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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 5-2/1

“Doppler Effect”
(«Доплеровский эффект»)

Публикации в трудах конференций

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"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. [C1]

"Considerations in measuring vital signs cross section with Doppler radar"

This paper describes the different considerations and challenges in measuring human cardiopulmonary radar cross section (RCS). The effect of clutter on the received signal is explained as well as the importance of preserving baseband dc content for valid readings. The center estimation algorithm with dc-cancellation is presented as a solution to restore dc content in the baseband signals and to exclude clutter contribution. The far-field conditions for the target range are revisited. By modeling the human torso as a half-cylinder and assuming unity reflectivity, the ratio of the RCS of the back of the torso with respect to the front is a function of wavelength. At 2.4 GHz and for a chest breadth of 30 cm, the back is expected to have an RCS that is 10 times that of the front while the RCS of the side is expected to be 4 times smaller. [C2]

"Tracking a moving target in wireless sensor networks using PDR sensors"

The Pulse-Doppler radar (PDR) is an ultrawideband radar system capable of not only detecting target location, but also measuring its radial velocity by using the Doppler Effect. However, the traditional radar signal processing techniques are mismatch with the limit computational and storage resources available on typical wireless sensor mote. In this paper, we explore the compatibility of PDRs and mote-class wireless sensor nodes by designing a new tracking system that utilizes small PDRs as sensor nodes. The system consists of several PDR sensor nodes to detect the presence and position of a moving target, a base-station node to collect the detecting data of sensor nodes, and an algorithm to estimate the location of the target from aggregated data. Our experiments which were taken place outdoor (real environment) show that the proposed system performed well to track moving objects with the average deviation error down to 0.18m. [C3]

"Robustness and reliability of BiCMOS embedded RF-MEMS switch"

Robustness and reliability of an embedded RF-MEMS switch are analyzed. Changes of key switch parameters, such as COFF, CON, and pull-in voltage, with the ambient temperature are investigated in the range of -30°C to 150°C. The biggest temperature effect, a decrease by a factor of 2 between -30°C and 150°C, is observed for COFF, while CONweakly increases by only about 6% in this temperature range. For the pull-in voltage, practically no T-effect is observed. The power handling performance is also analyzed. A DC self-actuation voltage of 20V was estimated. To hold the membrane in down position, an 1.2V DC voltage drop or 15dBm RF power was found to be necessary. Finally, a new reliability test was applied, using Laser-Doppler (LD) Vibrometry technique to analyze the change in the switch dynamic behavior after billion times of operation. The measurement results show that this behavior hardly changes for up to 50 billion times operation. [C4]

"Microwave Autodyne Sensor for Monitoring of Cardiac Rhythm of Mines Workers"

A design of microwave autodyne cardiac rhythm sensor for the mines workers is discussed in the paper. The sensor is a part of a system for searching people under rocks. The system design is based on placing into a miner's lantern of radio beacon. System is activated in a case of rescue actions remotely. In this case the cardiac rhythm sensor signal modulates the beacon signal. Rescue workers by means of searching device

determine the position and the state of suffered people. Principles of construction of the sensor, based on the Doppler's effect, are shown. It was shown the use of autodyne ensures excellent performance of the sensor. The sensor construction possesses extreme simplicity. Conventional patch antenna conforms to the microwave sensor design ideally. [C5]

"Gamma irradiation effects on resistance of surface micromachined polycrystalline silicon beams in MEMS"

This paper reports gamma irradiation effects on the resistance of polycrystalline silicon beams in MEMS. Co60 irradiation test was performed to reveal mechanisms underlying radiation effects. Changes of the resistances have been measured by Semiconductor Characterization Instruments. The mechanisms of gamma irradiation effects on the resistance of polycrystalline silicon were discussed in detail. Resonant frequencies were measured by Laser Doppler Vibrometer (LDV) to validate the mechanism of gamma irradiation effect on resistance. [C6]

"Channel Estimation for Wavelet Based OFDM System"

Orthogonal frequency division multiplexing (OFDM) is multi carrier modulation scheme. The channel estimation is a process of characterizing the effect of the transmission channel on the input signal. In this paper we compare the performance of Least Square (LS) and Linear Minimum Mean Square Error (LMMSE) channel estimation technique for Wavelet based OFDM system. The channel estimation based on block type pilot arrangement is performed by sending pilots at every sub-channel and using this estimation for a specific number of following symbols. In this paper we used wavelet transform instead of fast Fourier transform (FFT), which have more bandwidth efficiency, less prone to Doppler shift and also complexity of order O(N) as opposed to the FFTs O(Nlog2N). [C7]

"Embedding information into radar emissions via waveform implementation"

In this paper an approach for the joint design of multiple receive filters is described that enables the use of different waveforms during a radar CPI while minimizing the attendant Doppler coherency degradation due to range sidelobe clutter modulation. This capability allows for a set of unique radar waveforms to serve the dual purpose of acting as communication symbols while acceptable radar performance is maintained. The receive filter design approach is based upon the well-known Least-Squares (LS) mismatch filter formulation. The novel modification is the iterative adaptation of the desired response such that all the waveform/filter pair responses are driven to be identical. [C8]

"Design of an optimal radar signal waveform for a range-doppler spreading channel"

This paper deals with the optimal radar waveform design problem using the quadratically constraint quadratic programing (QCQP) in the narrowband signal echo to range-doppler extended target regime. The solution is obtained in the sense of signal to interference plus noise ratio(SINR) maximization with resolution and fixed transmit power constraints. The performance is compared with other conventional waveforms such as continuous wave (CW) pulse and linearly frequency modulated (LFM) pulse, in terms of resolution through ambiguity function. [C9]

"Golay waveforms and adaptive estimation"

An iterative range profile estimation process is derived for Golay waveforms. The Re-Iterative Super Resolution (RISR) algorithm is used in conjunction with Golay waveforms and processing for radar range-Doppler estimation. Various additional range-Doppler estimation methods that use RISR and Golay waveforms and processing are simulated for the sake of comparison. Range and Doppler sidelobes are seen in simulation to be mitigated to a significant extent by using RISR in conjunction with Golay waveforms and processing. [C10]

"Time-Range Adaptive Processing for pulse agile radar"

Some radar systems utilize pulse agility to mitigate interference or synthesize bandwidth. Transmitting different waveforms on a pulse-to-pulse basis can have deleterious effects when traditional pulse-Doppler processing is employed. In this paper a recursive MMSE-based receiver design, denoted as Time-Range Adaptive Processing, is presented. The new method jointly adapts in range and Doppler, thus yielding enhanced sensitivity when compared to adaptation in each dimension separately. [C11]

"SMSE-based DSA radar waveforms"

Previous communications systems research has demonstrated that the Spectrally Modulated, Spectrally Encoded

(SMSE) framework is well suited to SDR platforms and operation in both contiguous and non-contiguous spectrum given its ability to generate a wide variety of multicarrier waveforms such as OFDM, NC-OFDM, MC-CDMA, NC-MC-CDMA, CI/MC-CDMA, NCCI/MC-CDMA, and TDCS. In this paper, SMSE waveforms are extended for use in sparse frequency radar systems. Sparse frequency radar can be capable of dynamically sensing available spectrum, and tailoring the transmitted waveforms to suit the instantaneous RF environment conditions, simultaneously transmitting energy in multiple noncontiguous spectrum bands. Conventional radar performance metrics are reviewed, and a new metric is introduced which specifically addresses performance of noncontiguous spectrum waveforms through comparison to contiguous spectrum waveforms. Through simulation, various examples are shown to illustrate and characterize the impairments that are introduced in processing these classes of non-contiguous spectrum waveform returns, specifically the generation of large range sidelobes. [C12]

"The impact of internal clutter motion on a sample matrix inversion space-time adaptive processing algorithm and the GMTI minimum detectable velocity"

A MATLAB simulation was constructed to better study the effects of internal clutter motion on a notional X band monostatic airborne radar employing a ground moving target indicator (GMTI) algorithm to detect slow velocity targets of low radar cross section. A sample matrix inversion (SMI) fully adapted post-Doppler space-time processor (tapered and untapered) was utilized and the internal clutter motion model of Ward [1] was applied to the overall simulation. As one would expect, the untapered version yielded slightly better results but in all cases final minimum detectable velocities of about 1.0 meter/second were obtained. By judicious choice and implementation of a reduced rank/dimension algorithm, it should be possible to obtain similar MDV results. [C13]

"Pareto-optimal radar waveform design"

This paper deals with the problem of Pareto-optimal waveform design in the presence of colored Gaussian noise, under a similarity and an energy constraint. At the design stage, we determine the optimal radar code according to the following criterion: joint constrained maximization of the detection probability and constrained minimization of the Cramer Rao Lower Bound (CRLB) on the Doppler estimation accuracy. This is tantamount to jointly maximizing two quadratic forms under two quadratic constraints, so that the problem can be formulated in terms of a non-convex multi-objective optimization problem. In order to solve it, we resort to the scalarization technique, which reduces the vectorial problem into a scalar one using a Pareto weight defining the relative importance of the two objective functions. At the analysis stage, we assess the performance of the proposed waveform design scheme in terms of detection performance and region of achievable Doppler estimation accuracy. In particular, we analyze the role of the Pareto weight in the optimization process. [C14]

"Multiuser detection for asynchronous ARGOS signals"

In this paper, we investigate the application of multiuser detection techniques to a Low Polar Orbit (LPO) mobile satellite used in the ARGOS system. These techniques are used to mitigate the multiple access interference in the uplink transmission of the system. Unlike CDMA, due to the Doppler Effect, each signal has a different received carrier frequency and a different propagation delay. Multiuser detection techniques are proposed for asynchronous transmission in ARGOS system: the maximum likelihood detector, the conventional detector, and the sequential interference cancellation detector, as solutions to tackle the interference effects. Bit Error Rate performance graphs are shown for these techniques. [C15]

"Research on SAR image compression technology based on wavelet transform"

Based on the research on the existing SAR image compression technologies, this paper proposes a wavelet-based SAR image compression algorithm. The algorithm reduces the speckle noise impact on SAR images, improves the SAR image compression performance to some extent, so is an effective SAR image compression algorithm, and has some practical value. [C16]

"Visual Computer Game Features for Teaching Relativity"

In this paper we describe incorporating Einstein's Special Theory of Relativity into an interactive computer game intended for learning and teaching purposes in Australian senior high school and tertiary education. The game, which is based on emph{Asteroids}, embeds either a classical or relativistic model of physics in the game environment such that players interact directly with the physics in the course of playing, and can observe and contrast their behaviour. The emphasis is on conceptual portrayal with 2D graphics, rather than immersive and realistic 3D visualisation. The key relativistic concepts of length contraction, time dilation, and mass dilation are each represented, as well as Doppler shifting of colour. We discuss design considerations and graphical devices for portraying these effects in the game, along with results and responses from user experiments. [C17]

"The channel emulator for CBTC wireless communication system"

A channel emulator working at 2.4 GHz ISM band related to tunnel environments for testing communication based train control (CBTC) wireless system is introduced. Based on three mechanisms, path loss, multi-path fading and Doppler frequency shift, the multi-port channel matrix is adopted to construct a multi-input and multi-output channel environment. Different from the commercial emulators with delay time of few micro-seconds due to the signals are converted into base-band and treated digitally, in the emulator, whole signal processing is conducted at the radio frequency band by using RF circuits and the time delay decreases two orders of magnitude. The channels can be programmed in terms of time-varying by setting radio propagation model of tunnels in the emulator control unit. As a test bed, several types of wireless communication system have been tested on it for CBTC system performance verifying in China subway construction. [C18]

"OFDM radar waveform design for sparsity-based multi-target tracking"

We propose a sparsity-based approach to track multiple targets using an orthogonal frequency division multiplexing (OFDM) radar. The use of an OFDM signal increases the frequency diversity of our system as different scattering centers of a target resonate variably at different frequencies. We observe that in a particular pulse interval the targets lie at a few points on the delay-Doppler plane. Hence, we exploit that inherent sparsity to develop a tracking procedure. The nonzero entries of the sparse vector in our model correspond to the target scattering coefficients at different OFDM subcarriers. Therefore, the sparse vector and associated sparse measurement model exhibit block-sparsity property. We design the spectral weights of the transmitting OFDM waveform to minimize the block-coherence measure of the sparse model. In the tracking filter, we develop a block version of the compressive sampling matching pursuit (CoSaMP) algorithm. We present numerical examples to show the performance of our sparsity-based tracking approach and compare with that of a particle filter (PF). The proposed sparsity-based tracking algorithm takes significantly less computational time and provides equivalent, and sometimes better, tracking performance in comparison with the PF-based tracking. [C19]

"Bias removal of the reduced complexity channel estimator for OFDM systems with transmit diversity in mobile wireless channels"

Transmit diversity is an effective technique for combating fading in mobile wireless channels and improving the capacity of wireless networks. On the other hand, to cope with frequency selective fading channels, OFDM systems can be applied to transform the channels into multiple flat fading channels and solve the multipath induced ISI problem. Therefore, combining OFDM with transmit diversity can provide reliable and high-rate transmission in wide-area cellular networks. For the decoding of space-time or space-frequency coded OFDM transmit diversity systems, efficient channel estimation methods have to be developed at the receiver to obtain the up-to-date channel state information. However, channel estimation and tracking in OFDM transmit diversity systems suffers from high computation complexity due to the simultaneous estimation of channel parameters of all transmit antennas. In this paper, we first investigate the issue of estimation bias in the reduced complexity algorithm. Two bias removal schemes will then be proposed by exploiting the temporal correlation of channel responses. Simulation results show that the proposed methods can greatly reduce the estimation MSE of the reduced complexity algorithm for high frequency selective and fast fading channels. [C20]

"Exploring shot noise and Laser Doppler imagery with Heterodyne Holography"

Heterodyne Holography is a variant of Digital Holography, where the optical frequencies of signal and reference arms can be freely adjusted by acousto-optic modulators. Heterodyne Holography is an extremely versatile and reliable holographic technique, which is able the reach the shot noise limit in sensitivity at very low levels of signal. Frequency tuning enables Heterodyne Holography to become a Laser Doppler imaging technique that is able to analyze various kinds of motion. [C21]

"Joint Code Acquisition and Doppler Frequency Shift Estimation for GPS Signals"

The unavoidable Doppler frequency shift reduces the correlation peak for code acquisition in global positioning system (GPS). In contrast to conventional methods where the code phase and Doppler frequency shift are separately treated, this paper proposes a novel three-step scheme for joint code acquisition and Doppler estimation, whereby not only the Doppler effect on the correlation peak is removed, but also the reduced detection probability due to noise enhancement in low signal-to-noise ratio (SNR) environments is avoided. The theoretical analysis shows that the proposed method has low complexity and fast acquisition speed. Computer simulations demonstrate that code acquisition with high detection probability and Doppler frequency shift

estimation with high accuracy can be simultaneously achieved. [C22]

"Velocity evaluating of the moving objects"

The paper deals with methods of contactless tachometry by radar sensors. The radar sensors are characterized by a good reliability and relatively high accuracy of measurements. The goal of the paper is to propose and realize the system which would manage to measure moving objects with a pulse radar and the Matlab software. Measuring of moving objects has been realized through the radar sensor which operates in an X-frequency band. The audio output of the radar sensor has been used for the velocity measurement and for the signal processing, a PC sound card and Matlab DAQ libraries have been used. [C23]

"Distinguishing Patients with Gastritis and Cholecystitis from the Healthy by Analyzing Wrist Radial Arterial Doppler Blood Flow Signals"

This paper tries to fill the gap between Traditional Chinese Pulse Diagnosis (TCPD) and Doppler diagnosis by applying digital signal analysis and pattern classification techniques to wrist radial arterial Doppler blood flow signals. Doppler blood flows signals (DBFS) of patients with cholecystitis, gastritis and healthy people are classified by L2-soft margin SVM and 5 linear classifiers using the proposed feature-piecewise axially integrated bispectra (PAIB). A 5-fold cross validation is used for performance evaluation. The classification accuracies between either two groups of subjects are greater than 93%. Gastritis can be recognized with higher accuracy than cholecystitis. Cholecystitis can be recognized with higher accuracy on left hand data than right. The findings in this paper partly conform to the theory of TCPD. Though the sample size is relatively small, we could still argue that the methods proposed here are effective and could serve as an assistive tool for TCPD. [C24]

"Performance Evaluation of DVB-T2 Time Interleaving in Mobile Environments"

This paper investigates the performance of time interleaving in DVB-T2 in the context of mobile reception. By means of time interleaving it is possible to provide time diversity and improve the robustness of the transmitted information in mobile environments. DVB-T2 implements a highly flexible time interleaving that allows different trade-offs in terms of time diversity, latency and power saving. DVB-T2 also includes the possibility to particularize the transmission parameters on a service basis by means of multiple physical layer pipes. This way, it is possible to accommodate different use cases: fixed, portable and mobile, in the same frequency channel. This paper evaluates the time interleaving capabilities of DVB-T2 by means of physical layer simulations. The paper also proposes and evaluates a configuration that has been optimized for handheld reception. [C25]

"A Novel Spectral Parameters Estimation Approach for Weather Echoes Based on Fitting"

White noise pollution mainly reduce the precision of spectral moments estimation for weather echoes, this paper presents a novel spectral estimation method based on fitting to decrease the impact of white noise on spectral parameters estimation. Fitting polynomial is firstly formed by analyzing the spectral characteristics of weather echoes, and then calibrates the received fitted spectrum by triangle. The simulation results show that the method can successfully reduce the impact of white noise on the spectral moments estimation, and can get higher performance than FFT method with a measurement mean error less than 0.4%. So the proposed method can be applied in weather radar. [C26]

"Land-to-Ship Radio Channel Measurements over Sea at 2 GHz"

A land-to-ship (L2S) radio channel measurement mission at 2.075 GHz has been established in Trondheim, Norway, being fully described in this paper. The transmitter (TX) was installed onboard the High Speed Craft (HSC) M/S "Trondheimsfjord I" and the receiver (RX) was located at the building in the harbor. A frequency chirp with 20 MHz bandwidth is emitted by the TX on the moving craft within a maximum distance of 15.5 km, the received signal being compressed and analyzed at the RX side. Results of processed data are presented, such as average power-delay profile and delay-Doppler spectrum. When the ship is close to the shore the number of reflections is high and relatively strong. On the open fjord, the line of sight (LOS) is dominant, and its Doppler corresponds to the speed of the ship. The Doppler spectrum has some components different from the speed of the ship that may come from reflections from the sea waves. These are 30-25 dB down from the LOS component and may correspond to typical speeds of the waves in the fjord. Even at 15 km distance the LOS is quite strong, and fading is modest. Thus we may conclude that WiMAX can experience good propagation conditions over sea and in fjords, and at distances of 15 km as long as a LOS component is present. [C27]

"A New IFFT Method for Mobile-to-Mobile Rice Channels in VANET"

Inter-vehicle communication find increasing application in futuristic intelligent transport systems and ad hoc

mobile networks. However, the channel statistical properties for these mobile-to- mobile channel are quite different from traditional cellular wireless networks, and need to modify the simulation method. The paper proposes a method to simulate the Rician-faded mobile-to-mobile local in three-dimensional scattering scenario, based on a model for mobile-to-mobile Rayleigh channel. The method proposed here can simulate any K-factor according to a database, which is convenient compared with other existing method. [C28]

"Effect of Multiple Clusters on the Correlated MIMO Capacity in Geometrical Channel Model"

It has been proved that in an uncorrelated condition, the capacity of MIMO system will linearly increase with the minimum number of transmitter and receiver antennas. However, the practical capacity of Multiple-Antenna system may vary because of the existence of spatial-temporal correlation. Factors such as Antennas Spacing, Angular Spread, Power Angular Spectrum, Mean Angle-Of-Arrival, Multiple Clusters, Doppler Spread and Delay Spread, will comprehensively affect the space-time correlation coefficients. The multiple clusters' incident waves may cause oscillation of correlation coefficient and capacity as Antenna spacing increase. In this paper, based on the two-ring model, equations of multiple clustered correlation coefficient and channel capacity will be derived. Both ergodic and outage capacity in multiple clustered environments will be simulated. [C29]

"Compression of Channel State Information for Wireless OFDM Transceivers"

In this paper, we present a channel state information (CSI) feedback reduction algorithm to be used in an adaptive orthogonal frequency division multiplexing (OFDM) system. Adaptive OFDM transceivers, which offer improved data rates and power efficiency over conventional OFDM systems, require a duplex connection between the transmitter and receiver such that the CSI necessary for the transmitter to recalculate the optimal bit and power distributions can be fed back. When a large number of subcarriers are employed, the amount of CSI to be transmitted in the reverse link can consume a prohibitively large amount of bandwidth. In order for adaptive OFDM systems to be implemented in practice, this feedback data has to be reduced. Existing methods of reducing CSI feedback entail compressing the bit and power distributions separately, resulting in the transmission of redundant information due to the correlation between the two distributions. The proposed algorithm removes this redundancy and improves upon an existing feedback compression algorithm that both reduces the number of feedback transmissions necessary to maintain some desired bit error rate (BER) and compresses the CSI by feeding back subchannel gains rather than the bit and power distributions themselves. After applying the proposed algorithm to an adaptive OFDM system with parameters characteristic of wireless local area networks (WLANs), the results show that the number of feedback transmissions can be reduced by up to 90% for slowly varying channels and the CSI to be fed back can be compressed by more than a factor of three. [C30]

"Sampling Point Selection Scheme for Fractional Sampling-OFDM Receivers on Fast Time-Varying Multipath Channels"

Fractional sampling (FS) and Doppler diversity equalization in OFDM receivers can achieve two types of diversity (path diversity and Doppler diversity) simultaneously on time-varying multipath channels. However FS with a higher sampling rate requires the large amount of complexity in demodulation. In this paper, a novel sampling point selection (SPS) scheme with MMSE equalization in FS-OFDM receivers is proposed. On fast time-varying multipath channels, the proposed scheme selects the appropriate samples from the fractionally sampled signals. Through the computer simulation, it is demonstrated that with the proposed scheme, both path diversity gain and Doppler diversity gain can increase as compared to a conventional non-SPS scheme. [C31]

"Measurement-Based Evaluation of a Multiuser MIMO System in an Indoor Time-Varying Environment"

In the paper, we examine Doppler spectrum and bit-error rate (BER) performance of multiuser MIMO systems in an indoor time-varying environment based on our measured data conducted in a meeting room. Simulation results show that both Doppler spectrum and the BER performance are much dependent on the array orientation and the direction of the receiver motion. In the non-line-of-sight environment, the actual Doppler spectrum is quite different from the theoretical U-shaped spectrum in the Jakes' model. In addition, it has been shown that the BER performance is much degraded due to a channel change. [C32]

"A Multi-Mode Multi-Band and Multi-System-Based Access Architecture for High-Speed Railways"

With the rapid development of high-speed railways all over the world, it is very promising to deliver public broadband access to passengers aboard high-speed trains. However, it has been a challenge to support high speed (e.g. above 350 km/h) mobile users with broadband communications, because of rapidly fading radio

channels and Doppler frequency shift. This paper presents a review of network architectures providing broadband access to high-speed trains. A novel scheme referred as multimode multi-band and multi-system-based access architecture is proposed in this paper. It consists of three parts: (1) train network part that relays data to large number of users in carriages without changing their own terminals, (2) ground network part that deals with traffic from different operators' networks, and (3) ground-to-train network part that connects the train network and ground network. Moreover, this architecture could support high mobility with broad bandwidth, seamless handover, scalable and cost-effective deployment. [C33]

"Two-Dimension Adaptive Spectral Efficiency for SC-FDMA Systems"

We propose a two-dimension adaptive spectral efficiency scheme for a new-designed single-carrier frequency division multiple access (SC-FDMA) system by flexible reference signal (RS) and data multiplexing for each user. Based on Doppler spread, each user first determines the number of SC-FDMA symbols that bear RS in a time slot, and each of such SC-FDMA symbols, based on bandwidth allocation, then serves to estimate a shortened time-domain channel impulse response (CIR) as well as bear data. The proposed design significantly outperforms the channel estimation (CE) case of Third Generation Partnership Project (3GPP) Long Term Evolution (LTE) uplink in terms of spectral efficiency at a high Doppler spread. [C34]

"Dynamic Path Loss Exponent and Distance Estimation in a Vehicular Network Using Doppler Effect and Received Signal Strength"

Global Navigation Satellite Systems (GNSS) can be used for navigation purposes in vehicular environments. However, the limited accuracy of GNSS makes it unsuitable for applications such as vehicle collision avoidance. Improving the positioning accuracy in vehicular networks, Cooperative Positioning (CP) algorithms have emerged. CP algorithms are based on data communication among vehicles and estimation of the distance between the nodes of the network. Among the variety of radio ranging techniques, Received Signal Strength (RSS) is very popular due to its simplicity and lower cost compared to other methods like Time of Arrival (TOA), and Time Difference of Arrival (TDOA). The main drawback of RSS-based ranging is its inaccuracy, which mostly originates from the uncertainty of the path loss exponent. Without knowing the environment path loss exponent, which is a time-varying parameter in the mobile networks, RSS is effectively useless for distance estimation. There are many approaches and techniques proposed in the literature for dynamic estimation of the path loss exponent within a certain environment. Most of these methods are not functional for mobile applications or their efficiency decreases dramatically with increasing mobility of the nodes. In this paper, we propose a method for dynamic estimation of the path loss exponent and distance based on the Doppler Effect and RSS. Since this method is fundamentally based on the Doppler Effect, it can be implemented within networks with mobile nodes. The higher the mobility of the nodes, the better performance of the proposed technique. This contribution is important because vehicles will be equipped with Dedicated Short Range Communication (DSRC) in the near future. [C35]

"Introduction to the Absolute Phase in Mobile Channels"

The absolute phase is the accumulated phase change over an observation interval. It is a new variable for the mobile channel and can be simply derived from the wrapped phase or from the quadrature components. The absolute phase offers extra information about the channel, fostering new techniques for channel characterization and location estimation. However, the absolute phase has not been used in mobile communications. In this paper, the absolute phase is introduced including its mathematical definition and two different formulations. The mean of the absolute phase is derived for the mobile channel with directional scattering, including isotropic scattering as a special case. Simulations are used to support the analysis and discussion. [C36]

"Low speed target detection with short CIT in HF surface wave radar"

High frequency surface wave radar can detect targets beyond the horizon. It needs long coherent integration time (CIT) to detect low speed targets, such as ships, in the environment with sea clutter. In order to improve the efficiency of the radar system, and avoid the Doppler broadening caused by long CIT, it is necessary to shorten coherent integration time. Modern spectrum estimation technique is adopted to extract Doppler information from HF radar echo signals. It can provide high resolution to realize ship detection in short CIT. The real data processing and analysis show that the autoregressive spectrum estimation technology is effective to detect low speed target in short CIT in high frequency surface wave radar. [C37]

"A novel single-channel SAR-GMTI method based on defocusing shifted difference"

A novel single channel SAR-GMTI method is proposed in this paper. When the azimuth mismatch filter performs compression, it induces shifted difference between the stationary and moving targets because of having different

Doppler center. The proposed method employs this character to separate moving targets from stationary targets. It can produce two images by pulse compression which make use of two symmetrical mismatch filters in azimuth direction, and then cancel stationary and retain moving targets by subtracting one image from another. Compared with traditional methods, it is applicable to both low and high squint case and the detection capability is significantly improved. The simulation results validate the effectiveness of the proposed method. [C38]

"Fast computation of cross ambiguity function for DTTB based passive radar"

A new method is proposed to calculate the cross ambiguity function (CAF) for digital television terrestrial broadcasting (DTTB) based passive radar. The Doppler frequency of the targets is much lower than sampling frequency. The cascade integrator comb (CIC) filter is utilized to realize the large change of sampling frequency. The interpolated second-order polynomials (ISOP) filter is used to compensate the passband droop caused by CIC filtering. A half-band filter is employed to get narrow transition band. And then a short point FFT is performed instead of the long point FFT. The experiment results and computation complexity are given compared with other methods. It shows that the proposed method doesn't affect detection and estimation performance, and the computation is reduced significantly. [C39]

"Improved image mosaic method of ScanSAR"

For ScanSAR the mosaic of subswaths' images is very important. An improved method for scanSAR to process the mosaicking by using Range-Doppler location model is proposed in this paper. It is based on the precision of the R-D location method. This method avoids the pixel defocused and the simulation results are satisfied in practice. [C40]

"BER analysis of variable sub-carrier bandwidth OFDMA systems"

OFDMA is the preferred multiple access technique to provide high data rate services in mobile environment due its resilience against multipath propagation impairment and flexibility to provide multi-rate data services. However, it also has issue with susceptibility to ICI (inter-carrier interference) caused by frequency offset and Doppler spread due to mobility. Thus, OFDMA with certain number of sub-carriers will only be optimum over a certain range of mobility. Recently, a VSB-OFDMA (variable sub-carrier OFDMA), system has been proposed to relax the effect of ICI. Although it suffers from non-orthogonality caused by different sub-carrier sizes, as ICI is inversely proportional to the sub-carrier bandwidth, it rakes in benefit from reduced ICI in mix-mobility environment. It has been shown to produce higher system capacity under mix-mobility environment. In this paper we have performed comparison based on computer simulation to gauge the advantage offered by VSB-OFDMA in terms of BER. [C41]

