complexity with respect to these parameters is discussed [C796]

"Adaptation of a 3-D local position measurement system for 1-D applications"

In this contribution we present the reduction of an existing 3-D local position measurement system to 1-D applications. Due to this limitation the hardware complexity and therefore also the costs are reduced dramatically. Besides the discussion of the 1-D measurement principle a description of potential error sources is given. The use of the proposed 1-D position measurement system is shown on real measurement data [C797]

"Repeat-track SAS interferometry: feasibility study"

Repeat track interferometry is a commonly used technology in radar. It permits to obtain topography and elevation variation of ground. This technology is not used with sonar system, even though this configuration could provide interesting applications for underwater environment knowledge. This paper presents a study on repeat-track interferometry feasibility with sonar system, and especially for synthetic aperture sonar (SAS). We shortly expose the SAS and interferometry principle in the first part. Then we present the multi-track interferometry and discuss on limitation. In a third part, experimental results based on data acquired with the experimental low frequency SAS (LFSAS) of GESMA (France), are detailed and we expose methods to circumvent problems induced by repeat-track interferometry. Finally we discuss on future strategies to improve the encouraging results we obtained. [C798]

"System simulations for navigation and radar applications based on sophisticated numerical hybrid scattering analysis"

Classical and modern navigation, landing and radar systems rely on the radio transmission and reception. Relevant objects in the radiation field can harm the intended characteristics of these systems. Modern state-of-the-art simulations can predict in an increasing number of complicated cases the electrical performance in the presence of these objects. Countermeasures can be designed from this knowledge. This paper deals mainly with the "threat" (potentially in-acceptable distortions) by the forthcoming new large aircraft A380 on the widely spread ILS (Instrument Landing System; operating at 110/330 MHz) installed on every major airport. The related system simulations and the mathematical and numerical analyses are outlined and some results for different numerical cases are presented. It is in particular emphasized to apply three-dimensional and sophisticated state-of-the-art methods, which are adapted to the three-dimensional characteristics of the objects in contrast to inadequately simple methods. For the case of the new Airbus A380, some principle results are presented using simple physical optics based methods, trials to improve the simple PO by creating "fudge factors" by measurements and in contrast results for rigorous and quasi-rigorous numerical methods. Large errors for a simple physical optics PO treatment in contrast to the rigorous method-of-moments MoM and improved physical optics IPO solution are presented and explained. The practical consequences for airports illustrate the necessity of reliable state-of-the-art system simulations and the application of advanced electromagnetic scattering analysis [C799]

"Improving CFAR detection through adaptive determination of reference window extents"

Adaptive constant false alarm rate (CFAR) detectors operating on envelope-squared matched-filtered beam data generally employ two equal fixed-length windows, straddling the test cell, to collect reference samples. Our objective is to prevent the consideration of reference sample sets that do not behave even approximately i.i.d. A procedure to adaptively determine window sizes is presented. The nested hypothesis testing procedure is based on the principles of quality control and utilizes the Mann-Kendall rank test for randomness. Potential benefits include improved false alarm control, increased detection probability and closer tracking of extended clutter edges [C800]

"Some Practical Ways to Determine Coastal Current's Vertical Structure"

Remote sensing technology has made it possible to rapidly observe wide areas of the ocean surface. To determine subsurface conditions from these observations requires the application of hydrodynamic principles. For coastal currents, the viscous dynamics can be applied to efficiently project surface data downward to obtain the current's vertical structure in real time. This method has been developed for use with remotely sensed surface current data obtained from HF radars, and now is being extended to use remote sensing images. In this case, the surface currents are determined together with subsurface currents from the dynamic and conservation equations, as opposed to tracking or correlating image patterns in time. Alternatively, the surface data can be assimilated into a numerical coastal ocean model that solves for depth-dependent currents. But, presently, efficient assimilative computation appears to be feasible only with depth-integrated ocean models. In this case, a method can be developed to obtain current structure from the depth-integrated solution via the use of surface and bottom boundary stresses and associated shear equations. This method of determination can be practical as it requires only the depth-integrated solution and surface and bottom boundary conditions at the location of interest as input, in contrast to conventional modeling approach of determining currents over the whole model domain. Demonstration of the use of the various methods noted here will be given by means of numerical examples and comparisons with some field experimental data [C801]

"A Novel Maximum Likelihood Frequency Synchronizer for OFDM Systems"

Feedback carrier frequency recovery for orthogonal frequency-division multiplexing (OFDM) signals transmitted over frequency selective fading channels is presented in this paper. Its derivation is based on minimum variance conditioned maximum likelihood (MV-CML) principle. The channel power on subcarriers required to perform frequency synchronization is regarded as unknown slowly time-variant parameter and is estimated online. The performance of the proposed synchronizer is assessed by computer simulations with comparison to that provided by other schemes and modified Cramer-Rao lower bound (MCRB). Both theoretical analysis and simulation results show that our synchronization scheme is a good candidate for OFDM frequency synchronization. [C802]

"Small-aperture, high-resolution beam-scanning antenna array using nonlinear signal processing"

A high-resolution two-element antenna array is demonstrated using nonlinear signal processing of the output signals of the two antennas. The basic principle of this method is to convert the output signal of each antenna into a train of very short pulses and to extract a time delay between the two pulse trains by correlation. Compared to previous work, the input signals in this work are first down converted to a low IF frequency and then a nonlinear signal processing can be achieved using fast digital ICs. An experimental receiver was built, and the general principle of the new approach is demonstrated. In addition, including digital delay ICs into each channel, even beam scanning is included. Adding a transmitter with a FM-modulation, a simple radar sensor was built up. [C803]

"Visualization of the breast tumor by the integrated use of CP-MCT and chirp pulse microwave breast radar"

Chirp pulse microwave computed tomography (CP-MCT) is a modality for microwave imaging of biological objects. By using the high-resolution model, which uses the chirp pulse signal from 2 GHz to 3 GHz, diagnosis of an early stage breast tumor has been attempted mainly by numerical simulation. However, the FDTD-based numerical simulation showed that only diagnostic information provided by the tomographic images was not sufficient for localizing the tumor in the breast fat tissues. This is mainly due to the strong scattering at the surface of the breast and the boundary between the tumor and surrounding fat tissues because of the big difference in those permittivity values. To gain the compensative information, we have investigated feasibility of the breast radar, which provides the dosimetric image according to the same measurement principle as CP-MCT. The chirp pulse microwave breast radar (CP-MBR) can provide tumor information projected onto the imaging plane of CP-MCT. The numerical simulation of the breast radar shows that the integrated use of those microwave imaging systems is useful for localizing the early stage tumors in the breast. [C804]

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channel, even beam scanning is included. Adding a transmitter with a FM-modulation, a simple radar sensor was built up [C805]

"Some simulation results of 3D imaging based on chirp stepped-frequency signal"

In this paper, some simulation results of 3D imaging of ground moving target are presented. Chirp stepped-frequency signal is transmitted in the interferometric inverse synthetic aperture radar system. Before the processing of 3D imaging, the strong ground clutter has been removed by using a new chirp stepped-frequency signal format. Then the 3D images of the ground moving targets can be achieved according to the principle of the interferometric 3D imaging. [C806]

"Comparison of radar pulse compression techniques"

The aim of this paper is to provide an introduction to principle behind the pulse compression radar. Pulse compression is an important signal processing technique used in radar system to reduce the peak power of a radar pulse by increasing the length of pulse, without sacrificing the range resolution associated with a shorter pulse. In this paper, the pulse compression technique will be described and compared. [C807]

"A 94 GHz radar using a six-port reflectometer as a phase/frequency discriminator"

A 94 GHz radar sensor is proposed. The receiver front-end module of this system is based on a six-port reflectometer used as a phase/frequency discriminator. This device determines Doppler frequency (and consequently, relative speed) by means of the phase difference between transmitted and received signals. For the first time at this frequency, measurements with a real moving target are performed. The six-port circuit equations, the radar operating principle and architecture and speed measurements are presented [C808]

"A new method of HRR profile formation based on multiple radars LFM signal fusion"

In this paper, the authors present a new method of HRR profile formation based on the LFM signal fusion of the multiple radars with multiple frequency bands. The principle of the multiple radars signal fusion improving the range resolution is analyzed. During the fusion process, the B-splines interpolation and an entropy-minimization principle based phase compensation algorithm are applied. The theoretical analysis and simulations results show the proposed method can effectively increase signal bandwidth and provide a high resolution range profile [C809]

"The research of multiple-output SR-forward converter with voltage regulation"

The design principle of a kind of SR multiple-output DC/DC converter is discussed in this paper, based on the single end forward converter. The one-cycle control method of forward converter duty-ratio is explained. A new type of secondary loop SR-PWM regulator with SR-buck structure is brought forward in this paper, which has concisely achieved multiple-outputs [C810]

"Beam pointing error of wideband phased array antennas with reduced true-time-delay devices"

Phased array antennas have primarily been used for narrowband systems such as radar. However, in recent years, these systems have been increasingly used for wideband applications, such as satellite communication. In this paper, we describe the beam shift principle of a wideband linear phased array antenna with reduced true-time-delay devices, as well as a simple formula for calculating the beam pointing error. The results obtained from the application of the formula were in concurrence with the simulation results. We also propose a simple method for compensating for the pointing error, and report the simulation results. [C811]

"Photonic Technique for Radio Frequency Measurement"

A novel photonic technique for radio frequency (RF) measurement utilising dispersion in a multichannel chirped fibre Bragg grating (MCFBG) is developed. The underlying principle for fast photonic RF measurement is based on amplitude comparison of the RF power fading functions of double sideband (DSB) modulated optical carriers propagating through a dispersive medium. In this paper, a demonstration of the photonic RF measurement is presented. [C812]

"Handover of packet-switched services in GERAN A/Gb mode"

Due to strict quality of service requirements on low latency and packet loss, real-time packet-switched (PS) services require a minimal service interruption on the data transfer during cell change. Existing GPRS cell

change mechanisms with network assisted cell change (NACC) enable a theoretical minimum service interruption of 0.7-1.2 second, while real-time PS services of conversational class do not tolerate a service gap longer than 0.15 seconds. Therefore in GERAN A/Gb mode a PS handover procedure is being designed to allow for conversational services in GPRS that would improve the network performance for any PS service. PS handover follows the GSM circuit-switched handover principle of allocating radio resources in the target cell prior to changing cell. In this paper PS handover procedure is described and its performance evaluated in terms of service interruption by means of network simulations [C813]

"Flight path planning of UAV based on heuristically search and genetic algorithms"

Flight path planning of UAV is a complicated optimum problem. The research in this field is usually classified as two directions: optimal path planning without considering the computation cost and real-time suboptimal path planning. Aimed at the two problems, this paper presents two methods of path planning of UAV. One method is based on heuristically search. In this method, we search the threat net by using A-star algorithm. A shortest suboptimum path is obtained, which is composed of the lines on the Voronoi diagram, and then considering the UAV's turn constraint, the path can be smoothed by geometry method. The other method is based on genetic algorithm and potential fields technology. Because potential fields, however popular, have shortcomings, viz, trap situations due to local minima, the genetic algorithm is introduced. In this method, Firstly, construct the threats' Delaunay triangle net based on the principle of nearest neighborhood and a safe planning path goes across the lines of the triangles. Then designate each point (position of a threat) on the left of the path a index 0 and on the right 1 and only designate the points of line which is not passed the same symbol. Thus, based on the directions of passing the lines of Delaunay triangle, a kind of encoding is designed on the principle of "Left 0, Right 1". At last, a global planning path can obtained by the genetic algorithm and potential fields technology. At the same time, simulation results of the two path planning methods are given. [C814]

"Quadrature direct digital frequency synthesizers with super high memory compression ratio and its parameter optimization"

This paper presents a quadrature direct digital frequency synthesizer (QDDFS) with super high memory compression ratio and analyzes its design principle theoretically. Its parameters have also been optimized. Trigonometric approximation and linear approach are combined coherently in order to reduce the size of the ROM (1856 bit). The compression ratio for the look-up table is 565:1 and the spurious free dynamic range (SFDR) is 96 dBc. Finally the architecture for proposed scheme is given. [C815]

"Compression of frequency-swept microwave pulses using a helically corrugated waveguide"

Microwave pulse compression is an important area of research in vacuum electronics, with important applications for linear accelerators, RADAR and non-linear testing. The principles and methods of pulse compression differ greatly depending on the application. The concept of producing ultra-high-power nanosecond microwave pulses, using passive sweep-frequency compression, was studied. A novel waveguide with a helical corrugation of its inner surface was used as the microwave pulse compressor. This structure couples a TE11traveling wave with a near cut-off TE21wave producing a region far from cut-off with a large change in group velocity with frequency. A 2.08 meter long copper helical waveguide was used to compress a 67 ns, 5.7 kW frequency-swept pulse from a high power TWT, driven by a swept solid-state source, to a 2.8 ns 68 kW pulse containing 50% of the energy of the input pulse. The dispersion characteristics of the helically corrugated waveguide were investigated both experimentally and theoretically. A vector network analyser was used to measure experimentally the dispersion characteristics of complex waveguides and the code MAGIC was used to calculate the dispersion theoretically. Good agreement between experimental results and theoretical predictions was observed. [C816]

"Long term operation, performance and applications of cryogenic sapphire oscillators"

Cryogenic sapphire oscillators (CSO) developed at UWA have now been in operation around the world continuously for many years. Such oscillators are essential for interrogating atomic frequency standards at the quantum limit of projection noise; otherwise aliasing effects dominate due to the periodic sampling between successive interrogations of the atomic transition. For this reason, UWA oscillators are now operational at NMI (Sydney), LNE-SYRTE (Paris), the French Space Agency (CNES, Toulouse) and at UWA (Perth). Other applications, which have attracted attention in recent years, include tests on fundamental principles of physics, such as tests of Lorentz invariance. This paper reports on the long-term operation, performance of such oscillators. We compare the long-term drift of some different CSO's. The drift rates turn out to be linear over many years and in the same direction. However, the magnitude seems to vary by more than one order of magnitude between the oscillators, ranging from a few parts in 1014per day to a few parts in 1013per day [C817]

"UC Davis 94 GHz gyrotron traveling-wave amplifier developments"

Summary form only given. During the past year, record performance has been obtained at W-band from the UCD TE01 proof-of-principle gyro-TWT: 75 kW output, 45 dB gain, 22.5% efficiency, and 3.7% saturated bandwidth (BW) at 93.5 GHz. In this talk, we report the design and fabrication of a new follow-on ultra high gain (71 dB) gyro-TWT producing 110 kW output at 5% BW with the focus on advanced millimeter wave radars. [C818]

"SAR image processing algorithms based on the ambiguity function"

This work focuses on hardware implementations of the ambiguity function defined in terms of signal operators for synthetic aperture radar (SAR) sensor image formation applications. Due to the large quantity of data associated with SAR imaging, basic SAR operations demand high computational cost and are difficult to readily implement on existing commercial digital signal processing (DSP) units. In order to contribute to resolve this problem a search for new efficient algorithm variants in under way compute operations such as discrete Fourier transforms, discrete convolutions, discrete correlations, and Hadamard products of complex signals. These operations are commonly used in the computation of the discrete ambiguity function. Time-frequency tools have been the object of many different studies in SAR image formation operations. The principle behind SAR image formation is recovering a desired reflectivity density function through an inverse convolution process on the raw data generation. It is this particular fact that makes the ambiguity function so important in SAR image formation since it serves to model the impulse response function or point spread function of the SAR system itself. Algorithms for computing the ambiguity designed for this work are being developed in MATLAB and implemented the TMS320C6713 digital signal processor (DSP) unit. The implementation methodology is based on hardware/software algorithm co-design techniques, taking into consideration software and hardware characteristics such as memory cache overflows, twiddle or phase factor pre-computations, extended memory addressing schemes, stride permutation implementations, pipelining schemes, multiply-add DSP architectures, multiple concurrent memory accessing schemes, and overall latency response. [C819]

"Integrated dual spectral system of Earth surface monitoring"

Design principles of the integrated dual spectral (millimeter and infra-red ranges) system for Earth surface monitoring are presented. Technical characteristics of the system proposed have been also estimated according to the presented relations [C820]

"UWB radar for human being detection"

UWB radar for detection and positioning of human beings in complex environment has been developed and manufactured. Novelty of the radar lies in its large operational bandwidth (11.7 GHz at -10 dB level) combined with high time stability. Detection of respiratory movement of a person in laboratory conditions has been demonstrated. Based on experimental results human being radar return has been analysed in the frequency band from 1 GHz till 12 GHz. Novel principle of human being detection is considered and verified experimentally [C821]

"Optimal observation trajectory of an active maneuvering radar"

This article deals with the path optimization problem of aircrafts observing ships, using Kalman estimation. Observing that the continuous version of the Kalman filter equation is a Riccati differential equation, we formalize the problem as a minimization of the integral of the covariance trace. This integral is constrained by the Riccati equation coupled with aircrafts trajectory equations, giving an optimal control problem. Because our problem contains multiple optima and because maximum principle cannot solve optimization problems with multiple optima, we propose a graph theory approach using the Bellman dynamic programming principle. First we show that if we look at a lower bound of the criterion, we can separate the state space of the estimation (covariance) and of the trajectory (space time coordinates).This allows the use of integer programming like Bellman shortest path algorithm with state space given by the trajectory and criterion based on the estimation evolution versus trajectory. Shortest path algorithm is computed in a graph whose nodes are given by a space time coordinates grid, and whose edges are given by the path authorized by the maneuvre constraints. Once the lower bound is obtained and the Branch and Bound procedure leads to the global optimum conditionally to the grid. The algorithm gives an initial condition to local optimization procedures like variation descent search. We found that in certain cases non-trivial trajectories, like circles, U-turns and broken lines appear with this method. These trajectories are actually inaccessible with the maximum principle, unless the initial trajectory happens to be close to the optimum. When applying these methods with noise to the filtering process, we obtained encouraging results. Comparing with minimal time trajectory; we gained up to 40 % on the quadratic error mean. [C822]

"Numerical Study of Low Grazing Range-Resolved Radar Backscatter from the Sea Surface"

Statistical properties of X-band sea clutter are studied using 2-dimensional direct numerical simulations. Surfaces are modeled as realizations of a Gaussian random process with the Pierson-Moskowitz or Elfouhaily spectrum. Creamer transform is applied to reproduce the lowest-order non-linearities. Backscattered field at a given frequency is found using the first-principles integral equation technique. Calculations are repeated at a number of frequencies allowing to synthesize surface response to a pulse as short as 2.2 ns. The study is focused on the incidence angle of 85^ circ 5^ circ grazing), with an example at moderate 60^ circ incidence considered as well. Probability density functions (pdfs) for vertically and horizontally polarized clutter are obtained using Monte Carlo trials. The effects of variations in wind speed (sea state) and radar resolution are investigated. The technique also allows isolating and examining the impact of certain electromagnetic and hydrodynamic approximations. Simulated pdfs are compared to Weibull and K distributions. [C823]

"Airborne scan mode ISAR imagery of ships using high resolution spectral methods and particle filter"

The basic principle of Inverse Synthetic Aperture Radar (ISAR) imaging consists of performing a Doppler analysis of the signal returned by the target. In the context of maritime surveillance mission, the Doppler analysis, which is usually performed via FFT-based methods, enables to form a profile view of the ship. We propose to form the ISAR image while antenna is scanning via high resolution spectral estimation methods. The goal of using superresolution algorithms instead of Fourier methods is to improve resolution and to remove sidelobe, especially in our context where the rotation of the antenna implies a shorter dimension of the processed signals. We present in this article results of the application of such methods on both synthetic and real data. Next, this paper considers the possibility to track the scattering centers of the ISAR image along the different antenna scans. This technique will allow a better estimation of discriminating parameters in an additional classification step. We propose to use particle filter methods to perform tracking because they are more adapted to the context than Kalman filtering which imposes a linear state-space modelling and a necessarily white Gaussian noise. Preliminary results of these methods will be presented in this paper. [C824]

"Femtosecond white-light filaments: A new tool in atmospheric research"

The extraordinary physical properties of femtosecond white-light filaments open fascinating perspectives for the investigation of the atmosphere. In this presentation, the following aspects are also discussed: conventional air monitoring methods and their limits; principle of femtosecond LIDAR; formation and propagation of plasma channels in air; absorption measurements on atmospheric trace gases; electrical properties; and aerosol measurements. [C825]