"Bistatic SAR imaging with parallel flight track based on monostatic SAR processor"

Bistatic SAR uses separated transmitter and receiver flying on different platforms, and has the ability of the exploitation of additional information contained in the bistatic reflectivity of targets. This paper provides an efficient Nonlinear-Chirp Scaling (NCLS) algorithm for bistatic SAR with parallel track configure, which is based on the bistatic-to monostatic application (BTMA). The method described is a feasible solution for the image formation of bistatic SAR with such configure. The problem of Doppler ambiguity during the NCLS Processing and the choice of reference frequency are also discussed at last. This NCLS imaging algorithm is verified with a simulation experiment. [C42]

"Analysis of micro-doppler effect in SIMO radar"

SIMO (Single Input Multiple Output) radar system capitalizes on the receiving diversity, so it can obtain more information about the target and highly improve the target recognition capability of radar. In this paper, the micro-Doppler effect induced by rotation and vibration parts of target in SIMO radar system which transmitting single frequency signal are deduced respectively. Both the micro-Doppler effect induced by rotation and vibration are sinusoidal curves, but their amplitude vary with the selection of different receiving radar. In addition, the translation of the target's body will lead some horizontal shifts to the micro-Doppler curves with different value according to the selected receiving radar. Simulations are presented to validate the theoretic conclusions. [C43]

"Application of multi-antenna technologies in cellular mobile communications"

In cellular mobile communications, multipath fading, shadowing, near-far problem and the Doppler effect have led to a complex radio wave propagation environment. Furthermore, with the continuously increasing of users and operations, not only new bandwidth is required, new technologies and measures are also expected to improve the system capacity and channel capacity. This paper introduces the general structure of multi-antenna

communication systems firstly, then analyzes the characteristics of various multi-antenna technologies and their advantages over single antenna system when applied in cellular mobile communications. Finally, combined with the trends and requirements of cellular mobile communications, the further application of multi-antenna technologies in future cellular mobile communications is prospected. [C44]

"Three-dimensional micro-doppler signature extraction in MIMO radar"

In traditional monostatic radar, only the micromotion signatures projected in line-of-sight (LOS) could be extracted from the target's echoes, which are insufficient for accurate target recognition due to the target-aspect sensitivity. In this paper, we propose an algorithm for the three-dimensional micro-Doppler signature extraction using the multi-input multi-output (MIMO) radar technique. The micro-Doppler effect in MIMO radar induced by rotation is analyzed. Profited from the multi-view of MIMO radar, the three-dimensional micro-motion features, which are not sensitive to the target's aspect anymore, are obtained by solving nonlinear multivariable equation systems. Simulations are given to validate the effectiveness of the proposed algorithm. [C45]

"DVB-T mobile diversity reception"

Digital Video Broadcasting-Terrestrial (DVB-T), European standard for Digital Terrestrial Television, even designed for fixed and portable reception, offers various trade-offs between bit rate, robustness and mobile performances. Consequently, reception of DVB-T signal by moving vehicles becomes feasible under specific requirements on receiver's side, even for all DVB-T FFT modes. The receiver must be able to cope with Doppler Effect on high-speeds as well as with path-loss in unfavorable locations. Antenna diversity is an efficient way for making mobile reception of DVB-T possible, allowing such receivers to make benefit of dual antenna reception. In this paper, general problems with mobile channel have been investigated. Also, the gain of antenna diversity was demonstrated through limited field tests in and around Belgrade, Serbia. [C46]

"Space-time adaptive processing for sea clutter and jamming suppression in radar seekers"

When radar seeker searches and tracks moving target on sea surface, sea clutter spectra severely spread out due to the strong effect of sea conditions. Conventional methods for suppressing sea clutter have achieved poor performance. This paper mainly analyzes the sea clutter characteristics in azimuth-Doppler domain and clutter spectra with different scanning angles. Then space-time adaptive processing (STAP) technique is applied to suppress sea clutter. Research results indicate that sea clutter spectra have some special characteristics in space-time distribution, and the proposed STAP algorithm can detect slow moving targets effectively as it can suppress sea clutter and strong jamming. [C47]

"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. [C48]

"Application of multi-antenna technologies in cellular mobile communications"

In cellular mobile communications, multipath fading, shadowing, near-far problem and the Doppler effect have led to a complex radio wave propagation environment. Furthermore, with the continuously increasing of users and operations, not only new bandwidth is required, new technologies and measures are also expected to improve the system capacity and channel capacity. This paper introduces the general structure of multi-antenna communication systems firstly, then analyzes the characteristics of various multi-antenna technologies and their advantages over single antenna system when applied in cellular mobile communications. Finally, combined with the trends and requirements of cellular mobile communications, the further application of multi-antenna technologies in future cellular mobile communications is prospected. [C49]

"A robust space-time multiple-beam STAP algorithm"

Considering the limited sample support and computational complexity, the traditional localized STAP algorithms restrict adaptive processing in localized processing region and for the most part they have fixed system degrees of freedom (DOF). A new idea about the localized STAP algorithm which adjusting system DOFs adaptively with variable interference environment are presented, and some practical issues, such as performance metric

selection, initial system DOFs selection and the recursion fast algorithm of weight are discussed. The validity of the research is proved by measurement data processing results. This algorithm is more robust in complicated interference environment, and it reduces large computational complexity and improves the performance of jammer suppression. [C50]

"GPS Signal Acquisition Based on FFT"

The acquisition and tracking processes of Global Navigation Satellite System (GNSS) are heavy in the computation load of a GNSS receiver. In order to track and decode the navigation information in the GPS signal, an acquisition algorithm must be used to detect the presence of the satellite signal. Once the signal is acquired, the necessary parameters such as code delay and Doppler shift must be obtained and then the parameters are passed to the tracking program in order to obtain the navigation information. This paper presents the serial search algorithm and the FFT acquisition algorithm based on real GPS IF data. Experiments are finished to compare the performance and computing speed of both the algorithms. As a result, it shows that FFT acquisition algorithm is efficient and further reduces the processing time in signal acquisition process. [C51]

"FCM-based radar target detection in medium frequency signal of radar"

In radar target detection application fields, rich of information of targets may be included in medium frequency. Doppler shift caused by moving target is one of them. In this paper, Doppler shift and its Short Time Fourier Transform-STFT is analyzed and discussed. Since it is difficult to distinguish the Doppler shift of moving target even in frequency domain with STFF method, fuzzy C means clustering method is introduced to seek the two centers of the mixed signals in a radar scanning period. Using multiple radar scanning period, several centers can be determined by a center function using arithmetic mean filter. Finally the targets can be detected by threshold decision and calculated the detection probability. This algorithm is simple, easily to realize, with small computation burden and good target detection probability. [C52]

"Ortho-rectification of high-resolution SAR image in mountain area by DEM"

Because of the side-looking imaging characteristics, the quality of Synthetic Aperture Radar (SAR) image is badly affected by variable terrain. Such terrain can introduce large displacements in the SAR image geometry that inhibits the collocation of SAR-derived quantities with geographically referenced information acquired from other sources. So it is necessary to eliminate such inherent geometric distortions by generating a radar ortho-imagery that corresponds to a well defined map projection. In this paper, aiming at the newest high-resolution SAR data-RADARSAT-2 and TerraSAR-X, an effective ortho-rectification method was studied in detail and the result showed this method could achieve high geo-location accuracy. [C53]

"Precise SAR satellite orbit parameters determination based on Ground Control Points"

Aim to solve the georeferencing problem of spaceborne SAR imagery, accounting for the orbit physics model and the impact of the earth perturbations, some description models such as four parameters model and polynomial model could be applied to determine the satellite orbit parameters. However the orbit state vectors solved by 5 satellite state vectors supplied by header file in SAR data files could hardly acquire precise orbit parameters, which would greatly effect on the accuracy of co-registration, phase unwrapping, baseline estimation and the generation of Interferogram and DEM (Digital Elevation Model). In this paper, combined with R-D (Range-Doppler) conformation equation and earth ellipsoid equation, which explicitly describe the relationship of corresponding pixel between the 2D image coordinate and the 3D cartographic coordinate of ground targets, an advanced orbit model algorithm by adding few GCPs (Ground Control Points) to improve satellite state vectors is presented. All the correlative formulas are deduced and the orbit parameters can then be iteratively determined through solving a linear equation set consisting of the error equations from all GCPs under Recursive Least Square (RLS) algorithm. The algorithm is tested on an ERS SCL (Single Complex Looked) scene with a series of simulation experiments and the improved orbit parameters and contrasted with accurate SAR orbit data supplied by DEOS institution of Delft University in Holland, which could be demonstrated of validity and stability. [C54]

"Design and implementation of integrated test system of some series Doppler navigation radar"

This paper proposes the design and implementation of a test system to solve the problems of low detection efficiency and incomplete detection of the project during the progress of some type of aerial Doppler navigation radar's maintenance. The test system was designed based on the demand analysis of the radar and took into account its characteristics and avionics systems trend. It used Industrial Personal Computer (IPC) as the control center, window XP operating system as platform, Visual C + + 2005 to develop test program and took ARINC429 to complete the cross-linking between test system and navigation computer of the radar. Because of the above

measures, the system can be considered integrated test system of this type Doppler navigation radar which fused computer theory and intelligent instruments technology. The trial feedback proves that the system has high test accuracy, and can be applied to the maintenance test of this series Doppler navigation for some kinds of airborne. [C55]

"Influence of relative position and pose between sensor and human on respiration measurement with microwave Doppler sensor"

Measurement of human respiration with microwave Doppler sensor is influenced by the relative position and pose between sensor and human. In this paper, we propose a numerical representation of relation between the measurement and the position and pose. First, we devise a parametric expression of the relative position and pose whose parameters can also be used in microwave signal strength model. Then we prepare a dataset which consists of respiration signal and position and pose of the sensor and the target. The two kinds of data are simultaneously measured with a microwave Doppler sensor and a motion capture. Finally, a model whose inputs are the parameters and output is the measurability of respiration is constructed based on the dataset. Using this model, the influence of the parameters on the measurement is discussed. [C56]

"Two-Step Particle-Filter-Based AFC for LEO Satellite Receiver with Impulsive Noise"

In this contribution a novel particle filter based two-step automatic frequency control (AFC) scheme is proposed, which is used for non-cooperative receiver in the Low earth orbit (LEO) satellite communication system. The proposed AFC scheme employs particle filter techniques to implement both coarse and fine carrier estimations. Our study shows that the proposed AFC scheme is capable of achieving better Root-Mean Square (RMS) frequency error performance than extended kalman filter (EKF) based AFC scheme in non-Gaussian environment, but with less preamble symbols, which is suitable for burst packet receiving. [C57]

"Frequency Tracking for High Dynamic GPS Signals Based on Vector Frequency Lock Loop"

A method of estimating high dynamic GPS signal parameters based on Vector Frequency Lock Loop(VFLL) is put forward. Instead of using the discriminator, the VFLL focus on the nonlinear estimation. The navigation filter is realized utilize Unscented Kalman Filter(UKF). The VFLL method is based on the fact that comparing with the rate of change of the Doppler frequency caused by the motions of the satellite and the receiver, the acceleration of the receiver is the dominant factor. Instead of tracking the Doppler frequency of individual channel using the traditional loop, the VFLL tracking the velocity, acceleration.etc states of the GPS receiver from the measurement value of all channels. In vector mode, the navigation processor controls the carrier numerically controls oscillators (NCOs) based on the most recent velocity solution of the receiver. A major advantage of this method is that the velocity estimation from all the channels can be more accurate than Doppler frequency estimation from individual channel. [C58]

"A rapid radiative transfer model for SSMIS UAS channels that takes the earth-rotation doppler shift and Zeeman effects into account"

Special Sensor Microwave Imager/Sounder (SSMIS) on board the US Defense Meteorology Satellite Program (DMSP) satellites includes six upper atmosphere sounding (UAS) channels. Radiances in three of the UAS channels, channels 19-21, are influenced by a combination of Doppler shift caused by Earth's rotation and the effect of the Zeeman-splitting of the O2 magnetic transition. In order to operationally assimilate the radiance data or retrieve temperature profile from the data, a fast radiative transfer (RT) model for the SSMIS UAS channels has been developed and recently implemented in the Community Ratiative Transfer Model (CRTM). This paper provides a summary of the model algorithms and validations. Also included in the paper are the preliminary results of temperature profile retrieval from a one-dimensional variational system in which the fast model is applied. [C59]

"Brightness temperature correction of the sea state effect using GNSS-R data"

Sea Surface Salinity (SSS) is a very important oceanographie parameter that can be measured using L-band microwave radiometry. The measured brightness temperature measured over the ocean is influenced by the sea state that can even mask the salinity signature. Reflectometry using navigation signals (GNSS-R) has been proven to achieve sea state determination and has been proposed to be used to correct the measured brightness temperature for the sea state effect. In this framework, the "Advanced L-BAnd emissiviTy and Reflectivity Observations of the Sea Surface 2009" (ALBATROSS 2009) field experiment was undertaken collecting an extensive dataset of collocated radiometnc and reflectometnc measurements. In this paper the experimental results and mam conclusions of the ALBATROSS 2009 field experiment are presented. [C60]

"Development of a tele- stethoscope: Indian perspective"

Many attempts have been made to develop digital stethoscope for diagnosing auscultation. This study is part of current research project being undertaken at the University of Southern Queensland, Australia. The project addresses the issue associated with telehealth care system, through the development of a digital stethoscope. The objective of this article is to report the user's satisfaction with the information received from the existing digital stethoscope and guide the researchers to adjust its content to the best benefit to those uses the new improved digital stethoscope. University of Southern Queensland, Australia has developed a digital stethoscope composed of software and hardware components and user friendly. The system will be priced competitively and can be used both for telehealth diagnosis and for teaching of cardiology to medical students. The lack of specialized devices and professionals can be minimized with the adoption of solutions, such as this one. This could improve the diagnostic ability of remote clinics at a lower cost and avoid long hour travel. [C61]

"Theoretical study on time delay and Doppler stretch estimation of Chirp signal based on Wavelet-Cumulants"

The algorithm of wavelet analysis can be used to estimate the time delay (TD) and Doppler stretch (DS) of Chirp signals, but it cannot suppress the effect of Gaussian noises. In this paper, a definition of fourth-order Wavelet-Cumulants is given by combining the wavelet and the forth-order cumulant. This method can be used in unknown Gaussian noise environment. The simulation results demonstrate the effectiveness of this novel approach. [C62]

"Shear Features Matching Approach and Its Application to Rapid Positioning of Mesocyclone"

Together with the radial velocity shear features of Mesocyclone in doppler radar data and the experiences of experts, and in the case of having monitored the Mesocyclone, this paper proposed a rapid Mesocyclone positioning algorithm based on the features of velocity shear and matching method. This algorithm can rapidly and accurately locate the Mesocyclone during the continued radar data observation. Experimental results demonstrate that methods used in this paper are effective. [C63]

"On orthogonal waveform design for MIMO sonar"

MIMO sonar that transmits orthogonal waveforms via transmitter sensors is an emerging technology that has significant application potential. Compared to standard phased array sonar, orthogonal transform waveform can bring many advantages including improved angular resolution and multi-target detection ability. We derive in this paper a novel binary-phase waveform design coded by Gold sequences. This phase code is computationally efficient compared to other codes previously proposed in the literature. We provide some numerical examples to demonstrate the performances of the new code sequence. [C64]

"Physical layer design consideration for Underwater Acoustic Sensor Networks"

Unlike that of terrestrial sensor networks, the physical layer design of Underwater Acoustic Sensor Networks (UW-ASNs) faces far more challenges because of the limited band-width, extended multipath, refractive properties of the medium, severe fading and large Doppler shifts. This paper takes a tutorial overview of the physical properties of acoustic propagation, modulation schemes and power efficiency that are relevant to the physical layer design for UW-ASNs, and analyses the design consideration on each aspect. In the end, it presents several open research issues, aiming to encourage research efforts to lay down fundamental basis for the development of new advanced underwater networking techniques in the near future. [C65]

"Method of Doppler estimation for IR-UWB-system based on the rake-receiver"

In [1] a new scenario based on UWB-technique for transmission of data was presented, which is the rotor-telemetry. The rotor-telemetry is a special type of a radio-telemetry, where measuring data of physical parameters like pressure or temperature are captured by sensors predominantly on rotating objects such as shafts or gear parts, transmitted over special on the rotor mounted along-moved antennas and received by static antennas. The antenna on the rotor is rotating with high velocity. A new problem appears with this scenario: since such systems become faster and faster, the impact of Doppler rises significantly. The consideration of the effect of Doppler in UWB-signals is different than in narrowband signals. In narrowband systems, the Doppler shift is almost equal for all frequencies, so that the compensation is simple by translating the spectrum proportional to the carrier frequency. This assumption is no more fulfilled in UWB-systems, since the low frequencies of the band suffer less from Doppler shift than the upper ones. [C66]

"Synthetic ultra-wideband radar range profile based on stepped frequency pulse trains"

In this paper, stepped frequency pulse trains are utilized to synthesize ultra-wideband radar range profile. Because of the errors of measured target velocity, the synthesized range profile still has range migration and power divergence. Therefore, a new method, called iterative dimidiate approach, is proposed. By exploiting this new technique, the range migration and range spread along range dimension can be neglected. The simulation results prove the validity of the method. [C67]

"Phase continuous radar test set"

A method of generating phase-continuous, coherent radar target returns is described which leverages existing Commercial Off-The-Shelf (COTS) Radio Frequency (RF) channel simulator technology. This hardware-in-the-loop system avoids the generation of unintentional spurious signals due to the discrete range steps typically utilized in traditional radar test sets. The time delay, Doppler, and amplitude variations are entirely phase continuous, replicating the true analog behavior of a real target return. Digital signal processing techniques are employed to interpolate the RF propagation and scattering effects. The interpolation smoothes the motion dynamics to ensure a pure analog signal return to the radar. The radar test set also provides physics-compliant Doppler characteristics by time domain expansion/compression of the modulation as well as the RF carrier. Often, Doppler is simply emulated with a shift in the carrier frequency only. Doppler shifts on the modulation result in degradations in radar signal processing such as pulse compression fidelity. Without properly imparting time domain expansion/compression, these degrading effects are not tested. Further, the radar test set provides correlated range/Doppler dynamic motion without discrete phase discontinuity artifacts enabling superior test performance. [C68]

"Characterisation of dismounted combatants radar signature from airborne platforms"

The radar signature of dismounted combatants as observed from a moving airborne radar platform was examined and quantified. The dismounted target presented a characteristic amplitude and frequency modulated signature which proves useful in distinguishing true targets from those due to uncancelled clutter discretes. [C69]

"A multi-model track-before-detect algorithm for manoeuvring target detection for Over-the-Horizon Radar"

In this paper a multi-model track-before-detect (MM-TBD) is proposed for the HF Over-The-Horizon-Radar (OTHR) manoeuvring target detection. Multiple hypotheses about target manoeuvres and echo sources are represented in the multi-model-estimation framework with each sub-filter corresponding to one hypothesis. The track output of each sub-filter is obtained based on the maximum likelihood criterion and then a generalized likelihood ratio for hypothesis test is presented to target detection. A numerical simulation is presented to show the effectiveness of the proposed algorithm. [C70]

"Scan-to-scan sea-spikes filtering for radar"

High range resolution radars are often a solution to the problem of small target detection in the presence of sea clutter, however this solution leads to a high density of sea-spikes echoes. The number of false plots can be very high and need to be regulated in order to be able to control the tracking load and limit the number of false tracks. In this paper a solution for the Coast Watcher 10 and Coast Watcher 100 products is derived. The new patented scan-to-scan algorithm used to filter plots before tracking is presented. It uses the position and Doppler information of the plots on several scans to regulate the number of false plots at tracking level. [C71]

"Inter-period compensation algorithm in full-polarimetric FMCW radar"

This paper describes a new type of sounding signals for polarimetric FMCW radar and the corresponding signal processing technique. The inter-period compensation (IPC) algorithm is proposed for isolation increase in radar channels. The novelty concerns the use of orthogonal polarizations of two bi-cyclic LFM-signals having an additional phase shift every second sweep. Summation units proposed for use in the receiver channels allows for reducing the effects of interfering signals due to the specified phase of received signals over two consecutive sweep times. [C72]

"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. [C73]

"A method for differentially coherent detection of OFDM signals on Doppler-distorted channels"

Doppler distortion causes inter-carrier interference which prevents the use of differentially coherent detection in OFDM systems. To recover this efficient detection method, we propose to use several FFT demodulators operating in parallel over non-overlapping time segments, and to combine their outputs prior to detection. This technique aims for efficient implementation of front-end matched filtering, followed by differential MMSE combining. A low complexity algorithm is proposed for recursive computation of combiner weights, and its gain over the conventional detector is quantified through numerical examples of an underwater acoustic channel with severe Doppler distortion. [C74]

"MIMO GMTI radar with multipath clutter suppression"

This paper address ground-moving target indicator (GMTI) radar operation in the presence of strong multipath spread-Doppler clutter (SDC). Spacetime adaptive processing (STAP) for single-input-single-output (SIMO) radar is designed to mitigate direct-path SDC which leaks into the sidelobes of a moving radar platform. However, multipath SDC often returns via the receiver mainlobe and cannot be suppressed in a SIMO radar without also canceling the target. In this paper, we study multipath SDC mitigation using multiple-input-multiple-output (MIMO) GMTI radar. Clutter loci and adaptive array patterns for MIMO GMTI are presented in multipath SDC. By achieving range-dependent nulling on transmit, the effectiveness of MIMO GMTI radar at suppressing multipath SDC is shown. [C75]

"Iterative focusing algorithm to estimate moving target"

In this paper, the authors have presented iterative focusing algorithm (IFA). Under the condition of the same number of bins, IFA demonstrates imaging performance superior to that obtained using DAS because of the area focusing. IFA with DAS algorithm significantly improves the amount of computation than the conventional IAA algorithm. Furthermore, by focusing the scanning area, bin size is reduced, and the estimation accuracy is improved significantly. IAF with IAA algorithm performs better than IAF with DAS algorithm. Note that IAF with IAA algorithm takes huge amount of computation. If the authors allow little ambiguity, the IFA with DAS algorithm is effective for both target imaging and computation. [C76]

"Automated testing of communication systems in motion: Adding realistic testing"

The art of test is being able to anticipate and replicate the stresses of a product's intended end use. This paper is an overview of a range of test options for wireless transmitter-receiver pairs; in particular those that will ultimately experience separation distance, or relative motion, thereby introducing a wide range of additional Radio Frequency (RF) effects, not typically found in indoor wireless applications. The paper includes an underlying discussion of the range of choices engineers make, from using simple substitute tests to represent the final RF environment, all the way to sophisticated simulations and channel models that strive to accurately mimic the end users' complete RF operating environment. [C77]

"Improved range resolution for FMCW HF surface wave radar"

A modified signal processing for FMCW waveform has been proposed that yields an improved range resolution without increasing the transmitted signal bandwidth. The chirp duration is reduced by an appropriate factor while the interval of the beat signal sequence considered for the range transform is kept constant. This modification implies a range transform over several chirp sweeps and an interleaving technique for the Doppler transform. Range resolution is improved without affecting the maximum unambiguous Doppler. This is achieved on the expense of a reduction of the maximum unambiguous range. Actually, this is not a restriction for HF SWR systems where the maximum range is limited by surface wave attenuation. However, a minimum practical range bin size is given either by the size of the targets considered or by the acceptable size of range side lobe level coming along with increasing range resolution. With this approach first and second order sea clutter is reduced which is of significant interest for ship detection. [C78]

"Measurement-based delay-and-sum signal processing for linear antenna arrays"

The design of a delay-and-sum beamformer based on measured data is presented in this paper. Traditionally the weighting of a delay-and-sum beamformer is designed based on an idealized signal model, with specifications on the beam pattern in terms of the beam width and the sidelobe level (SLL). The goal is a trade-off between resolution and the ability to detect targets with a certain dynamic range. In this work we propose an approach to the optimization of a delay-and-sum beamformer with the same goal in mind however not based on

the ideal signal model, but based on measured data. Being a measurement-based method even effects of non-idealities that are not part of the ideal signal model such as mutual coupling can be suppressed. The proposed approach is validated in simulations for a 77-GHz 36-elements non-uniform frequency-modulated continuous-wave radar array. [C79]

"Multistatic passive radar geometry optimization for target 3D positioning accuracy"

The paper presents a design procedure for a multistatic passive radar system, that aims at its performance optimization, in terms of 3D positioning accuracy. Specifically, the proposed procedure considers the main features of the considered air traffic control scenario and the main physical and geometrical features of the passive radar receivers and guides the designer to select the geometry that maximizes the three-dimensional target positioning accuracy. The procedure can be applied to any type of sources of opportunity, the final accuracy results being inversely scaled by their frequency band occupancy. The proposed procedure has been applied to two different air traffic control scenarios, namely an en-route flight and an approach path. The results show that a multistatic passive radar system with just two or three transmitters of opportunity and a single receiver is able to localize targets with positioning accuracy comparable to conventional air traffic control systems. [C80]

"Radar polarimetry using sounding signals with dual orthogonality-PARSAX approach"

The article describes specific aspects of the radar polarimetry using sounding signals with dual-orthogonality. Such signals provide the unique opportunity to measure all elements of the polarization back-scattering matrix simultaneously, during one sweep/pulse period of radar signal. This approach has been implemented in the IRCTR PARSAX radar system, the fully polarimetric high-resolution Doppler FMCW radar. The digital architecture of the radar starts from intermediate frequency and makes the radar fully reconfigurable in terms of sounding waveforms and processing algorithms. [C81]

"A radar oriented ionospheric channel model based on ray-tracing theory"

A ionospheric channel model based on raytracing theory is here proposed. Several HF ionospheric channel models based on statistical approach have been presented. The here proposed model combines the statistical method with the deterministic method, using a raytracing approach. By means of raytracing we are able to simulate any ionospheric channel condition by varying the transmission frequency in the HF band, the elevation angle, the transmitter geographical coordinates, the season, the time of day and the solar activity. The here proposed model is a useful tool to simulate a signal received by an OTH (Over-The-Horizon) radar, that uses the ionosphere as transmission channel. [C82]

"New generation Doppler radar processing: Ultra-fast robust Doppler Spectrum Barycentre computation scheme in Poincarй's unit disk"

In case of short time series, we prove that we can replace classical Radar Doppler processing chain based on FFT by a new generation processing based on Lie Group Theory. We have defined a robust and ultra-fast computation of Doppler Spectrum Barycentre based on "Median Spectrum" estimation through an regularized autoregressive identification in lattice and ladder form like BURG algorithm. [C83]

"MPAR: Waveform design for the weather function"

An integrated target/weather surveillance at medium range, i.e. for the Terminal Manoeuvre Area (TMA) in the frame of Air Traffic Control (ATC) and regional weather monitoring, is made possible by MPAR (Multifunction Phased Array Radar) techniques, allowing a single technology to satisfy different requirements. The guidelines for system design, needed for cost/benefit analysis, were described in a previous EuRAD paper. As in many other radar applications, pulse compression is a key element to achieve the required MPAR performances with low-cost solutions using relatively low-peak-power Transmit/Receive modules. This paper describes a preferred novel solution for the waveforms to be used in the weather function of the MPAR. Performance comparison with more traditional codes is also presented. [C84]

"Airport radar monitoring of wake vortex in all weather conditions"

To assess maturity and capability of X-band radars to monitor wake roll-ups in all weather conditions, Radar data were collected on airports, near runway at ORLY airport and just under its ILS Interception Area. Additional trials took place on Paris-CDG Airport to benchmark Lidar & Radar Technologies. Continuous Detection, characterization and profiling capabilities of wake vortices, up to a range of 2000 m, have been proved in clear air and rainy weather. Recorded data have been correlated with electromagnetic and fluid mechanical models of

Wake Turbulences for better and more accurate understanding of roll-ups radar cross section (RCS) and Doppler signature. X-band Radar has been proved to be a full-fledged alternative, which can make a significant contribution to a wake vortex alert system, but to achieve as much reliability as possible, collaborative Electro-optical & electromagnetic sensors solution is envisaged encapsulated in a Wake Vortex Advisory System. These sensors could be used to permanently monitor wake turbulence on runways. [C85]

"Strategies for sub-optimal air to air STAP in forward looking configuration"

This paper deals with the selection of adequate sub-optimal strategies for air to air STAP in a forward looking configuration. The particular scenario is characterized by: (i) need of real-time operability; (ii) strong range dependency of the clutter statistics. To overcome these two aspects, a reduction of the overall number of degrees of freedom (DOFs) has to be performed, thus sub-optimal STAP approaches must be used. In addition, the range dependency of the clutter limits the overall number of available secondary data for clutter covariance matrix estimation. Three strategies for secondary data collection are presented and the corresponding performances are compared for a sample scenario. [C86]