"Strongly nonlinear feedback technique for significant phase noise suppression at microwave harmonic oscillators"

Calculations are presented to study the phase noise suppression effects of an additionally introduced highly nonlinear feedback loop in microwave harmonic oscillators. Calculations are done for determining the optimal structure and parameter set of nonlinearly feedbacked harmonic oscillators, with respect to the effects of the nonlinear properties on the behaviour of the phase noise characteristics. Using the calculated analytical form 6 dB of phase noise suppression was achieved. Measurement and simulation results far confirming our theoretical principles are also reported. [C826]

"A wideband receiver module of the ESM system"

This work presents a module of the receiver for the 2-18 GHz range, usable in RWR/ESM systems. Details of the construction, principle of operation and technical parameters of the receiver, as a part of the ESM prototype system are given. [C827]

"Broadband microwave phase discriminator with ring detectors"

The continuous growth in the range of the present electronics is guided by the progress of devices that are used for locating air objects, which "show" their position by emitting a very short electronic impulse of the order of a few nanoseconds. Owing to the specification of the effect, one of the best circuits that help to determine the object's location is the microwave phase discriminator. This work presents a general principle of a classic functioning version of the discriminator with ring detectors. A newer version of the discriminator that is characterized by symmetry in structure, lower level of phase detection's errors and operation in a wider frequency band (than a classic version) was also proposed. [C828]

"Development of ASIRAS (Airborne SAR/Interferometric Altimeter System)"

ASIRAS is an airborne system designed for sea-ice and ice sheet monitoring. It has been developed by ESA under a Technology Research Program contract. The main sensor of this system is a high resolution Ku-band radar altimeter with 1GHz bandwidth. The observation concept is based on a scaled configuration of SIRAL sensor on board CryoSat. The principle of the measurements is based on a combination of ranging, SAR and Interferometric techniques. The development and the validation of ASIRAS are now completed. The system will be extensively used during the Calibration and Validation campaigns of CryoSat mission. This paper describes the key design drivers and the main features of the system. The key operational parameters of the instrument are discussed, with particular focus on the link between the space-based and the airborne configuration. Finally, the performance of the instrument is presented, based on the results obtained from technical flights and a validation campaign. [C829]

"A polarization-rotating Van Atta array reflector and its application to polarimetric radar calibration"

This paper presents the principle, design, and measured characteristics of a 90-degree polarization-rotating Van Atta array reflector with suppressed scattered field as a reference target for polarimetric radar calibration. A polarimetric calibration method that uses a trihedral and the present reflector needs no assumptions on scene characteristics and statistics and no independent phase calibration [C830]

"Passive microwave detection of bubble wakes"

Microwave detection of ocean (sub)surface bubble populations including patches, patterns, flows, and wakes is considered. The physical principles are based on specific electromagnetic properties of the air-bubble-water media that produce strong anomalies in ocean thermal microwave emission, especially at X- C-, S- and L-bands (e.g., at wavelengths of 4, 6, 8, 18, and 21 cm). Related model estimations are presented. [C831]

"Feature extraction of SAR data based on eigenvector of texture samples"

Feature extraction of SAR data based on eigenvector of texture samples tries to find the principle components of the distribution of training sets. These eigenvectors can be considered as a set of features, which together characterize the variations between training samples for each class. Defining covariance matrix is also an important issue to achieve significant classification accuracy. In this study, classification is performed based on eigenvector of textures and gray level cooccurrence matrix. Both statistical based decision rules and neural networks are applied as a classifier to test the performance of the feature extraction method based on eigenvector of texture samples and cooccurrence matrix. [C832]

"InSAR technology processing and result analysis"

InSAR (synthetic aperture radar interferometry) is currently a hot topic that is rapidly evolving thanks to the spectacular results achieved in various fields, especially in the construction of digital elevation models (DEMs) of the Earth's surface. This paper goes deep into the interference imagery mechanism, and from the application requirement of surveying and mapping, stresses solving InSAR key technology. A phase unwrapping method based on the principle of mean field annealing (MFA) is put forward. Finally, we testing this algorithm on some InSAR data, the result shows that this algorithm can obtain DEM correctly and efficiently. Then we analysis the result and display it through 3D. The display effect looks better. [C833]

"Spaceborne P-band radar for ice-sheet sounding: design and performances"

The Antarctic ice sheet is one of the most prominent physical features on our planet. It represents an area of about 14 millions km2. The average ice thickness being around 2200 m (and up to 4500 m), the Antarctic ice sheet contains a 30 million km3ice volume corresponding to about 70 m of sea level. However, this huge reservoir of water is still partially unknown and due to its large extent, only observations from space can give some global insight into the structure of the ice sheet. The Antarctic ice sheet is an exceptional archive of the past climates and a major actor of the Earth water cycle. Each ice layer corresponding to one period of time keeps its own chemical characteristics linked to past atmospheric events. The typical temporal scale involved allow for a description of past climate over a few climatic cycles, or a few 100000-year events. A dedicated mission has been proposed to European Space Agency as a candidate for an Earth Explorer Opportunity mission. This mission is based on a P-band radar instrument with a nadir-looking geometry, working at 435 MHz with a bandwidth of 6 MHz (imposed by ITU regulation), allowing to sound the vertical structure of the ice from the surface down to the bedrock. A feasibility study of the mission was done in Alcatel Space under ESA contract with an emphasis on the radar instrument. For coherent reflection and deep sounding (corresponding to the so-called Fresnel zone), the useful signal coming from any ice layer or from the bedrock overlap with lateral

incoherent surface scattering. The surface clutter is reduced by the antenna pattern in the across-track direction (typical aperture is lower than 5°) and by Doppler filtering in the along-track direction. These beam requirements impose to have a very long antenna in the across-track direction. The typical dimension of the antenna is 10 m Ч 1 m. This work summarizes the principle of the instrument, and the associated antenna solution. Main performances are also presented. [C834]

"Raw signal simulation for very high resolution SAR based on polarimetric scattering theory"

A method for raw signal simulation for extended SAR scenes with very high resolution is described. This simulator can handle resolution better than 1 m, squinted geometry, elliptical orbit motion and use a polarimetric reflectivity matrix. Classical polarimetric scattering theory is based on electromagnetic harmonic fields using Maxwell's equations, Green's function, Huygens' principle and Kirchhoff's approximation. Here, the scattering theory is modified for a chirp field. Calculated expressions for the scattered chirp field or the reflectivity matrix are presented. Such a reflectivity matrix can then be input to the inverse-EETF4 for raw data generation [C835]

"A multisensor image fusion algorithm based on PCNN"

Based on the principle of pulse-coupled neural network (PCNN), a novel algorithm for multisensor image fusion is presented. Firstly a contrast pyramid decomposition of source images is performed, and then the contrast pyramids are used as the input of PCNN. The contrast is selected based on the number of output pulse of PCNN to realize image fusion. The novel algorithm utilizes the global feature of source images because PCNN has the global coupled and pulse synchronization characteristics. It accords with the physiological characteristic of human visual neural system. The novel algorithm is applied to fuse charge-coupled device (CCD) and synthetic aperture radar (SAR) images, and the fusion result is compared with those of some other fusion methods through some performance evaluation measures for fusion effect. Comparison results show that the novel fusion algorithm is effective. [C836]

"Maximum likelihood-based range alignment for ISAR imaging"

Motion compensation, including range alignment and phase compensation, is the core technique in inverse synthetic aperture radar (ISAR) imaging. In this paper, the maximum likelihood principle is researched for application in range alignment in ISAR imaging. It is proved that under the condition of ignoring the effect of target rotating components, the complex envelope correlating method is maximum likelihood-based range alignment, and this method is optimized by the criterion of the maximum likelihood principle and therefore should be better than other range alignment methods. Moreover, real data processing results in this paper also verify the conclusions described above. [C837]

"Transmit signal design for optimal deconvolution"

This paper solves the problem of designing successive transmit pulses to minimize the mean squared error of deconvolution in colored noise. The power spectral densities of the signal and noise are known a priori. In the special case of white noise, the analytical solution can be interpreted as the "water-filling" principle for the distribution of transmitted spectral energy. Numerical simulation of a simple example with exponentially correlated target signal and white noise illustrates the benefits of using adaptively designed transmit signals. [C838]

"Detection of sea targets from thermal images"

The sea target detection problem from thermal (IR) images is solved by using statistical classification methods. Background modelling is achieved via principle component analysis (PCA) followed by a two-class Bayes classification step, i.e., target or sea. A wavelet-denoising block is added to the system resulting in a significant increase in the detection performance. K-means clustering is also implemented to explore the target detection accuracy without training. It is concluded that the PCA training provides high detection accuracy while the K-means clustering mostly fails to classify sea targets. [C839]

"Laser radar prototype development"

High power lines, pylons, towers and other obstacles endanger helicopters flying at low or ground hugging altitudes. A design and prototype development activity for a laser radar system was initiated with NATO-WEAG support in 1999. The participants are the leading defence industries and institutions of Turkey, Portugal and Italy. Principles of operation, system parameters, and integration and test activities of the optics and scanning module, which is an ASELSAN responsibility, are explained. [C840]

"Monitoring and inspecting overhead wires and supporting structures"

Several optical measurement systems for recording catenary related parameters like contact wire position, wire wear, pole position as well as distance between pole and track are described. This paper presents the physical principle of distance measurement based on optical radar technique, the key features of the realised systems and their data evaluation. The results of measuring runs in Italy and Finland are shown. [C841]

"A simple IQ-regeneration technique for six-port communication receivers"

Modern radio terminals for high data rate communication require wideband receivers. The well-known receiver architectures, such as zero-IF-receivers usually require very accurate component matching. In order to relax these requirements digital techniques are used on one side. On the other side alternative receiver architectures such as the six-port are investigated. The six-port has been introduced as a very flexible and elegant means for microwave measurements in the 1960s and 1970s. Later on it has been used in radar applications. It was not until recently that communication receivers have been built upon the six-port principle. In order to generate the required IQ-signal from the output signals of a six-port, knowledge of the six-port structure and/or of the signal statistics must be available. The first can be obtained by means of calibration procedures, while the latter can be used in blind techniques. Classical calibration procedures employ probes that are connected to the six-port. This is not applicable in communication receivers. Alternatively, a method is presented that uses the incoming signal as the calibration-driving probe and moreover uses the fact that the I-component and the Q-component of the signal are uncorrelated in most practical scenarios. [C842]

"Measurement of distance and velocity of a moving target by short-range high-resolution radar utilizing standing wave"

In this paper, we propose a radar using standing wave, and describe the measurement principle and experiment results. This radar does not use a time delay like usual radars but uses the amplitude of the standing wave. As a result of experiments, this radar could measure the distance and velocity of a moving target using bandwidth of only 76 MHz permitted by the specification of low-power radio equipment to detect moving objects (24 GHz band). The bandwidth of the radar is narrower than that of a millimeter wave radar. [C843]

"Ultra broadband transmission line transformers-planar realization principles"

Three Guanella-type transmission line transformers (TLT) are presented: a coiled TLT on a GaAs substrate, a straight ferriteless TLT on a multilayer PCB and a straight hybrid TLT that employs semi-rigid coaxial cables and a ferrite. All three devices have 4:1 impedance transformation ratio, matching 12.5 Ω to 50 Ω. Extremely broadband operation is achieved. A detailed description of the devices and their operational principle is given. General aspects of the design of TLT are discussed. [C844]

"An investigation into smart antenna configurations for wideband communication"

The challenge of next generation wireless communication systems comes from the fact that they will have to offer data rates in the hundreds of megabits per second. This requirement translates into the demand for wide frequency bands. The problem of overcoming spectrum limitation while delivering high data rate requirement can be achieved using wideband smart antennas. In this paper, three technologies for a smart antenna system operating over a wide band of frequency are investigated. These concern: space-time signal processing, space-frequency signal processing and fully spatial signal processing. The fundamental principles of these three technologies are examined in this paper. [C845]

"A method of estimating frequency of a frequency-modulation continuous-wave (FM-CW) radar level gauge under low signal-noise-ratio background"

The basic principle of FM-CW radar level gauge is analyzed briefly. A method of estimating its frequency difference is proposed based on 219-point discrete Fourier transform (DFT) and interpolation. The frequency estimation includes two steps, called coarse-estimation and fine-estimation, both of which are based on 219-point DFT. As a result, the method is applicable to estimate a frequency under serious noise background where signal-noise-ratio (SNR) is as low as -32 dB. Simulation results show that the method is adaptive to noise and has high computational accuracy and small computation necessary, which makes it suitable for an on-line use for frequency-estimation. [C846]

"Buried target signature extraction from ground penetrating radar signal based on the equivalence principle"

First Page of the Article [C847]

"Circuitry and technological aspects of frequency synthesizers design for modern radars"

Different aspects and results of the development of multifunctional frequency synthesizers for coherent airborne radar systems of high detection characteristics are presented. The practical recommendations as to a circuitry choice, component base, design and production technology of synthesizers under consideration are given. The key element of advanced coherent radar is multifunctional frequency synthesizer (FS) forming the nomenclature of intercoherent signals, the main parameter of synthesizers are used to determine the characteristics of radar detection and its noise immunity. Thus the development of FS design is made by certain guided principles and considerations. [C848]

"Electromagnetic wave attenuation for propagation through a forest belt"

Some theoretical and experimental results on the attenuation of electromagnetic wave propagating through a forest belt are presented. A theoretical model proposed for evaluating the wave field amplitude is based on the Kirchhoff-Fresnel principle. It concerns with both the horizontal and vertical polarizations, relevant wave diffraction problems being solved in the two-dimensional approximation. An experimental study was carried out at the frequency of 0.6 GHz. The transmitter was located in front of the belt edge at the distance of 25 m, being positioned at the heights of 5, 11, and 16 m above the ground, while the receiver, placed at the height of 2 m, was being moved through the forest belt and further on to the point located at the distance of 60-120 m from the rear edge of the forest belt. The latter had about 100 m in width, and was situated 150 km to the northwest from the city of Ulan-Ude near Baikal lake, being consisted mostly of the birch and cedar trees. The height and diameter of trees varied from 10 to 15 m and from 0.15 to 0.25 m, respectively, with the average density of those being of 0.3 trees/m2. All measurements were conducted in August 2003. The magnitude of wave field was found to attenuate with the distance from transmitter as an exponential function. In the case of vertical polarization, the rates of attenuation were measured of 0.2-0.5 dB/m and of 0.05-0.08 dB/m, as related to the wave paths located inside the forest belt and behind it, respectively. As expected, the rate of attenuation for the wave with horizontal polarization was found 0.1-0.15 dB/m below that relating to the vertical polarization. Finally, the relative contributions of specific partial components to the total amplitude of wave field were analyzed, using the theoretical model proposed [C849]

"Emergence principle for electromagnetic waves polarization parameters at the scattering by complex radar objects"

In this paper, systems analysis and the emergence principle are used for investigation of electromagnetic wave polarization of the scattering by complex radar objects. [C850]

"An automatic procedure for SAR-optical satellite image registration based on multi-layer feature matching strategy"

This paper proposes a hierarchical registration strategy for multi-sensor satellite images. The method is a coarse-to-fine registration procedure. In the stage of coarse registration, area features are depicted by both shape matrix and principle component analysis (PCA), which provides not only a unified rule for the shape similarity measure but also the shape orientation consistency of this pair of area features. Therefore, the ambiguity of feature matching can be effectively avoided. For the registration refinement, the parametric description of edge features by nonuniform rational B-spline (NURBS) solves the problem of the "irregular edge" of the SAR image caused by speckle noise when registering SAR-optical data, and avoids mismatching of image features with local deformation, exploiting the local controllability of NURBS curves as well. By combining some constraints on two corresponding curves, the matching of control points of NURBS, which are invariant under affine transformation, can be achieved. Registration experiments on SAR-optical satellite images demonstrate the reliability and effectiveness of the presented method. [C851]

"Confusion relationship between patterns and its application in adaptive construction of hierarchical classifiers"

The hierarchical relationship and the objective patterns of subclassifiers is the primary difficulty to construct a hierarchical classifier. In order to solve this problem, firstly, the confusion relationship between patterns has been defined to describe the interweaving effects of patterns in the decision domain. Then a measurement of the relationship has been proposed by utilizing the confusion matrix. Abiding by the Fisher Principle, a multipattern confusion relationship analysis machine (MPCRAM) has been designed to adaptively construct the structure of a hierarchical classifier. Various data scenarios have been used to compare the hierarchical structures generated

with the MPCRAM and the conventional ways. The results have testified that MPCRAM was effective, and it could prominently improve the performance of a hierarchical classifier. [C852]

"Detection and estimation of target on using polarization signal processing"

It is very important to find an effective method for measuring the target range and estimating the target's power in the environment where the signal/clutter ratio (SCR) is small. In order to solve this problem, some new methods such as 'position by polarized angle' (PPA) and 'probability estimate polarization (PEP) filter are proposed based on the estimation of the polarization state of the clutter in this paper. The principle of these new kinds of polarization processing and their performance evaluation with experimentally derived data are discussed. The results from computer simulation indicate that the SCR can be improved above 20dB and the correct probability of tracking target can be increased from less than 10% to more than 97%. [C853]

"An automatic method of coarse registration between multi-source satellite images"

The paper gives an automatic registration method for coarsely aligning multi-source satellite images. The contributions of the presented method lie in its novel feature matching strategy. Area features are depicted by a shape matrix and principle component analysis (PCA). By fusing the constraints of shape similarity and object orientation consistency of corresponding area objects, the ambiguity of feature matching can be effectively avoided. The registration results for SAR-optical satellite images demonstrate the robustness and efficiency of the given method. [C854]

"The research of signal processing technique of continuous wave radar altimeter"

This research aims at promoting the survey accuracy of a continuous wave radar altimeter. An adaptive signal processing technique for the CW radar altimeter is the core of the research. The research means and techniques for realizing adaptive anti-jamming, and how to achieve adaptive cancelling of the revealed signal of the projector are introduced in detail. The system structure, working principle and algorithm derivation are also presented. The research and application pave way for the technological transformation of the next generation of continuous wave radar altimeters. [C855]

"Study on the principle and implementation of a step frequency phased-array radar"

This paper studies the principle and implementation of the step frequency phased-array radar. A new method for phase shift re-setup between stepped-frequency echo pulse is presented as a new solution for wide band phased-array radar with large scan angle. Several implementation schemes of step frequency phased-array radar are discussed. [C856]

"Antenna footprint measurements of stepped frequency CW radar on the air/ground interface [CGPR for landmine detection]"

This paper presents the antenna footprint measurements of a stepped frequency continuous wave radar. To image a subsurface, a knowledge of the wave fields radiated by the radar below the surface is necessary. Due to the complexity of the system it is hard to compute the emitted wave fields accurately in the ground. A remedy for this problem could be measurement of the antenna footprints on the air/ground interface and then apply synthetic propagation of the wave fields into the subsurface by using the Huygens principle. The footprint of a spiral antenna has been measured by using a 1 cm shielded loop antenna as a probe antenna positioned on the air/ground interface. Subsequently, the same measurement is repeated by positioning the probe in free space at the same elevation as the air/ground interface in order to analyse the correspondence between the measurements. The footprint patterns obtained after performing calibrations were comparable for both measurements. [C857]

"Communication and service platform for public safety personnel"

This paper describes a communication and service platform for public safety personnel. The platform demonstrates just in time provisioning of data and scalable communication services and operates in a heterogeneous network environment with high survivability. As an example use case the design is aimed at the ad-hoc facilitation of the communication between and co-ordination of firefighters in disaster areas. The principle network mechanism between the network nodes is multi-hop ad hoc routing with a gateway function to cellular networks. Jini is selected as the middleware technology to enable the service provisioning, service access and network handovers. The service applications are derived from interviews and discussions with firefighters. [C858]

"A New Baseline Estimation Approach Based on the Periodic Interferometric Phase"