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

The method using geostationary satellites to determine hydrometeors parameters and to diagnose hazardous occurrences, such us: showers, hail formations, lightings, turbulences, etc are presented. The advantage of the multiposition bistatic radar system is a capability of detecting small objects (turbulences) owning to a sharp increase in the value of Radar cross-section of objects close to base line and its environmental safety. [C87]

"Improving SAR images: Built-in geometric and multi-look radiometric corrections"

SAR systems installed on small aircrafts and UAVs suffer from trajectory deviations and instabilities of antenna orientation. These kinds of motion errors lead to significant geometric distortions and radiometric errors in SAR images. In the paper, we describe a time-domain multi-look stripmap SAR processing algorithm with built-in geometric and multi-look radiometric corrections. Geometric correction is performed due to azimuth reference functions and range migration curves specially designed to produce SAR images directly on a rectangular grid on the ground plane. Radiometric correction is based on multi-look processing with extended number of looks. The proposed techniques have been successfully tested with a Ku-band SAR system installed on a light-weight aircraft. [C88]

"A multiple target doppler estimation algorithm for OFDM based intelligent radar systems"

In this paper an approach will be presented that allows for estimating the velocity of multiple reflecting objects with standard OFDM communication signals. The proposed technique does not require any specific coding of the transmit signal and provides high dynamic range and low sidelobe levels. This allows for an efficient acquisition of velocity information in joint communication and radar systems. The paper discusses the developed algorithm and a possible OFDM system concept for automotive applications. Measurement results are provided that prove the operability in practical scenarios. [C89]

"Precise radial velocity estimation using an FMCW radar"

This contribution addresses radial velocity estimation with a frequency-modulated continuous-wave (FMCW) radar system. The estimator we propose aligns the up- and downchirp information of adjacent sweeps including the phasing of the chirps. The resulting one-dimensional signal depends on the radial velocity and can therefore be used for estimation purposes. Because the phase information between nearby chirps is preserved, the accuracy is seriously increased compared to estimators that evaluate only the frequency shift due to the Doppler effect. Additionally, the range of velocities that can be estimated without ambiguity constraints is extended considerably when compared to a standard range-Doppler procedure. [C90]

"Signal detection in multi-frequency Forward Scatter Radar"

The peculiarity of Forward Scatter Radar (FSR) is the absence of range resolution. As a consequence, possible low signal-to-clutter ratio is the most limiting factor in FSR detection. In this paper we will discuss non-coherent and coherent FSR Doppler signal processing and consider an alternative cross-correlation approach, which could be called `quasi-coherent' processing. Multi-frequency radar enables correlation of Doppler output of one of the channels with another which can be considered as the matching waveform, or the reference signal, to the first signal. This leads to a compression of the FSR return by cross-correlation with enhanced processing gain, and, consequently, enhanced detection. [C91]

"A Fit-to-Sine based processing chain to handle multiple-target scenarios"

The full coherent processing of non-equidistant sampled data has been the topic of many research activities. In this paper we propose a processing chain based on such an algorithm, the Fit-to-Sine function, which is able to handle multitarget and target/clutter radar signals. Starting from the computation of a least squares cost function in dependency of frequency, followed by a feature extraction method and the suppression of unwanted sidelobes, we conduct a simple noise/target distinction by utilizing basic fuzzy logic characteristics and operations. Finally we exemplify our processing chain and the achievable results on a real radar scenario with a target moving in strong clutter. [C92]

"Simulation study of relationships between Doppler-polarimetric parameters at microwave remote sensing of precipitation"

This paper studies the relationships between recently introduced differential Doppler velocity and other parameters of radar signal reflected from rain. Analytical calculation and simulation methods are used mostly. The results are checked by measurements in special cases. Some possibilities to derive information on distributed object structure are shown. [C93]

"Characterisation and cancellation of medium grazing angle sea clutter"

High grazing angle sea clutter data were collected and characterised using two different airborne radars with HH and VV polarisations. The ability to cancel sea clutter using single-channel and multi-channel coherent signal processing is investigated. [C94]

"Comparison of basis pursuit algorithms for sparse channel estimation in underwater acoustic OFDM"

Recently it has been shown that sparse channel estimation, implemented with orthogonal matching pursuit (OMP) and basis pursuit (BP) algorithms, has impressive performance gains over alternatives that do not take advantage of the channel sparsity, for underwater acoustic (UWA) communications. We in this paper compare the performance and complexity of three popular BP algorithms, namely l1_ls, SpaRSA, and YALL1, using both simulation and experimental data for underwater orthogonal frequency division multiplexing (OFDM) systems with both single and multiple transmitters. We find that all BP solvers achieve similar block-error-rate performance, considerably outperforming OMP. In terms of complexity, both SpaRSA and YALL1 reduce the runtime by about one order of magnitude relative to l1 ls, catching up with OMP. The efficient BP solvers such as SpaRSA and YALL1 are thus appealing to be implemented in real-time underwater OFDM modems. [C95]

"Progressive inter-carrier interference equalization for OFDM transmission over time-varying underwater acoustic channels"

In this paper we propose a progressive receiver for orthogonal-frequency-division-multiplexing (OFDM) transmission over time-varying underwater acoustic (UWA) channels. The progressive receiver is in nature an iterative receiver. However, it distinguishes itself from existing iterative receivers in that the system model for channel estimation and data detection is itself continually updated during the iterations. When the decoding in the current iteration is not successful, the receiver increases the span of the inter-carrier interference (ICI) in the model and utilizes the currently available soft information from the decoder to assist the next iteration which deals with a channel with larger Doppler spread. Numerical simulation and experimental data collected from the SPACE08 experiment show that the proposed receiver can self adapt to channel variations, enjoying low complexity in calm channel conditions while maintaining excellent performance in tough channel conditions. [C96]

"Application of high-precision two-way ranging to the spacecraft navigation"

The application of precision two-way ranging to orbit determination with relatively short data arcs is investigated for the interplanetary mission. Analysis of the X-band radiometric data acquired from the spacecraft indicated that assuming under good signal conditions sub-meter precision and 10-m ranging will be achieved. A range data filtering. The accuracy of the spacecraft orbit solution obtained with X-band Doppler and precision ranging were found to be consistent with simple theoretical calculations, which predicted that angular accuracies of a few nrad were achievable. The navigation accuracy achieved with precision ranging was marginally better than that obtained using Delta-DOR (Delta-VLBI). [C97]

"Further analysis of the modulation of high frequency radar spectra due to sea-induced antenna platform motion"

The scattering of high frequency electromagnetic waves from the ocean surface is considered for the case of the radiation source being a vertical pulsed antenna mounted on a floating platform while the receiving antenna is fixed on the shore. This represents a small extension to an earlier analysis by Walsh in which both the transmitting (TX) and receiving (RX) antennas were co-located on a floating platform and the effect of the sway was accounted for in the ocean cross section. It is known that additional features appear in the Doppler spectrum when the RX and TX antennas are permitted to sway slowly, and here a similar result is shown when only the TX antenna moves. It is seen in this case that the magnitude of the additional spectral features is reduced as compared to the case when both antennas are moving. As a motivation for continuing analytical work, a preliminary field result is depicted. [C98]

"Water profile navigation with an Acoustic Doppler Current Profiler"

A novel navigation method is introduced using water current profiles measured by an Acoustic Doppler Current Profiler (ADCP) mounted on a moving vehicle. These current profiles are combined with measurements of vehicle attitude and depth to simultaneously estimate the local current and the vehicle velocity. This velocity estimate can be integrated directly to give a position estimate, or it can be fused with measurements from other navigation sensors, such as an Inertial Navigation System (INS), Long Baseline (LBL) or Ultra-Short Baseline (USBL) acoustic tracking system. The method allows an underwater vehicle to maintain an estimate of its global position throughout all phases of its mission, including descent and ascent. [C99]

"The use of HF radar surface currents for computing Lagrangian trajectories: Benefits and issues"

Surface coastal currents mapped by a pair of high frequency ground-wave radars (HFR) have been used to predict Lagrangian trajectories in the proximity of Heron Island (Capricorn Bunker Group, Great Barrier Reef, Australia), and to compare with the current data measured by an Acoustic Doppler Current Profiler (ADCP) at three mooring stations. Overall the HRF and ADCP absolute current speeds showed a difference less than ±0.15 m s-1for 68% of the observations. A good agreement between HFR (at a depth of 1.5 m) and ADCP (at a depth of 5.5 m) data were observed for the u-component (cross-shelf) which presented a stronger tidal signal, while a poor comparison was found for the v-component (north-south) more influenced by the south-easterly and northerly winds. The HFR allowed inclusion of not only the temporal, but also the spatial current variability in the tracking computation. This proved to be crucial because the Lagrangian trajectories were very sensitive to the starting position and time in the studied area, where the currents exhibit a large spatial variation imposed by tides, winds, large scale circulation and topography. One challenge in applying HFR data for Lagrangian tracking consists of estimating the missing values and including the effects of small scale fluctuations. [C100]

"Case study of phytoplankton blooms in serangoon harbor of Singapore"

A recent algal bloom in the East Johor Strait has led to the damage of marine life in the water channel. This has lead to heavy economic losses to the fish farms located along the water channel. There is a desire to study and be able to predict the occurrences of algal blooms so that their effects on the fish industry can be reduced. Many factors such as weather patterns, tidal conditions and nutrient content in the water contribute to the extent of the eutrophication. This paper describes the design of experiments carried out in the East Johor Strait to study the dynamics of algal blooms. Physical and biogeochemical water column sampling were carried out using Acoustic Doppler Current Profilers (AD-CP) and a Conductivity, Temperature and Depth (CTD) probe that could measure various water quality parameters such as Turbidity, Salinity, pH level, Dissolved Oxygen (DO) and Chrolophyll-a concentration. Water samples from 1 m below the surface and 1 m above the channel floor were collected using Niskin Bottles. The water samples were sent to chemistry labs to test for the concentrations of various nutrients such as Ammonium, Nitrite, Nitrate and Phosphorus. Additional sampling was done using an Autonomous Underwater Vehicle (AUV) that was capable of measuring water quality parameters similiar to those measured by the CTD. The collection of the water sample data were meant to coincide with the spring and neap tides. The schedule is important to align with major phases of astronomic tide driving forces, such as flood tide, ebb tide and the transition between the two. Comparison can then be made to attempt to understand the various factors that contribute to algal blooms in the water body. Collected biogeochemical data can be used to improve water quality forecasts as well. [C101]

"Imaging velocimetry of range motion based on "moire Doppler effect" and frequency estimation"

A novel method for imaging velocimetry of range motion distribution is proposed. It is based on what we call "moire Doppler effect" and temporal frequency estimation on each pixel. We project a grating pattern translating with a constant speed. Every point on the object illuminated by it returns a sinusoidally varying intensity, and is

detected by the Correlation Image Sensor (CIS). In this setup, a range motion of the object causes a frequency shift of the light intensity proportional to its velocity. This is the "moire Doppler effect." The CIS can produce the Fourier coefficients of incoming light at up to three frequencies. From them, the frequency shift can be calculated by using the exact algebraic method, and thus the velocity can be estimated in each pixel. Several experiments were done to quantify the moire Doppler effect. A real-time measurement system was constructed which showed a feasible performance of the imaging velocimetry of range motion. [C102]

"A Novel Synchronization Technique Based on Kalman Filter for TD-SCDMA"

TD-SCDMA is the 3G mobile communication air interface specification released by International Telecommunication Union (ITU). As a TDD system, synchronization in TD-SCDMA is a key influence factor of Quality of Service (QoS). Considering that mobile communication systems work in the environment of serious interference, multipath propagation and Doppler effect, it is difficult to establish synchronization. In this paper, we propose a novel synchronization technique based on Kalman filter which can smooth most of the channel interference. The experimental results indicate that this technique can short the time taken during synchronization and improve QoS obviously. [C103]

"Localizing Stationary Target in Distributed Network Environment"

After discussing the drawbacks of localization algorithm for stationary or slow speed target in WSN, new algorithm based on precise propagation time delay measurement is introduced. Mechanisms for time sampling and TOA measuring procedure are described in detail, which make the measurement error equivalent to CPU instruction cycle. The effect of NLoS is considered in location calculation procedure, which leads to the adoption of variance weight method. Through simulation, the localization precision can reaches 10m in LoS environment and 20m for NLoS. [C104]

"An enhanced spectrum method for GPS weak signal acquisition"

FFT and IFFT are used to achieve two-dimension parallel acquisition for GPS signal. But peak of correct result is declined because of frequency resolution and navigation data transition and it results in error detecting. A method in frequency domain was proposed to ensure that the most probable Pseudo Random Noise (PRN) code phase and Doppler frequency could be detected. As the simulation showed, the method could eliminate jitter and relocate the correct peak under a Weak Signal Environment (WSE). [C105]

"Micro-doppler extraction of vibrating target based on dual-channel ATI technique in SAR"

Aiming at extracting the time-varying micro-Doppler feature of the ground vibrating target within ground clutter environment, the method of micro-Doppler extraction based on dual-channel ATI technique is presented. The ATI technique is utilized to suppress the ground clutter, and preserve the interferometric signal of the vibrating target in the raw data domain, which is presented as a straight line along the azimuth direction. According to this feature, we can find out which range cell the signal locates at, and then by taking the time derivative of its phase, the micro-Doppler modulation can be obtained. Compared to the single-channel situation, there is no need to compensate for the Doppler shift caused by the radar's translation in advance, and we can obtain the micro-Doppler feature induced by the vibration in any direction, which will help to reduce the computation burden and improve the target detectability. Simulated results verify the validity of the proposed method. [C106]

"An application of system identification theory to the ultrasound Doppler image processing system"

Currently, dual channel blood flow measurement using Doppler ultrasound systems appears in the field of diagnostic ultrasound. Such systems have a problem of velocity-range limitation. To address this problem, we use a mathematical model obtained by system identification. This model inputs the electrocardiographic (ECG) waveform and outputs the short time Fourier transform (STFT) image parameters. With this model, we developed a system that fills the 100 ms gap. Simulation results also demonstrate the effectiveness of the proposed method. [C107]

"Frequency and amplitude estimation in microwave Doppler signal and its application to car driver's foot motion estimation"

Aiming at car driver's motion estimation, foot motion estimation while no pedal operations has been investigated. We use a sensor utilizing Doppler effect in a microwave to detect motion of foot. Sinusoidal wave obtained from the sensor, we estimate time-varying frequency and amplitude of the wave by state space modeling approach with particle filter for state estimation. Furthermore, we devised a novel model for estimating position and velocity of the foot by incorporating pedal signal. Several experiments with Linear sliding machine for obtaining

fundamental property and foot pedal have been reported. [C108]

"Implementation/acceleration of vectorized acoustic source localization algorithms on the CELL multi-core processor"

This paper describes the optimized design and implementation of sonar signal processing algorithms (matched filter) on the CELL multi-core processor. The algorithm is modified to achieve maximum parallelism to enhance time performance on the multi-core platform. In this proof-of-concept effort, we show a factor of 10 speedup by parallelizing the matched filter code on 16 separate computing nodes on the CELL processor for broadband matched filter implementation. This demonstration of considerably faster signal processing capability should be of substantial interest to the signal processing community in general, and the oceanic engineering community in particular. [C109]

"Doppler aided blind source separation of communication signals"

Blind Source Separation (BSS) algorithms have been used in previous literature to mitigate, among other problems, co-channel interference in wireless communication systems. Algorithms developed for this purpose must not only have the capability of working in the complex domain but also be able to take into account non-stationarity of sources and sensors. Analysis of commonly used source separation algorithms shows that the performance deteriorates when the sources are close to each other, which increases the error probability in blind beamforming. In this paper, by accurately modeling the source position vectors and incorporating a Doppler shift in the mixing model, we show that the separation performance of BSS algorithms considerably increases. This technique can be further extended to tracking of the sources if the Doppler shift is assumed to be constant. Demonstration of the efficacy of the algorithm on communication signals has also been studied. [C110]

"Characterization of wireless communication channel based on scattering function"

Almost all communication channels introduce dispersive or multiplicative disturbances which give rise to dispersive effects known as time selective fading and frequency selective fading. Scattering function can be used to characterize this channel in terms of time delay profile and Doppler spread. Doppler spread gives a measure in frequency variation where it introduces time selective fading. Frequency selective fading on the other hand is the effect of time delay spread in frequency domain where certain frequency components in the received signal spectrum have greater gains than the others. Channel scattering function is determined based on the ambiguity function and it is derived based on the Fourier transform relationship of the cross bilinear. Based on periodogram of the scattering function, time delay spread and Doppler spread can be determined. PSK and QPSK signals having duration of 0.512 sec are used for this purpose. [C111]

"A wireless microwave sensor for remote monitoring of heart and respiration activity"

The aim of this paper is to present a new microwave contactless sensor for heartbeat and respiration activities. The system is operating on 9 GHz. It's composed of two parts: a hardware one based on Doppler radar with a Digital Multimeter, and a software one based on the acquisition of the signals and the separation of the 2 informations of heartbeat and respiratory signals using simple filtering method with Labview. [C112]

"Uplink interference identification for low earth orbiting (LEO) search and rescue satellites"

NOAA (National Oceanic and Atmospheric Administration)-LEO environmental satellites provide continuous coverage of Earth, supplying high-resolution global meteorological, oceanic and space observation data. In addition, these satellites are part of the international COSPAS-SARSAT program, which aides search and rescue teams worldwide. The USA segment is referred to as SARSAT (Search and Rescue Satellite Aided Tracking) system, designed to provide distress alert and location data in order to assist on search and rescue operation. SARSAT uplink detects and locates distress beacons (406 MHz) activated at distress location. System calculates the location of distress event using Doppler processing techniques. Processed data is repeatedly retransmitted through SARSAT downlink to Local User Terminals (LUT) when satellites are in view and also stored in on-board memory. The uplink interference on 406 MHz beacon frequency can result in masked bursts or no solutions received at LUT, consequently no data provided about distress location. The method applied on uplink interference detection and impact on system operation is presented in this paper. [C113]

"Space-time compressive sampling array"

We propose a space-time compressive sampling (STCS) array architecture by exploiting the sparsity in the angle and frequency domain. Two Doppler-DoA estimation methods are designed to efficiently reconstruct the two-dimensional (2D) sparse signal. The STCS array together with the 2D reconstruction methods allow for accurate

yet low-power location and speed estimation of moving targets. The proposed methods are not only tested by simulations but also using an experimental ultrasonic sensor array setup. [C114]

"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. [C115]

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"A maximum entropy framework for statistical modeling of underwater acoustic communication channels"

Based on a method of inductive inference known as the principle of maximum entropy, a time-varying underwater acoustic channel model is derived. The resulting model is proved to be consistent so that it only relies on the available knowledge of the environment to model. While requiring only a few parameters (e.g. channel average power and Doppler spread), it is shown through fading statistics and bit error rates measurements that accurate channel impulse responses can be obtained for communication applications. The Matlab code of the proposed model is available at http://perso.telecom-bretagne. eu/fxsocheleau/software. [C117]

"Turbo detection for mobile MIMO underwater acoustic communications"

Turbo detection for mobile transceivers is proposed for high data-rate single-carrier multiple-input, multiple-output (MIMO) underwater acoustic (UWA) communications. The proposed detection scheme employs a MIMO Doppler preprocessor and a low-complexity MIMO turbo linear equalizer (LE). The Doppler preprocessor estimates the motion-induced Doppler shift and compensates it via symbol resampling. The preprocessed signal is then detected by the MIMO turbo LE that utilizes soft-decision minimum mean square error (MMSE) linear equalization with maximum a posteriori probability (MAP) channel decoding, thus improving the detection performance iteratively while maintaining low complexity. The proposed turbo detection scheme has been tested by field trial data collected by the SPACE08 experiment near Martha's Vineyard, Edgartown, MA, in 2008. Excellent detection results are achieved for 2-by-8 MIMO with mobile speed around 3 knots. [C118]

"The high frequency underwater acoustic channel"

Underwater acoustic communication systems usually operate at frequencies below 40 kHz, which have low absorption rates that in turn enable long link distances. These links suffer from channel effects including multi-path, fading and doppler. Cellular and multi-hop strategies have been proposed that would use shorter path lengths, so would tolerate much higher absorption rates, and hence could work at higher frequencies. The short-range, high-frequency channel is not well documented. This paper reports on initial measurements of the short-range, high-frequency underwater acoustic channel. Re-examining the basic theory indicates that the short-range high-frequency channel should not suffer from the same multi-path or fading issues as the longer-range lower-frequency channel in common use. Initial collected and processed field data supports this conclusion. The implication is that relatively simple modems should provide adequate performance on the high-frequency channel. Coupled with large available bandwidth, these high frequency modems should offer data communication rates well in excess of those generally available. [C119]

"Time domain numerical simulation of microwave backscattering from sea surface for radar remote sensing"

Time domain numerical simulation technique has been developed to understand microwave backscattering mechanisms and evaluate sea surface observation methods. Backscattering coefficients and Doppler spectra can be obtained by this simulation technique. Physical optics approximation is applied to calculate scattering electric fields. The validity of the simulation has been verified by comparing with the results of the experimental basin. The results indicate that the simulation technique is effective to calculate microwave backscattering from the water surface changing in time. As an application of the simulation, we have simulated microwave backscattering

with a pulse Doppler radar to evaluate sea surface observation methods. Radar images of backscattering coefficient and Doppler velocity have been generated. The results of the simulation show that radar images of Doppler velocity are more effective than images of backscattering coefficient for sea surface observation. [C120]

"Adaptive transmitter weight design for clutter suppression"

The objective of this paper is to develop methods for enhanced clutter/interference suppression by redesigning the transmit pattern in the spatio-temporal domain to emphasize the target response and de-emphasize the clutter response. In this context, traditional adaptive transmitter weight design in the spatial domain to generate multiple spatial nulls is extended to both the spatio-temporal domains to suppress certain Doppler frequencies as well. Analysis of this approach and preliminary simulation results are included in this paper. [C121]

"Maximum likelihood blind deconvolution for sparse systems"

In recent years many sparse estimation methods, also known as compressed sensing, have been developed for channel identification problems in digital communications. However, all these methods presume the transmitted sequence of symbols to be known at the receiver, i.e. in form of a training sequence. We consider blind identification of the channel based on maximum likelihood (ML) estimation via the EM algorithm incorporating a sparsity constraint in the maximization step. We apply this algorithm to a linear modulation scheme on a doubly-selective channel model. [C122]

"Sea surface current mapping by Radar Doppler Current Profiler"

A Radar based method has been developed to measure surface currents directly. Applied techniques, results, capabilities and applications of this method will be discussed. [C123]

"Modeling VHF air-to-ground multipath propagation channel and analyzing channel characteristics and BER performance"

In this paper, a VHF air-to-ground multipath propagation channel model is proposed and channel characteristics and BER performance are analyzed. A tapped-delay line filter model with time-varying coefficients is used to model the channel. The taps represent signals with delay corresponding to their relative propagation time. Each delayed signal is modulated in amplitude and phase by independent baseband random functions of time that produces Rayleigh fading. Doppler frequency shift is also incorporated in the channel model. Channel characteristics are analyzed in terms of power delay profile, Doppler frequency shift and burst error occurrence probability. Finally, BER performance of the channel is analyzed using computer simulation and effect of interleaving and error correcting code on the performance is observed. [C124]

"An Empirical Doubly-Selective Dual-Polarization Vehicular MIMO Channel Model"

To optimally design vehicle-to-vehicle (VTV) communication systems, it is necessary to first fully characterize the response of the communications channel. Significant research attention has been focused on describing channels for various scenarios with both analytical and statistical models based on empirical data (empirical models). This paper extends this field by proffering a doubly selective (i.e., time- and frequency-selective) channel for VTV 2x2 multiple input multiple output (MIMO) systems where the pair of transmit and the pair of receive antennas each have orthogonal polarizations. The proposed empirical model is based on collected channel data in an urban setting and is described by a four-basis function Doppler spectrum for each delay tap. For verification, it is demonstrated that the modeled channel closely matches the collected channel data. [C125]

"Effects of Side Information on Complexity Reduction in Superimposed Pilot Channel Estimation in OFDM Systems"

A novel, reduced complexity iterative channel estimation algorithm for OFDM systems using superimposed pilots is proposed. It utilizes past channel estimations of double correlated channel as a side information to reduce number of iterations. Since pilots are available at all positions of the time-frequency OFDM grid in superimposed technique, the performance of the channel estimation does not degrade because of the variations of the fast fading channel between two pilots. On the other hand since no subcarrier is reserved for channel estimation purpose, superimposed pilot technique leads to improved spectral efficiency comparing to in-band OFDM pilots. However interference from data carrying signals made channel estimation more complex. In this paper, Least Square (LS) channel estimation followed by two dimensional Wiener filter for reducing OFDM symbol interference is done iteratively to achieve the Minimum Mean Square Error (MMSE). Small variations of the channel over each OFDM symbol duration are neglected due to a high data rate, but the values between different OFDM symbols are assumed correlated. The channel is modeled as a double selective, i.e. both

frequency selectivity channel and Doppler shift are taken into consideration. Past channel estimates are used as side information for the present channel estimation to improve the forthcoming channel estimation at the first iteration and reduce the total number of iterations required. [C126]

"3G HSPA for Broadband Communications with High Speed Vehicles"

This paper presents a proof of concept for a continuous superior quality Broadband Vehicular communication system enabled through 3G HSPA in very high speed mobility scenarios (beyond 300 km/h), suitable for telemetry applications in trains, emergency vehicles and motor sport events. The system is quite unique as radio transmission for telemetry services under extreme speed conditions requires not only superior Quality of Service guarantees but must also be able to satisfy these performance requirements under extreme and arbitrarily demanding environments as are typical during any e.g. Formula 1 racing event. Issues related to the Doppler Effect and abrupt changes of the serving HSPA channel are analyzed and addressed here. Conclusions show how a special 3G network design can help to mitigate Doppler Effect impacts. The processes carried out by both the UE and the network to cope with this high speed environment has proven essential to sustain the service in these conditions, as it has the use of suitable receiver Types in the UE. Using derived guidelines and conclusions, a unique system has been developed, built and tested in a Formula 1 environment with very promising results. [C127]

"Design and Simulation of Narrowband Indoor Radio Propagation Channels under LOS and NLOS Propagation Conditions"

This paper deals with the design and simulation of narrowband indoor propagation channels under line-of-sight (LOS) and non-LOS (NLOS) propagation conditions. We propose a reference channel model assuming that the scatterers are uniformly distributed in the two-dimensional (2D) horizontal space of a room. We derive analytical expressions for the probability density function (PDF) of the angle-of-arrival (AOA), the Doppler power spectral density (PSD), and the temporal autocorrelation function (ACF). We derive a sum-of-cisoids (SOC) channel simulator from the reference model. It is shown by numerical results that the statistical properties of the SOC channel simulator match very closely with the ones of the reference model. It turns out that our indoor reference model can be approximated by an SOC channel simulator with reduced realization expenditure. The resulting SOC channel simulator allows us to evaluate the performance of mobile communication systems in indoor environments by simulations. It is demonstrated that the generalized method of equal areas (GMEA) and the basic Riemann sum method (BRSM) are efficient parameter computation methods for the design of SOC indoor channel simulators. [C128]

"Modified Capon and APES for spectral estimation of range migrating targets in wideband radar"

In many radar and sonar applications, the narrowband signal assumption is not respected. To preserve good performance detection and/or parameter estimation for wideband signal, it is necessary to develop appropriate signal models and processing algorithms. More specifically, the range migration of the target during the processing interval induces a coupling between range and Doppler that is not taken into account by standard algorithms such as the Capon and APES methods. In this paper, we present a modified and enhanced version of the Capon and APES algorithms for a wideband signal model. These two algorithms are adaptive filters designed for spectral estimation. Performance of the wideband-Capon and the wideband-APES algorithms are studied via numerical simulations. [C129]

"A novel method to detect rotor blades echo"

In this paper, the effect of the main rotor of an armed helicopter on radar return signal and its modulation condition are considered. After analyzing references and experimental data, this paper proposes a new method based on inherent modulation in main rotor echo. This method is able to enhance the probability of detection. The simulation is performed for both simulated and practical echo signal. Simulation results confirm that our proposed scheme is effective. Moreover, a new domain for distinguishing and measuring the rotation feature of a rotary target is proposed. This paper is based on practical experiments (rotation domain). [C130]

"The instagram: A novel sounding technique for enhanced HF propagation advice"

Modern OTHR systems make extensive use of propagation support information for parameter setup advice. A novel method for increasing dimensionality and temporal resolution of this advice is demonstrated here using an instantaneously wideband waveform on a one-way path. A composite of pseudo-randomly phased, discretized, massively multi-channel signals is synthesized through a simple summing scheme. Upon reception the composite is rapidly processed in the frequency domain to produce channel scattering information simultaneously across the band. The channels may be collapsed in the Doppler domain to reduce to conventional oblique

ionograms. Total integration time required to produce the full Doppler ionograms, even with low transmit powers, is reduced over conventional methods by up to three orders of magnitude leading to the term `Instagram'. The technique is implemented on an oblique sounding system that provides the necessary direct digital arbitrary waveform generation and reception capability. A result from the initial field trial is provided. [C131]