Baseline is a key parameter in the principle of synthetic aperture radar interferometry (InSAR). It plays a highly important role in the geometric conversion from interferometric phase to terrain altitude. Conventional baseline estimation is calculated by orbit parameters. However, due to the influence of atmospheric resistance and universal gravitation, orbit parameters have uncertainty in a certain extent, which arouses the decrease of baseline accuracy directly. In this paper, baseline evaluation, which is unconnected with orbit parameters, is based on the periodic interferometric phase. Firstly the relationship between baseline and the interferometric phase period is analyzed in detail. Based on this, a new kind of baseline estimation approach is proposed. Furthermore the problem about selection of the given terrain is discussed. Finally the approach is validated by the example using the ERS-2 data. [C859]

"The cosmic ray radio detector data acquisition system"

Cosmic rays with kinetic energy larger than 1020eV have been detected by two experiments, AGASA and HIRES. The nature and origin of these particles are not known. Acceleration mechanisms that can produce particles at these energies could be due to yet unknown sources of energy. The extreme energy cosmic rays (EECR) are rare reaching earth at a rate of few per square kilometer per year. The rarity of these events implies that large detector arrays are required making construction cost one of the main issues. We are exploring the possibility to detect EECR using bi-static radar technique. For a proof of principle we use broadcast TV stations as source of RF. After our first round of data taking, a more reliable DAQ was built addressing problems found such as loss of data and inaccurate time stamping. The new DAQ design uses a real time operating system and multithreaded software. To solve the time stamping problem, a GPS bit stream and the precision 1 pps are now included in the data stream. [C860]

"A novel blast based on RAKE receiving for wireless communications"

Bell layered space-time architecture (BLAST) is a multi-antenna communication structure with high spectrum efficiency, and it has found wide applications in LANs and WANs. However, its performance is much poorer than other space-time coding approaches. In order to improve its performance, a novel BLAST based on RAKE receiving is investigated in this paper. The new system introduces orthogonal spreading sequences (OSS) into the transmitter while retains the basic structure of BLAST. The proposed receiver suppresses interferences from other antennas by using orthogonality contained in the received signals and extracts information from each receive antenna by using RAKE receiving principle to construct efficient statistic decision. We discuss the proposed system over both frequency-flat and frequency-selective fading channels. [C861]

"Robust subspace detectors based on weighted least-squares"

In this paper, we propose and design robust subspace detectors for classification of multidimensional subspace signals. Using the principle of M-estimators and least-median-of-squares (LMedS), we formulate the robust subspace detectors as weighted subspace detectors, where we weigh the rows of the measurement matrix prior to the signal matching. The detectors are demonstrated numerically by communication signals transmitted over an unknown frequency selective channel in impulsive noise, and shape classification of partially occluded two-dimensional objects. In both cases, the proposed robust subspace detectors outperform the classical subspace detector. [C862]

"The effect of spaceborne spotlight SAR antenna beam pointing steered on image quality"

In the condition of beam pointing steered spaceborne spotlight synthetic aperture radar (SAR) antenna model and imaging model are found. The math analysis confirms that beam pointing steered results in echo amplitude being modulated and causes infinite pairs of echoes. So beam pointing steered may deteriorate image quality. Besides, based on the analyses of tradeoff relation of beam pointing steered ratio, spot area azimuth width and image dynamic extension, the fundamental principle of designing beam pointing steered ratio is presented. Finally, point target simulation is given and simulation result tests the validity of theoretical analysis. [C863]

"Three-frequency principle for automotive radar system"

The paper proposes a three-frequency principal for developing high-performance FMCW radar systems. In our example, a 94 GHz radar sensor has been studied and demonstrated for high-precision position measurement applications such as automotive radars. This new scheme is based on an FSK CW radar framework. Two unambiguous ranges make the system choose the right range measurement. The proposed technique presents several advantages over conventional FMCW sensors. It is more accurate than FSK radar. It gives a greater maximum unambiguous range. Low cost can also be expected. The operating principle, experimental prototype,

and test results are described. [C864]

"Human factors issues in the collocation of URET, TMA, and CPDLC"

The Federal Aviation Administration (FAA) Free Flight Program individually deployed the user request evaluation tool (URET), traffic management advisor (TMA), and controller-pilot data link communications (CPDLC) to a limited number of air route traffic control centers (ARTCCs). Before deployment expands nationwide, it was important to identify any potential human factors issues that may arise due to the collocation of these tools at the controller's workstation. In this paper, we present the results of a high fidelity human-in-the-loop simulation we conducted to evaluate the impact of URET, TMA, and CPDLC collocation on air traffic controllers. We examined collocation issues with a "stovepipe" independent configuration where none of the tools were integrated or directly communicated with each other. Twelve certified professional controllers participated in the simulation working in two-person teams consisting of a radar (R-side) and data (D-side) controller. The most important collocation issue identified was that controllers had difficulty accessing important information on the D-side display when URET and CPDLC were both operational (i.e., display clutter). Although neither tool alone caused display clutter, both tools in combination made it difficult for D-side controllers to find the information they needed quickly. This was especially true for accessing CPDLC windows, which became covered when controllers used URET. Good human factors design principles prescribe that users must have immediate access to important information and that critical information should never be covered. A "stovepipe" independent deployment of these tools will result in impaired access to timely information. The results of this study indicated that better efforts should be made to integrate the information from URET, TMA, and CPDLC on the D-side monitor prior to deployment of all three tools at the controller's workstation. [C865]

"Photonics for RF signal processing in radar systems"

We present an overview of optical summation principles and technologies, related to architectures for signal processing and optical beam forming networks (OBFN). This paper relates theoretical analysis as well as experimental demonstrations for advanced radar and electronic warfare concepts. [C866]

"Remote local positioning radar"

Based on the FMCW radar principle a mobile measuring unit simultaneously measures the distance to all modulated active reflector units that are within the range of the base station. This work elaborates on a specific implementation of such a remote positioning system, whose transponder units (tags) are simply attached to various measured objects. The main advantages are the low costs of the mobile units, the high update rate, which is possible in this kind of system, and low power consumption. In contrast to the conventional self-positioning LPR-system it is now possible to measure many mobile tags at the same time in real-time and to build up cell structures in widely ramified buildings. [C867]

"Signal processing techniques at radar measurement of the UWB polarization characteristics"

In the report the principles of processing of the UWB signals for an estimation of frequency responses polarization matrices by results of measurements are discussed. The reviewed methods are introduced in a "TSUNAMI-3" collimating type radar measuring complex. The outcomes of obtaining 2D polarization object radar images on experimental data are resulted. [C868]

"The use of the monopulse type antenna system in GPR for increasing accuracy of horizontal coordinate measurement"

The possibility to increase accuracy of horizontal coordinate measurement of the local near surface object by means of using the monopulse type antenna system is presented. The basic principles of designing such an antenna are discussed. It is shown that if the receiving (or transmitting) unit is placed in the center of the antenna system there is a possibility to form in the symmetry plane an electromagnetic field with zero amplitude or absence of signal reflected from the object located in the symmetry plane owing to symmetry of antenna system and inverse driving of the antenna elements. It is proposed to use this phenomenon to increase accuracy of GPR measurements. Experimental GPR data illustrate high contrast of radar image of the object if these data are acquired by GPR with monopulse type antenna system. Such a design of the antenna system provides high electrodynamic isolation between the transmitting and receiving units of antenna system [C869]

"Advantages of the wideband and ultra wideband signals in the remote sensing"

Some aspects of the wideband and ultrawideband signals usage considered. Essential aspects of the processing techniques as well as models of the input process represented and discussed. The term efficiency bandwidth

and principle of the waveform selection represented. Concept of the wideband signals in the synthetic aperture radar presented. Results which show advantages of these signals are shown. [C870]

"A novel millimeter wave synthetic aperture radiometer passive imaging system"

A novel millimeter wave (MMW) passive imaging system scheme is introduced in this paper. By combining two technologies, namely one dimension synthetic aperture interferometer radiometer (SAIR) and real aperture with electronic scan beam in another dimension, this MMW passive imaging technology meets the demands such as high space resolution, high sensitivity, large instant field of view (FOV), low cost and light weight. The system principle as well as performances of signal detection is analyzed. Typical Ka band system design and system simulation results are given. [C871]

"A TAM-BP imaging algorithm in GPR application"

In airborne SAR, the principle of BP algorithm is delay and sum. However, in GPR imaging, traditional BP algorithm is restricted by the air-soil interface and the conductivity property of the soil. To obtain precise objects location and reflection intension, BP algorithm must be modified in time-delay and amplitude calculation. In this paper, a TAM-BP algorithm is presented. Measurement data using the HRGPR system are provided to illustrate the performance of the TAM-BP imaging technique. [C872]

"A deramp chirp scaling algorithm for processing spaceborne spotlight SAR data"

Based on two-step algorithm and chirp scaling algorithm, a deramp chirp scaling (DCS) algorithm for processing high-resolution spaceborne spotlight synthetic aperture radar (SAR) data is presented. The algorithm combines the advantages of SPECAN algorithm and chirp scaling algorithm. Firstly, the azimuth coarse focusing is achieved via a deramp processing with constant Doppler rate, and the azimuth spectral folding phenomenon, which is typical for spaceborne spotlight SAR, was overcome. Secondly, the precise range focusing is achieved by chirp scaling principle, and the residual azimuth phase error is compensated, so the refined azimuth focusing is acquired. Based on the squinted equivalent range model that is fitter for spaceborne geometrical relation than the broadside range model, the complete derivation of the algorithm is presented and the realizing approach is given. Finally, the computer simulation shows the validity of the algorithm. [C873]

"Passive location of maneuvering target by single station with non-cooperative illuminators"

Based on the time difference of arrival (TDOA) and the direction of arrival (DOA) of the non-cooperative illuminators, the interacting multiple-model (IMM) algorithm for passive location of maneuvering target by single fixed station is proposed in this paper. The maneuvering model and the measurement equation are built and the location principle with IMM algorithm is discussed. With the help of computer simulation, the proposed method is proven to be practicable and effective. [C874]

"Evaluation of coding's methods for the development of a radar sensor for localization and communication dedicated to guided transport"

To explore possibilities of new exploitation modes of automatic guided transport, our laboratories designed formerly a sensor radar called DIREP (Detection et Identification des Rames En Panne: detection and identification of broken-down trains). This system is founded on the principle of a co-operative radar using a transponder inside targets. It is based on a numerical correlation receiver and has a very broad band from 50 to 100 MHz. which remains unexploited. Thus we propose to benefit from this band to establish high flow communication. The proposed system is made of microwave transmitting and receiving equipment fixed on each train, one ahead and other behind. The two trains exchange data and specific signals coded that make the system able: to deduce the distance between the trains; to identify the state of the train (broken-down or not); and to allow the transmission of pictures or audio-video records with a high data flow. The aim of this work is to propose technical solutions for multiplexing communication data and localization code in order to allow high data flow transfer. Simulations are computed to evaluate the system's performance: BER, computing time and complexity. [C875]

"Simulation and calibration of ocean echo"

Simulation of ocean echo is necessary and important to calibrate HF-GWR in laboratory. Based on the principle of radar detection and Doppler theory, ocean echo comprises distance information and oceanic current information is simulated. Then the closed-loop experiment and calibration in laboratory is given [C876]

"A new way to solve the uncertainty of collision avoidance-VHF and Racon unite in combination"

Based on the analysis of the indetermination of rule definition and shortcomings of communication equipments currently used for collision avoidance, a collision avoidance coordination system using the VHF communication device with Racon at sea is established, and the schematic diagrams of two sub-systems of this system are presented. The coding principle of radar answer signals is also established. The system can effectively overcome the indetermination of collision avoidance, effectively combine both audio and vision, so that both parties can know the position and avoidance intention of the coming ship at any time, and produce a good avoidance result. Using this system, the ship can exchange information automatically because the information can go through between PC and VHF modem digitally. [C877]

"Schematic and technological aspects of frequency synthesizer design for advanced radars"

The architecture, construction and technology-related aspects of the frequency synthesizer design are studied. Generalized results of the development of frequency synthesizers are given. The main design principles behind prospective models of frequency synthesizers are presented. [C878]

"Use of 13.56 MHz transponders for vehicle infrastructure communication"

To ensure active safety, various techniques are being used by car manufacturers. This paper relates how communication between vehicles and infrastructures by means of transponders can be used. In the first part, it reminded the communication principle. Then, results of simulation of the internal architecture of the reader are presented as well as the type and the structure of the exchanged information. At the end, a fast discussion shows that the two-axle vehicle model was used to justify the transponders organization in the tread. To assure an 8 cm picking up with regards to the ideal trajectory distance, it is necessary to arrange the transponders of all the meters. [C879]

"Suppression of range ambiguities in synthetic aperture radar systems"

One of the principle limitations of synthetic aperture radar (SAR) systems is the restriction on resolution and coverage. In a conventional SAR simultaneous wide swath (coverage) and high cross range resolution is not possible, since the two requirements contradict each other. In practice, only a semi-optimum solution is obtained, which depends on the relation between the two performance parameters. This paper investigates possible enhancements of a conventional SAR system in order to overcome this contradiction. Special attention is paid to the analytic calculations necessary to evaluate the performance of the new methods and the feasibility of the hardware realization. [C880]

"Denoising SAR images"

The SAR images are corrupted by speckle noise. A new denoising method for this kind of images is reported in this paper. Inspired from the classical Donoho's denoising method, the procedure presented in this paper uses a new type of discrete wavelet transform, entitled Diversity Enhanced Discrete Wavelet Transform, DEDWT and a new filtering strategy. The construction of the new transform and the selection of the filtering strategy applied in the wavelet transform domain are inspired from methods used in communications. For the construction of the new wavelet transform used the principle of diversity enhancement and for the filtering in the wavelet transform domain used the principle of packet's filtering. Some simulation results prove the performances of the proposed denoising method. [C881]

"The quantum evolutionary programming"

Evolutionary programming (EP) is an efficient algorithm in solving optimization problems, but the criterion EP is of torpid convergence. In this paper, a novel kind of algorithm, the quantum evolutionary programming (QEP), is proposed based on the combination of quantum theory with evolutionary theory. It is a kind of evolutionary programming with the form of quantum chromosome, whose core lies on the concept and principles of quantum computing, such as quantum bit and superposition of states. Using quantum mutation, we can make full use of the information of the current best individual to perform the next search, so QEP has rapid convergence and global searching capacity. Some simulation experiments are also given to prove its superiority over its counterpart. [C882]

"Ground penetrating radar as an assisting tool for prospecting for oil"

Ground probing radar (GPR) is a fast and inexpensive method for probing in shallow depths of the earth. Since the weathering lone in some desert regions such the Sahara is relatively shallow, this paper proposes the application of GPR for its mapping for the sake of static correction. The radar survey results could be applied for

interpolation between upholes and perhaps for the selection of optimal distances between the upholes. This paper presents simulated results of a new radar design that works on the principle of step frequency. [C883]

"Research on evaluating method of projects for complex system"

In this paper, the concepts and characteristics of complex system, such as nonlinearity, gray, chaos and fuzzy, are given. The principle and method to deal with the characters are discussed. According to the theory of meta-synthesis from qualitation to qualitation and Wuli-Shili-Renli (WSR) methodology, the evaluating model of MDFGF for complex system projects is presented. The steps of the evaluation are provided. [C884]

"SAW based Delay Locked Loop concept for VCO linearization in FMCW radar sensors"

A novel linearization approach for VCOs in FMCW radar sensors is proposed. The principle relies on a SAW delay line that is applied to generate a reference beat signal. With the proposed concept it is possible to realize a Delay Locked Loop that generates a pre-distorted VCO tuning voltage. The system can be realized in CMOS technology. For the verification of the concept a test system was set up where the logic is implemented in a FPGA. In this paper the linearization principle and the test results of the demonstrator are presented. [C885]

"Wide-angle optical wave Bragg scattering at photonic band-gap structures"

The general principles of wide-angle optical wave Bragg scattering at photonic band gap structures in form of photorefractive holograms are offered. It was shown that ideal beam steering at the Bragg angle is possible when the condition θ0= θB± φ = const is met for each grating vector KG, in which θ0is angle of incidence of the optical wave, φ is the inclination of the grating vector, and θBis the Bragg angle. In contrast to acoustical waves photorefractive holograms as fan pattern offers practically unlimited of wide-angle optical-wave scattering and super high efficiency of modulation equal to 1. [C886]

"Adaptive QoS control by toggling voice traffic between circuit and packet cellular networks"

As cellular packet data services become widely deployed by the rollout of the networks such as general packet radio service (GPRS) and 3G cellular networks, packet-switched voice service such as voice over IP (VoIP) can soon be expected to be offered as an alternative to circuit-switched voice service. While circuit-switched voice offers better quality, packet-switched voice offers better resource utilization due to its multiplexing and compression techniques that can be used in packet radio principle. Therefore, the capability of having voice service over either circuit-switched network or packet-switched network provides a tradeoff between voice quality and bandwidth utilization. This paper proposes three schemes that allow users to toggle between circuit-switched voice and packet-switched voice based on the desired tradeoff. The basic idea is to allow ongoing voice traffic to alternate between circuit-switched network and packet- switched network using a 3-way calling mechanism in the SIP-enabled GSM/GPRS cellular network. We also show how these toggle schemes can be used depending on the cell load. Detailed performances of the proposed schemes are evaluated using simulation with realistic parameters of a cellular environment. The result shows our schemes can alleviate cell overloading as well as provide the smooth transition of an ongoing call between circuit-switched network and packet-switched network. Our schemes can be easily deployed in any cellular mobile network where circuit-switched network and packet-switched network coexist. [C887]

"MM-band transceiver for monoimpulse radar with continuous emission"

Millimeter band transceiver design principles are reviewed. Transceiver is designed for millimeter waveband radar, with noninterrupting emission, phase-manipulated by M-sequence. Technical characteristics of transceiver and its parts are shown. Transceiver is designed for car radar operating in 76-77 GHz waveband. [C888]

"Tunable preselector for EMC of same-type radars"

A principle is suggested of designing a tunable preselector built on fast switching elements and filters around dielectric resonators providing the following characteristics: a tuning rate of 50 ns, a 10 MHz passband, a 20 dB transmission factor, and a 30...35 dB damping at a 1.5 passband detuning. The noise factor of receiver devices is not compromised. [C889]

"Digital and optical beamforming techniques"

Summary form only given. In this tutorial we high advantages and problems of digital and optical beamforming relative to analog beamforming. We consider principles, components, and applications within the radar and communication areas. [C890]

"Turbo image restoration"

A new iterative processing for image restoration is proposed based on the turbo iterative principle. For this purpose, two uncorrelated component images issued from an original image are differently filtered and the pieces of information extracted from both filters are mutually exchanged in the iterative process. This scheme has achieved much better performances and reduced computational cost in restoring images with both additive and multiplicative (such as in SAR radar images) noise model. [C891]

"Results of, measurements, processing and modelling of GPR data showing the effect of soil moisture content on land-mine detection"

Summary form only given. To be able to predict the performance of a ground penetrating radar system (GPR) under certain environmental conditions, one needs to relate the parameters that predominantly determine the environment, to parameters that directly govern GPR performance. Soil type and soil water content are such environmental parameters. The latter is determined by prevailing (and historic) weather conditions and has a large effect on the electrical permittivity and conductivity of the soil medium. Thus, by relating soil water content to electrical permittivity and conductivity one can gain a better understanding of GPR performance and in principle could even predict GPR performance. For the purpose of land-mine detection it is advantageous to be able to have some idea of GPR performance under given circumstances. Knowledge about the environment will influence the choice of sensor and the moment in time, the de-miner wishes to deploy the GPR as mine detection sensor. In the summer of 2002 detailed GPR measurements were taken at the TNO Physics and Electronics Laboratory (TNO-FEL), mine-detection test-facilities. These measurements were executed under relatively dry as well as moderately wet conditions, in both sand and grassy soils. Data acquisition was done on a high-density grid with several GPR systems. The test facility contains a number of moisture conditions to GPR measurements. In this paper we will illustrate the effect of soil moisture content of different soil types, on the detection of buried land-mines, and compare this with the outcome of a numerical GPR model which takes moisture level and soil type into account. [C892]

"Subsurface imaging using measured antenna footprints"