"An algorithm of target tracking based on adaptive LFM waveform design"

An algorithm of target tracking based on adaptive waveform design was proposed with the help of Doppler estimation theory. According to the analysis of the ambiguity function for liner frequency modulation signal, a model between ambiguity function of the signal and Cramer-Rao bound of time and frequency delay was built. This paper realized the target tracking by adjusting the frequency width and pulse width using Kalman filtering method. With the same signal energy and noise environment, the simulation results show that the proposed adaptive tracking algorithm has a better tracking precision than the method which makes use of the constant parameter. [C132]

"Study on chaotic sequence and RS sequence for underwater communication"

Underwater acoustic communication channels are generally characterized as seriously time-space-frequency variant channels with strong multi-path interference, limited bandwidth, severe environment noise and Doppler effect. In underwater acoustic hop frequency communication system, every user's information is modulated by a special code on the transmitter, the information will be demodulated by the same code at the receiver. The code mentioned here is pseudo-random sequence, the spectrum of the signal will be expanded. Performance of pseudo-random sequence is directly related to system performance, therefore, pseudo-random sequence is a key point of implementing a hop-frequency communication system. This paper is based on the analysis of acoustic communication channel, some common sequences are evaluated, and simulation is made to compare the performance of chaotic sequence and RS sequence. [C133]

"Study of delay-delay rate 2-D correlation in satellite observation of VLBI"

Due to the self rotation and revolution of the earth and the satellite moving comparatively, the delay rate changes intricately and that affects correlation result when we use VLBI to detect Satellite. To solve the problem, a new method of delay-delay rate 2-D correlation is proposed which based on time-frequency 2-D correlation. This method applies ambiguity function calculation of time-frequency analysis theory to VLBI. The result of Doppler shift equal to the product of delay rate and the frequency of satellite transmitted was proved in this article, so the method of delay-delay rate 2-D correlation is put forward refer to the theory of time-frequency 2-D correlation, and this method can get the value of target's delay and delay rate by peak value search after ambiguity function calculation of two stations' received signal. Simulation results have indicated that this method can detect value of the delay and the delay rate at the same time, and it's useful for VLBI to detect Satellite. [C134]

"Cramйr-Rao Bounds for a Laser Doppler Anemometer: The effect of the particle trajectory via the measurement volume"

This paper derives the Cramer-Rao Bound for the frequency estimation of the noisy Doppler Burst Signal from the Laser Doppler Anemometry. The problem is solved by considering the effect of the particle trajectory via the measurement volume together with the dependency of the burst length on the Doppler frequency. The results provide an analytical expression for the lowest variance of the estimation of the Doppler frequency as a function of the direction of particle velocity relative to the fringe pattern. [C135]

"Performance Analysis of Alamouti Coded OFDM Systems over Rayleigh Fading Channels Correlated in Space and Time"

This paper deals with the performance analysis of Alamouti coded orthogonal frequency division multiplexing (OFDM) systems over time-varying multipath Rayleigh fading channels. In our analysis, we consider a physically more realistic channel, which can be correlated either in time or in space or even in both domains. We derive an analytical expression for the bit error probability (BEP), which describes the performance of an Alamouti coded OFDM system over fading channels correlated in space and time. It is shown that the derived BEP can be reduced to the known BEP obtained over fading channels correlated in time or space. The correctness of all theoretical results is validated by system simulations. The knowledge of the obtained theoretical results makes the BEP evaluation more straightforward and less time-consuming compared to simulations. Moreover, it allows us to discuss the effect of the maximum Doppler frequency and the antenna spacing on the system performance. [C136]

"Fractal modelling and analysis of flow-field images"

We introduce stochastic models for flow fields with parameters that dictate the scale-dependent (self-similar) character of the field and control the balance between its rotational vs compressive behaviour. The development of our models is motivated by the availability of imaging modalities that measure flow vector fields (flow-sensitive MRI and Doppler ultrasound). To study such data, we formulate estimators of the model parameters, and use them to quantify the Hurst exponent and directional properties of synthetic and real-world flow fields (measured by means of phase-contrast MRI) in 3D. [C137]

"Study on listmode OSEM reconstruction including image-space resolution recovery techniques for Compton camera"

Although Compton camera may has a great potential as next generation imaging modality comparing to SPECT and PET, its fully three-dimensional image reconstruction requires the considerable computational burden and the spatial resolution is suffered from the various physical phenomena arising during detection process. In this study, we investigated the accelerated statistical image reconstruction in which system matrix included a resolution recovery (RR) technique. We considered 3D Gaussian resolution model for the integrated angular and geometric uncertainties. The angular uncertainty is closely related to the limited energy resolution of the Compton camera and Doppler broadening and the geometric uncertainty is due to the segmented detectors. For RR, the 3D Gaussian resolution model is incorporated into listmode OSEM (LMOSEM) using image-space convolution operation. We investigated two different RR approaches: one (denoted by LMOSEM-RRF) is when the convolution is only performed in forward projection step, and the other (denoted by LMOSEM-RRFB) is when it is performed in both forward and backward projection steps. The simulation results showed that both RR approaches gave an improvement on spatial resolution for the resolution-degraded data due to both angular and geometric uncertainties. Although LMOSEM-RRFprovided better resolution than LMOSEM-RRFB, LMOSEM-RRFBcould still useful for low counting statistics in measurement. [C138]

"Phase-coded-linear-frequency-modulated waveform for low cost marine radar system"

This paper proposes a continuous waveform to realize low transmitted power in a Radar system. The proposed waveform utilizes a pulsed compression scheme based on phase-coded modulation and linear FM which combines the desirable properties of both types of modulation. This paper also verifies waveform operation under channel effects such as multipath and noise. We determine power optimization due to waveform compression gain for given system specifications and use correlation values to detect both unambiguous range and Doppler shift. With a pre-determined noise and Doppler threshold, we can distinguish targets from sea clutter. Finally, we show the improvement in accuracy of elevation measurements by simulation when auto-correlation instead of signal strength ratios are used to determine target height. [C139]

"Space and frequency diversity for moving personnel spectrogram estimation"

In this paper we investigate the application of frequency and space diversity as a mean for providing a better understanding of the features of a target. For this purpose space diversity is exploited for developing a way for processing the information gathered through multistatic measurements of moving targets. The aim is to decompose and rearrange the gathered information, which can be of interest when the radar network is comprised of a multitude of devices. Processing appropriately angle-diverse spectrograms can actually help recovering side-effects due to the movement of the target, such as shadowing of characteristic features. Although in this paper the targets are moving persons, the presented technique can be applied to any class of targets. In addition the effects of the variation of the carrier frequency are also investigated. This allows us to understand the potential of having an increased discrimination of the features and to compare the effects of the proposed technique. [C140]

"Signal modelling for ground moving target in complex image domain of multi-channel SAR"

For along-track multi-channel synthetic aperture radar (SAR), this paper proposes a novel ground moving target signal model in the high-resolution complex image domain. It is shown that moving targets can be divided into three types according to the 2D motion distribution and the SPP approximation conditions. Moreover, a single target can be split into two targets in the image. All types of targets will have the same Doppler interferometric effect along multichannel images, which is decided by the target's ambiguous Doppler frequency. Furthermore, with our derived signal model, the complex image properties, i.e., amplitude reduction, azimuth shift, azimuth defocus, range blur, 2D slant, second-order phase modulation, split, interferometry and the effects of 2D accelerations are analyzed for airborne and spaceborne SAR, respectively. Finally, some experimental results are also provided to demonstrate the effectiveness of the proposed signal model and analysis. [C141]

"Characterization of Doppler effects in the context of over-the-horizon radar"

This paper addresses the problem of the characterization of Doppler effect of maneuvering targets in the context of over-the-horizon radar. The received signal has a complex Doppler structure which is composed of several arrivals, each corresponding to a particular path. In essence, it consists of several close time-frequency components with non-linear signatures in the time-frequency domain. The nonlinearities are the projections of the target's motion vectors on the propagation paths. Estimating the time-frequency contents of all paths reveals the Doppler effects characterizing the target's trajectory. Analysis of such signals in the presence of strong clutter requires effective non-stationary signal processing techniques. In this paper, we propose a new technique based on local analysis of the phase information using warped high-order ambiguity function. The results depict resolvable multipath estimates which are very close to the ground truth. [C142]

"Performance bounds on MIMO radar with optimized coded constant modulus waveforms"

A multiple-input, multiple-output (MIMO) radar system uses multiple, spatially diverse transmitters and receivers with separable, independent waveforms with the goal of enhancing resolution and, thus, improving performance. Key to the achievement of these performance benefits is the degree to which the transmitted waveforms may be separated on receive, e.g. the correlation properties amongst the waveforms. A previously defined correlation metric useful for designing "good" waveforms is simplified and its global minimum prescribed for M coded constant modulus waveforms each consisting of N chips and shown to be equal to M-1 (independent of the number of chips). The theory is validated using random phase waveforms as well as optimized waveforms using a previously defined iterative procedure ("CAN"), which is shown to effectively achieve the derived minimum bound. An important consequence of this large level of correlation residue for an optimal waveform set when used to perform a ground moving target indicator (GMTI) function in an airborne radar observing distributed clutter is that the rank of the resulting MIMO interference covariance is increased beyond that of an idealized orthogonal waveform set leading to significant degradation in the clutter mitigation performance, as shown through simulation. An approach to mitigating this effect through the use of partially optimized waveforms tailored to the scenario of interest is demonstrated to achieve the performance of an idealized orthogonal waveform set. [C143]

"Joint channel and Doppler estimation for multicarrier underwater communications"

Underwater wireless communications are subject to multipath propagation and Doppler effects. In the receiver side, it is necessary to estimate both Doppler and channel parameters in order to compensate for their effects in the transmitted signal. In this paper, in the OFDM (Orthogonal Frequency Division Multiplexing) context, we derive a new estimation scheme based on the resolution of two harmonic retrieval problems. Unlike standard methods, data resampling and estimation of residual carrier frequency offset are avoided. The efficiency of the proposed scheme is evaluated by means of simulations. [C144]

"Passive bistatic WiMAX radar for marine surveillance"

In this study we investigate the feasibility of using passive bistatic radar to exploit WiMAX communication signals as transmitters of opportunity for marine surveillance. The range and Doppler characteristics of such a system are first assessed through ambiguity function analysis on a typical set of WiMAX data transmission waveforms. Theoretical simulations are then used to investigate the ability of passive WiMAX radar for detecting marine vessels within three busy shipping areas in the UK, and in the presence of noise and interference signals. The initial analysis shows a range resolution of 5.6 m is achievable. Additionally, the simulations demonstrate specific scenarios where WiMAX radar may be used as a low cost surveillance device for detecting both small and large marine vessels in port areas and open waters. [C145]

"High density FPGA based waveform generation for radars"

Various modulation techniques are usually utilized to enhance the radar performance, or to add more capabilities to the radar that otherwise would not have been possible. Digital generation methods of frequency modulated continuous wave signals include direct waveform synthesis and frequency synthesis. The implementation of waveform generation and upconversion method are described in this paper with a simplified digital implementation technique using FPGAs (Field Programmable Gate Array). The design follows a systematic approach following steps of timing generation from external encoder, baseband modulated waveform generation, upconversion of the waveform to intermediate frequency, filtering and finally frequency synthesis using external DDS (Direct Digital Synthesizer). The design is also capable of generating BITE waveform for test checking in the system. Our design is capable of generation of waveform for stationary as well as non-stationary radars. For non-stationary radars, the waveform is so generated that the doppler effect due to the movement of the radar is

compensated. The paper explains more on this. This work mainly focuses on the fact that the total design has been implemented on a single FPGA and the implementation solution utilizes the efficient FPGA resources so as to meet the timings in crucial applications. Moreover, the paper enhances the features of the design with simulation and real time results used to validate the design. [C146]

"Multipath Doppler signatures from targets moving behind walls"

Detection, localization, and tracking of moving targets are highly desirable in through-the-wall sensing applications. Since the indoor environment is rich in multipath reflective sources, such as walls, floor, and ceiling, the received signal is composed of the direct path and several multipath arrivals. However, on occasions, the direct path to the target may be blocked as the target traverses behind large metallic objects such as file cabinets, etc. In such cases, multipath is the only observable return and can be exploited to detect and maintain tracking of moving targets. In this paper, we provide range-Doppler analysis of multipath arrivals for a diffuse target moving in an enclosed urban structure, which provides insight for the development of through-the-wall detection and tracking techniques based on multipath exploitation. [C147]

"Delay-Doppler radar tracking using moments"

In this paper, we propose a new blind approach for joint time delay and Doppler estimation. The delay and Doppler have been imposed onto a signal modeled as a Gaussian mixture contaminated by a non-Gaussian and non-stationary noise. The estimation is done using the moments of received signal. This procedure provides lower complexity and more accuracy relative to other rival methods such as Wigner-Ville (WV) and wavelet transform. In this method, the noise power is assumed unknown and estimated as well. Then, the proposed delay and Doppler estimation is used for radar tracking. Based on the estimated delay and Doppler, we track the position and velocity of the target. We compare the new approach against extended Kalman filter and particle filter tracker. [C148]

"Performance analysis of two-step algorithm in sliding spotlight space-borne SAR"

The focusing performances of two-step algorithm are analyzed in the paper. The convolution processing in two-step algorithm is detailed analyzed. It can be found that the operation can reduce the Doppler bandwidth effectively and overcome the alias of azimuth echo by making the residual Doppler bandwidth smaller than PRF. The formula of residual Doppler bandwidth is derived here. According to the formula, range large bandwidth signal has influence on the residual Doppler bandwidth, which is not considered in the traditional imaging algorithm. In the high resolution sliding spotlight space-borne SAR system, the residual Doppler bandwidth is affected largely by the wide range bandwidth. PRF should be larger than the residual Doppler bandwidth in two-step algorithm; else it will result in defocus of the SAR image. The computer simulation is given to verify the presented analysis. [C149]

"Novel side-view imaging of ships at sea for airborne ISAR"

For airborne ISAR imaging of ship targets at sea, both ship's three-dimensional rotation driven by waves in the sea surface and the relative tangential translational motion between the platform and the ship contribute to the imaging. At high sea-state and in long-range and low-altitude observation, the rotation component produced by the relative tangential motion between the radar and the ship is negligible. A well-focused side-view image of a ship formed by utilizing the ship's dominant roll and pitch is always available via a suitable imaging time selection scheme. However, the effect of the rotation due to the platform tangential motion with respect to the ship, which provides much top-view information of the ship, has to be taken into account in some cases, such as when the ship is observed in a relatively close range. In these cases, the resulting image presents a mixture of the ship side-view and top-view that is less valuable than a pure side-view image for further classification. We present a ship side-view imaging method in this paper to solve this issue. The Doppler frequency derivative of each scatterer is shown to approximately only contain the height information and is estimated and utilized for the side-view image formation, with the use of 'CLEAN' technique and a concentration measure that is introduced to increase the estimation accuracy of the Doppler frequency derivative. For a short imaging interval, the Doppler frequency derivative is approximate to a constant chirp rate. The corresponding estimation reduces to a chirp rate estimation. The proposed method is verified by experiments on simulated data. [C150]

"Ultra-wideband forward scatter radar fence for maritime surveillance-Initial experimental results"

The work described in this paper is a continuation of previous analytical work that has progressed to an experimental phase. The paper discusses the development of an ultra-wideband (UWB), forward-scatter radar (FSR) system for the detection and (ultimately) automatic recognition of low reflectivity maritime targets. Here we present the concept, developed hardware and selected initial experimental results. A number of novel ideas have

been developed to reduce cost, size, prime power requirement, complexity and utilise the advantages of FSR operation. System benefits include increased target cross section (over conventional bi/monostatic radar), increased target detection capability, robustness to stealth targets, decrease in sea clutter effects from synthesis of extremely narrow beams whilst using omni directional antennas and sub-Hertz Doppler frequency measurement capability. The experimental work investigates the use of an UWB FSR fence for security, UWB propagation measurements, UWB sea clutter measurements at very low grazing angles, UWB spectral coverage and the synthesis of narrow beamwidth antennas using forward scatter pulse transmission. [C151]

"MIMO radar sparse angle-Doppler imaging for ground moving target indication"

We present in this paper a regularized sparse signal recovery algorithm, referred to as sparse learning via iterative minimization (SLIM), to provide ground moving target indication (GMTI) through multiple-input multiple-output (MIMO) radar angle-Doppler imaging. A slow-time modulation scheme with code division multiplexing is employed to achieve transmit diversity. In this way, we avoid the high correlation properties of orthogonal waveforms and the Doppler ambiguity that is encountered with Doppler division multiplexing schemes. After removing jammer and clutter effects using semi-unitary projections, we show that SLIM, using primary data only, is able to form sparse angle-Doppler images and to provide for accurate target localization. [C152]

"Range and Doppler walk in DVB-T based Passive Bistatic Radar"

This paper analyzes the effects of range and Doppler walk for a Digital Video Broadcast-Terrestrial based Passive Bistatic Radar of both simulated and experimental data. Range and Doppler walk cause energy dispersal in the correlation, thus the coherent integration time is limited by the bistatic velocity and acceleration. A method using the readily available Doppler information to compensate for the range displacement during integration due to non-zero bistatic velocity of target is described. By compensating and non-coherently adding several coherently processed intervals, the target signal to noise ratio is increased. [C153]

"Uplink array calibration via lunar Doppler-delay imaging"

Coherent arraying of transmitting antenna signals at a distant spacecraft provides an effective gain proportional to N2, where N is the number of antennas in the array. This technology is currently being developed for NASA's Deep Space Network (DSN) to provide greater range and data throughput for future NASA missions, including manned missions to Mars and exploratory missions to the outer planets, the Kuiper belt, and beyond. However, successful uplink arraying of X-band (~7.2 GHz) carriers transmitted by large 34 meter antennas separated by several hundred meters on the ground requires differential Doppler compensation and proper initial phasing to ensure coherent addition in the far-field of the array. This article describes a spacecraft-independent technique to phase-calibrate the array, where the calibration phases for two and three-antenna arrays are determined via lunar Doppler-delay imaging. This approach is required whenever the spacecraft range is large enough to render spacecraft-assisted calibration impractical due to long round-trip light times. The accuracy of the resulting calibration technique is evaluated, and long-term stability of the calibration phase-vector discussed in this article. [C154]

"Telecommunications relay support of the Mars Phoenix Lander mission"

The Phoenix Lander, first of NASA's Mars Scout missions, arrived at the Red Planet on May 25, 2008. From the moment the lander separated from its interplanetary cruise stage shortly before entry, the spacecraft could no longer communicate directly with Earth, and was instead entirely dependent on UHF relay communications via an international network of orbiting Mars spacecraft, including NASA's 2001 Mars Odyssey (ODY) and Mars Reconnaissance Orbiter (MRO) spacecraft, as well as ESA's Mars Express (MEX) spacecraft. All three orbiters captured critical event telemetry and/or tracking data during Phoenix entry, descent and landing. During the Phoenix surface mission, ODY and MRO provided command and telemetry services, far surpassing the original data return requirements. The availability of MEX as a backup relay asset enhanced the robustness of the overall relay plan. In addition to telecommunications services, Doppler tracking observables acquired on the UHF link yielded a highly accurate position for the Phoenix landing site. [C155]

"Cooperative communication for multiple satellite network"

When it comes to space communication networks, there are many different kinds of space vehicles that need to communicate with each other, in space as well as with ground terminals and air borne platform. Example: Geosynchronous Earth orbit (GEO), Low Earth Orbit (LEO) satellites and UAVs. There is an ever growing demand for higher data rates and minimal redundancy, with satellites and various space platforms travelling at high speeds relative to each other and relative to the ground establishing such links can prove to be a real challenge when Doppler Effect and line of sight (LOS) can play a significant role in SONET timing and

synchronization. As the number of users grows the space communication links need to address several types of coding and modulation. This paper analyzes the use of cooperative communication techniques for point-to-point and point-to-multipoint communication links. To this end we start with a simplified single relay model and proceed to analyze the multi-node scenarios. We will then apply the amplify-and-forward, decode-and-forward and coded cooperation protocols to the best case scenario to compute the efficiency and synchronization of the link. The single relay and multi-node scenarios are evaluated on the basis of the signal to noise (SNR) power received and inter channel interference (ICI). The intention is to demonstrate the theoretical performance by simulating outage probability versus spectral efficiency for different relaying protocols. Subsequently we will show the effect of cooperative communication on bandwidth utilization for mobile satellites and space platforms. [C156]

"A Pattern-Based Coordination and Test Framework for Multi-Agent Simulation of Production Automation Systems"

Production automation systems consist of many entities (like robots and shuttles) that interact in complex ways to provide the overall system functionality like product assembly. Multi-Agent Systems (MAS) can simulate these system entities and their interactions to better understand the system behavior according to production strategies and system configuration, which are otherwise hard to determine before their (costly) implementation. A main challenge is to coordinate the groups of agents effectively to reach a common production goal, e. g., fast and robust delivery on customer orders for assembling a set of products. In this paper, we introduce the pattern-based extension of the MAS-based manufacturing agent simulation tool (MAST) to support the simulation and evaluation of business processes in an assembly workshop: a layered coordination and test framework has been implemented and evaluated in cooperation with industry partners. Domain experts found the coordination patterns usable and useful to elicit their knowledge. The test framework allowed exploring the effects of production strategies on the system 30 times faster than with a real-world hardware workshop. [C157]

"Laser Doppler velocity measurement system"

The measurement of fluid velocity by laser Doppler Effect is the trend of the velocity measurement filed in recent years, the laser Doppler velocity measurement has the characteristics of high accuracy and non-contact, but due to the laser's restrict, this technique has not been widely used. This paper deduces the principle and computation of the laser Doppler velocity measurement in details and hopes this may offer some help to the concrete issue, such as the design of the flue's flow meter. [C158]

"An experimental study of squirrel cage fan rotor width on performance and velocity profiles"

This article reports an experimental investigation of the effect of fan width on performance and velocity profiles of a squirrel cage fan. Optimum rotor width to diameter ratio was 0.38 for present configurations which had the highest maximum total pressure coefficient and the highest maximum axial flow rate. This also means that it handled more flow in the same occupied volume. Maximum efficiency dropped with an increase in rotor width and therefore narrower rotors have higher efficiencies for a lower total pressure coefficient. A wider rotor has a flatter performance curve, higher efficiency in the operating range and a more uniform radial velocity around the rotor. For the four rotors under study, velocity components were measured by LDA across and around the rotor. The results showed that in the narrowest fan maximum flow out of the rotor exits near the cut off. Less flow in volute reduced secondary flow losses in this fan and therefore a higher efficiency ensued. [C159]

"Experimental Study on the Circulating Characteristics of the Return Particles in CFB and the Validity of the Particles to Desulphurization"

The cold-model experimental system that particles flow from the top of CFB reactor is set up to study the circulating characteristics of the particles in the reactor. In order to get further information about the particles distribution and interaction with air flow, the two-phase gas-particle flow and particle concentration in the tower are studied with the use of phase-Doppler particle dynamic analyzer (PDA) system. The effects of the operating parameters including the mass flow rate and the superficial gas velocity on the process of the particles return to the main flow were investigated. The definition of valid internal circulation is put forward in this paper to describe the contribution of the particle to the SO2removal reaction. The results showed that the concentration distribution tends to be right high and left low in the radial direction. In axial, more particles concentrated in the upper of the reactor, especially in the case of high superficial gas velocity. With the decrease of the superficial gas velocity, the maximum fallback length of particle and the average particle concentration increase quickly. While the valid particle concentration increases slowly. The quantity of valid particles increases a little. Sending the particle from the top of the reactor has little contribution to the SO2removal reaction. [C160]

"Effects of I/Q mismatch on measurement of periodic movement using a Doppler radar sensor"

In this paper, the effect of I/Q mismatch in a 5.8 GHz direct-conversion quadrature Doppler radar sensor detecting periodic movement is studied. The measured movement amplitude under specific I/Q amplitude or phase mismatch is affected by the residual phase, which is determined by the nominal distance from the target to the antenna. It was found that there exist optimal residual phases minimizing the degradation of detection accuracy caused by amplitude and phase mismatches. Experiments were conducted to verify the theory. [C161]

"Two-Dimensional Differential Demodulation for 64-DAPSK Modulated OFDM Signals"

A novel two-dimensional differential demodulation (2-D DD) algorithm, which exploits both the time and frequency dimensions by using the orthogonal frequency division multiplexing (OFDM) frame structure, was investigated for 64-differential amplitude and phase shift keying (DAPSK) modulated OFDM signals. Without changing the transmitter, the proposed algorithm based on graph attempts to search for a more confident bypass, probably containing multiple DD operations, to demodulate one 64-DAPSK symbol rather than conventional direct DD. In order to carry out the optimal path searching process, the soft decision metrics of the amplitude ratio and phase difference were derived by making use of a Gaussian approximation. Simulation results show that the proposed algorithm can obtain substantial performance gains with reasonable computational complexity for uncoded AWGN and frequency selective fading channels. In addition, it is advantageous to withstand the Doppler effect, which is hence suitable for high mobile (e.g., in a car or train) broadband wireless access (BWA) systems. [C162]

"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. [C163]

"Simulating Doppler components in the vehicle-to-vehicle communication channel"

Deep understanding of the Doppler spectrum components is an indispensable part to alleviate fading impairments in Vehicle Ad Hoc Networks (VANET). This paper presents a method to simulate the different Doppler components, incorporating vehicle speeds, environment and traffic. We hope this can serve as a building block for realistic simulation, and can be used to improve the reliability and robustness of wireless communications in VANET systems. [C164]

"Doppler sensor's measuring vehicle speed and traveled distance antennas"

The criteria of the microwave sensor of speed and traveled distance antenna choice are considered from the viewpoint of minimization of Doppler signal spectrum expansion. [C165]

"Enhanced gaseous natural convection from micro-scale fin structures using acoustic stimulation"

This paper investigates the effect of acoustic stimulation on natural convection heat transfer in micro-scale fin structures. Enhancement of heat transfer from electronic components enclosed within compact geometries is a key goal in thermal management. Among the techniques to enhance heat transfer, extended surface is a simple approach to achieve the goal. However, micro scale fin heat sinks have little effect on natural convection heat transfer. Previous work has shown that heat transfer via flow-induced vibration in a micro fin array can be enhanced, but only in a forced convection scheme with high flow rates. Acoustic stimulation has also been investigated in boiling and we extend this method of stimulation to enhance gaseous natural convection. The acoustic stimulation is generated using a speaker placed close to the micro fin array device. Waves of varying amplitude and frequency are generated and device surface temperatures recorded along with the speaker velocities, measured using Laser Doppler Velocimetry. The results obtained suggest that natural convection heat transfer can be enhanced using acoustic stimulation in micro-scale fin structures where the fins contribute negligible effect on overall heat transfer, and the enhancement varies with fin geometries. The results indicate that gaseous natural convection is feasible as a thermal management scheme in micro fin structures for low heat flux applications. Future works will be devoted to finding the resonance frequency of natural convection in micro-scale fin structures that can enhance heat transfer dramatically with little additional power consumption. [C166]

"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. [C167]

"Novel Way of Scalar Miss Distance Measurement"

In this letter a novel method of scalar miss distance measurement is proposed, which can keep high estimation precision even in the noisy background with very low signal-to-noise. What's more, the good performance is not accompanied with heavy computation load. Simulation results demonstrate the effectiveness and feasibility of the proposed method. [C168]

"A frame synchronization method for underwater acoustic communication on mobile platform"

In this paper, we propose a frame synchronization method for underwater acoustic communication on mobile platform. This new method involves transmitting signal based on hyperbolic frequency modulated (HFM) signal as a preamble of the frame, while the receiver uses a correlator which is matched to the transmitted signal. This method can provide us with good signal detection ability which is very important in underwater acoustic (UWA) channels, and can provide Doppler scale estimation for accurate synchronization. It can also provide multiple access capability for UWA communication network. We analyze and simulate the performance of the HFM signal. A contrast is made with the linearly-frequency modulated (LFM) signal compared to the LFM based method. The proposed method works with a robust correlation output of the Doppler Effect and is suited to handle the presence of dense multi-path channels. [C169]

"Fast electric field change pulses location technique"

Using both fast and slow electric field change sensors and field mill, multi-station observations on lightning flashes in Chinese Inland Plateau was conducted during the summer of 2004. All of the stations were synchronized by GPS with a time-resolution of ±50 ns. Using the different time of arrival (DTOA), a lightning radiation location technique, based on the fast electric field change sensor, was developed. Radiation pulses in the five intra-cloud (IC) lightning discharges which occurred on 20thAugust and cloud-to-ground (CG) lightning discharges which occurred on 16thJuly were analyzed. The results indicated that the technique developed could effectively locate the lightning radiation sources. Furthermore, the lightning discharges were compared with the Doppler radar data. Results showed that the radiation sources were well associated with the storm development. [C170]