For the detection of landmines, images of the subsurface are made using a bistatic stepped frequency continuous wave radar system. During the measurements, the system moves along the surface and due to the presence of objects in the subsurface changes in measured voltages are observed. These changes are formulated as a convolution of a complex contrast function with a sensitivity function. In fact, this sensitivity function is the vectorial inner product of the incident and the total electric wavefield. Using the Born approximation, the sensitivity function is obtained as the inner product of the field emitted by the transmitter and the field from the receiver operating in transmitting mode. For imaging purposes, knowledge of the wavefields in the subsurface is needed. Since it is difficult to model the radiation characteristics very accurately, we measure the footprints of the antennas at one level and propagate the emitted wavefields using Huygen's principle. After we verify the usability of this principle, we create synthetic data using measured patterns and apply back-propagation on the data to localize objects. [C893]

"A new method of high-accuracy level-measure based on combining radar frequency-modulation and phase-discrimination"

The basic principle of frequency-modulation radar level gauge is analyzed briefly. A new method to improve the precision of radar level gauge is proposed based on combining radar frequency-modulation and phase discrimination. The method adopts frequency-modulation technique to get rough data of an unknown level, uses phase-discrimination technique to get subtle data, and then joins them together to get high accuracy composition data of the level. Effective conditions for data composition of rough data and subtle data are also discussed especially. [C894]

"Sequential ing and adaptive processing (SNAP)"

The sequential ing and adaptive processing concept is an interference suppression technique applicable to modern phased array antennas. Using many of the same basic principles as the fully adaptive array approach, SNAP provides comparable interference suppression with significantly simpler antenna architecture. [C895]

"SAW based Delay Locked Loop concept for VCO linearization in FMCW Radar sensors"

A novel linearization approach for VCOs in FMCW radar sensors is proposed. The principle relies on a SAW delay line that is applied to generate a reference beat signal. With the proposed concept it is possible to realize

a Delay Locked Loop that generates a pre-distorted VCO tuning voltage. The system can be realized in CMOS technology. For the verification of the concept a test system was set up where the logic is implemented in a FPGA. In this paper the linearization principle and the test results of the demonstrator are presented. [C896]

"DOA estimation utilizing directive elements on a conformal surface"

In this paper we present a methodology on how to use directive elements in an adaptive array methodology. Typically one uses isotropic elements having practically no gain then the signal level is increased by putting hundreds and thousands of these elements together. In this paper we demonstrate a methodology where the elements can be arbitrarily spaced and may even be non-planar. In addition it is shown how to deal with nonuniformly spaced and non-planar arrays. We illustrate these principles in a direction of arrival (DOA) estimation utilizing directive elements. [C897]

"Finite difference time domain simulation of moving objects"

Normally in the finite difference time domain (FDTD) technique, stationary objects are modeled in a time domain simulation as a field propagates around them, and possibly inside these objects. This paper illustrates a method in which EM fields and a moving object can be modeled using the FDTD technique. By using a technique of dielectric approximation and intermediate step field movement, it is possible to model the movement of objects by the FDTD technique. This paper illustrates these principles in a one-dimensional domain with extensions and results for 2D as well. [C898]

"Phase compensation for ISAR imaging combined with entropy principle"

Inverse synthetic aperture radar (ISAR) imaging is a powerful tool in microwave imaging for moving target. It provides high range resolution by transmitting wide-band signal, and high cross-range resolution by coherently accumulating echoes, where phase compensation is one core technique for range-Doppler image formation. However, conventional phase compensation methods usually have problems to compensate the translational motion between radar and target with sufficient accuracy when the motion has high order or even random terms. To solve this problem, the minimum entropy idea is introduced in this paper for ISAR imaging via a nonparametric estimation method. [C899]

"Electromagnetic scattering from a homogeneous material body using time domain integral equations and bandlimited extrapolation"

In recent years, the time domain integral equation based solvers for Maxwell's equations have been gaining popularity. Although for certain types of problems they possess a number of advantages over other computational methods, their widespread usage has been hampered because of the instability and inefficiency encountered in early implementations. One new scheme that seems to overcome these instability problems is time marching using bandlimited extrapolation, which uses bandlimited basis functions for temporal representation, and bandlimited extrapolation to create a causal scheme from these noncausal basis functions. This paper presents an extension of this scheme to compute the scattering from homogeneous dielectric bodies. The results obtained from the new method show an excellent correspondence with those obtained from the standard, frequency domain method of moments. [C900]

"A robust DOA estimation algorithm for uniform linear array in the presence of mutual coupling"

It is well known that the mutual coupling between array elements is inversely related to their separation and may be negligible for elements separated by a few wavelengths, and at the same time the coupling between any two equally spaced sensors is approximately the same. Moreover, following the principle of reciprocity, the mutual coupling can always be expressed by a symmetric matrix. Consequently, a banded symmetric Toeplitz matrix provides a satisfactory model for the mutual coupling of ULA (Uniform linear array). In this paper, a robust subspace-based direction-of-arrival (DOA) estimation algorithm in the presence of mutual coupling is proposed for ULA. Based on the banded symmetric Toeplitz matrix model for the mutual coupling of ULA, the new algorithm provides a favorable DOA estimates and exploits no knowledge of the sensor mutual couplings. More importantly, an accurate estimate of mutual coupling matrix can also be achieved simultaneously for array calibration. [C901]

"Antenna modelling and pattern synthesis method for conformal antenna arrays"

We investigate the influence of inter-element coupling in conformal arrays. Physical parameters are examined as well as possible compensation methods. As a first approach, a simplified antenna model based on the interaction between idealised elements (electrically small dipole and current loop antennas) has been developed.

Experimental results show that the coupling influence predicted using this antenna model can be compared to the effects found in practical antenna arrays. Also, a synthesis method for conformal arrays based on Huygens' equivalence principle has been developed. The reference field is composed of cylindrical or spherical sector wave modes which are superposed to produce the desired far field. Array element weights can then be derived by projection of the reference fields onto the element positions. Both the antenna modelling and pattern synthesis method have proved useful for conformal array performance evaluation. Various single and double curved array shapes have been calculated to support the design of antenna arrays. The presented pattern synthesis method using spherical sector wave modes can be used to calculate excitation coefficients for double curved conformal antenna arrays. The resulting modal far fields may also serve as reference fields for other beamforming methods. [C902]

"A novel direct-imaging radar sensor with frequency scanned antenna"

The principle, design and experimental results of a simple direct imaging radar sensor are presented. The FM-CW radar principle and a frequency scanned antenna are combined with waveforms of different frequency slopes in such a way that angular and range information are provided by the amplitude envelope of a fixed video frequency. The sensor architecture uses a minimum of active RF components and digital signal processing. With low cost frequency scanned antennas, this architecture can be applied in radar surveillance stations or automotive side looking sensors. [C903]

"Broadband log-periodic normal mode helical antenna"

The normal mode helical antenna (NMHA) is a common antenna used on transceivers for wireless communications due to its omnidirectional radiation pattern, large bandwidth and small physical size. Applications such as ground penetrating radar (GPR) and Croswell radar tomography (CRT) require ranges of frequency in the order of 4 MHz to 1 GHz and can benefit from the use of NMHA. A scale model of a NMHA operating from 0.2 GHz to 10 GHz has been developed for a CRT system at Northeastern University. The antenna must operate with an omnidirectional radiation pattern and be less than 0.01 m in diameter. A new methodology and procedure to enhance the bandwidth of the NMHA is presented. The log-periodic principle is applied to the separation (S) between turns of the NMHA; the bandwidth of this antenna is increased considerably. This technique is based on the three Kraus' criteria to guarantee the helical normal mode operation. Several LP-NMHA antennas designed using this technique were built and tested; the bandwidth is significantly improved for each of them. The frequency range of operation obtained covered from 2.7 GHz to 12 GHz. To verify the normal mode operation, several radiation pattern measurements were performed. [C904]

"Re-configurable Sierpinski gasket antenna using RF-MEMS switches"

Fractal antennas are well known for their multiband characteristics. A new approach to multi-frequency re-configurable antennas using RF-MEMS switches is presented. Fractal antenna elements can be connected together using RF-MEMS switches in order to achieve a larger number of resonances. The RF-MEMS switches permit a controlled connectivity of sections of the antenna's conductive parts. This conductive coupling between the triangular elements of a Sierpinski structure provides clear multiple frequency operation with a single fractal antenna. The analysis and design principles are discussed and presented. [C905]

"Development of a classification algorithm for operational polarimetric NEXRAD radar"

Classification of meteorological and nonmeteorological radar echoes will be one of the key functions of the operational polarimetric NEXRAD radar. In this paper, basic principles of the classification for several cases are presented. The data were obtained from the polarimetric prototype of the NEXRAD radar. [C906]

"A methodology for true orthorectification of large-scale urban aerial images and automatic detection of building occlusions using digital surface model"

In urban area with high buildings, conventional orthorectification using digital terrain model (DTM) cannot meet the requirements of true orthoimage generation. Using digital surface model (DSM) integrating from DTM and digital building model (DBM), we propose a methodology in the study to automatically orthorectify large-scale urban aerial image and detect building occlusions for true orthoimage generation. Principle behind the methodology is the optical characteristic of buildings in photogrammetry, in which roof and root sharing the same coordinate are featured with different distances to imagery center. Therefore, in practical operation, we first compute the distances of input image pixels to imagery center and their coordinates is output orthoimage. A data matrix is used to remember the distances and coordinated. Then we compare the coordinates in the matrix. When pixels have the same coordinate, the one with the longest distance represents building root. For true orthoimage generation, only gray value of the roof need to convert into the output image and others are treated

as occluded area. By creating an index image, the occluded area can be recorded for next step processing, such as refilling form neighboring orthoimages. Therefore, using a data, matrix and an index image, we are able to automatically orthorectify large-scale urban aerial images and detect building occlusions for true orthoimage generation, provided that the digital surface model is available and the overlap of neighboring image is large enough to ensure 100% visibility of the occluded area. [C907]

"An empirical model to retrieving ocean wave period from nadir altimeter data"

Accurate measurement of the ocean wave period is of much scientific interest both operationally and for research. Shipping and offshore industries are keen to obtain real-time and climatological information on wave period in the open ocean to assist the design of sea-going structures and maximise safety at sea. Similarly, wave period is relevant for short-to-medium term ocean and weather forecasting, and more broadly, to ocean circulation and climate research, given the reported dependence of atmosphere-ocean momentum transfer on some measure of sea state development. In principle, full ocean wave spectra can be obtained from satellite synthetic aperture radars (SAR), yet the systematic extraction of wave period information from SAR has so far not been pursued. Hence, global wave period information is presently available only through numerical wave models, and there remain concerns about the lack of large scale validation of the geographical distribution and temporal variability of the modelled ocean waves. Here, we propose that ocean wave period information can be retrieved with adequate accuracy using satellite altimeters. There is evidence that satellite altimeter data contain wave period information, in addition to that on wave height. The existence of sea state development effects on the retrieval of altimeter wind speed is well documented and a few earlier studies have already considered the development of altimeter wave period models. However, the sea state dependence in these semi-empirical models is complex, and in both cases, the datasets of collocated altimeter/buoy measurements used to develop the models spanned only a small range of environmental conditions. In this paper, we present preliminary results of a new, purely empirical, wave period algorithm developed on the basis of the largest to-date dataset of collocated altimeter/buoy spectra measurements. The empirical wave period model is validated using independent collocated altimeter/buoy data, and by computing global monthly wave climatology. These are compared with existing wave period climatologies derived from numerical wave models. [C908]

"Investigations in radar rainfall estimation using neural networks"

Rainfall on the ground is dependent on the four dimensional distribution of precipitation aloft. In principle one can obtain a functional relation between the rain rate on the ground and the four-dimensional radar observations aloft. However it is difficult to express this in a useful form. Neural networks provide a mechanism to solve this complex problem. Using ground measurements of rain rate as the target output neural networks have been developed in the past that use the radar measurements as input and produce rainfall rates on the ground. Several topics related to neural network based radar rainfall estimates are addressed in this paper. This paper investigates the input vector types and sizes that are useful in a radar rainfall estimation context. Similarly, the neural network is trained with an initial data set, but updated adaptively. Various updating mechanisms are investigated with respect to accuracy of rainfall estimation. Two years of data from the Weather Surveillance Radar-1988 Doppler (WSR-88D) radar and a network of gages from Melbourne, Florida are used to evaluate the topics listed here. [C909]

"Novel radar technology and applications"

The behaviour of electromagnetic waves as described by the fundamental equations developed by James Clerk Maxwell around 1864, are governing the performance of radar technology and applications, along with appropriate signal waveform design, generation and processing. Novel radars are utilizing innovative modulation methods through digital signal generation and processing, with powerful data handling techniques and all-solid-state electronics, to realise the radar principles. Contemporary radar applications are particularly focused on (vehicle) traffic supervision and control, subsurface exploration, industrial measurements and automation processes, in addition to more sophisticated military applications. [C910]

"Prediction & modelling of EMI in communication systems due to non-linearities"

The interference in radio receivers has been an issue of concern right from the days when radio communication was in its infancy. Many techniques like super-heterodyne principle were introduced to simplify radio receivers, which brought along with them more interference problems due to the image frequency & the local oscillator frequency and its harmonics. Interference is also caused due to the inherent non-linearities existing in the transmitter subsystem. Receiver subsystem or even joints and rusty bolts in the immediate vicinity of the antenna which give rise to effects like intermodulation and cross modulation. This paper attempts to give an approach to modelling of the interference in radio receivers concentrating mainly on the intermodulation problems

to give an alternative to the tentative & inaccurate methods used to calculate their effects. [C911]

"Coherence estimation and speckle filtering based on scattering properties"

In this paper, we propose a new speckle filter for polarimetric SAR that preserves pixels' scattering properties. The basic principle is to select pixels of the same scattering characteristics to be included in the average. To achieve this, the algorithm first applies the Freeman and Durden decomposition to separate pixels into three scattering categories: surface, double bounce and volume, and then unsupervised classification is applied. Speckle filtering is performed using the classification map masks. Pixels centered in a 9Ч9 window are filtered by including only pixels in the same and two neighboring classes from the same scattering category. This algorithm is extended to the coherence estimation of polarimetric interferometry SAR data. The effectiveness of this new algorithm is demonstrated with JPL AIRSAR and E-SAR data. [C912]

"A new image registration method for multi-frequency airborne high-resolution SAR images"

High resolution airborne synthetic aperture radar (SAR) is useful for surveillance and remote sensing applications. The higher resolution leads to more speckle ad well as a need for more accurate pixel-level registration. Also, the curvature of the Earth needs not to be taken into account while registering two images because the swath of terrain being imaged in an airborne SAR is small. This article describes a new technique for registering multi-frequency airborne high-resolution SAR images. The image registration is set forth based on the fundamental principle of relaxation method, which uses image segment comprising of the relaxation registration results of point feature as global control. In order to guarantee the accuracy and reliability of image registration, line moment of edge feature is first used as match units to develop the traditional relaxation method. Airborne SAR images in Ku-band and X-band are used to test the new image registration method. Experimental results show that the proposed method outperforms standard image registration techniques in terms of reliability and rapidity in most cases. It also achieves better performance than wavelet pyramid method. [C913]

"Single-layer reactive impedance PSS"

The phase switched screen (PSS) is a technique that can be used to provide 'real-time' dynamic control of the radar cross section of an object. Conventional, passive radar absorbing materials operate either on the principle of phase cancellation, such as a Salisbury screen, or use lossy materials to absorb incident electromagnetic energy, as in a Dallenbach layer. In the PSS approach however, the energy scattered by an object is translated in the frequency domain to regions that are outside the bandwidth of detection systems. The PSS achieves this translation in frequency by imposing phase modulation onto the energy scattered from the object to produce a signal with a low time-average energy spectral density. In previous publications we have demonstrated both theoretically and experimentally that a resistively switched PSS has similar reflectivity characteristics to that obtained from a Salisbury screen. Larger operating bandwidths and tuneable PSS absorbers can be realised by using two or more active layers, but at the expense of increased absorber thickness. We describe how a single-layer PSS based on reactive impedance switching can be used to provide a significant increase in reflectivity bandwidth performance, and also a reduction in absorber thickness without using high permittivity materials. [C914]

"Wireless LAN PC card sensing of vital signs"

Heart and respiration activity can be monitored remotely without any sensors attached to the subject, using the microwave Doppler radar principle. Implementation of this function using wireless LAN PC cards is described. Heart rate was successfully obtained with two minimally modified LAN cards each driven by a laptop computer, at a distance of 40 cm from the subject. This is the first demonstration of the use of a modified wireless terminal for remote sensing of vital signs. [C915]

"Generalised monopulse estimation and its performance"

Monopulse is an established technique for phased array radars for fast and accurate angle estimation. The term monopulse stems from the fact that historically, the estimate was based on a single data snapshot. This is not essential for the method, but we keep the term for tradition. We generalise the monopulse technique as a method to determine the maximum output power of the linearly filtered data, where the filter weighting depends on the non-linearity of a set of unknown parameters. This optimum parameters are sought from a measurement of the filter output and its derivative at the parameter values close to the desired optimum. This principle is extended to the linearly filtered data sampled in time and space to estimate an arbitrary number of non-linear parameters. In particular, we consider the frequently appearing case of pre-processing (partial pre-filtering). An application of special interest is the filtering with weights determined adaptively in space and time (STAP). Finally we determine the distribution of the estimated parameters under Gaussian assumptions. [C916]

"VHF/UHF synthetic aperture radar-principles and motivation"

At frequencies below 1 GHz, vegetation is becoming transparent, the more so the lower the frequency. Tree clutter on the other hand tends to be as strong as in the microwave regime as at frequencies above 200 MHz. Below 100 MHz, i.e. in the VHF band, tree clutter levels are significantly smaller. Foliage penetration SAR is feasible at both UHF and VHF but has to overcome significant challenges. For one, resolution must be high, viz. of meter order at VHF and submeter order for UHF. In both cases resolution of wavelength order is thus called for, requiring special processing methods which will be discussed here. Secondly, the signal-to-noise budget is critical due to the severe radio frequency interference below 1 GHz. In fact SAR operation at these frequencies is not feasible unless there are some means to identify and remove the RF1. Thirdly, for SAR surveillance the target detection method is crucial. VHF resolution is too low to make any target recognition scheme effective as a means to reduce clutter false alarms. At UHF, even though resolution can be made high, intense forest clutter level creates a very difficult environment for target discrimination. These concerns and their remedies are discussed in the paper. [C917]

"An unsupervised classification method for polarimetric SAR images with a projection approach"

Two unsupervised training algorithms are presented based on a projection method for polarimetric SAR images. For this, polarimetric features, including the entropy H, angle α, anisotropy A, the largest eigenvalue of the coherence matrix λ1and coherence γ, are computed. Based on these features three noncorrelated and independent variates, which are the first three principle components are extracted using the principle component analysis. Then, a three-dimensional Cartesian coordinate is constructed using those three resultant variates. In order to reasonably define the initial cluster centers for the unsupervised classification, a projection method is proposed. As a result, a sophisticated two-dimensional feature space is obtained. Two initial cluster center determination algorithms, the histogram and histogram-quadrant methods, based on the above two-dimensional feature space are presented. Unsupervised classifications (with a minimum distance decision rule) are conducted based on the defined initial cluster centers. The classification results show that these approaches have high performance in convergence, speed, data volume and accuracy of training and classifying. [C918]

"Validation of bidirectional reflectance models using the first scene acquired by the CHRIS sensor over the Jornada Experimental Range"

Multi-angular reflectance data over desert grasslands and shrublands in the USDA, ARS Jornada Experimental Range near Las Cruces, New Mexico, were obtained by the Compact High Resolution Imaging Spectrometer flown on the PROBA satellite on August 5, 2002. An experimental satellite-borne sensor, the CHRIS, is one of the few sources of consistent multi-angular reflectance data on kilometer scales, providing up to five looks at a given target within the space of a few minutes. Two images acquired at different sun-target-sensor geometries were used to examine the validity of a simplified geometric-optical model (SGM) of bidirectional reflectance which incorporates a priori, empirical knowledge of the scattering properties of the underlying soil. The model is based on principles of geometric-optics while providing a mechanism for encapsulating volume scattering effects. It has been subjected to sensitivity studies and tested using a radiosity-based method, with simulations driven by detailed plant maps and measurements of the optical properties of plants and soils. However, up to this point it has only been tested against multi-angular data acquired from the air by tilting a digital multispectral camera; work here using data from the CHRIS sensor extends and corroborates the results presented in the previous studies. [C919]

"Development and application of a SAR training processor"

In order to make the concepts of SAR more accessible to a general audience, a SAR Training Processor (STP) was developed. The SAR Training Processor was used in lecture and laboratory exercises for graduate-level Remote Sensing classes and for public seminars. The software allows the user to interactively visualize data and explore the effects of processing options. Users can view any intermediate processing results, modify the processing steps, and change processing parameters. The processor can be run either from the command line or from a graphical user interface. Examples of exercises that demonstrate SAR principles and strategies for using the STP are given. [C920]

"Locating calibrators in airborne InSAR calibration"

The condition number of sensitivity matrix is a key factor that influences the performance of InSAR calibration. On the basis of InSAR calibration theory, basic principles of locating calibrators are proposed, and constraints of locating calibrators are also derived. Under the theory of condition number minimization, an algorithm of locating calibrators is presented to minimize the sensitivity matrix condition number. Theoretic analyses and computing

results show that the algorithm is efficient. [C921]

"Multi-image satellite SAR interferometry: state of the art and future trends"

In this paper, we wish to review briefly the principles underlying a recently developed approach, known as the permanent scatterers (PS) technique and aimed at the joint exploitation of a series of spaceborne interferometric SAR images for the retrieval of high precision elevation and ground deformation data on a sparse grid of privileged point-wise radar targets. [C922]

"M-sequence ultra-wideband-radar: state of development and applications"

The UWB approach is a promising and challenging technique for a great deal of sensor tasks for volume applications with economical and social impact. Impulse and swept sine waves are the classical methods to cover a wide spectral band. The M-sequence technique joins the merits of both principles without their drawbacks. The M-sequence technique provides stable UWB-data at reasonable costs and device dimensions due to its simplicity and the absence of bulky off-chip components which are amenable to monolithic integration. [C923]

"An FM/cw breadboard ladar using a 32-element linear self-mixing detector array"

The US Army Research Laboratory (ARL) is investigating a ladar architecture based on FM/cw radar principles that uses metal-semiconductor-metal (MSM) detectors as self-mixing detectors. ARL has recently incorporated a 1Ч32 pixel linear detector array of such detectors into a breadboard FM/cw ladar system and performed a series of characterization and outdoor image collection experiments. This paper discusses the basic operation of the system and presents some ladar imagery taken on the ARL Adelphi campus. [C924]

"Bistatic synthetic aperture radar with application to moving target detection"

Bistatic radar involves the use of a physically separated transmitter and receiver. This paper describes a bistatic radar system which uses the combination of a spaceborne synthetic aperture radar transmitter on board the European Space Agency's Envisat satellite, and a low-cost, stationary, groundbased receiver. The advantages of this variant of the bistatic configuration involve the passive and therefore undetectable nature of the receiver, in addition to standard bistatic considerations such as forward scatter. Experimental results obtained using the receiver, and an analysis into the utility of the system for moving target detection in the presence of clutter, based on a simulation in Matlab of the electronic Displaced Phase Centre Antenna technique are both presented. It is found that the DPCA method considered has a possible signal-to-clutter-and-noise ratio after cancellation and processing of approximately 10dB although this is with the assumption of adequate received pulses and so integration gain, to offset the signal-to-noise ratio degradation caused by the canceller. A discussion of future experimental work, including the possible use of two such receivers for an investigation into interferometry concludes. [C925]

"Analyses of directivity function characteristics channel mismatch correction for DBF in subarray"

We analyze the directivity functions of DBF in subarray under the ideal condition and with channel mismatch, and give the sum and difference directivity functions. We correct the reception channel mismatch by using the channel equalization method. The way, based on the principle of inverse filtering for recovering the ideal signals, can be realized both in time domain and in frequency domain. The method can correct the mismatch inside a channel and among channels, and is also suitable for both DBF in array element and DBF in subarray. Both of the analyses and the simulation results demonstrate that the method is fairly effective. [C926]

"A review of time-delay estimation techniques"

This paper reviews and evaluates suggested methods for estimating the time-delay of linear systems in automatic control applications. A classification of the methods according to the underlying principles is suggested. The evaluation, done by analyzing the estimates of the methods from extensive simulated data in open loop, shows that different classes of methods have different properties and are suitable in different cases. Some method are clearly inferior to others. Recommendations are given on how to choose estimation method and input signal. [C927]

"From a different perspective: principles, practice and potential of bistatic radar"

Bistatic radar systems have been studied and built since the earliest days of radar. They have the advantages that the receivers are passive, and hence undetectable. The receiving systems are also potentially simple and

cheap. Bistatic radar may have a counter-stealth capability, since target shaping to reduce monostatic RCS will in general not reduce the bistatic RCS. In spite of those advantages, rather few bistatic radar systems have got past the 'technology demonstrator' phase. It has also been remarked that activity in bistatic radar tends to vary on a period of approximately fifteen years, and that currently we are at a peak of that cycle; there is particular current interest in passive coherent location (PCL) techniques, using broadcast and communications signals as 'illuminators of opportunity'. This paper presents a review of some of the history, and the properties and current developments in the subject, and conjectures whether or not the present interest is just another peak in the cycle. [C928]

"A new realizable technique to improve the VCO linearity"

In this paper is presented a new technique to improve the VCO linearity by resampling the measured IF signal in short-range frequency modulated continuous wave (FM/CW) radar based on a known reflecting reference, which caused intentionally by a specially fabricated paraboloidal antenna. The basic principle and special attention are given in following discussion. Moreover, a confirmed experiment in microwave non-reflective chamber is simulated. The result shows the feasibility of our self-made antenna and this method satisfactorily. [C929]

"Role of EMC in packaging of electronic warfare systems"

The extensive application of EM spectrum to communication, radar, and navigation provided the armed forces with powerful tools. Radio communication provided coordination amongst forces. Radio navigation gave accurate location of the deployed forces and radar performed surveillance of the battle to verify force deployments and detect hostile forces. The EM spectrum is so extensively exploited, that today without its use, the survivability of armed forces is jeopardized. In the military sector the efficient use of the radio frequency spectrum-from extremely long waves up into the region of light waves-is forever increasing importance in the command and control of modern armed forces and for conducting successful operations. The critical dependence of the military command process on radio emissions makes it vulnerable, because radio emissions can in principle be intercepted by a potential adversary, analyzed for his purposes and used or countered to his own advantage. The requirement here, therefore, is to protect the frequency spectrum used by one's own command, control and information systems against interference by a potential adversary and to have the capability of deriving information by surveillance of the frequency spectrum used by the opponent or, depending on where the greater tactical advantage lies, of denying him use of it. This is the broad outline of electronic warfare or EW. Electronic warfare equipment requires the state-of-the-art subsystems or systems and a high degree of packaging because of the extremes of unknown and known variables encountered while in operation. Packaging the entire system into a modular form to facilitate easy replaceability is the present trend. This involves partitioning of the design into various modules. It is at this stage that the designer is faced with problems of interfacing and interference - electromagnetic interference (EMI). This paper presents some of the aspects that can reduce the electromagnetic interference (EMI) and provide electromagnetic compatibility (EMC) amongst various modules. [C930]

"3-dimensional object reconstruction from frequency diverse RF systems"

Conventional phased arrays operate on narrow bandwidth principles to achieve resolution in imaging of buildings and other objects of interest. Unfortunately, such narrow bandwidth methods to not allow sufficient resolution to reconstruct objects of interest in 3 dimensions at low frequencies and with small apertures. We propose a method that is computationally efficient and allows dynamic use of spectrum to achieve high resolution 3 dimensional reconstruction of objects from small or distributed apertures. This method also allows available spectrum bands to be used on a non-interference basis. [C931]

"Architecture considerations and integrated-passives-based design for a dual-mode GPRS-WLAN SiGe RF transceiver"

Seamlessly roaming user applications in converging GSM-WLAN environments are creating the need for highly integrated, dual-mode transceivers, amenable to single-die integration on silicon. Based on the direct conversion principle, an efficient system architecture that can be switched between both standards is proposed. It is shown that, for implementing the dual-mode radio, the design of wideband RF cells and switches is called for, which is nontrivial. Appropriate design techniques based on the extensive usage of on-chip passives are proposed to address the design of the dual-mode RF circuitry and render their performance on silicon as predictable as possible. The development of a SiGe BiCMOS GPRS-WLAN transceiver is showcased. Measurement results are provided at the cell level, for a 1.8-2.5 GHz 24 dB-gain LNA and an embedded +24 dBm WLAN PA. [C932]

"Shape dependence of the scattered electromagnetic field of spheroidal perfect scatterers"

In the present paper an approach to investigate the shape dependence of a perfect axissymetric scatterer and

especially a spheroid, with relation to its scattered electromagnetic field is attempted. For this investigation a spheroid has been selected with varying ratio of its dimensions. The investigation is based on the principle of maintaining the scatterers area constant while changing its shape from oblate to spherical and then to prolate. For this purpose, the method of moments with the use of numerical electromagnetics code (NEC) and a hybrid method are applied and the results of the bistatic and monostatic radar cross section computations are analyzed and presented. For these spheroids, it is shown that when the incident plane wave travels towards the -z axis, there are some elevation angle regions that the radar cross section of the bodies keeps to remain in very low levels even when the ratio of the spheroids' dimensions change [C933]

"Parameter estimation in chaotic noise and its performance simulation"

Signal detection in chaotic noise has been discussed in several papers, but the estimation of signal parameter hasn't been studied deeply. This paper focuses on parameter estimation in chaotic noise. The LS-AR algorithm is used for this purpose. First, we analyzed the proposed algorithm's principle and its advantage for parameter estimation. Second, simulation experiment results and analysis are given out to show the performance of the proposed algorithm. Lastly, MPSV is introduced to improve the LS-AR in some specific condition and some analysis of the alternative algorithm is also given out. To sum up, the LS-AR is effective for most uses. When it is necessary to use MPSV, one should find good trade-off between computation burden and performance. [C934]

"Singular signal detection with fractal"

Singularities and irregular structures often carry the most important information in signals. The method of singular signal detection based on fractal technique is presented at the beginning of this paper. Mathematics model of singular signal is expressed with local Lipschitz exponent. The characteristics of singular signal and the principle of this detection method are introduced; and the algorithm of this detection method is discussed in detail. According to short-duration grille fractal dimension of signal, information like the start-time and end-time of singular signal can be obtained. The experimental results verify that the method can detect singular signals in the electrical power system accurately. Finally this detection method with fractal is no more complex and can be implemented easily. [C935]

"Analysis of mirror frequency rejection in quadrature coherent detectors via interpolation method"

The basic principles of quadrature coherent detectors via the interpolation method are described in this paper. Signal flow being analyzed, the rejection of mirror frequencies is discussed, based on computer simulation. Both the theoretical analysis and simulation make good reference to engineering applications. [C936]

"On the way to 3G networks: the GPRS/EDGE concept"

This work describes the principles and use of GPRS. The main problems of transition towards the UMTS are also stated. [C937]

"Experimental investigations of digital signal processing techniques in an FMCW radar for naval application"

Recently we have observed increased interest in frequency modulated continuous wave (FMCW) radars, mainly because of their low probability of intercept (LPI) properties. In such radars the information on range of targets appears in the frequency domain and it is obtained on the basis of spectrum analysis carried out for a so called beat signal. The beat signal is a product of mixing the received signal with the transmitted signal in the receiver of homodyne configuration. In the paper we briefly describe the principle of operation and design of the FMCW radar. Special attention is paid to digital processing of the beat signal. A prototype of an FMCW radar for naval application was made in the Telecommunications Research Institute. The prototype was tested among other things for optimisation of digital signal processing in a real sea environment. The noncoherent processing comprises FFT, CFAR thresholding, binary integration and scan-to-scan correlation. The paper deals with an experimental study on how different algorithms influence signal detection. The method consists of estimating the detection performance under various conditions. We examine the detection performance in relation to, for example, the kind of smoothing window in FFT, length of FFT, length of CFAR window, and rule of integration. The results obtained are presented. [C938]

"Airborne weather radar as an instrument for automatic mapping"

The classification of navigational radar landmarks and the principles of their display at automatic radar mapping are proposed. Selection algorithms of each type of navigational landmarks are developed. The priority of navigational landmark classes is established, and the scheme of the combining different channels is designed.

The automated recognition of landmarks and radar mapping is implemented in a new airborne weather radar. [C939]

"Conditions to the radar vector signal providing simultaneous measurements of all back-scattering matrix elements"

The properties of the illuminating waveforms and conditions of the signals, forming orthogonal (by polarization) vector sounding signals are discussed. These signals are needed in order to estimate the back-scattering matrix (BSM) of real media and objects. It is shown that the correct BSM estimation of fluctuating objects, having a-priori unknown ranges and radial velocities, is possible only when complicated orthogonal signals are being used. The principles of forming the needed radar waveforms as well as principles of backscattered vector signal processing, assuming Gaussian noise at the receiver is formulated. [C940]

"Numerical modeling of an optical beam-splitter by the time-domain wavelet-collocation technique"

Biorthogonal interpolating functions have been applied to electromagnetic field modeling through the wavelet-collocation technique in the time domain, yielding a versatile first-principle algorithm for the solution of time dependent Maxwell's equations with inhomogeneous media. The resulting technique is rigorous and maintains high accuracy, while, by virtue of its sub-gridding capability, significant reduction of the computational requirement has been obtained particularly for the modeling of electrically large dielectric waveguides. The proposed technique has been applied to a two dimensional dielectric waveguide beam splitter, with dimensions typical of optical waveguide systems, and improvement in the computational efficiency has been demonstrated. [C941]

"Transportable multi-beam Doppler polarimetric radar"

TARA (transportable atmospheric radar), a unique radar system developed at the International Research Centre for Telecommunication transmission and Radar (IRCTR) of Delft University of Technology, can be used to observe the formation of precipitation and various other physical processes that occur in clouds. This provides important information that is used to map effects of global warming on the world's climate. The Delft radar system is sensitive enough to detect turbulent airflows. TARA may therefore be used to improve safety near airports. The TARA antenna system consists of a hybrid feed array in combination with a precision reflector to obtain instantaneous high-resolution, three-dimensional, dynamic measurements of wind and rain. The paper summarizes TARA's basic principles illustrated with initial measurements. [C942]

"Computational verification of the concept of microwave drilling towards increasing its safety"

The paper reports an original and independent verification of the concept of microwave drilling recently proposed in a US patent. While its design has been based on a simplified analytical model and verified by a 1D and 2D computer simulation, an accurate numerical 3D electromagnetic analysis is applied herein. It confirms the underlying idea of creation of a highly localised hot spot and thus proves the microwave drill principle in general. However, a strong leakage is also revealed, which may limit practical use of the drill without appropriate shielding. Simple and technologically feasible measures for reducing this leakage are subsequently analysed. [C943]

"Teaching the principles of microwave oscillator design"

Theory of oscillators usually starts with an oscillator fundamental circuit containing two components: a negative resistance and a frequency stabilising circuit. Conditions for the oscillation start-up and for the steady state follow then, leading to so-called amplitude and phase conditions expressed in the case of microwave oscillators either in the immitance form or written with the use of the oscillator components reflection coefficients. From the mathematical point of view both approaches should be equivalent. However, it has been shown in the past that only the immitance-based approach guarantees a successful oscillator design. In the paper this question has been reconsidered from the didactic point of view. It has been shown that both approaches are actually equivalent, provided that over-simplifications appearing sometimes in the literature are avoided. The extended Smith chart has been also used, yielding a clear graphical interpretation of the involved relationships. [C944]

"Tracking in decentralised air-ground sensing networks"

This paper describes the theoretical and practical development of a decentralised air and ground sensing network for target tracking and identification. The theoretical methods employed for studying decentralised data fusion problems are based on the information-filter formulation of the Kalman filter algorithm and on information-theoretic methods derived from the Bayes theorem. The paper particularly focuses on how these methods are

applied in very large heterogeneous sensor networks, where there may be a significant amount of data delay or corruption in communication. This paper then describes the development of a practical system aimed at demonstrating some of these principles. The system consists of a number of unmanned air vehicles (UAVs), with radar and vision payloads, able to observe a number of ground targets. The UAV sensor payloads are constructed in a modular fashion, with the ability to communicate in a network with both other air-borne and other ground sensors. The ground sensor system comprises of multiple modular sensing nodes which include vision scanned laser, steerable radar, multiple fixed radar arrays, and combined night vision (IR)-radar. [C945]

"CryoSat: a mission to determine fluctuations in the Earth's ice fields"

This paper provides an overview of the CryoSat satellite mission, the first of the European Space Agency 'Opportunity' Missions. It is aimed at measuring fluctuations in Earth's land and marine ice fields. The mission objectives, instrument system and measurement principles, mission operation and the approach to the calibration and validation of the measurements are described. [C946]

"Using cross-entropy for polarimetric SAR image classification"

In this paper, the concept of cross-entropy is introduced for measuring the difference between two scatterers in polarimetric SAR image classification. The difference between two scatterers is composed of three parts, i.e., the difference of average scattering mechanism, the difference of scattering randomness and the difference of the two spans of scattering matrices. The minimum cross-entropy principle is adopted to make the classification decision. The capability of this method is demonstrated by the experimental results. [C947]

"The principles of positioning with space-borne SAR images"

The researchers of surveying and mapping have paid much attention to SAR radar because of its capabilities of observing the Earth by all weather and all-time. With the development of science and technology, especially with the improvement of SAR resolution and orbital positioning accuracy, the application of SAR to surveying and mapping field has been broadened. The principles and methods proposed in this paper are aimed to realizing (a) mapping with single SAR image; (b) generating SAR orthophotomap; and (c) mapping with SAR stereo-image provided that orbital parameters are already known in the digital photogrammetric system. Finally the principles have been successfully applied to automatic generation of DEM through image matching by using ERS-1 and RADARSAT1 images to construct image pairs. [C948]

"Glacier surface velocity measurements from radar interferometry and the principle of mass conservation"

Presents a relation between the three glacier surface velocity components, the surface flux-divergence, glacier thickness and bottom melt and displacement. The relation can be used as an extension to the surface parallel flow assumption often used with interferometric synthetic aperture measurements of glacier velocities. The assumptions for the derivation are described and important limitations high-lighted. [C949]

"Interferometric calibration with natural distributed targets"

Cross-calibration is a fully automated algorithm for calibration of interferometric synthetic aperture radar (IFSAR) data. It has been developed for single-pass interferometry, but the principles may be applicable to multi-pass interferometry, too. The algorithm is based on natural distributed targets and it excels by neither requiring surveyed ground control points nor dedicated calibration scenes. However, the parameters to be calibrated must be stable during mapping. The algorithm has been applied to data from the Danish airborne SAR, EMISAR, and the performance has been assessed. The algorithm appears to be fairly robust with respect to the terrain type. However, the result of the calibration may deteriorate if the terrain elevation, as measured with the SAR, changes systematically with the incidence angle or the aspect angle. [C950]

"The interferometric cartwheel: a multi-purpose formation of passive radar microsatellites"

The interferometric cartwheel (CNES patent) is composed of three passive identical microsatellites set in a particular orbital geometry and flying behind or ahead of an active synthetic aperture radar (SAR) satellite. This satellite illuminates a ground swath and the reflected signals are received by the microsatellites with specific viewing configurations. The obtained data are mainly used for the computation of a Digital Elevation Model (DEM). This paper details first the across-track interferometry principle specific to the cartwheel geometry. General system and satellite characteristics are then presented as well as their main constraints. Finally, a performance budget based on a typical satellite configuration is carried out and leads to the topographic accuracy of the DEM. [C951]

"Preliminary design of the SWIMSAT radar for the measurement of ocean wave spectra"

The main objective of SWIMSAT is to measure the directional spectra of waves thanks to a space-borne radar. The instrumental concept involves a real-aperture radar using a multi-beam conical scanning, in order to provide measurements of the spectral properties of the wave field, and to estimate the profile of radar cross-section depending on incidence (0° to 10°) and azimuth (0° to 360°). The paper provides an overview of the mission and of the measurement principle, and the status on instrument design. [C952]