"An Improved Method for Generation of Multiple Uncorrelated Rayleigh Fading Waveforms"

In this paper, an improved parameter computation method is proposed for generation of multiple uncorrelated Rayleigh fading waveforms. The improved method employs random Doppler frequency wobble for all individual sinusoids based on the original Exact Doppler Spread Method (MEDS), and when the random wobble amplitude is set to be an infinitesimal real value, the autocorrelation (ACF) of inphase (quadrature) components will converge to the ones of reference model exactly. Due to the ACF arithmetic errors of the inphase and quadrature components compensate each other over a determined domain, the ACF of complex waveforms almost the same to the generalized method of MEDS (GMEDS) but with random Doppler frequencies. Simulation results show that the proposed method is useful for the design of simulation models for diversity-combined fading channels, frequency-selective channels, and multiple-input multiple-output (MIMO) channels, moreover, it has close-form and simple expression for model parameters and can be directly used to simulating multiple uncorrelated Rayleigh fading waveforms with low model complexity and low computation costs. [C171]

"Doppler estimation for OFDM based Aeronautical Data communication"

The frequency spectrum is deemed to be a valuable estate. Mobile users specifically the high-speed platforms are dependent on connectivity from satellite systems. Orthogonal frequency division multiplexing (OFDM) in combination with dense encoding, offers a robust communication and spectrum compression. OFDM is sensitive to frequency shift. This results in intercarrier interference (ICI) and degrades bandwidth efficiency. High mobility platform, such as train and aircraft offer a challenging environment for increasing the spectral efficiency of the physical layer. This paper discusses the potential development of an Aeronautical Data Network (ADN) and its channel issues in particularly the high mobility and its effects of using an OFDM communication structure. OFDM ICI and frequency shift caused by the high mobility of the platform is investigated and potential methods are proposed. [C172]

"A novel approach to synthesize the range profile via predesigned stepped-frequency waveforms"

In stepped-frequency radar systems, the phase error due to target motion in each burst make range profiles blur. Conventional technology, such as motion compensation, requires velocity estimation to eliminate the distortion of the synthetic range profile. However, it suffers a major drawback, namely that it is difficult to achieve real-time accurate estimation of the velocity of the target. A novel technology is presented to achieve a focused target range profile via predesigned stepped-frequency waveforms. By applying a new stepped frequency waveform, HRRP of the target can be obtained by the Fourier transform without any other process. The simulation results demonstrate the effectiveness of the proposed technology. [C173]

"The effects of satellite's spin on doppler measurements"

This paper reports the regular variations of the satellite's spin frequency harmonics during SELENE lunar mission. When the antenna is loaded on a spin satellite, the satellite's spin frequency, fs, and its harmonics occur and become noise in Doppler measurements. In our project, because both of Rstar and Vstar have octagonal prismatic bodies, the 8th, the 16th and the 24th spin frequency harmonics are relatively stronger than the other ones. The three harmonics' amplitudes over the entire mission longer than one year varied with a period of 27.32 days (one sidereal month) clearly. Also a low pass filter is used to remove these spin frequency harmonics. Using the 24th spin frequency harmonic, a novel method of estimating the satellite's spin frequency with an accuracy of 10-4 Hz is developed. [C174]

"Statistical properties of the capacity of double Nakagami-m channels"

In this article, we have presented an extensive statistical analysis of the capacity of double1 Nakagami-m channels. The double Nakagami-m channel model has applications in keyhole channels and amplify-and-forward relay based dualhop communication systems in cooperative networks. We have derived exact analytical expressions for the probability density function (PDF), the cumulative distribution function (CDF), the level-crossing rate (LCR), and the average duration of fades (ADF) of the capacity of double Nakagami-m channels. Moreover, the influence of severity of fading on the statistical properties of the channel capacity has been studied. It is observed that an increase in the severity of fading in one or both links in dualhop communication systems decreases the mean channel capacity, while it results in an increase in the ADF of the channel capacity. Moreover, this effect decreases the LCR of the channel capacity at lower signal levels. The results presented in this paper also reveal that an increase in the maximum Doppler frequencies of the wireless nodes in a dualhop communication system increases the LCR of the channel capacity, while it has an opposite influence on the ADF of the channel capacity. The results presented in this article are useful for mobile communication system engineers for the design and optimization of dualhop communication systems. [C175]

"Channel estimation for MIMO-OFDM systems in Fast Time-Varying Environments"

A channel estimation algorithm for MIMO-OFDM systems in Fast Time-Varying Environments is proposed. The channel estimation function is based on the equivalent discrete-time channel taps or on the physical propagation channel parameters. To handle rapid variations of channels within a transmission block, we approximate the channel by a basis expansion model (BEM). Based on the Jakes process, an auto-regressive (AR) model of the BEM coefficients dynamics is built, making it possible to estimate and track the BEM coefficients using Kalman filter . Hence, the channel matrix is easily computed, and the data symbol is detected with free ICI . Our claims are supported by theoretical analysis and simulation results, which are obtained considering Jakes' channels wA channel estimation algorithm for MIMO-OFDM systems in Fast Time-Varying Environments is proposed. The channel estimation function is based on the equivalent discrete-time channel taps or on the physical propagation channel parameters. To handle rapid variations of channels within a transmission block, we approximate the channel by a basis expansion model (BEM). Based on the Jakes process, an auto-regressive (AR) model of the BEM coefficients dynamics is built, making it possible to estimate and track the BEM coefficients using Kalman filter . Hence, the channel matrix is easily computed, and the data symbol is detected with free ICI . Our claims

are supported by theoretical analysis and simulation results, which are obtained considering Jakes' channels with high Doppler spreads.ith high Doppler spreads. [C176]

"Noise analysis for noncontact vital sign detectors"

A method for analyzing the overall noise performance of vital sign detectors is introduced. For demonstration purpose, the noise analysis on a quadrature direct-conversion vital sign detector is performed. The detector is divided into three sub-systems including RF Front-end amplifiers, mixer with LO, and baseband amplifiers. The noise characteristics of the sub-systems are studied individually and combined to form the overall noise evaluation of the detector. The study on mixer sub-system results in a key design consideration of mixer. The signal-to-noise ratio at the sampler input is defined as the output SNR and is used to measure the overall noise performance of the vital sign detectors. The effect of output SNR on vital sign detection is presented. Tradeoff between output SNR and detection distance is verified by the experimental results. [C177]

"Microwave noncontact measurement of pulse wave velocity for healthcare applications"

In this paper, a noncontact method of measuring the pulse wave velocity (PWV) is proposed based on the Doppler phase modulation effect. System level design and simulations are presented to demonstrate the detection mechanism. Preliminary experimental results are reported. [C178]

"Maximum likelihood estimator for Doppler parameter and cramer rao bound in ZP-OFDM UWA channel"

A Doppler estimation system using a maximum likelihood criterion is presented in the context of underwater acoustic communications between moving transmitter/receiver. We simulate the method for the estimation of the Doppler effect induced by an underwater acoustic channel (UWA) using Zero Padded-Orthogonal Frequency Division Multiplexing (ZP-OFDM). Among the wide range of physical processes that impact OFDM communications through the underwater environment, Doppler effect is an important cause of loss of orthogonality and must be compensated before discrete Fourier transform based demodulation can be performed. The proposed approach is based on the perfect knowledge of the emitted signal during one block and rely on the assumptions of a small variation of the Doppler effect induced by the canal between two ZP-OFDM blocks and, above all, during one block. [C179]

"Low Complexity LSQR-Based Block Decision Feedback Equalizer for OFDM Systems over Rapidly Time-Varying Channels"

In orthogonal frequency division multiplexing (OFDM) systems, Doppler effect introduced by high-mobility leads to the loss of subcarrier orthogonality and the occurrence of inter-carrier interference (ICI). In this paper, a novel low complexity block decision feedback equalizer (BDFE) is proposed in order to mitigate ICI over rapidly time-varying channels. The proposed equalizer algorithm obtains the tradeoff between computations and performance by exploiting band factorization and time domain LSQR iterative computation. Simulation results show that the proposed equalizer outperforms existing MMSE-DFE algorithms for the same complexity over rapidly time-varying channels. [C180]

"Cramer-Rao bound for joint location and velocity estimation in multi-target non-coherent MIMO radars"

In this paper, we focus on a performance bound for joint location and velocity estimation in non-coherent MIMO radars with multiple targets, which has not been studied before. Closed-form expressions for the Cramer-Rao bound are provided for a two-target case. We use numerical simulations to validate the Cramer-Rao bounds and use these bounds to study the performance of a non-coherent MIMO radar system. We analyze the influence of the distance between two targets on the estimation performance. Simulation results reveal that the spatial advantage, which was uncovered previously for a single-target case, also applies for two targets. [C181]

"OTA measurements of wireless stations in reverberation chamber versus anechoic chamber: from accuracy models to testing of MIMO systems"

The paper will describe the fundamental characteristics of different wave propagation environments (such as Rayleigh fading, Rice fading, and polarization balance; coherence bandwidth and time delay spread; and fading speed, coherence time and Doppler spread), and relate these characteristics to the Line-Of-Sight (LOS) emulated by good anechoic chambers, and the rich isotropic multipath environment emulated by good reverberation chambers. The conclusion is that the reverberation chambers mean the same to Over-The-Air

(OTA) testing of antennas for use in multipath environments as anechoic chambers do to antennas for free-space-like environments. They enable a unique, objective and repeatable antenna characterization that cannot be achieved in other environments. Thereby, the reverberation chambers and anechoic chambers complement each other perfectly. The paper will also give examples showing that the performances of three different types of incremental antennas are very different and depend strongly on their orientation when they are located in a 2-D horizontal multipath environment with incoming waves only in the horizontal plane, whereas their performances are equal and invariant to orientation when they are located in a rich isotropic multipath environment as emulated by a reverberation chamber. The paper also summarizes how the reverberation chamber during the last ten years has been developed to an accurate tool to determine the performance characteristics of complete wireless terminals, stations and systems both for the transmitting case (total radiated power) and the receiving case (total isotropic sensitivity and average fading sensitivity), and when the stations are provided with antenna diversity and MIMO (Multiple Input Multiple Output) capability. [C182]

"High performance reflector-based Synthetic Aperture Radar: -A system performance analysis -"

The success of current spaceborne Synthetic Aperture Radar (SAR) is boosting the performance requirement of next generation systems. In order to cope with the evolution of SAR the design of the new systems will need to meet higher requirements for spacial and radiometric resolutions together with an increased availability. This tendency is recognized nearly independently of the application area and manifests itself through several study programs initiated by space agencies aiming at the design of future SAR systems. In this context the use of large reflectors combined with digital feed arrays for SAR has not always received adequate attention. This paper suggests an X-band spaceborne SAR system utilizing a deployable reflector together with a digital feed array, analyzes its performance and highlights its advantages compared to other systems based on direct radiating arrays. [C183]

"A software defined UMTS passive radar demonstrator"

Passive radar systems, also referred to as Passive Coherent Location systems (PCL), exploit non-cooperative illuminators of opportunity (IO) in order to detect and track targets. Some of the main advantages of such systems with respect to conventional radars include low cost architectures, low energy requirements, the capability of operating without any spectrum resource allocation and a potentially null probability of intercept. In this paper, we introduce a passive radar demonstrator based on the use of UMTS (Universal Mobile Telecommunications System) signals as a source of opportunity. An overview of the UMTS standard and some preliminary measurements are firstly presented in order to verify the suitability of the UMTS waveform for radar applications. Secondly, a low cost software defined experimental radar system is introduced together with a measurement scenario. Finally, some live data detection results are presented and discussed in order to demonstrate the capability of this passive radar system. [C184]

"Multi-look stripmap SAR processing with built-in geometric correction"

Small airborne SAR systems suffer from trajectory deviations and instabilities of antenna orientation. These kinds of motion errors lead to significant geometric distortions in SAR images. In the paper, we describe a time-domain multi-look stripmap SAR processing algorithm with built-in geometric correction. In the algorithm, the azimuth reference functions and range migration curves are designed to produce SAR images directly on a correct rectangular grid on the ground plane. The proposed technique has been successfully tested by using a Ku-band airborne SAR system, installed on a light-weight aircraft. [C185]

"Nonuniform spatial sampling in a noise SAR"

The paper presents an idea of nonuniform spatial sampling applied to a noise synthetic aperture radar. Lowering number of spatial (along-track) domain samples taken in a SAR radar may lead to spatial aliasing and incorrect reconstruction of the image. Nonuniform sampling allows to reduce the aliasing effect and reconstruct the image better. This technique may be useful when the overall number of samples or the spatial sampling frequency is limited by external constraints. The idea will be verified with an experimental noise SAR built at ISE PW. [C186]

"Pedestrian recognition based on 24 GHz radar sensors"

Some 24GHz radar signal features are introduced in this paper for a reliable recognition of pedestrians and vehicles in an arbitary traffic situation. It examines in particular the Doppler spectrum and the range profile. [C187]

"Development milestones in 24 GHz automotive radar systems"

Driving a car means a dangerous task! There are about 5000 fatalities on German streets every year, which are absolutely too many. Drivers have strong limitations in the ability to measure precisely the distance and the speed difference between cars, which is the reason for several accidents. Therefore some assistance is needed. There is large progress in waveform and system design as well as in MMIC chip development for 24 GHz radar sensor technology [4]. [C188]

"FM based passive bistatic radar target range improvement-Part II"

The bistatic radar has been revitalized over the last few years through the rapid development of the passive bistatic radar technology. Passive bistatic radar systems have unique properties, especially is time on target high compared to traditional radar systems, as well as the freedom in choosing from the available transmitters of opportunity. This paper will focus on how to take advantage of the latter of these two special properties in order to achieve better range resolution. [C189]

"Turbo equalization and channel re-estimation in OFDM over doubly-selective channel"

We study the application of turbo equalization in orthogonal frequency division multiplexing (OFDM) system over doubly-selective channel. Maximum A Posteriori (MAP) equalization that exploits characteristics of the banded channel structure in OFDM is used in our turbo equalization. In settings similar to Japan's ISDB-T standards, we find that banded channel structure that accounts for only 1 neighboring subcarrier (on one side) is sufficient to ensure a good equalization performance. At moderate Doppler frequency, turbo equalization does not enhance the system performance significantly. Furthermore, the effects of 1) initial channel estimation with turbo equalization; 2) channel re-estimation with turbo equalization are investigated, with the latter conferring greater bit error-rate (BER) enhancement than the former. Channel estimation has a more prominent effect on performance than turbo equalization, as verified by numerical simulations. [C190]

"Fast and accurate frequency estimation algorithm for ADCP carrier frequency"

ADCP is a sonar that attempts to produce a record of water current velocities for a range of depths. When testing the accuracy of ADCP, estimating the carrier frequency of ADCP is required. However, a variety of measurement techniques based on fixed-sampling algorithm, it is difficult to meet the requirements of simple calculation, high speed and accuracy. A new technique is introduced in this paper for frequency estimation algorithm based on Fourier transform and variable sampling rate method. The measurement algorithm avoids complex operation with low computational complexity. Simulation results show that the algorithm is high accuracy, and is suitable for application in estimating the carrier frequency of ADCP. [C191]

"Extraction of ionospheric clutter in HFSWR"

The two main applications of High frequency surface wave radar (HFSWR) are maritime surveillance of the Exclusive Economic Zone (EEZ) and the remote sensing of the sea. Ionospheric clutter strongly limits the detection capabilities of HFSWR. In order to analyze the effect of ionospheric clutter, a method based on image processing is proposed to extract ionospheric clutter. In this method, the Range-Doppler spectrum of radar echo was processed as image, and the color image segmentation technique was used to extract ionospheric clutter. By a preliminary analysis of the ionospheric clutter extract results, we can get that the average power of ionospheric clutter is big, and it occupies many Range-Doppler cells, and it has direction. The results provide a frame of reference for the ionospheric clutter assessment, suppression and frequency selectivity, etc. [C192]

"Cross Wigner Ville distribution of the wireless communication channel"

Almost all communication channels introduce dispersive or multiplicative disturbances which give rise to the dispersive effects known as time selective fading and frequency selective fading. Two parameters are used to characterize the dispersive and multiplicative channel. They are time delay spread and Doppler spread. Doppler spread gives a measure in frequency variation where it introduces time selective fading or flat fading. Time selective fading can be further classified as slow and fast fading. Frequency selective fading on the other hand is the effect of time delay spread in frequency domain where certain frequency components in the received signal spectrum have greater gains than the others. In this work, Doppler spread and time delay spread are estimated based on Cross Wigner Ville distribution (CWVD). It is derived from the Fourier transform of the cross bilinear product between the output and input of the system. Linear FM signal is adopted in the analysis where fading condition under Watterson channel model is considered. [C193]

"Correction of radiometric errors by multi-look processing with extended number of looks"

The application of the clutter-lock technique in case of fast and significant instabilities of the antenna orientation

leads to strong geometric distortions in SAR images. In the paper we propose a radiometric correction approach which could be used with SAR processing algorithms without clutter-lock. The technique has been tested by using a Ku-band airborne SAR system, installed on a light-weight aircraft. [C194]

"Multiple decision feedback equalizer for satellite AIS coherent detection"

The Automatic Identification System is a universal shipborne system adopted to improve safety at sea and efficiency of navigation. This system allows to identify and localize vessels in a short range for collision avoidance by exchanging messages with navigational information. [C195]

"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. [C196]

"Milestones in radar and the success story of automotive radar systems"

Radio Detection and Ranging (RADAR) is a world wide well-known technique since more than 100 years, which is originally based on the invention of the German engineer Christian Hьlsmeyer, who applied his patent at the Kaiserliche Patentamt in Berlin on April the 30th, 1904. He called his invention Telemobiloskop in a good tradition of using Latin terms for technical subjects. The radar story started with the theoretical work of James Clerk Maxwell, followed by Heinrich Hertz, born in Hamburg, who did all the experimental work to understand the nature of electromagnetic waves. Collision avoidance between ships was the first application for this new technique. Today we come back to the collision avoidance application however now between cars. This is just the beginning of the automotive radar systems success story. [C197]

"Scenario modeling and simulation for performance prediction of a modern radar in electronics warfare environment"

A Simulation software is presented to evaluate radar performances in EW environments. This Software includes detailed radar and Jammer Models and Scenarios including different signal losses, noise, clutter and Doppler Effect. This software simulates different passive and active jamming techniques and models coherent and no coherent effects and other factors causing losses in jamming to signal ratio (JSR). Required JSR for different techniques to be effective, is output of this simulation software for different radars. This simulation can be used for radar and jammer performance evaluation with changes in input parameters. A sample application for performance evaluation of a UAV based jammer against naval air defense radar is presented. [C198]

"Cross ambiguity function analysis of the '8k-mode' DVB-T for passive radar application"

One of non-cooperative illuminators recently considered for passive radar applications is the DVB-T (Digital Video Broadcasting-Terrestrial) station. The thumbtack ambiguity function of the DVB-T signal in addition to being stationary makes such signal a good candidate for such applications. However, certain ambiguities in its ambiguity function necessitates certain issues to be carefully considered when DVB-T signals are to be utilized. In this paper, after studying the origins of these ambiguities, we propose special processing schemes to resolve them. [C199]

"Modeled gait variations in human micro-doppler"

Measurement of human motion is important for security applications. One would like to observe humans unobtrusively and without privacy issues, and using radar provides one method to detect abnormal activity without using images. In this paper we focus on modeling the characteristics of human walking parameters in order to determine signature differences that are distinguishable and to determine the variability of normal walking to be compared to armed or loaded walking. We extract micro-Doppler from motion-captured human gait models and verify the models with radar measurements. We then vary the model to determine extent of normal micro-Doppler variation in multiple dimensions of human gait. We also characterize the ability of radar to determine gender and suggest that alternative views to the frontal view may be more discriminative. [C200]

"The use of high speed FIFO chips for implementation of a noise radar"

An ultra wide band spread spectrum radar (a noise radar) can be built using a system that generates two wide band spread spectrum (pseudo-random) waveforms. One waveform is transmitted by the system and one waveform is used to correlate against the received signals. Because of system dispersion, propagation channel dispersion and radar target dispersion, it is often appropriate for the receive correlation waveform to be of a different form than that of the transmitted waveform. Thus a noise radar often needs to be able to generate two different wide band waveforms with controlled differential delay time. This paper will discuss the implementation of such a system using commercially available FIFO microchips. [C201]

"TCD data compression technology based on DCT and MWT"

A novel Doppler signal compression technology based on DCT and multiple wavelet transform (MWT) is proposed in this paper. Firstly, TCD audio signal is transformed by DCT. Then the DCT coefficients are transformed by MWT. The wavelet coefficients are used as characteristic data of the original signals, which can be saved or transmitted in the future. The original signals are restored by reverse DCT transform and reverse MWT. Changes in the spectrogram and power spectral density are used as the yardstick for compression. Without losing useful information, high compression ratio is achieved by our compression method. Experimental results show that the TCD data compression technology presented has the advantages of high compression ratio and less loss of useful information compared with other approaches. [C202]

"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. [C203]

"A visualization method of cardiovascular flow velocity vector field based on color Doppler image information"

In the study of visualization quantitative evaluation of cardiovascular flow, this paper presents a visualization method of cardiovascular flow velocity vector field based on color Doppler image information. The method extracts velocity component in beam direction by the Doppler image information, decompose the flow of two-dimensional observation plane into the basic flow and vortex in the light of its characteristics. Then, the velocity components of basic flow and vortex are calculated in the beam direction and the perpendicular direction to beam. Finally, the real velocity vector of each particle is obtained by synthesizing the various velocity components vector. Experiments shows that the method can effectively describe the velocity vector field of cardiovascular flow, and can provide an effective visualization basis for the evaluation of cardiac function and cardiac disease diagnose. [C204]

"Autodyne system with a single antenna"

A Clapp's single tuned transistor autodyne Oscillator at 1.2 GHz with 12.25 dBm output power is designed and fabricated on a RO4003 substrate with planar capacitors and loop antenna. This small size fuse operates at 7-10 m distance from surface. [C205]

"Moving target estimation using distributed MIMO radar in non-homogeneous clutter"

In this paper, we consider parameter estimation for moving target detection using a distributed MIMO radar, where the multi-static transmit-receive configuration causes non-homogeneous clutter. Specifically, the clutter power for the same resolution cell may vary significantly from one transmit-receive pair to another, due to azimuth-selective backscattering. Moreover, the clutter power may also vary across resolution cells in the

neighborhood of the test cell. In this work, the non-homogeneous clutter is modeled using a subspace approach, whereby the subspace is spanned by a few Fourier bases and the non-homogeneity of the clutter is captured by coefficients that vary with different transmit-receive pairs and/or different resolution cells. The choice of the Fourier bases is based the fact that the clutter Doppler spectrum is bandlimited. We develop a maximum likelihood (ML) estimator for the parameters associated with the target and clutter. The Cramer'r-Rao bound (CRB) for velocity estimation is also derived. Numerical results show that the proposed estimator outperforms an alternative solution that ignores the non-homogeneous nature of the clutter. [C206]

"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. [C207]

"Design and implementation of a highly configurable low power robust signal processor for portable ground based "multiple scan rate" surveillance radar"

FPGA based realization of a highly configurable low-power robust signal processor for a portable ground-based multiple scan ratesurveillance radar is presented. Portability feature of the radar demands a compact radar system which should be able to detect low flying aerial targets against clutter/interference background. All requirements could be met in a FPGA-based design of a multi-channel signal processor to cater for low peak power large bandwidth waveforms, separate processing for special targets and an embedded softcore processor. Reliable self-test mechanisms-external as well as internal have been built into the signal processor for functional verification of entire radar system. [C208]

"Use of Digital-Television terrestrial (DTV) signals for passive radars"

Purpose of this paper is the description of how to use the Digital-Television terrestrial Video (DTV) stations as a non-cooperative illuminator in bistatic radar. Based on [1] it is shown that the original DTV signal contains random and deterministic components. Analyzing the ambiguity function of the DTV signals, it is found that the deterministic components cause unwanted peaks around the desired peak pertaining to the useful echo thus the target detections is difficult to do and/or false targets can be revealed. In this paper, a new approach to improve the ambiguity function around the useful echo will be proposed. In order to study, evaluate and elaborate the DTV signal, a simulator of the complete signal was performed This paper is organized as follows: next section 1 will describe the obtained outputs of DTV simulator; section (2) will describe the complete block diagram of passive radar using DTV signal, describing the new signal processing approach to improve the ambiguity function; section (3) will describe the obtained results from a realistic scenario; section (4) will present some preliminary results about the multipath effect on the system performance. [C209]

"Data fusion algorithms for sea target tracking using coastal radar model"

The fusion of multiple monitoring systems data is very important, to get a full view of situation in coastal waters. Sea target tracking algorithm is modeled, coast radar system model implemented, multiple ships tracking and detection is tested. [C210]

"Advantages of the DVB-T signal for passive radar applications"

One of the attractive opportunistic signals for passive radar applications is the DVB-T (Digital Video Broadcasting- Terrestrial) signal. The thumbtack ambiguity function of the DVB-T signal in addition to being stationary makes such signal a good candidate for such applications. In this paper we want to consider its feasibility for this application in more details. So we first examin this signal for the main parts of the the passive radar: Resolving ambiguities before evaluating CAF and direct path intereference rejection, and then consider its processing gain in detecting targets. [C211]

"Seismic Exploration with VCSEL Based on Doppler Self-Mixing Effect"

In order to improve the resolution of seismic exploration, a self-mixing semiconductor laser measurement system based on VCSEL is proposed in this paper. Both the most principle frequency method based on short time Fourier transform and the modulus maximum method based on wavelet transform are employed to identity Doppler signal and restrain noise effectively. By technique of triangle-wave current modulation, the direction of motion can be discerned accurately. In comparison with experimental data of normal vibration platform, the relative error of measurement is less than 1%. [C212]

"Forward Link Performance Analysis for the Future IEEE 802.16-Based Airport Data Link"

In this paper, an analysis of the performance of the OFDM version of the IEEE 802.16e standard is provided in a realistic airport scenario. We implemented a novel stochastic airport channel model describing the main wireless propagation phenomena related to the airport environment. Multi-path and Doppler effects with the potentially resulting inter-symbol interference and inter-carrier interference have been taken into account, respectively. System performance is evaluated for the forward link case in the apron, parking, taxi and runway scenarios, showing strengths and lacks of the system characteristics. For the most critical scenario (i.e., the parking one), an investigation of the reduction of the pilot sub-carriers spacing and on the introduction of antenna diversity is proposed, showing large performance gains. [C213]

"Second-order nonlinear optical effects of spin currents"

We show by symmetry analysis and microscopic calculation that a pure spin current has sizable second-order nonlinear optical effects. Thus spin currents can be studied by standard nonlinear optical spectroscopy. [C214]

"Impact analysis of wind turbines blockage on doppler weather radar"

The split-step solution to the parabolic wave equation describing beam propagation permits examination of the signal degradation in a Doppler weather radar caused by wind turbines blockage under general atmospheric conditions and at arbitrary transmitter and receiver configurations. At radar wavelengths, an understanding of turbine and terrain obscuration effects is essential for deciding the reliability of radar measurements affected by blockage. [C215]

"On-body patch antenna with parasitic PEC wall for the miners cardiac rhythm sensor"

A patch antenna with parasitic PEC wall for the minor cardiac rhythm sensor is discussed in the paper. Better bandwidth performance and stability of the resonance frequency distinct the antenna from a conventional patch. The sensor is a part of a system for searching people under rocks. Principles of construction of the system, based on measuring the Doppler effect, are shown. [C216]

"Experimental analysis of electromagnetic scattering by rotating blades"

The high frequency backscattering by rotating skew-plated metal blades was investigated experimentally. Radar cross section (RCS) was measured in an anechoic chamber. The RCS spectra, relating to Doppler effect, were got by fast Fourier transform (FFT) from time-domain signature. The main characteristics are the periodic fluctuating of time-domain RCS and the asymmetry of RCS spectrum. The results agree well with the computational analysis of past literature. [C217]

"Analysis of rain attenuation from experimental drop size distributions"

The prediction and analysis of rain attenuation is gaining interest in the recent years, because of the increasing use of millimetre-wave radio communication systems. In these frequencies, propagation in the troposphere produces strong degradations in the presence of rain, with deep fades for even moderate rainfall rates. More detailed measurements of the rain phenomena can be obtained with the use of modern equipment. This kind of equipment provides experimental drop size distributions (DSD) that can be used to analyze the effects of past rain events. In this paper, the use of the experimental drop size distributions of rain to predict its effect on the propagation is discussed, taking into account the available measurements of the different instruments. [C218]

"SFBC design tradeoffs for mobile SC-FDMA with application to LTE-advanced"