"A high sensitive receiver for baseband pulse microwave radar sensor using hybrid technology"

This paper describes an improved ultra-wideband (UWB) receiver for the receiving of ultra short electrical pulses transmitted by a short-range microwave radar. The receiver comprises an ultra-wideband balun operating in a frequency range of 600 MHz to 6 GHz and an integrated pulse sharpening circuit. The pulse sharpening circuit is driven by square-wave pulses with an amplitude of 1.5 V, a pulse width of 70 ps (FWHM), a rise time of 30 ps and a fall time of 80 ps. The receiver is realized in hybrid technology on CuClad substrate which makes it low cost and easy to integrate. The principle of operation of the receiver is based on the symmetry of the received input pulses leading to a high sensitivity and a dynamic range of 60 dB. [C953]

"10 GHz Doppler radar sensing of respiration and heart movement"

A vital signs detection system, based on motion sensing principle of the Doppler effect, will be described. This system can be used to determine respiration and heart rates remotely, without any sensors attached to the subject. The system consists of a Doppler radar transceiver, an A/D converter, data acquisition software, and DSP software for rate extraction. The radar function can be realized with compact and inexpensive commercially available motion sensor detectors [C954]

"High voltage commutator on the basis of an electron-beam valve (EBV) for powerful modulator"

Creation of high-voltage modulators with pulse duration and recurrence rate varied over a wide range in connection with a problem of radar-tracking systems for satellites is discussed. The powerful high-voltage switching tube developed in VEI electron beam valve (EBV) is the optimum switching device for such a modulator. Basic EBV feature is use of a principle of energy recuperation with decelerating of an electron beam at the anode which allows one to provide low internal resistance and high electronic efficiency of a tube. Due to some design features EBV has pentode voltage-current characteristic with weak dependence of a switched current from anode voltage. The anode and accelerating grid have water cooling and allow dissipation of high power that provides EBV serviceability in a long pulse mode or in a pulse-frequency mode with high average power. [C955]

"The dynamics and radar cross section density of chaff clouds"

A new chaff cloud model is described which is based on fundamental principles with modifications based on laboratory observations. Excellent approximations to the exact physical model have been developed which can rapidly predict the chaff fiber density and orientation as a function of location, time and fiber characteristics. Using this information, the time varying RCS density is determined for any frequency and polarization anywhere within the chaff cloud. The results are consistent with full scale observations and the computational speed allows the model to be integrated into existing real time radar simulations. [C956]

"A 76 GHz multiple-beam planar reflector antenna"

A multiple-beam antenna based on the principles of a folded reflectarray antenna and a bifocal antenna is presented. Experimental results are given for a 76.5 GHz antenna with 90 mm diameter, a height of 26 mm, and a scanning range of Г,В±13.5 as well as for an antenna with 130 mm diameter, a height of 30 mm, and a principle scanning range of Г,В±30Г,В°. With its low height and potentially low fabrication cost, this antenna is an interesting candidate for next generation automotive radars. [C957]

"Radar Sensors to Determine Position and Physiological Parameters of a Person in a Vehicle"

Two different sensor concepts based on the impulse radar principle are proposed to determine position and physiological parameters (heartbeat and breath frequency) of a person in the interior of a vehicle. In this paper, the sensor concepts are presented as well as first measurement results collected in both laboratory and vehicle environment. [C958]

"Quasi-Optics of Near-MM and Sub-MM Waves in IRE-Kharkov, Ukraine in the 1960-70's"

The paper presents a retrospective review of the development of short millimeter (mm) and sub-mm wavelength quasi-optical technology based on the hollow dielectric beamguide as a transmission line. This development started in 1964 and was widely used in the nuclear fusion research in USSR. Later on the same principles were applied in the development of battlefield radars and microcompact RCS measurement ranges. [C959]

"Nonlinear processing of n-dimensional phase signals"

Many measurement principles in physics and engineering deliver a set of ambiguous phase signals, from which the unknown quantity, e.g. a distance or angle, has to be calculated. In this paper a novel nonlinear algorithm is introduced, in order to achieve an optimized determination of this unknown quantity from phase measurements. This algorithm is based on a generalization of the well-known nonius principle and applies nonlinear signal processing. The main advantages compared to known methods are an enormous reduction of measurement errors and a significant increase of robustness against large input errors. Furthermore, this approach can be implemented very effectively on digital systems. Examples show the usefulness and easy implementation of the proposed algorithm. [C960]

"Frequency-swept microwave imaging using multi-source illumination"

The principle and experimental results of bistatic frequency-swept microwave imaging of continuous shape and discrete line conducting objects using simultaneous multi-source illumination are presented. Images of scattering objects reconstructed from the experimental data measured in the frequency range 7.5 GHz to 12.5 GHz are in good agreement with the scattering object geometries. The experimental results show that using multi-source illumination can provide a cost-effective approach for a wider imaging viewing angle and higher resolution of the scattering object. [C961]

"Principles of simultaneous measuring the radar objects' full scattering matrix"

The principles of the correct estimation of backscattering matrix (BSM) under real conditions in monostatic radar are discussed. The term "correct" means that the estimate keeps all global properties of symmetry of a real object's "instantaneous" BSM. The relation between the required accuracy of BSM estimation and the base N (BT product of bandwidth and time interval of the measurement) of the illuminated vector signal is shown. [C962]

"COMESA: concurrent measurements of the elements of the scattering matrix"

Up to now, the full scattering matrix of a radar target can only be measured with a sequence of pulses where, in each pulse, a different sub-set of the scattering matrix is measured. In best case, a dual polarized receiver is used and two pulses are needed to measure the full scattering matrix. Although for many applications this works fine, it has inherent limitations. For a correct measurement of the scattering matrix, all elements should be measured simultaneously. To do this, a method must be used to isolate the transmitted and received signals corresponding to the different scattering elements. This can be done using so-called orthogonal signals. In this paper, a first experiment is described showing the possibilities of orthogonal signals based on the FM-CW radar principle. The experimental set-up as well as the results are described in detail. Also a block scheme of a radar system using the principle based upon the use of orthogonal FM-CW signals is described. This new radar is called COMESA. [C963]

"Theoretical aspects of Bayesian approach to aperture synthesis for radar imaging"

The theory of radar and synthetic aperture radar (SAR) imaging using the maximum likelihood (ML) approach and statistical regularization formalism does not consider two crucial points which are of a prime importance for the statistical optimization of SAR imaging techniques. These are: (1) how to ground the statistical randomized model of the SAR imaging experiment incorporating the maximum entropy principle of information theory; (2) how to design the statistically optimal Bayesian maximum a posteriori probability (MAP) estimation method for solving the inverse problem of restoration of the spatial spectrum pattern (SSP) of the wave field scattered from the probing surface (referred to as the radar image) via processing the finite number of sampled recordings of the SAR trajectory data signals. We fill these gaps by addressing a novel look at the SAR imaging as an ill-conditioned SSP estimation problem with model uncertainties. We extend the theory (see Kravchenko, V.F. et al., Measurement Techniques, vol.58, no.1, p.101-7, 1995) by developing the Bayes ME method for SAR image formation. Our study is intended to establish a foundation to assist in understanding the basic theoretical aspects in designing the signal processing techniques for SAR imagery with enhanced image performance. [C964]

"An obstacle sensing radar system for a railway crossing application: a 60 GHz millimeter wave

spread spectrum radar"

We have developed a 60 GHz millimetre wave spread spectrum radar system. The radar was designed as a sensor for an obstacle sensing radar system for a railway crossing application, in which the sensing range per radar installation covers up to 90 degrees. With a pair of these radar systems (radar 1 and radar 2), the whole area of the railway crossing can be monitored. This paper describes the structure of the radar and it's working principles, and also our experimental test results [C965]

"A compact low-cost add-on module for Doppler radar sensing of vital signs using a wireless communications terminal"

A simple add-on module that allows the detection of human respiration and heart activity using an unmodified wireless telecommunications terminal is presented here. The module combines an antenna and mixing element to receive direct and back-scattered transmissions from the wireless terminal, and through Doppler radar principles produces an output signal proportional to the motion of the user's heart and chest. This signal can be used to monitor heart and respiration rates, and can potentially be relayed by the wireless terminal to a remote health monitoring facility via the existing telecommunications infrastructure. Module functionality is demonstrated here using a 2.4 GHz cordless telephone [C966]

"Nonlinear images processing based on a changing of distributions at parametric and nonparametric stochastic estimation"

Nonlinear image processing approaches based on both nonparametric and parametric principles were developed. A new method of nonlinear function determination on the basis of solving a nonlinear equation has been created when this equation was written by cumulative distribution functions of the random variable. The efficiency of the proposed approach was proved with examples of both quality increase of low contrast images with various natures and denoising of radar images at their homomorphic transform. [C967]

"Analyzing on phase error for single pass interferometric SAR"

The height error induced by phase errors is decisive for the final performance of interferometric synthetic aperture radar (InSAR) systems. The principle reasons associated with the phase errors are illustrated in this paper, including SNR, baseline length, number of looks, etc. The derived models are applied to a practical example. [C968]

"Forward scatter radar detection"

The forward scatter signature of a target provides the radar systems designer with an alternative approach to the detection of 'very low radar cross section (RCS)' targets. This paper outlines the rationale for a forward scatter radar system, the forward scatter principle, and the architecture of a forward scatter radar systems performance model. This model has been developed to analyse the effect of variations in the choice of operating frequency, transmitter and receiver characteristics, detection and tracking algorithms. The paper discusses these aspects with results from modelling and performance predictions for target forward scatter signature, transmit and receive antenna designs, analogue to digital converter (ADC) performance and coverage for a forward scatter radar system operating in the ultra high frequency (UHF) band. [C969]

"Comparison between LS and TLS in adaptive processing for radar systems"

Electromagnetic noise like interference (NLI) disturbs the proper working of radar by injecting noise from specific angular directions. Phased-array radars contrast this phenomenon via adaptive spatial filtering of the interference; this objective is reached by distorting the receiving antenna pattern by generating a in the interference direction of arrival (IDoA). In the real world the adaptive cancellation of directional interference is limited, among other error sources, by the presence of clutter and by the amplitude and phase mismatch of receiving channels; thus adaptive signal processing strategies have to be conceived to permit the NLI cancellation in real environment. This paper compares two methods for adaptive signal processing in modem radar systems. We recall the working principles of the least squares (LS) and total least squares (TLS) algorithms. These processing methods are applied to three study cases in adaptive phased-array radar. We study the estimation of the jamming covariance matrix in presence of clutter in an adaptive phased-array. The depth in adaptive jammer cancellation is then analyzed, and the problem of equalization of receiving channels is considered. [C970]

"Absolute and relative measurement of the sea surface wind vector by an airborne altimeter"

A pilot needs operational information about wind over sea as well as wave height to provide safety of hydroplane landing on water. Near-surface wind speed and direction can be obtained with an airborne microwave scatterometer, a radar designed for measuring the scatter characteristics of a surface. Mostly narrow-beam antennas are applied for such wind measurement. Unfortunately, a microwave narrow-beam antenna has considerable size that hampers its placing on flying apparatus. In this connection, a possibility to apply a conventional airborne radar altimeter as a scatterometer with a nadir-looking wide-beam antenna in conjunction with simultaneous range Doppler discrimination techniques for recovering the wind vector over sea is discussed, and measuring algorithms of sea surface wind speed and direction are proposed. The principle considered and algorithms proposed in the paper can be used for creation an airborne radar system for operational measurement of the sea roughness characteristics and for safe landing of a hydroplane on water. [C971]

"Discrete diode microwave phase shifter"

The results of research, computer simulation and development of the discrete p-i-n diodes phase shifter (PS) in the centimetric wave band are represented. The selected buildup principle allows one to create a PS that passes pulsed microwave power up to the level 2-3 kW, with relative on-off time ratio 18 and commutation speed 1-2 μs. The application of storage units in the control system allows us to optimize PS parameters to obtain high accuracy of setting of a phase discrete value and low loss of transmitted microwave power. Test results are given. [C972]

"Application of extended Huygens' principle to scattering discontinuities in waveguide"

A recently proposed extended Huygens' principle for scattering objects in a waveguide is reviewed. This technique allows the coupling of a finite element discretisation with a quasi method of moments (MM) surface element approach. Perfectly conducting posts are considered as test cases. Implementational details are discussed and results for the conducting post are presented. [C973]

"Wide-band hybrid computational electromagnetic technique using an impedance/admittance interpolation method"

A hybrid technique linking the frequency-domain method of moments (MoM) and the finite difference time domain (FDTD) method provides a powerful and flexible approach to the numerical solution of a complex antenna structure in the presence of a large lossy dielectric body, especially if it is inhomogeneous. If broadband analysis is required, such as the transient response for a sub-surface radar, this can be accurately modelled by iterating the field propagation over the two different domains. To do this it is necessary to compute the fields on an equivalence-principle surface (the surface that couples the two domains), over the entire bandwidth. In this paper, the fields are computed using the method of interpolation of impedance/admittance matrices on the antenna side, using MoM. This saves execution time and memory requirements for the MoM. Basically, the inverse discrete Fourier transform (IDFT) is performed on the equivalence-principle surface within the FDTD domain and, on the other hand, the discrete Fourier transform (DFT) is used to account for the back-scattered fields for the MoM domain. The number of frequency samples required to predict the coupling fields between the two domains over the entire bandwidth is investigated and discussed. The positions of these samples over the selected bandwidth are also studied in relation to their effect on recovery of the time-domain fields for different resonant structures. Several examples are presented and the results are compared with available data. [C974]

"A new microwave-millimeterwave amplitude-phase measurement system and applications"

A new microwave-millimeterwave amplitude-phase measurement system and its typical applications are proposed in this paper. Compared with the traditional system, it is based on a novel principle, has simple construction, easy frequency band expansibility and convenient applications. The basic system configuration and two expanded applications, remote testing and local testing are presented. So far, this system has been applied in many fields successfully, such as CATR electric performance testing, antenna pattern measurement and RCS measurement, with the frequency band from 1 GHz to 110 GHz. [C975]

"Target decomposition through polarimetric, disjoint Doppler and frequency band (I)SAR images"

A fully polarimetric (I)SAR image target decomposition process has been developed to aid automatic target recognition (ATR) for disjoint Doppler and frequency bands. In this paper the principle of target decomposition into scattering primitives is first demonstrated for a flat plate and then for a more complex target. [C976]

"A platform-based data fusion and sensor management node"

The potential for data fusion (DF) and sensor management (SM) in sensor networks is high but not fully

exploited. This is true especially for systems with electronically scanning antenna (ESA) sensors, and it applies both to internal platform networks and to networks of platforms. Some reasons for that are presented here. In order to explore the space of DF and SM methods on the platform level, a fusion node has been designed and implemented. It has been used for realizing all kinds of data fusion processing that are needed in single- and multi-platform sensor systems. A basic design principle is modelling of the function concept, with reference to 'multi function sensors'. It is based on the similarity between the function model and the basic loop for operator action, or OODA loop (observe/orient/decide/act). [C977]

"A Doppler-based automatic target classifier for a battlefield surveillance radar"

This paper describes the automatic target classifier which has been introduced into the Man Portable Surveillance and Tracking Radar (MSTAR) battlefield surveillance as part of its mid-life improvement. It discusses the background to the use of Doppler classifiers for radars of this type, based on the already-prevalent use of audio as a classification aid. It then discusses the principles of the classifier used in the MSTAR radar. This uses the Doppler spectrum to form a feature vector and uses a hierarchical Fisher linear discriminant to resolve the different classes. The training and testing of the classifier are discussed, together with the performance achieved. [C978]

"A new principle for measuring the generalization performance of SVMs"

A new method for estimating the VC dimension in advance is proposed, which can be taken as a principle for measuring the generalization performance of SVM. Our method adopts the two-order statistic of training samples and maintains consistency with the method for estimating the VC dimension in statistical learning theory. Our method can be applied to the problem of model selection and sample pre-processing. Simulation results show the feasibility and practicability of our method. [C979]

"Conception of "signal sharing" in integrated radar and jammer system and the integrated signal design"

A new concept of "signal sharing" in an integrated radar and jammer system is introduced. The principles of the integrated signal design are deduced by comparing the differences between radar and jammer. A specific integrated signal, linear FM-random pulse cluster (LFM-RPC), is presented. It is shown that this signal has good characteristics of detection and jamming. [C980]

"A column-orthogonal two dimensional spread spectrum technique"

In this paper, a conception of a general 2-dimensional spread spectrum (2DSS) is proposed. The principles of the transmitter and receiver of this 2DSS communications for additive white Gaussian noise channels are discussed, the BER of this scheme is also analyzed. Moreover, the simulation result of the BER of the 2DSS communications is provided. [C981]

"Passive coherent detection via exploiting illuminator of opportunity"

An experimental passive coherent target detecting system via exploiting illuminator of opportunity (also can be considered as external illuminator, such as broadcast, television etc.) is constructed, based on this experimental system, the principle of coherent receiving is analyzed and its power coverage is estimated, also, an applicable signal processing scheme is described. With the help of real data collection and processing, researches on the influence of direct signal rejection, channel properties and multi-path clutter rejection on the performance in passive coherent detection are investigated, results show the effectiveness of such system can be implemented by employing elaborated system allocation and advanced signal processing. [C982]

"VLSI implementation of universal random number generator"

A universal random number generator which can generate random numbers drawn from a uniform distribution, exponential distribution, Rayleigh distribution and Gauss distribution has been implemented as a VLSI circuit. The proposed system is based on the principle of arithmetic iteration which is implemented as a pipelined architecture. This random number generator has the characteristics of high speed, low power consumption and high output precision, and it is especially suited in communication systems and radar echo simulation environments where multi-distribution random numbers are required. The simulation and measurement results verify the validity of the design. [C983]

"Design on return signal simulator of scatterometer and method of generating its signal"

The return signal simulator (RSS) of the Chinese spaceborne scatterometer is designed in order to compensate for the insufficiency of the common test and calibration device. The RSS can calibrate and test conveniently the transfer function and signal processing function of the scatterometer in ground-based tests. It employs the principle of pulse reconstruction. The characteristics of the return signal are generated by a digital method. The accurate round trip path delay of the radio-frequency signal, pulse width modulation and Doppler frequency shift are simulated. Also the phase difference shift is improved. By using the RSS, the testing and calibrating experiments for the scatterometer are implemented, which indicate that the generated return signal not only can fully express the statistics of the real return signal, but also can meet the requirements of testing and calibrating the scatterometer. This method of generated return signal can be realized easily and the results are correct, so it will provide a reference for future RSSs. [C984]

"Broadband operation of a radio frequency spectrum analyzer based on spectral hole burning"

Summary form only given. We recently demonstrated the principle of radio frequency spectrum analysis based on the engraving of multiple monochromatic gratings in a Spectral Hole Burning (SHB) material. This device is considered for applications in radar and sub-millimeter wave astronomy. In the first experiment, the frequency scanning procedure limited the bandwidth to 35 MHz. With a new broadband setup we have achieved an instantaneous bandwidth of 2.5 GHz and demonstrated the spectral zooming capability of the analyzer. [C985]

"Phase-coded LIDAR"

Summary form only given. Our approach represents an important improvement to the pseudo-noise (PN) coded LIDAR technique. We modulate the laser with a bipolar phase coded PN microwave signal rather than a baseband unipolar sequence. Hence, we can use the bipolar phase codes that have been developed for microwave ranging systems. Furthermore, as we have demonstrated, the LIDAR return sign can be processed using techniques and components that are already in place for microwave ranging. These results demonstrate the principle of operation for a bipolar phase coded LIDAR with range gated vibration signature capability. While this experiment was performed at close range and a moderate PN code rate of 1.3 GHz, one could envision extending the code rate to approximately 10 Gb/s in order to obtain a range resolution on the order of 1.5 cm. Furthermore, the addition of EDFAs and telescope apertures would allow the system to range distant targets. [C986]

"Development of return signal simulator for Chinese satellite altimeter test and calibration"