Single-carrier frequency-division multiple-access (SC-FDMA) has been adopted in the uplink of the LTE standard due to its lower peak-to-average-power ratio (PAPR) compared to orthogonal frequency-division multiple access (OFDMA). Recent activities in the LTE-advanced (LTE-A) standardization have focused on effective uplink transmit diversity schemes with low PAPR but without considering the performance degradation due to Doppler despite the fact that LTE-A is required to support high mobility. In this paper, we present an

open-loop space-frequency block coding (SFBC) scheme for the SC-FDMA uplink and demonstrate its robustness to high Doppler and large multipath delay spread while enjoying full spatial diversity, low PAPR and practical decoding complexity by a suitable design of the frequency span of each SFBC codeword. In this paper, we study the design tradeoffs involved in SFBC design for mobile SC-FDMA. [C219]

"Single antenna time reversal detection of moving target"

This paper is concerned with a moving target detection using time reversal in dense multipath environments. We show that the Doppler shift in the time reversal re-transmission simplifies the detector design, yet still achieves the focusing effect. Thus, the Doppler diversity is utilized to achieve high target detectability by time reversal. [C220]

"A signal-specific bound for joint tdoa and FDOA estimation and its Use in combining multiple segments"

We consider passive joint estimation of the time-difference of arrival (TDOA) and frequency-difference of arrival (FDOA) of an unknown signal at two sensors. The classical approach for deriving the Cramer-Rao bound (CRB) in this context assumes that the signal (as well as the noise) is Gaussian and stationary. As a result, the obtained Fisher information matrix with respect to the TDOA and FDOA is diagonal, implying that the respective estimation errors are uncorrelated (under asymptotic conditions). However, for some specific (non-Gaussian, non-stationary) signals, especially chirp-like signals, these errors can be strongly correlated. In this work we derive a "signal-specific" (or a "conditional") CRB for this problem: Modeling the signal as a deterministic unknown, we obtain a bound which, given any particular signal, can reflect the possible signal-induced correlation between the TDOA and FDOA estimates. We further demonstrate that this bound is instrumental for proper weighting when combining joint TDOA and FDOA estimates from independent intervals. [C221]

"Knowledge-aided STAP algorithm using convex combination of inverse covariance matrices for heterogenous clutter"

Knowledge-aided space-time adaptive processing (KA-STAP) algorithms, which incorporate a priori knowledge into radar signal processing methods, have the potential to substantially enhance detection performance while combating heterogeneous clutter effects. In this paper, we develop a KA-STAP algorithm to estimate the inverse interference covariance matrix rather than the covariance matrix itself, by combining the inverse of the covariance known a priori, R0-1, and the inverse sample covariance matrix estimate R-1. The computational load is greatly reduced due to the avoidance of the matrix inversion operation. We also develop a cost-effective algorithm based on the minimum variance (MV) criterion for computing the mixing parameter that performs a convex combination of R0-1and R-1. Simulations show the potential of our proposed algorithm, which obtain substantial performance improvements over prior art. [C222]

"Switchable power combining network for 35GHz"

Power combining networks are a key component for most radar systems. In combination with micromechanical switches the network can be used for multi-beam lens systems, filter bank etc. The main disadvantage of such a switchable power combining network are high losses. In a Doppler beam sharpening system (DBS) for 35 GHz a power combining network with Micro-Electro-Mechanical-Systems (MEMS) switches was realized. [C223]

"Research on carrier tracking in Hybrid DS/FH spread spectrum TT&C system"

Because of the effect of carrier frequency hopping, the input IF signal of carrier tracking loop in DS/FHSS (Direct Sequence/Frequency Hopping Spread Spectrum) TT&C (Telemetry, Tracking & Command) System is characterized by the Doppler frequency agile. The tracking loop will shift to the frequency step response state ceaselessly and the measurement resolution severely decline, even the loop is likely to be unlocked. This paper presents a carrier tracking loop aided by frequency hopping pattern. In order to keep the stability of the tracking loop, the Doppler frequency agility in the next frequency hopping dwell is estimated and timely compensated to the frequency adjustment of carrier NCO according to the preset frequency hopping pattern and current spacecraft velocity. Simulation results show that this method effectively eliminates the instability due to carrier frequency hopping, and the resolution of loop meets the requirement of TT&C system. [C224]

"Effects of basis-mismatch in compressive sampling of continuous sinusoidal signals"

The theory of compressive sampling (or compressed sensing) is very attractive in that it is possible to reconstruct some signals with a sub-Nyquist sampling rate provided that they are sparse in some basis domain. But if there exists a mismatch between the signal basis and the pre-defined reconstruction basis, the reconstruction

performance is significantly degraded even if the signal is sparse enough. In this paper, the degradation due to this basis mismatch is investigated and a way to minimize the effects of basis mismatch in compressive sampling of continuous sinusoidal signals is discussed. [C225]

"Channel model for tyre pressure monitoring systems (TPMS)"

Tyre pressure monitoring systems rely on radio transmissions to transfer measurement data from the sensors to the vehicle body. These systems operate on a propagation channel which is time variant and introduces Doppler shifts due to vehicle movements. In the following paper we investigate these effects. First we propose, develop and characterise a channel model for TPMS, which is comprised of a deterministic and a stochastic component. In a second part channel simulations with an arbitrary vehicle model are presented to gain insight to the behaviour of TPMS channels. Finally an example out of a series of static channel measurements is shown. [C226]

"Optimizing polyphase signals for orthogonal netted radar"

Orthogonal netted radar systems (ONRS) can fundamentally improve radar performance by using a group of specially designed orthogonal polyphase code signals. However, the existing numerical solutions only address autocorrelation and cross-correlation properties with the result that the signals degrade severely in the presence of small Doppler shifts. In the context of these problems, a new set of polyphase sequences is presented with good correlation properties as well as resilience to Doppler shifts. These sequences are built using numerical optimization based on correlation properties as well as the Doppler effect on matched filter output, which maintains Doppler tolerance. The statistical simulated annealing algorithm and the greedy code search method are used to optimize the sequences. Correlation and Doppler results are compared with best-known sequences and shown to be superior. [C227]

"Accuracy analysis of DVL/IMU/magnetometer integrated navigation system using different IMUs in AUV"

This paper presents an integrated navigation system for autonomous underwater vehicles which is based on a Strapdown inertial navigation system (SDINS) accompanying Doppler velocity log (DVL), pressure sensor and magnetometer. The paper focuses on the performance analysis of the bias of inertial sensors and the error of position using different level IMU. An extended Kalman filter is employed to estimate the bias of the inertial sensors and then give the ultimate error of position in about one hour campaign. Numerical simulation was presented and the result shows that the performance of AUV mainly depends on the precision of DVL and magnetometer. The simulation also shows that the performances of the position accuracy with different IMUs are almost same. [C228]

"An injection-locked detector for concurrent spectrum and vital sign sensing"

This paper proposes a concurrent spectrum and vital sign sensor using an injection-locked detector. To achieve this goal, two different sensing mechanisms are involved. One is to employ the injection locking and pulling effects in an oscillator to fast detect the frequency and power of a wireless communication signal. The other is to use a self-injection-locked oscillator to detect Doppler shift for measuring the breathing and heartbeat rate of a target. A prototype system operating in S-band has been implemented to validate the proposed sensor architecture. [C229]

"Oxide traps in MOS transistors: Semi-automatic extraction of trap parameters from time dependent defect spectroscopy"

An algorithm to extract the statistical properties of oxide traps in ultra-small metal oxide silicon field effect transistors (MOSFETs) is presented. The algorithm uses data from time dependent defect spectroscopy (TDDS) measurements. It works reliable in a great range of circumstances, and automatically detects and correctly processes variations in the measurement data due to channel percolation path modulations. The algorithm is designed to require minimal user interaction, making parameter extraction from a large base of experimental data feasible. [C230]

"Performance analysis of the MIMO zero-forcing receiver over continuous flat fading channels"

A zero-forcing (ZF) receiver has a quite simple structure and relatively good performance at high SNR. This paper studies the performance of a Multiple-Input Multiple-Output (MIMO) ZF receiver over continuous flat fading channels in the presence of practical channel estimation errors. We derive the bit error rate (BER) of MPSK for the MIMO ZF receiver considering the practical effects of channel estimation errors and interferences caused by

Doppler spread of the channel, and analyze the effects of the number of transmit and receive antennas on the performance. [C231]

"Low current single wire optical spectroscopy experiments"

Summary form only given. Experiments on the Low Current Pulser LCP3 at Cornell University are exploring the properties of high energy density plasmas generated by current-driven explosions of single fine metal wires. These experiments are employing non-perturbing emission spectroscopy at visible wavelengths to obtain plasma conditions, including temperatures, electron density, ionization state, and magnetic field. A new diagnostic technique is being developed to determine the magnetic field which makes use of Zeeman-effect-produced differences in the line shapes of two fine structure components of a multiplet that are equally broadened by Stark and Doppler effects. This technique has been demonstrated in experiments performed at the Weizmann Institute of Science in plasmas with lower energy densities. We are studying the time integrated and time resolved visible spectra to determine appropriate spectral lines for measuring magnetic field strength, including the Al III 5696 A and the Al III 5722 A transitions used in previous work. Preliminary results will be discussed. [C232]

"Synthetic time and space resolved spectra including Doppler splitting from simulations of stainless steel pinches on refurbished Z"

A two-dimensional radiation MHD model that includes a self-consistent calculation for non-local thermodynamic equilibrium kinetics and ray trace based radiation transport1is employed to simulate 65 mm diameter stainless steel double wire array Z machine experiments of 5.0 mg and 2.5 mg, respectively (shots Z1859 and Z1860). Temporal knowledge of the plasma internal energy, ion density, velocity, and opacity at each 2D grid point allows us to postprocess the results to reconstruct the atomic populations at any time and location. With these populations and velocities, we can then apply detailed multifrequency raytrace radiation transport, including Doppler effects, to construct time and axially or radially resolved synthetic spectra. Calculated radially resolved spectra for He-like iron near the time of peak emission are compared with experimental data. [C233]

"Performance evaluation of ad-hoc routing protocols in underwater acoustic sensor networks"

Underwater acoustic sensor networks (UWASNs) is an emerging technology, comprising of sensor nodes and unattended automated vehicles (AUVs), all working in a collaboration to sense various phenomenon, process digital information, store processed data and communicate among each other and base stations. Acoustic propagation in water is characterized by high and variable delays, fading effect, Doppler spread and multi path which in turn lead to a limited bandwidth and high error rates. Also, battery life and storage capacity of nodes is limited. So there is a need of suitable routing protocol that takes all these limitations into consideration and makes communication in underwater networks viable. This is the first attempt to analyze the performance of ad-hoc routing protocols in underwater acoustic network environment. We used performance metrics like packet delivery ratio, average end-to-end delay, throughput, routing overhead and energy consumption of the sensor nodes. AODV, DSDV, DSR and OLSR are compared for their performance at different traffic conditions, number of nodes and depths. By analyzing our simulation results, we found that among the discussed protocols, AODV may be used for denser networks but with less traffic and DSDV is suitable for higher traffic conditions with optimal number of nodes. [C234]

"Performance Analysis of STBC-OFDM Systems in Temporally or Spatially Correlated Fading Channels"

This paper analyzes the performance of space-time block coded orthogonal frequency division multiplexing (OFDM) systems. In our analysis, we abandon the usually made assumption of quasi-static channel conditions. Instead of this, we consider the more general and realistic case that the channel envelope changes during two consecutive transmission time slots. In addition, we take the spatial correlation between sub-channels into account. We first present a general formal expression for the bit error probability (BEP), from which we find analytical solutions for the BEP not only for temporally fading channels but also for spatially correlated channels. The knowledge of the obtained analytical solutions makes the determination of the BEP less time-consuming compared with system simulations. Moreover, they give a deep insight into the impact of the Doppler effect and the antenna spacing on the system performance. [C235]

"On the Performance of Pilot Symbol Assisted Modulation for Cooperative Systems with Imperfect Channel Estimation"

In this paper, we analyze the impact of imperfect channel estimation on the performance of pilot symbol assisted modulation (PSAM) used in a relay communication system with distributed space time block code (STBC) and

amplify-and-forward protocol. We derive correlation coefficients between the channel coefficients and their estimates when the relay-to-destination link is either non-fading or fading, in terms of Doppler frequency, number of pilot symbols and SNR. This enables us to choose the optimum number of pilot symbols to compensate for the estimation error when the fading and Doppler effects are severe. Our performance analysis demonstrates that the presence of fading in the relay-to-destination link manifests itself by introducing additional Doppler frequency terms. Furthermore, we derive a tight lower bound for the bit error rate (BER) of BPSK modulation with channel estimation errors in terms of cross correlation coeffcients and the number of pilot symbols. Simulation results are also presented to validate our analytical results. [C236]

"A New Signal Processing Method Based on Doppler Effect for Targeted Ultrasound Contrast Agent Imaging"

Targeted ultrasound molecular imaging technology is emerging as a novel imaging modality that shows initial successes in sensitive detecting of inflammation, heart transplant rejection, thrombus and angiogenesis. In the targeted imaging, one challenge is to detect the signal from targeted contrast microbubles. The paper presents a new targeted contrast agent imaging method which could differentiate adherent and free agents effectively by using Doppler frequency shift. The Doppler frequency shift is employed to analysis the flowing bubble signal and stationary bubble signal. The Doppler shift frequency can be calculated due to the reflecting central frequency and bandwidth in addition to the velocity of the free bubble controlled by a syringe pump in the experiment. The wall filter is applied for filtering the signal that brings up the Doppler shift frequency. By using the method, experimental study shows compressed the free contrast agent and tissue signals while leaving the targeted bubble signal unaffected. [C237]

"An injection-locked detector for concurrent spectrum and vital sign sensing"

This paper proposes a concurrent spectrum and vital sign sensor using an injection-locked detector. To achieve this goal, two different sensing mechanisms are involved. One is to employ the injection locking and pulling effects in an oscillator to fast detect the frequency and power of a wireless communication signal. The other is to use a self-injection-locked oscillator to detect Doppler shift for measuring the breathing and heartbeat rate of a target. A prototype system operating in S-band has been implemented to validate the proposed sensor architecture. [C238]

"Study on Effect of External Pressure on Skin Blood Flow at Lower Limb Using Wavelet Analysis"

To understand circulation control mechanism of skin blood flow(SBF) responding to various stimulus, wavelet analysis was widely used. External pressure was one of the factors induced SBF response. In this study, SBF at ankle and calf under pressure of 20mmHg in sitting posture respectively were observed, then wavelet analysis on SBF signals was also carried out. The results showed that SBF increased when external pressure exerted no matter on ankle or calf. Moreover, the increment at ankle was bigger than that of calf. Wavelet analysis results showed that peak spectrum amplitude of intrinsic myogenic activity increased, while characteristic frequency decreased significantly(p<;0.01) due to pressure loading. It's implicated that external pressure induced the change of myogenic activity and thus affected SBF. [C239]

"Modeling Twinkling Artifact in Sonography"

The purpose of this work was to re-examine the reasons for the appearance of power doppler artifact referred to as "twinkling" artifact, which is usually observed in hyperechoic regions and which introduces ambiguity in diagnosis. Two key parameters: physical dimensions of the analyzed object and its roughness or irregular shape were initially considered. Several tests were done on Renal and artificially generated stones in order to visualize twinkling artifact and to obtain meaningful results. It is shown that "Radiation force" which is generated by a change in the energy density of an incident acoustic field, causes an oscillation with a frequency equal to the PRF of the sonography device and therefore movement in the object being imaged which will cause the twinkling artifact. This artifact is modeled in the MATLAB programming language. The radiation force factor causing the vibration is applied to a stone which is assumed to be made of some random scatterers. The velocity of the scatterers movement which is causing the appearance of the twinkling artifact is calculated. Later the effects of different vibration parameters on the production of the twinkling artifact are shown. It is shown that the increase in vibration amplitude and frequency, both cause a velocity increase of the object being imaged. The size of the object being imaged has an indirect influence on the production of this artifact, while the roughness of the object intensifies the artifact. [C240]

"On probing waveforms and adaptive receivers for active sonar"

Active sonar systems involve the transmission and reception of one or more sequences, which provide a basis

for extraction of the information on targets in the region of interest. The probing sequences at the transmitter and signal processing at the receiver play crucial roles in the overall system performance. We consider herein using CAN (cyclic algorithm-new) to synthesize probing sequences with good aperiodic autocorrelation properties. The performance of the CAN sequences will be compared with that of pseudo random noise (PRN) and random phase (RP) sequences, which often find uses in the active sonar systems. We will also consider two adaptive receiver designs, namely the iterative adaptive approach (IAA) and sparse learning via iterative minimization (SLIM) method. We will illustrate the performance of the algorithms via numerical examples, by comparing IAA and SLIM with the conventional matched filter (MF) method. Experimental results show that CAN, IAA and SLIM can contribute to the overall performance improvement of the active sonar systems. [C241]

"Simultaneous spatial and spectral characterization of flow using Photoacoustic Doppler in a turbid media"

Spatial and spectral analysis of flow based on the Photoacoustic Doppler (PAD) effect with tone-burst excitation and time-gated spectral analysis is demonstrated using a model emulating a blood-vessel in a turbid medium. The proposed method mimics pulsed Doppler ultrasound and enables simultaneous measurement of axial position and flow with full characterization of the Doppler spectrum. A wide range of flow velocities in both infusion and withdrawal modes were generated in the phantom. Two-dimensional maps of velocity vs. axial position along with comparison of the estimated velocity to the theoretical prediction demonstrated the feasibility of this method for flow characterization. [C242]

"Tracking of a moving emitter based on delay and Doppler shift using a particle filter"

The gelocation and tracking of a moving transmitter using receivers mounted on stationary or moving platforms is considered. It is assumed that the transmitted radio signal is unknown and that the transmitter dynamics model is known. Two-step conventional methods measure time difference of arrivals and differential Doppler in a first step and in the second step use these measurements for geolocation and tracking. We present a novel approach based on particle filter that uses the received radio signal directly in order to determine the location and velocity of the transmitter. The proposed method exhibits nearly optimal performance with reduced computational effort in contrast with conventional methods which require 4-dimensional grid search. We obtain expressions for the Bayesian Cramer-Rao Lower Bound and the performance of the algorithm is compared to the bound by Monte-Carlo computer simulations. [C243]

"Effective noise correlation matrix structure for equalization of shallow water channels"

Shallow water acoustic communication is challenging due to the delay and Doppler spread resulting from acoustic scattering from surface gravity waves. A channel estimate based decision feedback equalizer (CEB-DFE) has been shown to be very effective at mitigating these channel effects. One component of the DFE that is often overlooked is the effective noise correlation matrix. In much of the literature, the effective noise correlation matrix is approximated by a scaled identity matrix, where the scaling is assumed to be near the reciprocal of the signal to noise ratio (SNR). For the underwater channel, explicitly estimating the full effective noise correlation matrix leads to a reduction of the residual data estimation error. In this paper we show that correlated changes in channel impulse response coefficients cause the effective noise correlation matrix to have off-diagonal terms. Since the correlated changes tend to occur slowly over time, the effective noise correlation matrix is Toeplitz. An algorithm which exploits this fact to reduce computational complexity is presented and is demonstrated using experimental data. [C244]

"Comparisons of a fully coherent and coherent-on-receive marine radar for measurements of wave spectra and surface currents"

A new coherent solid state marine radar has been developed for short range coastal ocean remote sensing applications. It has been applied to the measurement of coastal ocean currents and ocean wave spectra, examples of which are reported here. The radar is based on a standard marine radar package, but using a solid state power amplifier incorporated as part of the transceiver subassembly. The solid state transceiver subassembly was developed based on a SMA-connector component prototype that was reported on at the Oceans 2019 Biloxi meeting. A series of parallel tests were run with a prototype coherent-on-receive radar, which is based on modifications to a standard Koden marine radar. For the latter, the leakage signal of the transmitted pulse is used as the reference for realigning the phase of the received echo. Due to the non-coherent nature of magnetron sources used for marine radars, the pulse-topulse stability of the transmitted frequency of such a system creates problems with pulse-pair phase-differencing estimates of Doppler shifts. This effect creates a rather noisy Doppler image, and mean Doppler estimates over many rotations can be in error. Data were collected with the pair of radars during the passage of 2-m waves up to 13-s period at the FRF pier

in Duck NC. We report on differences in Doppler estimates for the fully coherent and coherent-on-receive marine radars for data collected during this storm, comparing with FRF measurements of wave spectra and surface currents. [C245]

"A simple design for joint channel estimation and data detection in an Alamouti OFDM system"

To obtain full benefits of the Alamouti space-time code design on a time-varying acoustic channel, the channel variation is decoupled into two parts: the gain, which is assumed to be constant over an Alamouti pair (two consecutive OFDM blocks), and the phase, which is not restricted in this manner, but allowed to vary from one block to another in a piecewise linear fashion. Under this model, the receiver assumes a simplified structure in which conventional Alamouti data detection and channel estimation are aided by Doppler tracking. System performance is demonstrated using experimental data transmitted over a 1 km shallow water channel in the 8-18 kHz acoustic band, using QPSK modulation and a varying number of carriers (up to 1024). The proposed design shows a gain of up to 2 dB as compared to the reference single-transmitter case. [C246]

"Miniature, low power, generic Doppler sonar"

The Oceanographic Systems Laboratory at Woods Hole Oceanographic Institution has developed a small, low power, single-axis, range-gated pulse-coherent Doppler sonar, that is primarily intended for boundary layer turbulence studies. This instrument is composed of a receiver-transmitter, a 24MHz analog-to-digital converter, a down converter, and a low power Digital Signal Processor (DSP). The system is capable of autonomous operation from a variety of stationary platforms, such as buoys, moorings, and bottom frames, and small mobile platforms, including gliders, profilers, towed bodies and autonomous underwater vehicles (AUVs). [C247]

"A specific mobile relay with Doppler diversity in OFDM system for high-speed railway scenario"

Relay is considered as an effective method to improve the coverage of high data rates, group mobility, temporary network deployment, and cell-edge throughput and provide the coverage in new areas. Mobile relay station (MRS) is considered as an extension of fixed relay in mobile scenarios such as bus, car and train. Doppler diversity is a diversity technique to improve reliability in highspeed scenario, which has been discussed in recent years. However it is so complicated that may not be suitable and economical for MS. This paper proposes a scheme about the combination of mobile relay station with Doppler diversity in OFDM system communications for high-speed railway scenario. This scheme can provide good quality in relay-MS link in which MS is at low or no velocity. System performance has been evaluated. Several other environments, which include non-relay systems, mobile relay without Doppler diversity system, are considered in this paper to be compared with this scheme. Moreover, fading channel model is analyzed and WINNER II channel model is used as the basic channel model for the simulator. [C248]

"Research on the linear frequency diverse array performance"

The application of the linear frequency diverse array (LFDA) provides the more freedom for the waveform design in time, frequency, amplitude and phase domain. The antenna pattern of the LFDA is analyzed firstly. The main-lobe width of the antenna pattern is narrower and narrower with the increasing of the frequency interval between antenna elements. The ambiguity function of both LFDA and the conventional broadband linear frequency modulation (LFM) signals is compared. The blur between range and Doppler of the LFDA ambiguity function is improved evidently. The simulation and assay indicate that the application foreground of the LFDA is comprehensive. [C249]

"Overlaying orthogonal coding for sidelobe suppression in HFSW radar"

Strong sidelobes not only lead to false alarm, but also affected the target detection. By overlaying an orthogonal coding over any analog or digital signal, we can completely remove most of the ACF (auto correlation function) sidelobes without any increase to the mainlobe sidelobes. In this paper, we discuss how to choose the original signal for HFSW radar and give the affection of different overlaying matrix. [C250]

"Underwater moving noise sources identification based on acoustic holography"

Near-field acoustic holography (NAH) is a well established method for the reconstruction of sources. In this paper, the inclusion of an underwater moving medium is introduced and a new set of equations for NAH is developed. For a stationary acoustic field, the method continuously sweeps the acoustic field by using a line array of hydrophones fixed in space. This method enables the visualization of noise generated by moving noise sources and removes Doppler effect. Theoretical formulation has been systematically addressed which demonstrates how the idea of utilizing this method constructs the desired hologram. At last, the validity and the

correctness of method are assessed by underwater near-field acoustic holography experiments based on measurement of horizontal line array of hydrophones. The experimental results show the merits of this method in the reconstruction of acoustic field, identification and localization of underwater moving noise sources. [C251]

"Numerical Simulation and Experimental Study on BF Raceway"

Considering effects air turbulent and other chemical reactions in blast furnace (BF) raceway, the raceway turbulent mathematical model was built. CFX software has been applied to complete the numerical simulation of the mathematical model and to analyze the physical and chemistry states in a visualization way. The maximum concentration of CO is about 27.4% under the condition of 1000 coke particles. The distribution rule of the gas flow is that the gas flow is poor in the center of BF and the gas flow is high in the BF fringe. To simulate the coke action, a cold experiment has been carried out. According to the theory of similarity and modeling, a raceway cold model was also established. Three-dimensional (3D) laser Phase Doppler Analyzer (PDA) was utilized to measure the turbulent flow in the raceway cold model. The instantaneous, time-averaged and root mean square (RMS) of fluctuating velocities of the gas and the grain were obtained. The distribution rules of the grain velocities were analyzed. Two eddy flows had been verified in the BF raceway by the numerical simulation and the experiment. The results of the numerical resolution are basically in accord with the BF experiment results. This study provided the guidance for BF operation. [C252]

"A Novel Algorithm of Velocity Ambiguity Resolution for Wind Profiling Radar"

Wind Profiling Radar can be used to detect the distribution of atmospheric three-dimensional wind, the quality of velocity information affects its performance directly. Compares to other weather radar, wind profiling radar's velocity ambiguity is particularly prominent when used to detect signal. Multiple PRF (pulse repeat frequency) is often used in radar system in order to solve the ambiguity problem. In this way, radar system has a variety of solutions for ambiguity algorithm in signal processing. In this paper, Doppler frequency series (DFS) algorithm can recover target's true velocity from the coupling velocity estimating directly. Simulation results proved the effectiveness of the method, and show us the DFS algorithm for speed estimation performance. Finally, optimization of one-dimensional set of algorithms-compare screening algorithm and DFS algorithm to ambiguity-resolving, given the speed estimated in the DFS algorithm superiority. [C253]

"Recognition of wobbling and nutating cone-shaped targets"

Recognition of wobbling and nutating cone-shaped targets is a major challenge in space target recognition area. In this paper, we develop a signal model of multiple scattering centers on the wobbling and nutating cone-shaped targets, analyze the micro-Doppler characteristics of their echo. It is concluded that the micro-Doppler features have remarkable differences due to their different micro-motion. Therefore, we apply viterbi algorithm to extract the micro-Doppler and micro-motion parameters, the simulation results demonstrate that the wobbling and nutating cone-shaped targets can be recognized effectively in this way. [C254]

"Estimation and compensation of Doppler effect using variable sub-carrier spacing in multiband UAC OFDM systems"

Doppler shift causes loss of orthogonality in Orthogonal Frequency Division Multiplexing (OFDM), which in turn may severely degrade receiver performance. In high data rate underwater acoustic communication (UAC), the effect of Doppler varies considerably over OFDM subcarriers. This paper will propose an algorithm to estimate the varying effects of Doppler shift over subcarriers and to avoid/mitigate the ICI produced by such effects using variable sub-carrier spacing in multiband OFDM. [C255]

"An H∞ filtering approach for robust tracking of OFDM doubly-selective channels"

In OFDM systems, fast time-varying channels can be effectively estimated and tracked by coupling a channel basis expansion model with a Kalman filtering approach. Although the Kalman filter is asymptotically MSE-optimal when the channel statistics are known, it may suffer some performance degradation in the presence of statistical mismatches. We propose to estimate OFDM doubly-selective channels by an H∞filtering approach that, although suboptimal in the MSE sense, is more robust than classical Kalman filtering to statistical mismatches. Simulation results and performance comparisons assess the effectiveness of the proposed solution. [C256]

"Assessment of GNSS signal acquisition sensitivities for indoor and urban scenarios"

Signals of Galileo and modernized GPS will provide a new possibility in the next five years that will enable to overcome current limitations in indoor/urban environments. With modernization of GPS L1C, L2C, L5 and full

deployment of Galileo, E1b, c, E5a, b, E6 signals will be available. It is therefore of major interest to assess new capabilities of the incoming GNSS signals and their potential for the location based and emergency services in GNSS enabled mobile phone or PDA. In this paper, the acquisition performance of the available GPS and Galileo signals are evaluated related to the receiver sensitivity and the computational complexity within different scenarios. By using a weighting evaluation, we show that GPS L5 pilot signal gives the optimum performance among available signals. [C257]

"A 77-GHz SiGe frequency multiplier (Ч18) for radar transceivers"

For 77-GHz automotive radar applications, a monolithic frequency multiplier with a multiplication factor of 18 is presented. The main circuit of the multiplier chain consists of two frequency tripler and one doubler. Additionally interstage amplifiers and filters are integrated in a 200-GHz SiGe:C production technology. The output power is -1dBm for a wide input power range (-20dBm-+8 dBm) at room temperature and 76.5 GHz output frequency. The output power flatness is better than 2 dB for an output frequency range of 69 GHz to 80 GHz. The power consumption of the multiplier is 170mW at a single supply voltage of 3.3V. [C258]

"A time-variant statistical channel model for tri-polarized antenna systems"

Polarized MIMO systems are an efficient solution for reducing inter-antenna correlation while maintaining compact terminal size. In this paper, a time-variant statistical channel model is proposed for tri-polarized antenna systems. The model is based on a coherent and a scattered component, where each component includes inter-channel correlation and cross-polar discriminations. The temporal variations of the channel are separated in slow and fast channel variations. A measurement campaign has been performed at 3.6 GHz to parameterize the model, in both static and mobile cases. A variant of the variogram technique has been adopted for extracting the slow-varying channel parameters. Experimental results are investigated and presented. The Doppler spectrum of the fast channel variations show fundamental differences between the static case and the mobile case. Finally, it is explained how the proposed model can be generated. [C259]

"Automatic data segmentation based on statistical hypothesis testing for stochastic channel modeling"

In order to extract the statistical characteristics of propagation channels, multiple impulse responses of the channels are measured and saved e.g. in terms of cycles or bursts. In the case where measurements are performed in time-variant environments, the received signals need to be divided into multiple segments. It is essential to perform the data segmentation reasonably in order to guarantee that each segment contains the observations of the same stationary process. In this contribution, we first show experimentally the impact of the number of data bursts per segment on the clustering results. Then a novel Kolmogorov-Smirnov hypothesis-testing-based approach is proposed for automatically determining the number of bursts in each segment. The applicability of this approach is evaluated using indoor channel measurement data. The results obtained show that the number of bursts in a segment follows lognormal distributions with parameters dependent on the environments and the mobilities of the transmitter, receiver and the scatterers during the measurement campaigns. [C260]

"Time variant channel estimation using a modified complex exponential basis expansion model in LTE-OFDM systems"

In future wireless communication systems like LTE, wide bandwidths for the transmission of high data rates result in frequency selective mobile radio channels. If data transmission takes place at high mobile speeds the mobile radio channel becomes also time selective. In this paper we propose for the estimation of such double selective channels a modification to the well known complex exponential basis expansion model, which is based on the assumed knowledge of the maximum Doppler frequency at the mobile user. We are able to reduce the estimation error by an order of magnitude up to very high mobile speeds for the OFDMA-based LTE downlink. [C261]

"Optimal pre-weighting design using pilot sub-carrier cluster in MIMO-OFDM channel application"

Instead of using eigen-beamforming approach to increase capacity gain, an optimal weight scheme is employed in the closed-loop multiple-input multiple-output (MIMO) orthogonal frequency division multiplexing (MIMO-OFDM) wireless system design. In particular, this scheme provides an uplink scale weight vector pre-weighting space-time block code (STBC) signals at each transmit sub-carrier in accordance to its space-time constellation, without utilizing the transmit channel state information (TCSI). A Bayes decision rule is adopted to generate the optimum weights using channel statistics measured from pilot sub-carriers cluster per OFDM symbol. Analytical

expressions of the signal-to-noise power ratio (SNR) improvement, based on the 2 Ч 2 MIMO-OFDM system model, are derived and discussed over spatially correlated fading channel. From our Monte Carlo simulations, the proposed scheme outperforms the Alamouti's detection in terms of the bit-error-rate (BER) performance with respect to various OFDM symbol size and pilot interval. The Doppler effect causes the inter-subcarrier-interference (ISI) are also taken into account. Hence, the derived analytical expressions of the SNR improvement are validated. [C262]

"New methods for in-situ calibration of attitude and doppler sensors for underwater vehicle navigation: Preliminary results"

This paper reports two new methods for the problem of in-situ calibration of the alignment rotation matrix between Doppler sonar velocity sensors and gyrocompass attitude sensors arising in the navigation of underwater vehicles. Previously reported solutions to this alignment calibration problem require the use of navigation fixes from an absolute external navigation fixes of the underwater vehicle, thus requiring additional navigation sensors and/or beacons to be located externally and apart from the underwater vehicle. We report a alignment calibration method employing only internal vehicle navigation sensors for velocity, acceleration, and attitude. Results from simulation data comparing these new methods to previously reported methods indicate satisfactory performance of the proposed methods in the presence of simulated sensor noise. [C263]

"Wideband monopulse spatial filtering for large receiver arrays for reverberant underwater communication channels"

Underwater acoustic communication (ACOMMS) is critical for many applications including marine science, oceanographic exploration, offshore surveying/drilling, and military uses. ACOMMS data rates are usually limited by multiple propagation paths with different time delays and Doppler characteristics. It is often difficult to coherently recombine all paths, especially in shallow water, leaving incoherent paths that interfere with the receiver. One way to suppress unwanted paths is with a directional receiving array. Indeed, many existing large, directional acoustic arrays could be used as ACOMMS receivers. In a number of these arrays, wideband monopulse outputs could be made available. These directional beam outputs, in monopulse pairs, can selectively suppress, or even null, offending multipath when combined with a simple scalar weight. Using an experimental system, we show how a relatively short equalizer, using as inputs the wideband monopulse beam outputs of a large array, can form the backbone of an ACOMMS system that performs effectively in a multipath-limited environment. Our contributions include (i) a multipath-Doppler channel model validated by experimental results, (ii) a receiver design that utilizes monopulse processing, and (iii) an analysis of its performance using simulated and experimental data. [C264]

"Frequency diversity for active sonar/radar application and optimal receiver design"

MIMO (Multiple Input Multiple Output) concept has been explored for radar/sonar application recently for improving target detection and estimation performance. The existing work in this direction mainly investigates the spatial diversity and waveform designs based on the assumption of the same carrier frequency for multiple transmitters. In this work, we investigate the frequency diversity by using multiple narrowband transmitters of different center frequencies. We prove that the ambiguity function for such signal is not an optimal receiver, and propose an optimal receiver for signals with different frequency components. [C265]

"Identification and matching of sparse Delay-Doppler Spread Functions from high-frequency communications signals"

This work proposes methods for estimating the responses of time-varying underwater acoustic channels using ℓ2- ℓ1basis pursuit and quantifying their similarity. This is motivated by problems where environmental information is to be extracted from communications signals through high-frequency ocean acoustic tomographic techniques. We view underwater channels as time-varying linear systems and characterize them by their Delay-Doppler Spread Functions (DDSF), which have many adjustable parameters but are often very sparse. Basis pursuit estimation of DDSF coefficients is achieved with either the SpaRSA or TwIST algorithms, which can efficiently handle sparse unconstrained ℓ2- ℓ1minimization even for very large problem sizes, and directly operate on the complex signals of baseband communication models. We show that these algorithms offer better performance than matching pursuit methods, in terms of DDSF estimation accuracy and computational complexity, using both simulated and real data. We examine criteria based on Euclidean distance, correlation, and Kullback-Leibler divergence for quantifying the similarity of DDSFs, as needed in the envisaged tomographic systems for matching observations and model predictions. Their performance is found to be similar, with the correlation metric showing somewhat less consistent performance than the other two in simulation. Our matching approach also enables a simplification of DDSF estimation algorithms by tolerating the inherent biasing in ℓ2-

ℓ1solutions, and thereby avoiding the need for further postprocessing. [C266]

"High gain pseudo-Doppler antenna"

Research into location finding using Direction Finding (DF) techniques has been biased in recent times towards variants of classic techniques such as MUSIC and ESPRIT. These covariance matrix based techniques remain computationally intensive and require precisely characterised antennas. Even more important is the hardware cost of multiple receivers associated with multiple antennas. The pseudo-Doppler technique boasts a lower computational and hardware cost but has not, until now, been considered suitable for DF at cellular telecommunication base station sites. This paper presents a novel pseudo-Doppler antenna array capable of high gain. The performance of the array and associated signal processing algorithm was analysed using a frequency normalised simulation model written in Simulink. The RMS error performance for an 8 element calibrated array is <;0.2° with a SNR ≥10dB when modulation frequency components are compensated for. The high antenna gain achievable (>20 dB) enables mobile station signals to be detected from deep within the current and neighbouring cells. [C267]

"Quantifying turbulence for tidal power applications"

Using newly collected data from a tidal power site in Puget Sound, WA, metrics for turbulence quantification are assessed and discussed. Of particular interest is the robustness of the "turbulent intensity," defined as the ratio of velocity standard deviation to velocity mean. Simultaneously, the quality of raw ping Acoustic Doppler Current Profiler (ADCP) data for turbulence studies is evaluated against Acoustic Doppler Velocimeter (ADV) data at a point. Removal of Doppler noise from the raw ping data is shown to be a crucial step in turbulence quantification. Excluding periods of slack tide, the corrected turbulent intensity estimates at a height of 4.6 m above the seabed are 10% and 11% from the ADCP and ADV, respectively. Estimates of the turbulent dissipation rate are more variable, from 10-3to 10-1W/m3. An example analysis of coherent Turbulent Kinetic Energy (TKE) is presented. [C268]

"A high data-rate, software-defined underwater acoustic modem"

Most underwater acoustic modems offer only low data rates. This is largely because they operate at low frequency, which limits the channel bandwidth available, and hence the symbol rate. The low frequency acoustic channel suffers from substantial multipath and doppler effects, which constrain the signal quality at the receiver. As a result only 1 or 2 bits per symbol are achieved, with the effective data rate further reduced by error control coding. High frequency acoustic signals are heavily attenuated in water, severely constraining the range of high frequency links. High frequency signals however offer substantially greater signal bandwidth, and probably improved channel quality which guides our design choice of a high frequency acoustic modem for underwater communication. Contemporary Field Programmable Gate Arrays (FPGAs) can provide good system functionality at low cost and with the flexibility to perform rapid testing and development of communication algorithms. They may also be competitive in production systems. In this paper we describe current progress in development of a high frequency, high data-rate modem which is implemented entirely in FPGA. This differs from most existing modems which are based on DSP processors. Being software defined, the modem is flexible because the parameters can be reconfigured with relative ease, minimising the cost of rework as the design evolves. This modem will not only demonstrate the feasibility of high frequency FPGA based modems, but will also be a valuable tool to provide a better understanding of the high frequency acoustic channel, and demonstrate the utility of absorption to enhance channel re-use rates in underwater acoustic networks. The modulator has been implemented in the FPGA, to produce laboratory and open water tests that conform to modelling. The demodulator has been implemented in Matlab, and recovers the carrier, code synchronisation and data from recordings of both laboratory and open water tests. Coding--of the demodulator into the FPGA is currently in progress. [C269]

"Impacts of Keystone formatting on Space-Time Adpative Processing in airborne radar"

Keystone formatting (KF) has the capability of compensating multiple targets' (including ground clutter) range walk simultaneously without using any specific knowledge of the target motion. However, due to serious Doppler ambiguity of the fast moving targets, KF will affect the distribution of the clutter and degrade the Space-Time Adaptive Processing (STAP) performance. Based on the above reasons, the impacts of KF on the clutter distribution are analyzed firstly, and then the impacts of KF on STAP are analyzed. The conclusions obtained are helpful to figure out better methods for fast dim air moving target detection. [C270]

"Correlation radar signal processing on basis of probability Kravchenko weight functions"

In this report the combined method of correlation radar signal (RS) processing based on the theory of atomic

functions (AF) is examined. Examples of using of new probability Kravchenko weight functions (WF) designs are presented. Quality functional for estimate accuracy and efficiency of RS processing for concrete physical models is constructed. It is shown that the proposed approach significantly improves the quality of the coherent analysis of the RS. [C271]

"Orthogonal waveform set design for netted radar"

Orthogonal netted radar system requires the transmitted waveforms with a very low autocorrelation and cross-correlation sidelobe peak level. Pseudo-random Phase Coded Modulation (PCM) waveform is suitable for orthogonal design in this sense. In this paper, the correlation properties of Gold sequences as binary phase codes are discussed. Numerical examples are presented to demonstrate the desired orthogonal properties of the coded pulse signal. The effect of Doppler shift and computation cost are also discussed. [C272]

"A novel STAP method for the detection of fast dim air moving targets"

Space-time adaptive processing (STAP) is an effective method for moving target detection in airborne radar. In this paper, a novel STAP method for fast dim air moving target detection is proposed. The new method suppress clutter in the received data firstly, and then apply Keystone formatting (KF) to compensate the target's range walk. Finally, target is accumulated by the conventional space-time beamforming. Effectiveness of the new method is verified via simulation examples. [C273]

"Spinning targets imaging based on OMP algorithm with radial basis function"

A new radar imaging method is proposed for spinning targets in space. The rapid spin motion of the target induces multi-period sinusoidal modulation of the radar echoes in both range and doppler domain, which causes Range-Doppler (R-D) algorithm invalid in conventional radar imaging. The presented method analyzes the echo model of the target spinning around an arbitrary axis. An exponential radial basis function (RBF) is then constructed from the scatters' range profile based on a distance-weighted criterion, and the image is rebuilt by recovering the projection of the target base on orthogonal matching pursuit (OMP) algorithm with the radial basis matrix. The simulation results show that the proposed method can obtain the radar image more effectively for the target with a uniform speed spin motion. [C274]

"Research on Scan-GMTI technology of airborne MIMO radar based on STAP"

Through successive azimuth scanning with narrow beam steered to different angles, Scan-GMTI technology provides a significant way to implement wide-area surveillance and track a particular target simultaneously. Applying MIMO mode to Scan-GMTI, abundance channel and frequency resources provide significant advantages for STAP algorithm to implement. The space-time-frequency joint processing will provide an effective approach for improvement of detection of slowly moving targets, reduction of Doppler ambiguities and blind velocities. [C275]

"Inverse synthetic aperture ladar imaging with the Range Instantaneous Doppler algorithm"

Inverse synthetic aperture ladar (ISAL), which operates at visible or infrared wavelength, is more sensitive to maneuver than inverse synthetic aperture radar (ISAR). In this paper, we propose the Range Instantaneous Doppler (RID) algorithm for very high resolution ISAL imaging of maneuvering targets. The Wigner-Ville distribution (WVD) and the Radon transform are used for computing the time-varying Doppler spectrum of maneuvering targets. The data processing of the RID algorithm is illustrated. The simulation shows that the RID algorithm can reconstruct a clearer ISAL image of the maneuvering target than the conventional rang Doppler (RD) algorithm. This is a crucial step in developing a real ISAL system. [C276]

"An improved algorithm for passive bistatic radar detection and parameters estimation"

In passive bistatic radar system, both detection and joint estimation of time delay and Doppler shift of target are based on the cross-ambiguity function (CAF) between direct-path signals and target echoes. However, the drawback of this approach is the excessive processing load which is caused by the fast Fourier transforms (FFT) for long input samples. Since the interested frequencies of target often occupy a small portion of the whole frequency range, it only required to analyze the sub-band of the whole frequency. A decimation technique which can decrease the operation complexity was applied to solve this issue. The cascaded integrator-comb filter (CIC filter) theory was briefly introduced, followed by detailed signal processing procedures used to implement the target detection and parameters estimation. This improved algorithm needs several extra steps to decimate the signals, while greatly reduces the overall computation complexity with almost no loss of signal processing gain. Finally, the effectiveness of this proposed algorithm is verified by the real data analysis. [C277]

"Clutter detection algorithms for airborne pulse-Doppler radar"

Clutter detection is an important stage of target detection. Clutter may not always appear around zero Doppler frequency when realistic terrain models and moving platforms are considered. Two algorithms developed for clutter detection using range-Doppler matrix elements and their performance analysis are presented in this paper. The first algorithm has higher error rates but lower computational complexity whereas the second one has lower error rates but higher computational complexity. The algorithms detect clutter position by filtering range-Doppler matrix elements via non-linear filters. [C278]

"Burst mode to strip-map mode SAR interferometry of ALOS PALSAR"

A complete processing flow is proposed to implement burst mode to strip-map mode interferometry for ALOS PALSAR data. The processing flow is applied to an interferometric pair comprised of FBD (High Resolution mode [Dual polarization], belonging to strip-map mode) and WB1 (Wide observation mode, belonging to burst mode) mode of PALSAR. Interferometric products including differential interferometric phase and DEM are generated. The evaluation of these products shows satisfactory precision. [C279]

"Weak signal acquisition of high earth orbits based on new BAP method"

In order to use GPS at the position of high orbits, it is necessary to research acquisition of weak GPS signal in the environment of high orbit. BAP (Block Averaging Pre-Processing) method is an effective algorithm to process weak signal, but it assumes that the receiver does work in the indoor environment with little dynamic effects. Based on the analysis of orbit parameters' effects on the Doppler shift, this article concludes that it is necessary to improve BAP for using in the high orbit environment. From the offset compensation of code Doppler, calculated amount improvement of the algorithm, threshold value reduced, this article does further improvement to the BAP algorithm, making it suitable for high-orbit environment. Simulation results show that: Using of this improved algorithm can effectively reduce the algorithm's acquisition threshold value, thus enhancing the ability to acquisition the navigation signals. [C280]

"The cascaded time-space reverberation suppressing method based on primary component analysis"

The performance of detecting weak targets is not fine for active sonar by using the cascaded time-space adaptive method. Based on which, this paper presents a modificed cascaded time-space adaptive method. The new method enhances the performance of active sonar detecting weak targets greatly by means of ODN narrow notch filter that is carrid out by the technology of reverberation primary component analysis. The sea trial results to verify its effectiveness are presented. [C281]

"An improved passive location algorithm for maneuvering target emitter"

With the merits as hiding receiving, far responding distance and easy-deploying, the single observation passive location has a broad application in military domain. Especially, it plays an important part in passive radar, navigation and aerospace, etc. With the information of phase-difference, phase-difference rate of change and Doppler frequency rate of change, a new algorithm based on EKF (called PFRC) is proposed. Compared with two popular passive location methods which are bearing-only (BO) and phase-difference rate of change (PRC), the PFRC has good performance in that it has higher precision and higher speed. However, the PFRC, based on the EKF, can only give a biased state estimation, which has poor robustness and precision against model mismatching and is inapplicable for maneuvering target tracking. In order to overcome the above limitations, based on the PFRC and the strong tracking filter (STF), an improved passive location algorithm is proposed. Simulation results show that the proposed algorithm has better performance. [C282]

"High order Doppler parameter estimation of bistatic forward-looking SAR based on CPF-Radon transform"

For high quality synthetic aperture radar (SAR) processing, Doppler parameter estimation is an essential procedure. In this paper, the azimuth data of bistatic forward-looking SAR are modeled as cubic polynomial phase signals, and the CPF-Radon transform is used to estimate the high order Doppler parameter. Simulation results validate the effectiveness of this method. [C283]

"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. [C284]

"Analysis of inner-pulse Doppler effect for the echoes of inverse synthetic aperture LADAR"

Inverse synthetic aperture LED AR is an active imaging system, which can achieve high resolution real time imaging for moving targets. For the traditional inverse synthetic aperture radar, the inner-pulse Doppler frequency will reduce the quality of image obviously only when the target has high speed. However, due to the ultra-high frequency and ultra-wide bandwidth of the laser signal, the influence of inner-pulse Doppler cannot be ignored even for the low speed moving targets in the ISAL. This paper analyzes the inner-pulse Doppler effect of the ISAL echoes and presents an echo model for the ISAL. Via the conventional motion compensation method, in which the accurate estimation of reference point's track is obtained after range realigning and phase focusing, the inner-pulse Doppler effect can be removed and then the image of target can be achieved. Finally, some simulation results are given in the paper. [C285]

"Micro-Doppler effect analysis based on inverse synthetic aperture imaging LADAR"

Although the micro-Doppler (m-D) effect can provide additional information for target recognition, the microwave radar cannot afford enough resolution to detect the m-D effect of small targets and long distance targets. To obtain high range resolution for the extraction of the fine m-D signatures, inverse synthetic aperture imaging LADAR (ISAIL) is used here. Because of the frequency modulation continuous wave (FMCW) laser signal is used in ISAIL, the m-D effect of ISAIL is different from the microwave radar. In this paper, the m-D effect of ISAIL is analyzed and compared with that in X-band radar. The experiment results show that ISAIL can offer sufficient information of micro-motions when the feature of motions is tiny. [C286]

"Research on adaptive beamforming for airborne phased array radar"

PD mode is usually adopted in airborne phased array radar. However, there are two problems which severely degrade the performance of adaptive beamforming. One is the ground clutter return in the training data, the other is the target return in the training data. Therefore, in this paper, the two problems above are analyzed in detail, and then the methods suitable for engineering realization are presented. Computer simulation results are presented for illustration. [C287]

"Time delay and doppler shift estimation accuracy analyses of moving targets in non-cooperative bistatic pulse radar"

According to the characteristics of non-cooperative bistatic pulse radar systems and the issue that the doppler mismatched loss of the cross-correlation detection of moving targets is serious, two fast methods for joint time delay and doppler shift estimation of moving targets, based on segment correlation-FFT processing and modified partial segment correlation-FFT processing, are proposed, after analyzing the common methods for cross-ambiguity function processing such as direct calculation, FFT, Zoom-FFT method. The processing performance of direct calculation and partial segment correlation-FFT processing of LFM pulse-series is analyzed in theory and by simulation. And the simulation shows that the weak moving target can be detected effectively and the time delay and doppler shift can be fast estimated by the methods presented in this paper. [C288]

"Spectral analysis of Doppler ultrasound blood flow signals from stenosed vessel in a steady flow"

A simulation approach was proposed to analyze the spectra of Doppler signals from stenoed artery in a steady flow, which can provide a useful guidance for detecting the formation understanding, diagnosis and treatment of many cardiovascular diseases. Firstly, by solving Navier-Stokes equations, the velocity distributions in the vessels with various stenoed degrees are calculated. Secondly, power spectral density (PSD) of the Doppler signals is estimated according to the relationship of velocity profiles and power spectral density. Finally, Doppler signals are generated using cosine-superposed methods. The results show that the spectra of Doppler signals are similar to those found in practice. Therefore, the proposed approach is useful for simulating the spectra of Doppler ultrasound signals from stenoed artery in a steady flow. [C289]

"The inversion of sea state based on the micro-Doppler analysis of sea-clutter"

The real sea-clutter data are always hard to analyze due to their instinct complexity, large scale non-stationary,

and lack of fundamental understanding of the natural dynamics. Measurable modeling of sea clutter is an important precondition in many research areas and practical applications, such as salvage and marine radar signal processing. However, few works have been down on the time-frequency analysis of sea clutter, especially no effective method for sea state inversion from sea clutter has been proposed. In this work, the author take into account the motion model of sea surface in typical scenarios via time-frequency and micro-Doppler effect analysis. Different contributions of the waves' velocity may provide intuitionistic ISAR images and contain certain motion parameters, from which certain sea state parameters might be inversed. Both theoretical simulation and experimental results indicate the usefulness of the model and method proposed in this work. [C290]

"Mobile unit velocity estimation in micro-cellular systems based on the statistical characteristics of the received signal"

Estimation of the maximum Doppler spread or, equivalently, the vehicle velocity is useful in improving handoff algorithms and necessary for the optimal tuning of parameters for systems that adapt to changing channel conditions. A new mobile station velocity estimator is presented based on the time-frequency characteristics of the received signal to evaluate the velocity of Mobile Station, which considers many parameters we need to know beforehand to estimate velocity such as Ricean-factor κ, signal-to-noise ratio γ, scattering directivity χ and jointly uses the first moment of the instantaneous frequency and Zero Crossing Rate of the received signal by employing the first three spectral moments of received signal. The proposed method has superior performance compared to other velocity estimation methods because it considers many parameters' effect which is not or partly not considered in existing velocity estimators. Simulations illustrate our approach. [C291]

"A novel ISAR alogrithm for the imaging of ship targets based on AM-LFM model"

Rang-Instaneous-Doppler (RID) processing is widely used in ISAR imaging of maneuvering target and acceptable image can be achieved when the amplitude modulation effect of scatterers echoes can be neglected during intergation time, whereas, the RID method based on the assumption above does not work properly when the variant amplitude modulation of scatterers' echoes involved, such as ship target. In this paper, a multicomponent amplitude modulation and linear frequency modulation (AM-LFM) signal model developed and a fast parameter estimation technique-DechirpClean method proposed. To achieve the best quality in DechirpClean ISAR image, a new effective optimum imaging interval selection scheme addressed. The performance of proposed method is verified by comparing the result with the image produced by conventional RID method from the real data processing. [C292]

"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. [C293]

"Study of continuous wave radar for human motion characteristics measurement"

Human motion characteristics study based on radar is a new technique developed in recent years. This paper firstly analyzes the model of human radar returns, and then designs an X-band continuous wave radar for human motion characteristics measurement. Experiments for measuring the human motion characteristics have been performed based on the radar. The Doppler features of human motion are extracted with time-frequency analysis from actual measured data generated by the radar, which verifies the validity of the measurement data. [C294]

"Analysis and suppression for nonstationary clutter in airborne conformal array radar"

The characteristics of clutter nonstationarity for airborne radar with conformal antennas array (CAA) are analyzed, and an improved angle-Doppler compensation method is proposed based on above analysis. Unlike the uniform linear antennas array (LAA), the elements of CAA distribute in three-dimension space which lead to

that the clutter angle-Doppler spectrum distribution should be described in four-dimension space. According to this theory, the clutter nonstationarity for airborne radar with CAA is firstly analyzed and the nonstationary nature of it is given. Then an improved STAP method for airborne radar with CAA which compensates the mainlobe clutter in four-dimension frequency domain is proposed. Finally, the simulation shows the effectiveness of the novel method for clutter suppression in airborne radar with CAA. [C295]

"A novel CFAR detector for terminal guidance coherent radar"

In different Doppler channels, the amplitude distributions of sea clutter received by terminal guidance coherent radar are different. The Rayleigh distribution and Weibull distribution can be used to describe the amplitude distribution of different Doppler channel. A novel CFAR detector is proposed. Its performance is compared with column-window CFAR detector. The simulation results confirm that the proposed CFAR detector has a better detection probability compared with column-window CFAR detector. [C296]

"Analysis of signal characteristic and resolution in ground forward scattering radar"

In this paper, the target magnitude signature and Doppler signature characteristics are analyzed in detail. Based on the Doppler signature, the target motion parameters can be extracted. Combining the magnitude signal and Doppler signal, the target convoy resolutions in ground forward scattering radar (FSR) are analytically obtained, which is different from the conventional shadow inverse synthetic aperture radar (SISAR) resolution. Finally the experimented results fully verify the correctness of theoretic analysis. [C297]

"Self-calibrated method for distributed small satellite SAR systems"

In practice, the performance of the Distributed small satellite synthetic aperture radar (DSS-SAR) systems is affected seriously by the unavoidable array errors. In this paper, the phase and position errors are considered with the gain error calibrated by the adaptive processing. The clutter echo usually has Doppler (azimuth) ambiguities which is caused by lower pulse repetition frequency (PRF) in such systems. The array error estimation method is given based on the Doppler ambiguities. By analyzing the conventional method in which the phase error and the position error are estimated by iterating between each other, we And that: the steering vector of one Doppler ambiguity associated with the zero Doppler bin is conjugate to its opposite one. So the phase error can be directly obtained though the position error exists. The proposed method is given based on this. It estimates and the position error independently without iterations between them. The proposed method can performs approximately as well as the conventional method but with less computation load. Simulations can verify its effectiveness. [C298]

"Modeling and simulation of small-scale fading for vehicle-to-vehicle communication"

Small-scale fading has its origin in the constructive and destructive superposition of electromagnetic waves. The fading process can be modeled by adding vectors in the complex plane using the so-called phasor model. Simulation results showed that this modeling allows very accurate reproduction of measured fading processes. The parameters of the phasor model can be obtained from measured Doppler power spectra. Statistical distributions of these parameters are offered for the oncoming traffic scenario in urban environment. [C299]

"Doppler profile estimation in VHF radar signals using wavelets"

The wind profile estimations are the fundamental objective of the Indian MST radar with the received signal ranging from nearly 3.5-25 Km height. A widely accepted narrow band model is considered, for the analysis of the signal received. Though the received signal SNR is stronger at lower altitudes, as the height progresses the strength becomes feeble and the noise dominates the received signal. The classical Time-Frequency analysis is made on the received signal from different altitudes and observed that the zero Doppler influence is significant at higher altitudes along with the noise. A Hilbert transform based DC bias removal is proposed in contrast with the existing 3 point MA technique. To handle the noise, in particular at higher altitudes a wavelet based adaptive denoising is proposed and found satisfactorily for the spectral cleaning of the Doppler spectrum. The validation of the proposed algorithm is made with the GPS data. [C300]

"Influence of rain Doppler frequency on MMW Doppler fuze"