The prelaunch performance assessment and function modes assurance of Chinese first satellite altimeter, developed by the Center for Space Science and Applied Research, must be subjected to a rigorous test and calibration program. As an important part of this program, an ocean Return Signal Simulator (RSS) is developed. This paper describes the principles of the RSS with its means of testing and calibrating the satellite altimeter. By employing a chirp regeneration technique, a full de-ramp technique, an ocean return spectrum digitally synthesizing technique and a high speed DSP technique, a full signal RSS is successfully developed for the Chinese satellite altimeter test and calibration, full range of time delay and full sea state simulation is achieved. Time delay precision is 0.2 ns, significant wave height simulation precision is 0.5 m and backscattered coefficient precision is 1 dB. By using the RSS, the full system testing and calibrating experiment to the Chinese satellite altimeter are implemented, and the dynamic performance of the altimeter is validated by the obtained results. [C987]

"SAR image matching using the edge strength map"

Based on the principle of stereovision, radargrammetry uses the parallax between a couple of SAR images to reconstruct the 3D information of the scene. In the radargrammetric process, the matching step is the most problematic one, due to speckle noise. In this paper, we present our radargrammetric chain, and then, focus on the matching module we are developing, which includes an edge detection to improve the reconstruction. [C988]

"An airborne multi-mode microwave sensor and flight experiments"

An airborne multi-mode microwave sensor has been developed in order to verify the design and performance of future Chinese spaceborne multi-mode microwave sensor. Like spaceborne system, the airborne system also includes altimetry, scatterometry and radiometry functions. There are five frequency channels in radiometry mode. Altimetry mode, scatterometry mode and one of radiometry channels operate at the same Ku band. Flight experiments have been conducted on southern sea of China. The results show that future Chinese spaceborne multi-mode microwave sensor is practicable. In this paper, the principle of spaceborne and airborne multi-mode microwave sensor is briefly introduced. Flight experimental details and results are described. [C989]

"A microwave sensor for agricultural implements"

For soil preparation, the concept of precision agriculture requires real time measurements of soil characteristics and cultivator behavior. The microwave sensor presented in this paper overcomes the limitations of sensors based on optical or ultrasound devices towards agricultural environment (dust, rain, etc.). The sensor uses the principle of frequency-modulated continuous wave (FM-CW) radar, low cost technology well intended for short range applications. First laboratory results of two major applications are presented. The first one is the distance measurement applied to the control of working depth. Soil-implement distances are computed with the measurement of a beat frequency: a maximum positioning error of ±5 mm is obtained for distances between 0.7 and 1 m. The second one is the evaluation of soil roughness in order to control seedbed quality. The backscattered coefficient, measured at normal incidence with samples of dry soil, is correlated with the rms height. [C990]

"Re-configurable array antennas for wideband applications"

A new approach to wideband re-configurable antennas using RF MEMS switches is presented here. Several antenna configurations can be connected together using RF MEMS switches. The goal is to cover several frequency bands by using a "smart combination" of antennas, including fractal antennas. The analysis and design principles are discussed and presented in here. [C991]

"Radical revision of air traffic management"

The problems of contemporary air traffic management are caused by the lack of any systematic design of the ATM system. Essentially classic ergonomic principles applied to existing technology can resolve the current capacity crisis. To demonstrate this approach, a skeleton of a systematic re-design of 'en-route' air traffic management is presented. A demonstrator (TROTSKY) has been constructed. This demonstrator has been shown to be easy to learn, resistant to human error and capable of handling much more traffic than existing systems. [C992]

"Real-time integrity monitoring of stored geo-spatial data using forward-looking remote sensing technology [Caircraft navigation/displays]"

Terrain awareness and warning systems (TAWS) and synthetic vision systems (SVS) provide pilots with displays of stored geo-spatial data (e.g. terrain, obstacles, and/or features). As comprehensive validation is impractical, these databases typically have no quantifiable level of integrity. This lack of a quantifiable integrity level is one of the constraints that has limited certification and operational approval of TAWS/SVS to "advisory-only" systems for civil aviation. Previous work demonstrated the feasibility of using a real-time monitor to bound database integrity by using downward-looking remote sensing technology (i.e. radar altimeters). This paper describes an extension of the integrity monitor concept to include a forward-looking sensor to cover additional classes of terrain database faults and to reduce the exposure time associated with integrity threats. An operational concept is presented that combines established feature extraction techniques with a statistical assessment of similarity measures between the sensed and stored features using principles from classical detection theory. Finally, an implementation is presented that uses existing commercial-off-the-shelf weather radar sensor technology. [C993]

"Helicopter in-flight tracking system (HITS) for the Gulf of Mexico"

Helicopters and other low-altitude air traffic over the Gulf of Mexico operate without the benefit of radar surveillance due to the location and range of existing onshore radar installations. The NASA Ames Research Center (ARC) is sponsoring deployment and testing of a prototype helicopter in-flight tracking system (HITS) in a portion of the Gulf of Mexico offshore area. Using multilateration principles, HITS determines the location and altitude of all transponder-equipped aircraft without requiring changes to current mode A, C or S transponders. In addition to multilateration, HITS provides surveillance reports for aircraft equipped for automatic dependent surveillance roadcast (ADS-B). This paper describes the HITS project-specifically, the system equipment (architecture, remote sensors, central processing site, and communications equipment) and system performance (accuracy, coverage, and reliability). [C994]

"Wave diffraction by axially symmetrical system of finite soft cylinders"

A new strong mathematically rigorous and numerically efficient method for solving the boundary value problem of scalar wave diffraction by a system of infinitely thin circular cylindrical screens is proposed. The method is based on a combination of orthogonal polynomials method and analytical regularization method. The solution is generalization of the investigation done for one cylinder and the method has been demonstrated on flat soft circular ring. As a result of the suggested regularization procedure, the initial boundary value problem was

equivalently reduced to the infinite system of the linear algebraic equations of the second kind, i.e. to an equation of the type (I + H)x = b, x, bєl2- in the space l2of square summable sequences. This equation can be solved numerically by means of truncation method with, in principle, any required accuracy. Pilot experiments show good perspective of such cylindrical reflector for development of individual antenna tag for rescue radar or broadcast systems in mm waveband. [C995]

"Miniature microstrip resonators and filters for GSM/GPRS"

The theoretical design principles of new compact resonators are presented. The coupling coefficients between resonators was investigated and their dependence on the coupling gaps is discussed. Two-pole and four-pole preselector filters, for GSM900, have been designed and manufactured. The filter responses demonstrate the feasibility of selective filters developed with the proposed miniature resonators. [C996]

"Combination of low power radars and non-rotating sector antennas for surveillance of ground moving traffic on airports"

This paper describes relevant technical principles of construction of a novel radar system. This so-called Near-Range Radar Network (NRN) is a modular structured low power radar system designed as a candidate for the non-co-operative surveillance of ground moving traffic on airports as a complement to existing surveillance systems or as single sensor. A prototype system comprising four locally distributed radar stations, each equipped with non-rotating antennas, has been developed. Typical results from field experiments at different airports demonstrating the system performance are presented and discussed. [C997]

"Cramer-Rao bounds for parametric shape estimation"

We address the problem of computing fundamental performance bounds for estimation of object boundaries from noisy measurements in inverse problems, when the boundaries are parameterized by a finite number of unknown variables. Our model applies to multiple unknown objects, each with its own unknown gray level, or color, and boundary parameterization, on an arbitrary known background. While such fundamental bounds on the performance of shape estimation algorithms can in principle be derived from the Cramer-Rao lower bounds, very few results have been reported due to the difficulty of computing the derivatives of a functional with respect to shape deformation. We provide a general formula for computing Cramer-Rao lower bounds in inverse problems where the observations are related to the object by a general linear transform, followed by a possibly nonlinear and noisy measurement system. [C998]

"Development of switch power supplies for radar applications"

The experience of designing switched mode power supplies (SMPS) for radar applications is demonstrated. Methods of solving the following problems are revealed: maintaining high quality output voltage of SMPS in a full range of changing destabilizing factors; reduction of electromagnetic interference (EMI) level; increasing efficiency and reliability; reducing the cost; designing multichannel SMPS with equivalent and independent channels; maintaining a high level of load currents; parallel operation of several SMPS. The principles of designing the resonant power supply for the microprocessor system of a multichannel radar with phased antenna lattice are considered. The features of designing multichannel SMPS for radio-receiving and transmitting devices are shown. The topology and main technical data of power supplies are adduced [C999]

"Shuttle radar topography mission (SRTM): experience with the X-band SAR interferometer"

The X-SAR single pass SAR interferometer as part of the Shuttle radar topography mission (SRTM), its measuring principle and configuration, as well as the operation of the system during the mission in February 2000 is shortly described. The experience with the system was, that it was well designed and manufactured, it had very good monitoring capabilities and its performance was excellent and the preliminary results are very promising. The calibration activities post mission deal with the Shuttle and mast motions which as well as the phase errors due to temperature variation have to be compensated [C1000]

"Surveillance information radar station remote control and remote measure system"

This article presents a surveillance information radar station remote control and remote measurement system. Using computer measuring and controlling technology and through the microwave image transmitter, the system serves the function of remote control and remote measurement on a two coordinate radar and a height-finding radar at a long distance (up to 50 kilometers). The system constitution, working principle, functions and characteristics are described [C1001]

"Built-in self-testing based on compressed 2-dimensional signature analysis"

The design of modern electronic systems demands high system reliability and maintainability. In order to perform fault detection, localization and isolation effectively, it is necessary to design a built-in self-testing (BIST) module specific to the corresponding system. This paper presents a BIST method based. on compressed 2-dimensional signature analysis. The principle of compression and performance of test are discussed in detail. Using the presented method, a high faulty coverage ratio (FCR) can be achieved with a short signature compressed in both time domain and space domain. Theoretical analysis shows that this method is reliable and it can be easily implemented in hardware [C1002]

"A novel countermeasure to polarization interference for circular polarization phased array radar"

Circular polarization phased array radar is low-cost high-performance modern radar, and has an encouraging application vista. However the polarization screen cannot be adopted in this kind of radar to reduce the cross polarization jamming, and on the other hand, the generation of cross-polarized wave for a circularly polarized wave is much easier than the linear polarization case. The authors give their countermeasure to cross polarization jamming based on the analysis of its phase shift principle, and point out the use off axis tracking rather than conventional on axis tracking to suppress cross polarization jamming [C1003]

"The analysis and design of modern Low Probability of Intercept radar"

In the modern battlefield, radar faces more and more serious threats from ECM and ARM, etc. Only the Low Probability of Intercept (LPI) radar can survive. In this paper, the principle of LPI radar is introduced first. Then the effects of radar parameters on LPI performance are discussed in detail. Finally, some advice is proposed for the design of the ideal LPI radar system [C1004]

"A 3 mm-wave battlefield surveillance radar for the mini-UAV"

This paper describes the configuration, operation principles and the performance of battlefield surveillance radar for the mini-UAV (unmanned vehicle). It is a light-weighted, coherent pulse-Doppler radar, which operates in both high resolution ground mapping (HRGM) and moving target detection (MTD) modes. The transmitting pulse power of the radar is 35 W, while the range resolution is 4.5 m, and the azimuth resolution is 0.4°. It can provide a forward azimuth coverage of ±20°. The range of detecting a jeep is 2~3 km. The radar can be used for reconnaissance and surveillance missions with good performance even in adverse weather conditions or a smoky battlefield environment. It is especially suitable for the operation on an unmanned surveillance air vehicle [C1005]

"Two calibration methods of wideband quadrature receiver mismatch errors"

The theory of digital calibration for the gain and phase imbalances between the in-phase and quadrature branches of a wideband receiver is discussed. Two novel and practical methods for the estimation of the relative amplitude and phase error function are presented, including the least squares and a modification based on the principle of Gram-Schmidt orthogonalization. Computer simulations show their effectiveness [C1006]

"Analysis and experimental results on sparse-array synthetic impulse and aperture radar"

Sparse-array synthetic impulse and aperture radar (SIAR) is a new concept of 4D radar, based on the use of a transmit array, simultaneously radiating a set of orthogonal waveforms, and of a reception array, delivering sampled signals to a processing equipment, dedicated to Doppler filtering, time-space beamforming (including a transmitting beam and a receiving beam by calculation), and target extraction, thus, it can isotropically radiate. This radar adopt sparse arrays to improve its angle resolution. This paper introduces the principle of the SIAR, discusses some questions (including optimization of the frequency coding of the transmitting signal. to eliminate the coupling effects between distance and angles, a low-range-sidelobe technique based on frequency-coding agility among these frequencies and application of large time-bandwidth signals) and presents a description of the experiment system. Finally, some experiment results are given. Moreover, the strong agreement observed on both experiment and theoretical results [C1007]

"A multi frequency radar for detecting landmines: design aspects and electrical performance"

A radar has been designed and built for application in the problem of anti-personnel landmine detection. The radar is based on the principle of a Stepped Frequency Continuous Wave (SFCW) transmission scheme. The novelty of the system is, that it transmits 8 frequencies at the same time through one antenna and that it repeats this procedure 16 times with shifted frequency offsets in order to collect a set of 128 frequency samples. The

resolution in the synthesized range profile in air is just over 3cm, while the total frequency coverage is from 400MHz upto 4845 MHz, so ultra wide band. The architecture of the radar however is based on Commercial Off The Shelf narrow band technology. The acquisition time for collection of a full set of 128 frequencies covering the ultra wide band is less than 2 msec. This short time was achieved by simultaneously transmitting 8 frequencies and using Direct Digital Synthesis for signal generation. The concept of SFCW radar is prone to errors in phase. Therefore a calibration facility is built in. First results of the system while it is still in the setting-to-work phase are encouraging. [C1008]

"Potential and limits of InSAR data for the reconstruction of buildings"

The automatic reconstruction of buildings for the generation of city models is of great interest for different tasks. 3D information can be directly obtained from both, laser (LIDAR) and radar (InSAR) measurements. The data acquisition by SAR is described, with emphasis on the special properties of the interferometric SAR principle. A segmentation approach for building reconstruction is proposed. In the case of InSAR, special effects are taken into account, which are caused by the side-looking illumination. The estimation of the signal noise is considered in the segmentation process. Besides the elevation, the intensity information is exploited to detect building areas. The results show that building reconstruction is possible from InSAR, but the achievable level of detail cannot be compared with LIDAR. Inherent geometric constraints which limit the reconstruction of buildings from SAR data of dense urban areas are discussed [C1009]

"Technical aspects of a new S-band atmospheric profiler"

A Transportable Atmospheric RAdar, TARA, has been developed at the International Research Centre for Telecommunications-transmission and Radar, IRCTR. State of the art but commercially available technology has been integrated to build a sensitive, versatile research radar primarily intended for atmospheric research. The system is based on the FM-CW principle and is fully solid-state. This yields improved system lifetime in comparison to tube-based systems. The antennas are dual linearly polarized for polarimetric applications. Multiple beams at 15Г,В° offset in two orthogonal directions in combination with the Doppler capabilities of the system are used for measuring three-dimensional wind fields. In this paper attention is paid to the technical realization of the system and some measurements are shown using the Doppler and multi-beam capabilities. [C1010]

"A Sideways-Looking Radar and its Measuring Principles"

A 24GHz Sideways-Looking Radar is expected to become a key component of a warning system for lane changes on the highway. This report describes relative positional measurement for distance and velocity and the results of an experiment. [C1011]

"Research on the technology of adaptive nulling antenna used in anti-jam GPS"

The necessity of the research on the technology against strong interference with the same frequency of the GPS is first proved through calculation, the operating principle and process of the adaptive nulling antenna (ANA) is described and demonstrated. The characteristic of the power inverted (PI) algorithm is summarized synthetically. Two feasible antenna array forms are developed, in which is a 4-element circular array whose pattern has been calculated and the other is a rectangular microstrip antenna, the theory of which is unveiled. Finally, some problems and tendencies that are considered during the practical design are presented [C1012]

"The resolving method of radar nonrigid multi-target"

Combined with the basic principle and method of radar multi-target resolution, the application of time-frequency analysis is discussed for nonrigid multitarget resolution. The integrated generalized ambiguity function (IGAF) is used to resolve a nonrigid multi-target, for it is an ideal tool to analyze polynomial phase signals, and it is proved to be effective by analyzing the radar data [C1013]

"Processing time-varying signals by a new method"

The concept of an empirical mode decomposition method with which any complicated data set can be decomposed into a finite and often small number of intrinsic mode functions (IMF) is introduced. This method is used for time-varying signal analysis and provide a better joint time-frequency resolution than other methods like the STFT, wavelet and the Wigner-Ville distribution. Then we bring forward a new principle of the local wave method and the expression of the intrinsic mode function. We also introduce our new signal decomposition method called local mean mode decomposition (LMMD) which can provide better data mean and results [C1014]

"Development of a 3 cm band reflected power canceller"

This paper describes the principle and design for solving the problem of isolation between transmitter and receiver using a reflected power canceller (RPC) combined with the development of a single antenna for frequency modulated continuous wave (FMCW) radar. Some design problems met in developing the canceller are analyzed and the results are presented By using these analyzed results, a 3 cm band RPC has been developed and its performance reaches the expected design specifications [C1015]

"Analyses of pattern function of the DBF in non-uniform subarrays and a modified weighting method"

The characteristics of the pattern function of a DBF (digital beamformer) composed of subarrays are analysed and a condition for the formation of grating lobes is given. For the design of a DBF, some conventional weighting methods, e.g., Hamming weighting, cosine-squared weighting and cosine-cubed weighting, are only suitable for a uniform array directly composed of array elements. We modify these methods to let them be self-adaptable, that is, suitable for a variety of arrays including the DBF in non-uniform subarrays. The principle of this new method is to modify weighted coefficients according to the relative positions of subarrays in the array. Both the analyses and the computer simulation results demonstrate that this method is rather effective [C1016]

"Bistatic matched illumination radar involving synthetic aperture and synthetic pulse for signal to clutter enhancement and target characterization"

The "Radar Fence" is a bistatic multi frequency radar system. Based on the principles of frequency coding, time coding and space diversity we detect and characterize objects and geophysical phenomena. The system's capability is illustrated with results from detection of internal wave wake produced by a submerged vehicle. and aircraft identification [C1017]

"A possibilistic exclusion principle for tracking multiple objects"

Tracking multiple targets in a dense environment where there is a high density of false alarms has received recently a wide interest in the literature due to its important repercussions in many radar and military type applications. The challenge arises from how to determine the evidence with which a given measurement is associated to a given track. Typically, the class of algorithms based on joint probabilistic data association filter (JPDAF) investigated by Y. Bar-Shalom and his team is widely explored. In an attempt to use some possibilistic tools for determining the evidence of measurement-track association, we have recently proposed a hybrid approach that keeps track of the structure of JPDAF while one makes use of fuzzy clustering methodology. In this paper. we extend the proposal to the case where the track itself may not be observable, or does not exist. This refers in the literature to track initiation problem. In probability theory, such purpose is handled, for instance, using Integrated probabilistic data association filter (IPDAF) proposed by D. Musicki (1994). Two proposals are put forward, the first one makes use of multiple model approach while the second one is based on adding a second class of noise prototype which captures the lack of perceivability of the target. Some simulation results are performed to prove the feasibility of the proposals [C1018]

"Adaptive signal processing by particle filters and discounting of old measurements"

In adaptive signal processing the principle of exponentially weighted recursive least-squares plays a major role in developing various estimation algorithms. It is based on the concept of discounting of old measurements and allows for better performance in problems with time-varying signals and signals in nonstationary noise. We show how this concept can be combined with the Bayesian methodology. We propose that the discounting of old measurements within the Bayesian framework be implemented by employing particle filters. The main idea is presented by way of a simple example. The methodology is very attractive and can be used in a very wide range of scenarios including ones that involve highly nonlinear models and non-Gaussian noise [C1019]

"Comparison of GLR and maximal invariant detectors under structured clutter covariance"

There has been considerable recent interest in applying maximal invariant (MI) hypothesis testing as an alternative to the generalized likelihood ratio (GLR) test. This interest has been motivated by several attractive theoretical properties of MI tests including: exact robustness to variation of nuisance parameters, finite-sample min-max optimality (in some cases), and distributional robustness. However, in the deep-hide target detection problem, there are regimes for which either of the MI and the GLR tests can outperform the other. We discuss conditions under which the MI tests can be expected to outperform the GLR tests in the context of a radar imaging and target detection application. We also show that the relative advantage of the MI tests is robust to

boundary estimation errors [C1020]

"An application of nonlinear spatial filtration methods for improving the small ships observation on the sea clutter background"

In the process of synthesizing systems for temporal filtering of signals on a background of passive clutter, created by surface reflections, as a rule, one may use the differences in both distribution laws and spectra of clutter and useful signals, observed in a radar resolution element. The experimental research has allowed one to determine, that the signal, reflected from the sea, is characterized by the presence of a spatial periodic structure. At the same time the sizes of the majority of surface objects do not exceed the size of the radar resolution element and they can be considered as points. So, it is possible to use information about clutter spatial characteristics for improving the radar observation of small sized slow objects on a sea background by applying a spatial auto-compensator. For spatial compensator design it is possible to use the classic principle of matching the signals, separated by some time period. In this paper the possibility of using multiplicative signal multiplexing on the outputs of single-unit compensator channels, realizing different spatial delay, is discussed [C1021]

"Coding theoretic approach to image segmentation"

This paper introduces multi-scale tree-based approaches to image segmentation, using Rissanen's coding theoretic minimum description length (MDL) principle to penalize overly complex segmentations. Images are modelled as Gaussian random fields of independent pixels, with piecewise constant mean and variance. This model captures variations in both intensity (mean value) and texture (variance). Segmentation thus amounts to detecting changes in the mean and/or variance. One algorithm is based on an adaptive (greedy) rectangular recursive partitioning scheme. The second algorithm is an optimally pruned "wedgelet" decorated dyadic partitioning. We compare the two schemes with an alternative constant variance dyadic CART (classification and regression tree) scheme which accounts only for variations in mean, and demonstrate their performance on SAR images [C1022]

"Short range spectral lidar using mid-infrared semiconductor laser with code-division multiplexing technique"

Summary form only given. A short-range spectral lidar based on the code-division multiplexing (CDM) architecture using mid-infrared Sb semiconductor lasers for remote sensing has been demonstrated with near detector-limited performance. The system principle is similar to optical-CDMA for communications and applicable to any number of wavelengths, but was demonstrated with two wavelengths similarly to conventional DIAL (Powers et al, Appl. Opt. vol. 39, pp. 1440-1448, 2000; McRae and Kulp, Appl. Opt. vol. 32, pp. 4037-4050, 1993). An experiment using <20-mW transmitter average power could detect an open-air acetylene gas leak from 10 m away with dynamic, random, noncooperative backscatters. We believe this is among the first demonstrations of this semiconductor spectral lidar with orthogonal CDM architecture, as well as the first demonstration of mid-IR Sb lasers used in open path, noncooperative target remote sensing [C1023]

"Usage of millimeter waves in an on-board radar for detection of objects at small depth in ground"

The principle of construction of millimeter-wave radar for detection of objects at small depth in ground from a flying vehicle is offered. In millimeter wavelength range it is possible to generate a sounding signal of very short duration (1 ns or less), which ensures a necessary resolution of depth. Other advantages of millimeter wavelength range is, that it allows one to ensure a high directivity of an airborne antenna at the acceptable dimensions of an antenna and to decrease the square of the irradiated section of the Earth's surface. It essentially diminishes temporal extent of passive background interference from the Earth's surface and allows detection of underground objects at small depth in the ground. However in a given set of cases it is not enough, as the Earth's surface is irradiated with side lobes of an airborne antenna, to lower which below -20 dB by known means is usually very difficult. Therefore selection of a weak echo signal returned from an underground object at small depth in ground out of intensive passive background interference of the Earth's surface requires application of special hardware. The essence of signal processing and its technical realization is illustrated [C1024]

"PRK-001 non-contacting radar flow meter for double-phase gas-and-liquid flows"

The results are presented for the PRK-001 non-contacting radar flow meter for double-phase gas-and-liquid flows. The flow meter provides online component flow metering of a well production product at gas condensate fields (GCF) without any preliminary separation for fractions. It works on the principle of componentwise measuring of the gas-and-liquid mixture rate and density in the millimeter wave range. The PRK flow meter

provides standard digital protocols of data exchange with a field automated control system for technological processing. Stock production has been organized in order to equip some of Gazprom's enterprises. [C1025]

"Systems for controlling of reservoir supplies of oil and oil-products"

High-accuracy measurement of product level in a reservoir is very necessary for determination of its mass both in static and in dynamic states. The exactness of level determination is connected with the exactness of distance measurement up to the air-product boundary. The designed system uses the radar phase method of distance measurement. Based on this level radar, the design principles and experimental results of a level control system for oil reserves in reservoirs and oil products are discussed. [C1026]

"Cyclotron protected integrated amplifiers for radar receivers"

The principle of operation, structure and main parameters of cyclotron protected complex amplifiers are described. The main advantages of these devices are reliable protection of radar receiver input cascades against microwave overloads and super short recovery time of their sensitivity. [C1027]

"In-situ characterisation of building materials"

The knowledge of the electromagnetic properties of building materials is increasingly important in modern wireless communications due to high indoor communications demands. This paper describes a free-space measurement technique based on the ground penetrating radar (GPR) principle to characterise building materials. The constitutive parameters of the material under test such as the number of layers, the thickness and dielectric constant of each layer can therefore be determined. An inverse scattering algorithm for reconstructing these parameters, which is based on the global minimisation of the defined objective function using the multilevel single-linkage method, is developed and applied to this application. Results of measurements on standard sample materials and some building materials are presented and discussed [C1028]

"Adaptive CFAR detection of multidimensional signals"

Adaptive detection of multidimensional signals in the presence of interference with unknown covariance matrix is an expanding topic in a variety of scenarios ranging from radar/sonar to digital communication systems. We attack the problem of detecting a multidimensional radar signal, modeled as an unknown NЧH matrix, embedded in Gaussian noise with unknown covariance matrix, with the ambition of devising receivers which yield the constant false alarm rate (CFAR) property. We show that this aim can be achieved by resorting to the principle of invariance, namely restricting our attention to hypothesis testing problems which remain unaltered under a proper group of transformations. Several detectors based on the maximal invariant statistic are studied and, in particular, the generalized likelihood ratio test (GLRT) is shown to belong to the class of invariant tests [C1029]

"Novel opportunities for optical level gauging and 3D-imaging with the photoelectronic mixing device"

The novel Photoelectronic Mixing Device (PMD) possesses a variety of unique characteristics that open up new fields for optical distance measurement technology. PMD devices for the first time allow the use of straightforward modulation and system concepts previously constrained to radar and ultrasonic systems. This paper first reviews the PMD principle and then points out the differences between conventional optical systems and PMD systems. The requirements of two different applications, level gauging and 3D object position measurement, are discussed. Suitable system concepts are introduced and verified with experiments. The results prove the feasibility of single pixel sensors capable of high accuracy and multitarget resolution as well as low cost 3D imaging systems [C1030]

"Simulation of microstrip small antennas"

Microstrip patch antennas are being increasingly used in communication and radar systems because they have many advantages over conventional antennas, such as being lightweight, compact and conformal. There has been increased interest in minimising microstrip patch antennas for some specific applications, such as mobile communications and monolithic microwave integrated circuits. There are a number of approaches to reduce the size of patch antennas. In this paper, a meander slot antenna and a meander line antenna were investigated using a 3-D FDTD simulator and a microwave network analyser. The meander slot antenna is a single layer structure fed by an open-end of a stripline whereas the meander line antenna is a multilayer structure fed by an open-end of a microstrip. The basic principle of these meander antennas is developed and illustrated through a transmission line theory and simulated electric and magnetic field distributions in the meander slot or line. The return loss, resonant frequency, bandwidth, radiation patterns and radiation efficiency of these meander antennas

with various meander sections have been presented and compared with measured results. The agreements between the simulated and measured results are good [C1031]

"SRTM X-SAR motion compensation: concept and first assessment of the interferometric observation geometry"

The space shuttle Endeavour that flew from 11 until 22 February carried the radar systems for the Shuttle Radar Topography Mission (SRTM). In the course of this project the first space born single pass interferometer has mapped the Earth's topography. Two different radar systems operated on board of the space shuttle: the C-band radar of the American NASA/JPL and the X-band radar of the German DLR and the Italian ASI. It is the objective of this mission to generate a digital elevation model (DEM) of the Earth with an accuracy that has never been reached before on this global scale. The inevitable technically caused oscillation of the secondary antenna turns this task into a scientific and technological challenge. The Synthetic Aperture Radar (SAR) observation is influenced by a resulting sensor motion in the line of sight. The consequence of this effect on the secondary SAR scene and subsequently on the DEM is described in this paper. To obtain the requested height accuracy in spite of the antenna oscillation, the principle of motion compensation is applied. The concept of this key algorithm in the X-SAR SRTM project is explained in detail. The essential parameters of the interferometric observation geometry were recorded by the Attitude and Orbit Determination Avionics (AODA) system of the JPL. These AODA data are employed to investigate the movement of the secondary antenna [C1032]

"Overview of the performances and tracking design of the SIRAL altimeter for the CryoSat mission"

This paper presents the principle of the measurements, the main system features and the basic ground processing of SIRAL. Simulations of the main performances in the different modes are also discussed including the bidimensional impulse response (range and azimuth). A major scientific requirement is to ensure the continuity of the measurements. This is particularly challenging for the on-board tracker over the steepest parts of the Antarctica. As a consequence a new tracking algorithm has been designed for SIRAL with the expertise of CNES. The algorithm has been derived from the analysis of simulated echoes using an Antarctica DEM and a radar echo simulator. The tracking design and performance are briefly described [C1033]

"The 3G GPRS mobile systems problem of the traffic analysis and dynamic control of QoS"

The development of 3G mobile networks is attended by revolutionary changes in the telecommunication and service technologies of mobile systems. There have been impressive rates of evolution from circuit switching (CS) to packet switching (PS) and IP protocols; from monoservice voice systems, operating on CS principles, to multiservice PS system for integrated transmission of fast data, voice, video etc. with differentiation and quality of service (QoS) control. The amount of traffic with access to broadband Internet services is rapidly increasing. The time principles of payment are substituted by accounts for data volume and quality of service. The new technologies require development of new methods of traffic theory, optimization and design. It is necessary to change from one-dimensional Erlang models for homogeneous traffic in point-to-point channels to develop the theory of the multi-dimensional distributed queues with priority service for integrated traffic in multi-point radio channels with multiple access. This article presents such new methods for the analysis of traffic, optimization and dynamic QoS control for 3rd generation mobile networks, taking GPRS systems as an example. The offered solutions are based on the development of a numerical method of balancing traffic intensities (see Markhasin, A.B., 2nd All-Union Confer. on Multiple Access Systems, pt1, p.146-52, 1999; Markhasin, A.B. and Kokoreva, E.V., Proc. VI Business-Forum "Mobile Systems'01", vol.1, pp.175-81, 2001), and also on the development of our results concerning the analysis of traffic, optimization and dynamic QoS control in integrated packet satellite and radio ATM networks (see Markhasin, IEEE Int. Conf. on Communications, p.1914-18, 2001) [C1034]

"3D scene modeling from data fusion"

We proposed in this paper a key approach for remote sensing data fusion for the purpose of three dimensional (3D) modeling. A 3D digital elevation model (DEM) is a full description of the scene, including 3D geometric representation and 2D radiometric classification. In this context the purpose of fusion is to provide a more reliable and more accurate model than single data would provide. We give thereafter the main principles of the approach. The application is on Poyang lake, in the Jiangxi province of China. This is an ongoing project [C1035]

"Waveform design principles for automotive radar systems"

This paper presents a high performance 77 GHz FMCW radar sensor for automotive applications. Powerful automotive radar systems are currently under development for various applications. Radar sensor based comfort systems like Adaptive Cruise Control (ACC) are already available on the market. The main objective from a radar sensor point of view is to detect all targets inside the observation area and estimate target range and

relative velocity simultaneously with a high update rate. FMCW radar sensors have the advantages of very high range resolution but a serious task occurs in multiple target situations to suppress so-called ghost targets. In classical FMCW waveforms this has been solved in using multiple chirp signals with different slope. But in this case a long measurement time (approximately 50 ms) is needed which is a contradiction to a high update rate. Therefore, in this paper a new waveform design is presented which has all advantages of FMCW radars but needs an extremely low measurement time (10 ms) in a radar sensor with 3 different antenna beams [C1036]

"Extraction of DEM from single SAR based on radargrammetry"

Topographic information is important in many geographic applications. Synthetic aperture radar (SAR) is a kind of imaging radar capable of producing high-resolution images in all weather and all-day conditions. But it is usually needs image pair or more images to generate DEM from SAR imagery, such as interferometric SAR (InSAR) and radargrammetry. The imaging conditions (look-angle, space baseline, for acquiring the image pair) sometimes are very difficult. SAR is a side-looking imaging mode and its image is very sensitive to the terrain shape. The undulation of the terrain may induce the change of the image gray distribution and/or the texture characteristics. In this paper, the radarclinometry for extracting the earth elevation from only single SAR image is investigated, which is based on the shape-from-shading principle developed in computer vision. Firstly, the approaches for generation of the digital terrain elevation from the SAR image data are discussed. Secondly the method of radarclinometry is briefly described. The elevation reconstruction relies on a Lambertian assumption for the terrain backscatter model. Then a single-line integral process is applied to calculate each pixel altitude, but it is still contaminated by noise. Finally the multi-line integral processing with various directions and the simulated annealing algorithm are respectively introduced to improve the single-line integral processing result. The presented experiment results promising in many geographic applications [C1037]

"The application of SLAR image in surveying fossil river course"

Keliya River is in the hinterland of the Taklamakan desert. Revealing the distribution of the lower reaches of the fossil river has important significance for its ecological construction and groundwater source surveying. Using an X-band SLAR image as an important information source, and combing this with the field investigation, the fundamental principle and imagery feature of the river course in the airborne SLAR image are studied and analyzed. The study indicated that the X-band of the SLAR image could pass though 14.6 cm depth in the background desert, and 10.34 cm depth in the fossil riverbed [C1038]

"MAC principles for an ultra wide band wireless access"

Ultra wide band (UWB) radio is becoming a promising field for the design of new digital communication systems. This technique, mainly based on the impulse radio paradigm, offers great flexibility and enormous potentiality in view of a broadband wireless access. This paper presents the main principles for the development of a multi-access scheme based on UWB. The principles for the definition of a distributed medium access control for mobile computing applications are described as well as the detailed functional model involved in the capacity-sharing procedures [C1039]

"Potential enhancements to the performance of ASDE radars derived from multistatic radar principles"

Airport surface surveillance systems, such as airport surface detection equipment (ASDE) radars, are susceptible to multipath propagation and scattering effects that can result in the placement of false targets located at critical locations on airport surfaces such as runways and taxiways. Such false targets can readily compromise the performance of these radars and lead to highly undesirable controller reactions, including unnecessarily aborting landing and takeoff operations when such multipath false targets are located on runways. These situations affect the efficiency of operations and also reduce user confidence in ASDE radar and related systems, thereby adversely affect safety. Evaluation of this problem led to consideration of enhancing ASDE radar performance by transforming the current monostatic radar to a multistatic configuration (ASDE-MP). Multistatic radar provides for multiple detection of targets as well as significant differential responses to the multipath scattering phenomenon responsible for false target detection. The latter property diminishes the detection of false targets by combining information from a number of radar receivers, positioned at different locations to provide surveillance over common areas of interest on the airport surface [C1040]

"Phi-scatterometry for integrated linewidth control in DRAM manufacturing"

A cost-effective scatterometry method is presented which is suitable for integrated linewidth control and which is a supplement to conventional SEMs. The phi-scatterometry procedure is carried out directly on periodic

functional patterns instead of using additional test structures. Long-term simulations of diffraction effects are not required. The measurement results are evaluated by neural networks performing classifications of pattern parameters. Thereby, fast fault detection and immediate process control is enabled. A phi-scatterometry prototype was built for flexible mobile metrology in 300-mm production environments. The measurement principle was verified with DRAM patterns having trenches in two dimensions [C1041]

"Multifrequency HF radar observations of surface currents: measurements from different systems and environments"

The authors present three aspects of current HF radar research. First, they examine the consistency of measurements by HF ground wave radars with different designs, but operating on the same physical principles. This is done using data from the commercially available SeaSonde (Codar Ocean Systems) and from the Multifrequency Coastal Radar (MCR), which is a research system. Data from the two systems are compared for co-located units at Santa Cruz and Moss Landing CA on Monterey Bay. They conclude that the two systems make current-vector-field measurements that are consistent to an accuracy of better than 10 cm/s and that the data from two such systems can be integrated to form reliable composite current maps. Second, they present results from an air-sea interaction investigation using the MCR systems on Monterey Bay during 1997 and 2000. We show that near surface currents are correlated with the wind with correlation coefficients 0.6 and are rotated 35 to 45° with respect to the wind in the sense of the Ekman spiral. They also show results of near shore observations on Lake Michigan during the EEGLE campaign of 2000. These measurements show the capability of HF radars to operate over fresh water [C1042]

"Accuracy of rain rate retrieval from dual-frequency precipitation radar data"

This paper outlines the principles and issues of dual-frequency algorithms to estimate the raindrop size distribution parameters from a space-borne radar system that is planned to be flown on the Global Precipitation Mission's "core" spacecraft [C1043]

"Quantitative intercomparison of polarimetric ground radar and TRMM PR observations"

The Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) is a spaceborne radar operating in a nearly circular orbit at 350 km altitude with 35 degrees inclination and period of about 91.5 minutes. Simultaneous comparisons of radar observations were made between the National Center for Atmospheric Research (NCAR) S-POL radar and TRMM PR during the TExas and FLorida UNderflights (TEFLUN-B) campaign that took place near Melbourne, FL in 1998, and the Large Biosphere-Atmosphere experiment in Amazonia (LBA) near Ji-Parana, Brazil in 1999. Though direct intercomparison between space and ground radar observations is, in principle, straight forward, differences in viewing aspects between space and Earth point observations, propagation frequencies, resolution volume size and time synchronization mismatch between instrument measurements can contribute, in a significant way, to intercomparison errors and should be taken into account. Vertical profile of polarimetric radar variables, namely, reflectivity (Zh), differential reflectivity (Zdr), specific differential phase (Kdp), cross-correlation coefficient (ρco) and linear depolarization ratio (LDR) are used to describe the precipitation characteristics through the TRMM PR beam. These observations are, in turn, used to determine the type of hydrometeor along the PR beam using a fuzzy-logic technique [C1044]

"Improvement in spacebased scatterometers and increased scientific impact in the past decade"

The past decade has seen continuous improvement to the coverage and resolution of ocean surface winds by spacebased microwave scatterometers. The principles of scatterometry and the characteristics of these sensors are summarized. Examples of scientific applications with these improvements are given. The high quality and resolution of scatterometer winds allow improved study of tropical atmospheric convergence zones, particularly a southern intertropical convergence zone in the Atlantic. Scatterometer data describe the wind jets out of Central America with sufficient detail to provide the forcing to simulate realistic coastal upwelling in an ocean general circulation model. QuikSCAT reveals for the first time an ultra long wake composed of alternate high and low wind streaks and lines of positive and negative curl of wind stress; they stretch a few thousand kilometres from the west side of the Hawaii Islands to beyond Wake Islands in the western Pacific. QuikSCAT also reveal the atmospheric manifestation of the westward-propagating tropical instability waves in the equatorial Pacific. Scatterometers are capable of monitoring not only the ocean winds, which feed moisture towards land, but the consequent flooding of the land. Flooding in Asia, resulting from monsoon and typhoons are described. The plan for future missions and proposed new technology is presented [C1045]

"Joint Mean and COvariance Matching Estimation Techniques: MCOMET"

The EXtended Invariance Principle (EXIP) has been applied to the structured covariance estimation of a zero

mean Gaussian vector: the resulting method was named COMET (COvariance Matching Estimation Techniques). We present an asymptotically efficient approximate maximum likelihood method for the joint estimation of the structured mean and covariance of a Gaussian vector. We call the obtained criterion MCOMET (Mean and COvariance Matching Estimation Techniques). It is shown to be separable with respect to mean and covariance parameters and composed of the COMET criterion and a new additional term MMET. Moreover this criterion can be optimized in a computationally efficient way through the use of embedded estimators. It is finally applied to array processing problems. [C1046]

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