Guided weapon systems require a proximity fuze device to trigger the explosive warhead. Various proximity fuze types are currently employed. The millimeter wave (MMW) radio Doppler fuze is a potential advantage system, and it is required for a wide range of military application. In this paper, the MMW fuze Doppler Effect is discussed in the encounter course of fuze and target. The target Doppler frequencies (DF) caused by the target moving relative to fuze are calculated at 35 and 95GHz. The relationship of the target DF with the distance

between fuze and target is obtained. The rain Doppler frequencies induced by the volumetric rain medium for the interested rain area around target moving relative to fuze are calculated at 35 and 95GHz. The relation of the rain DF with the distance between fuze and the interested rain area are given. The influences of rain DF on target DF are analyzed. It is shown that when the distance between fuze and target is less than about 30m, the difference between the rain DF and the target DF decrease gradually with the distance decreasing. The influences of rain DF clutter on target DF information become gradually bigger with the distance approach, especially, for heavier rainfall, a smaller target and a wider fuze radar beam. Therefore, when the encounter distance between fuze and target is less than about 30m, the influence of the rain Doppler clutter on the target Doppler signal is severe, and need be considered for the MMW Doppler fuze application. [C301]

"Mobile radio channels' estimation for SC-FDMA systems by means of adequate noise and inter-carrier interference filtering in a transformed domain"

This paper proposes a new channel estimation technique for mobile radio multipath channels in the context of SC-FDMA system. SC-FDMA is currently adopted for mobile radio uplink communications in 3G LTE because of its low PAPR. In this system, 1/7 SC-FDMA time symbols are dedicated to perform the channel estimation. This is sufficient when the channel can be considered as constant over the 7 symbol periods. But it is clear that transmission channel can change rapidly over time, typically when the user (UE) moves with an important enough velocity, thus introducing Doppler effect and therefore Inter-Carrier Interference (ICI). Our proposition deals with this situation, and consists in filtering the channel noise and ICI perturbation through a new transformed domain. This approach is based on the variation rate of the channel's frequency response and the nature of the noise and ICI component in the Transformed domain. The performances obtained are very convincing since we have up to 3 dB gain compared to the simple interpolation solution encountered in the literature. [C302]

"Improved data-aided receiver for high-speed mobile environment"

In order to ensure service quality of communication in high mobile speed, the improvement of receiver's performance is of great importance. The paper takes high-speed communication as the researching background. Algorithms for equalizing intersymbol interference and Doppler Effect are studied for data-aided transmission. The inputs of equalization are improved by the mended derotation method. Take frequency deviation introduced by Doppler Effect and receiver itself into consideration, a cascade structure of frequency estimation and compensation for equalization algorithm is proposed. Simulation results show that the method promote the performance of the system well. [C303]

"Impact of inter-carrier interference (ICI) on SIMO OFDM system over Rayleigh fading channel"

Performance of a single input multiple output (SIMO) orthogonal frequency division multiplexing (OFDM) system is analyzed considering the channel characterized by frequency selective and Rayleigh fading environment with maximal ratio combining (MRC) at the receiver. The analysis includes the effect of inter-carrier interference (ICI) due to frequency offset caused by Doppler frequency shift. The result are presented in terms of bit error rate (BER), power penalty, BER-floor for different values of fading, number of subcarriers, symbol duration and different receiving antennas for BPSK and QPSK modulation schemes. It is noticed that the system suffers significantly due to ICI and can be improved by increasing the number of receiving antennas. [C304]

"A combined analytical model on the bit error performance of a DS-CDMA wireless communication system in presence of Doppler shift, timing error and frequency offset"

In this paper a composite analytical model of DS-CDMA wireless communication system considering multipath Nakagami fading along with Doppler frequency shift, tracking jitter, local oscillator frequency offset and multi-access interference (MAI) for different PN sequences is presented. The analysis presents the development of a novel approach to find the pdf (probability density function) of the signal to interference plus noise ratio (SINR) at the output of Rake receiver considering combined influence of fading, timing jitter and Doppler frequency offset etc with maximal ratio combining (MRC) scheme. Performance results are evaluated in terms of average bit error rate (BER) at the output of MRC receiver by averaging the conditional BER over the pdf of SINR. The results are presented in term of BER for Gold and m-sequence codes and different system parameters. Analysis shows that increasing independent multipath detection ability of rake receiver improves SINR performance and mitigates the effect of Doppler frequency shift. [C305]

"Fast acquisition for Galileo CBOC signal"

In this paper, a fast parallel acquisition unit with combination of data and pilot components for Galileo CBOC

receiver is presented. Due to secondary code and high rate data, the coherent time is limited by bit transition, so code serial acquisition in this unit is adopt while carrier frequencies are scanned in parallel based on FFT. Coherent time can be extended with the assistant of secondary code and data code. In this unit, coherent time, non-coherent times as well as code rate are configurable via interface to MCU, which enable user to adjust to variant situations. Theoretical analyses and simulation performances are given for different configurations. Details for implementation in different cases of this unit are further discussed, and finally, improvement consideration for code phase parallel scan is given. [C306]

"The study of Range Doppler Algorithm in focusing Bistatic SAR"

Comparing to monostatic SAR, Bistatic SAR has specific advantages, such as the reduced vulnerability in military systems, additional information about the target and characteristics of signal. Nevertheless, it brings the complication of processing algorithms because of the range history of a Bistatic target is the sum of two hyperbolic range equations, which give a double square-root term in the range equation, and the traditional RD algorithms using in monostatic SAR can not apply for processing Bistatic SAR. This paper obtained the point target signal by establishing the echo signal model, then derived the approximate two-dimensional spectrum of echo signal by using POSP, and a Range Doppler Algorithm suitable for Bistatic SAR is presented. The algorithm is validated by the simulation experiments of point targets. [C307]

"Design and realization of PN code tracking loop in spread spectrum transponder"

PN code phase has been approximately synchronized after PN code acquisition. But code phase is keeping changing constantly under high dynamic environment, and then the correlation peak will be losing lock rapidly if without any compensation approach. Thus how to design code tracking loop under high dynamic environment has become a key step in spread spectrum transponder. This paper begins with the analysis of loop characters, not only derives the sensitivity of phase detector, but also describes the design of loop filter parameters, and at last it gives the simulation results. The analysis and simulation results indicate that it can achieve the goal of accurate tracking of code phase by this kind of code tracking loop. [C308]

"A study of wireless channel on GSM-R network"

GSM-R is a railway communication system based on the GSM technology. With the widely develop of high-speed rail, the GSM-R quality of service (QoS) is becoming much more important than ever. We analyze GSM-R by measuring field coverage and radio field coverage model, deducing the Doppler frequency offset, giving the upper and lower limits of overlap in handover at different speed, and studying the data-transmitting error rate of GSM_R network. We propose that increasing the space of two neighbor cells does not significantly weaken the quality of field coverage, but can reduce the chance of ping-pong handover and other network performance. We also discover that the Doppler frequency is decreasing gradually and the error rate is decreasing shakingly when the train is becoming closer to the base station. All the data we used in this paper is comes from drive tests on JJ-DPL and W-G DPL, China. [C309]

"Low-resource and efficient parallel frequency search method for GNSS receiver"

Partial Matched Filtering based on Fast Fourier Transform (PMF-FFT) is one of the rapid and effective parallelism algorithms to capture the satellite navigation signal. In order to reduce the barrier effect which caused by the FFT-based fast parallel frequency search, zero-padding and windowing are the two common compensation methods. Nevertheless, zero-padding and windowing will lead to heavy computation. In this paper, we propose a novel acquisition algorithm which integrates the low-bit quantization on the FFT/DFT coefficients based on PMF-FFT and zero-padding. It not only reduces the barrier effect but also the computation load, the resource and the power. Global navigation satellite system (GNSS) receiver can benefit from this algorithm much more than the single-mode satellite navigation receiver. [C310]

"Combined method for single satellite passive localization based on PSO"

Enlightened by the combined method (CM) for traditional passive localization of ocean and air based applications, and considering that passive localization is a typical nonlinear filtering and optimal estimation problem, CM for single satellite passive localization is examined based on Particle swarm optimization(PSO), which provides an evolutionary computation method to solve the nonlinear optimal problem. However, PSO can not be straightforwardly applied to satellite passive localization because satellite passive localization is a constrained nonlinear optimal problem when using the constraint condition of the earth surface. We suggest calculating the particle swarm directly using the earth surface constraint, and the uncertainty of particle position can be resolved by the angle measurements. Computer simulation experiments are performed to validate the effectiveness of the proposed method. [C311]

"Design of vinyl chloride dehydration-type hydrocyclone based on test research"

Vinyl chloride(VCM) and water were be the research objects, by changing the swirl cone angle and inlet flow, Phase Doppler Particle Analyzer (PDPA) was used to test the hydrocyclone's flow field. By comparative analysis its internal laws, the best operating conditions of vinyle chloride dehydration were obtained. A 35mm diameter VCM dehydration-type liquid-liquid hydrocyclone was developed, and it was used in PVC production industry, product quality and devices continuous operation were improved. Significant economics and social benefits were obtained. [C312]

"A new method for simulation of embolic signal in ultrasound blood flow signals"

A new method for simulation of Blood Flow signal containing embolus is introduced. This method relies on acoustic field calculations. Other researchers such as Jensen proposed an approach for flow data generation which shots of scatterers at different times were taken and did not take the Doppler effect into account. This method is based on Rayleigh integral and spatial impulse response. According to Rayleigh integral and using Ring function, we calculate the spatial impulse response of each scatterer. So by using that, the acoustic pressure can be simulated. When a scatterer travels across the vessels the spatial impulse response will be time variant. With assuming this fact we add the Doppler effect to signals. For simulating the embolic signal we add a high intensity transient signal. The result signal can be useful for testing embolic detection algorithms and for training purposes. [C313]

"Compensation techniques for doppler effect in UWB-based rotor-telemetry system"

This paper covers a new scenario based on UWB-technique for transmission of data, which is the rotor-telemetry. The rotor-telemetry is a special type of a radio-telemetry, where measuring data of physical parameters like pressure or temperature are captured by sensors predominantly on rotating objects such as shafts or gear parts, transmitted over special on the rotor mounted along-moved antennas and received by static antennas. A new problem appears with this scenario: since the rotor moves fast, the impact of Doppler rises significantly. In this paper we will first analyze the Doppler effect mathematically, then we will give a short overview about techniques, how to estimate the frequency dependent Doppler shift of the UWB-signal and finally we will focus in detail on techniques to compensate the Doppler effect caused by very fast rotation speed. [C314]

"Performance evaluation of a distributed SFBC relay-assisted scheme for OFDM systems"

In this paper we investigate the performance of a 2-relay cooperative scheme, where all the nodes are equipped with a single antenna. We consider Decode-and-Forward as relaying protocol and a distributed space-frequency block is employed. Two schemes are proposed: one with and another without the direct path available. Signals expressions are derived under various propagation scenarios, considering power constraint imposed on cooperating nodes. The aim of this work is to evaluate the proposed relay-assisted schemes, under realistic situations (e.g. correlated antennas, precise channel models, Doppler effects) for typical pedestrian scenarios based in WiMax specifications and using channel turbo coding. The coded performance of the proposed relay-assisted schemes is evaluated, considering different modulations, and compared against non-cooperative OFDM based systems. The proposed cooperative scheme outperforms in most of the studied scenarios the SISO and the co-located 2Ч1 SFBC. [C315]

"Time-scale domain characterization of nonstationary wideband vehicle-to-vehicle propagation channel"

The design and deployment of efficient vehicle-to-vehicle (V2V) communications systems require the knowledge of the propagation channel in which it will operate. Due to the mobility of the transmitter/receiver terminals as well as the existence of dynamic scatterers, the V2V channel is nonstationary. To account for the nonstationarity, channel characterization methods that employs the non wide-sense stationary uncorrelated scattering (non-WSSUS) approach are often desired. More also the inadequacy of the Doppler shift operator to properly account for frequency variation effects by the wideband channel operator implies that the time-frequency characterization methods that employ the Doppler shift operator are not appropriate for wideband V2V channels. In this paper we present the time-scale domain characterization of the non-WSSUS channel which employs time scaling operator to account for frequency variation and also emphasizes on the non-stationary property of the channel. The non-WSSUS statistical property termed local sense stationary uncorrelated scattering (LSSUS) is employed. The effect of the channel nonstationarity on the channel capacity is also addressed. From the simulated example, it is inferred that the assumption of ergodic capacity depend on the number of available independent fades which invariably depend on the degree of the V2V channel nonstationarity. [C316]

"Verification of a VHDL GPS baseband processor using a simulink-based test bench generator"

In the last decades, Global Positioning System (GPS) receivers have become more popular and are now incorporated in mobile phone electronics and also in navigation systems, namely in automotive, marine and aerospace equipment. This paper presents the design of various digital signal processing (DSP) and communication blocks which form an integral part of a typical L1-band Coarse/Acquisition (C/A)-code baseband receiver. These modules are designed using synthesizable VHDL code and implemented on a Field Programmable Gate Array (FPGA). Furthermore, a novel satellite signal modulation model is also designed to model how signals are generated by the satellites. This is designed to ultimately generate the VHDL test-bench to verify the functionality of the designed receiver. This model can be extended to cater for second order effects such as Doppler shifts, atmospheric delays and weather conditions. In this work, the noise performance of the receiver is analyzed. It is noted that the minimum signal-to-noise ratio (SNR) that the baseband processor can tolerate is −10 dB given a correlation window of 2 ms. [C317]

"Blood flow analysis using euclidean distance algorithm and discrete wavelet transform"

To improve the quantitative analysis of Blood flow signal, measured with Laser-Doppler Flowmetry, Wavelet Transforms are used. This proposed algorithm consists of three phases. In the first phase, RBC's in the blood flow signal is measured with the help of the LDF model. In the second phase, the Wavelet Transforms are used to extract the features of the signal. Two signals are used for analysis, one from the normal patient and another from abnormal (diabetic) patient. In the third phase, to identify the abnormal patient, the Euclidean distance algorithm is used. [C318]

"Experimental evaluation of channel prediction based on linear prediction of frequency-domain parameters"

If the future channel response is predictable we can employ pre-equalization before transmission in order to overcome the degradation of communication quality in a time division duplex (TDD) system. Previously we proposed a linear parameter prediction method for highly accurate prediction of time-varying channels by using chirp Z transform (CZT) and regarding the channel as summation of discrete Doppler paths in the frequency domain. In this paper, we report experimental results of our method, namely, linear prediction of frequency-domain parameters (LPFDP). We show the evaluation results in the phase and power predictions experimentally. We succeed in the improvement of the prediction accuracy by applying our LPFDP method to the actual data. [C319]

"Influence of hand tremor for 60-GHz-band broadband wireless communication terminal based on advanced kiosk model"

For realizing over 2 Gbit/s transmission rate at portable terminals, we propose Advanced Kiosk Model (AKM) of 60 GHz band indoor multipath condition with hand tremor. In the AKM, coverage and bit error rate (BER) are defined as 10 m and 1 Ч 10−5or less, respectively. Environment of multipath with Doppler effect by hand tremor causes serious inter-symbol interference (ISI). In this paper, we evaluate influence of hand tremor at 60 GHz communication systems. Measurements of relative amplitude with 2 path environment are well matched to simulation results. Simulation results show hand tremor cause serious ISI. Due to ISI, large degradation of BER performance is occurred every 1 ms periodically. Therefore, it is strongly necessary to consider influence of hand tremor with multipath environment for designing of 60 GHz-band wireless communication system. [C320]

"Wavelet-modulated pulse for compressive sensing in SAR"

A new wavelet modulated pulse is proposed for synthetic aperture radar (SAR). Conventionally SAR image is constructed using chirp, i.e., FM in the range direction, and the Doppler effect in the azimuth direction. The proposed scheme is to physically modulate the amplitude of the radar pulse (AM) using wavelets. Such a radar pulse results in the shift of the wavelets in the temporal domain due to the range, while the Doppler effect causes variation of the scaling coefficient. In both directions, pulse compression can be achieved by taking advantage of the autocorrelation function of the compactly supported orthogonal wavelets and processing the echo signal in the two directions accordingly. Furthermore, by using wavelet modulated pulses, the echo signal is equivalent to the wavelet transform (WT) to the target area. Since WT has been proved more effective in image compression than conventional discrete cosine transform (DCT), wavelet-modulated pulse is equivalent to compression to the SAR image thus to achieve compressive sensing. Experiments have been performed using the latest embedded software defined radio (SDR) technology. Equipped with the most recent FPGA and digital signal processors along with high speed analog-to-digital and digital-to-analog converters, the SDR allows signal

processing tasks commonly done by analog circuits to be performed digitally with high flexibility in algorithm design. Based on the developmental need of the user, the small form factor software defined radio (SFF SDR) can serve as a simple data collection device for waveform testing or it can be programmed into a real-time embedded radar system. [C321]

"Doppler-aided target tracking in heavy clutter"

Target tracking in clutter uses measurements of uncertain origin. In addition to target detections, in every scan the sensor returns clutter measurements. Standard target tracking in clutter most often uses the position measurements only. The tracking then becomes clutter limited, and beyond a limited clutter measurement density target tracking algorithms do not perform. Using the Doppler information of each measurement can significantly increase these limits. Previous publications used Doppler measurements either to improve the data association probabilities only, or to improve trajectory state estimates only. Whilst it helps, it often is not enough. This paper extends popular Integrated Probabilistic Data Association to use Doppler information in the track update step both to enhance the Data Association probabilities, and to improve trajectory state estimation. A simulation study shows that this approach may provide reliable automatic target tracking in the case of severe clutter. [C322]

"Radar tracking performance when sensing and processing compressive measurements"

Radar tracking performance is improved when using waveforms at high delay-Doppler resolution with concentrated ambiguity functions. High resolution measurement acquisition and processing, however, requires high rate sampling and intensive processing. Alternatively, compressive sensing and processing can be used to significantly reduce data rates with no loss in resolution. The drawback is, however, that using compressive measurements increases ambiguity function sidelobes and thus tracking error. In this paper, compressive sensing and processing is applied to single target tracking. The effect of compressive sensing and processing on the ambiguity function sidelobes is examined. Moreover, estimation using compressively sampled and processed Bjojrck CAZAC sequences is shown to be improved over estimation using linear frequency modulated waveforms sampled at the Nyquist rate. This shows that low-rate acquisition and processing maintains reliable tracking performance at high resolution, while simplifying the receiver and reducing computational expense. [C323]

"A coherent underwater acoustic communication system based on joint iterative equalization and decoding algorithm"

Underwater acoustic communication is one of the key technologies in various important research fields, such as ocean geography, offshore oil industry and defense. However, conventional system design can not achieve desirable results, since the underwater channel suffers a lot from multipath propagation and Doppler Effect. In this paper, we aim to introduce a type of coherent underwater acoustic communication system, which combine the joint synchronization and equalization scheme and the joint iterative equalization and decoding technique to combat the severe underwater environment mentioned above. The platform belongs to the physical layer and can take various high layer applications. The proposed system is tested in computer simulated scenarios and experimental data, both of which demonstrate good performance. [C324]

"Position USBL/DVL sensor-based navigation filter in the presence of unknown ocean currents"

This paper presents a novel approach to the design of globally asymptotically stable (GAS) position filters for Autonomous Underwater Vehicles (AUVs) based directly on the nonlinear sensor readings of an Ultra-short Baseline (USBL) and a Doppler Velocity Log (DVL). Central to the proposed solution is the derivation of a linear time-varying (LTV) system that fully captures the dynamics of the nonlinear system, allowing for the use of powerful linear system analysis and filtering design tools that yield GAS filter error dynamics. Simulation results reveal that the proposed filter is able to achieve the same level of performance of more traditional solutions, such as the Extended Kalman Filter (EKF), while providing, at the same time, GAS guarantees, which are absent for the EKF. [C325]

"Negative optical phenomena"

Negative refractive index meta-materials are new kinds of artificial materials having both negative permittivity and negative permeability. Some negative optical phenomena can be anticipated with negative index, such as inverse Doppler effect, anomalous Cerenkov radiation, and negative refraction. The peculiar properties of meta-materials have been experimentally confirmed, and have aroused strong concern these years. However, negative optical phenomena do not always occur in negative refractive index media. Here we review various negative optical phenomena of meta-materials and other materials. Our recent progress is also given. [C326]

"Adaptive spectral doppler estimation based on RLS algorithm"

In this paper, an adaptive spectral doppler estimation based on recursive least squares (RLS) algorithm is proposed for blood velocity distribution estimation. The purpose is to (i) minimize the observation window needed to estimate the spectral distribution and get better temporal resolution, (ii) adaptive estimate the spectral distribution using the current data. An optimization problem is built and solved by matrix gradient method and Matrix Inversion Lemma to get the optimal weighting coefficients and adaptive realization. Simulation results illustrate that the proposed scheme can significantly realize the purpose. [C327]

"Throughput enhancement by cross-layer header compression in WLANs"

A major limiting factor in increasing the throughput of wireless networks has been the bottleneck of prohibitive signaling overhead. A number of header compression schemes have been proposed to solve this particular problem. These, however, come with their set of limitations and suffer from a loss of practicality in certain cases. Our contribution in this paper is two-fold; firstly, we propose a practical framework for cross-layer header compression which improves vastly on existing data rates (by more than 25% of raw throughput at high SNRs). This is achieved by applying independent compression algorithms to both MAC and PHY data units, thus ensuring better throughput. Secondly, we analyze the performance of proposed scheme in slow fading as well as fast fading environments to demonstrate robustness. [C328]

"Analysis of Turbulent Characteristics of Unevenly Velocity Signals in KSM Used Empirical Mode Decomposition and Lomb Periodogram"

In this paper, Lomb periodogram estimate as a new spectrum calculation approach was used to deal with unevenly sampled signals sampled by Laser Doppler Particle Analyzer in Kenics Static Mixer. The effectiveness of the method was demonstrated by the simulations of deterministic model. The time series of instantaneous velocity in the turbulent region under the range of Re between 3972 and 11916 were firstly decomposed by empirical mode decomposition, and intrinsic mode functions were obtained. After that, the spectrum analyses of intrinsic mode function were evaluated based on Lomb periodogram estimate. The power spectra distribution shows that the energy of instantaneous velocity signal in KSM concentrates within 10Hz, and high frequency signal contains low energy. [C329]

"A Novel Velocity Compensation Algorithm by Graph Matching Method"

A novel velocity compensation algorithm is proposed. By extracting all potential scatters of two range profiles as two point patterns, the algorithm matches the point patterns by means of graph matching method. The velocity is estimated by the distance of correspondent points. The simulation experiments on range profiles with varying SNR, false scatters, and clutter aiguilles show the robustness of the new algorithm. [C330]

"Subspace compressive GLRT detector for airborne MIMO Radar"

In this paper, the design of a subspace compressive GLRT (SSC-GLRT) detector has been pursued for MIMO airborne radar system when the secondary sets of data are available in addition to the primary one. It is observed that with very reduced amount of measurement data at sub-Nyquist rate that is equal to the number of virtual bi-static radar in the presence of a single target, SSC-GLRT provides the same performance as the conventional GLRT with much larger length of the data, i.e., an order of magnitude higher given by the product of the number of elements in the received antenna array and coherent pulse interval (CPI). Therefore, SSC-GLRT is much energy efficient and useful in the scenario where the computational complexity becomes a burden. Also, this paper illustrates an elegant way of mapping the angular and Doppler domain to an one dimensional discrete vector for the formulation of compressive sampling (CS) based ℓ1reconstruction of the signal subspace when it is unknown so that it can successively be used in SSC-GLRT. The simulation example further corroborates the effectiveness of the proposed SSC-GLRT detector. [C331]

"Validation of high-speed broadband satellite communications on airborne platforms"

The desire for satellite-based airborne communications on the move (COTM) has been an emerging trend in recent communication systems. This has been true for both DoD and Civilian systems being deployed. Early implementations of COTM have mostly been focused on the Land-Mobile environment, but this is starting to broaden into other domains as well. There is burgeoning domestic and international interest in airborne platforms to provide high-speed broadband communications. The predominant satellite-based implementations to date have been at frequencies such as L-band, which offers some benefits with omni-directional antennas and large coverage areas. However, these frequency ranges suffer from relatively low data rates (e.g., in the kbps range), overcrowding in key areas of operation, and expensive costs for end users. This has created a desire to shift

some of the airborne communications to available Ku and Ka bands, both commercial and military. This paper will clarify the challenges of the airborne environment for satellite communications and present solutions for each of them. Areas that are especially challenging include satellite handover, Doppler correction, and coverage areas. Also, the results of a recent airborne demonstration with very small aperture terminals (VSAT)s are presented to validate a solution to this difficult but indispensable capability. [C332]

"Statistical channel modeling of wireless shallow water acoustic communications from experiment data"

This paper analyzes statistical characteristics of underwater acoustic channels estimated by ocean experimental data. The baseband complex channel impulse responses (CIRs) are estimated by a time-domain least square method with sliding windows applied to long probing sequences. The probability density functions (PDF) of the real part, imaginary part, magnitude, and phase of the CIR are evaluated, and the two-sample Kolmogorov-Smirnov test is used to measure fitness of the magnitude PDF to the Gamma, Rayleigh, and compound-K distributions. The second-order statistics of the channel are also investigated in terms of autocorrelation function, channel coherence time, and scattering function. The experimental results demonstrate that underwater channels are often worse than Rayleigh fading channels. [C333]

"Modeling the effects of wind turbines on radar returns"

Wind turbines located near radar installations can significantly interfere with a radar's ability to detect its intended targets. In order to better understand and mitigate the adverse effects of wind turbines on radar, the government and wind farm community need tools that can be used to analyze the radar returns from wind turbines. Remcom's XGtd®software is a high frequency solver capable of calculating the radar cross section of electrically large objects. In this paper, interference from wind turbines is predicted using XGtd simulations and new post-processing algorithms that calculate Doppler shift quantities based on points of interaction with the rotating turbine blades. Results of the analysis are used to calculate the bistatic radar cross section and Doppler shift from two blade orientations. In addition, the time-varying monostatic radar cross section and Doppler shift for a single wind turbine are analyzed and shown to agree well with measured data from actual wind turbines. [C334]

"Investigation of Doppler effect in UWB-based rotor-telemetry system"

This paper covers a new scenario based on UWB-technique for transmission of data, which is the rotor-telemetry. The rotor-telemetry is a special type of a radio-telemetry, where measuring data of physical parameters like pressure or temperature are captured by sensors predominantly on rotating objects such as shafts or gear parts, transmitted over special on the rotor mounted along-moved antennas and received by static antennas. Most of the typical applications based on the UWB-technique are used on environments, where the channel is time invariant or very slow variant. A new problem appears with this scenario: since the rotor moves fast, the impact of Doppler rises significantly. The consideration of the effect of Doppler in UWB-signals is different than in narrowband signals. In narrowband systems, the Doppler shift is almost equal for all frequencies, so that the compensation is simple by translating the spectrum proportional to the carrier frequency. This assumption is no more fulfilled in UWB-systems, since the low frequencies of the band suffer from less Doppler shift than the upper ones. Not only the radio channel is of importance for the analysis of the Doppler effect but also the geometry of the antenna system has an important impact on understanding the Doppler effect. [C335]

"Power Delay Doppler Profile Fingerprinting for mobile localization in NLOS"

For existing localization algorithms, Non-Line-of-Sight (NLOS) propagation introduces some problems for the determination of the mobile position. This is because most of these algorithms depend on the information extracted from the Line-of-Sight (LOS) path such as Time-of-Arrival (ToA) or Time-Difference-of-Arrival (TDoA) received by either one or more Base Stations. On the contrary, algorithms based on Power Delay Profile Fingerprinting (PDP-F) take advantage of the uniqueness of the multipath channel between the Base Station (BS) and the Mobile Station (MS) over the geographical region of interest. The fingerprinting approach as its name implies performs a matching between a simulated database quantity and its corresponding measured quantity and indicates a match based on some cost function between the two. In this paper, we introduce an extension to this approach by including the effects of the Doppler shifts of the paths which we call the method as Power Delay Doppler Profile Fingerprinting (PDDP-F). With the inclusion of this extra information, we aim to increase the localization accuracy by resolving the paths not only in delay dimension but also in Doppler dimension. [C336]

"On the detection probability of parallel code phase search algorithms in GPS receivers"

The first stage of the signal processing chain in a Global Positioning System (GPS) receiver is the acquisition, which provides for a desired satellite coarse code phase and Doppler frequency estimates to subsequent stages. Thus, acquisition is a two-dimensional search, implemented as demodulation and non-coherent correlation. For a certain Doppler estimate, software-defined GPS receivers typically compute the correlation for all time lags in parallel. One way to detect the presence of a signal is by comparing the ratio between the largest and the second largest correlation peak against a threshold. For this type of receivers, the detection and false alarm probabilities are derived. Interestingly, the false alarm probability is independent of the noise power spectral density, which allows a fixed threshold setting. The analytic results are verified by a series of simulations. [C337]

"Mobility-aware spatial interference cancellation for mobile ad hoc networks"

Interference limits the throughput of a mobile ad hoc network (MANET). Multi-antennas can be employed at a node for interference cancellation besides attaining array gain. Spatial interference cancellation requires each node to estimate the interference channels, which is potentially inaccurate due to node mobility. As a result, maximizing the network capacity requires optimally allocating spatial degrees of freedom (DoF) to cancel interference and enhance link reliability based on the node mobility. This paper addresses this issue for a MANET with Poisson distributed transmitters and employing zero-forcing beam for spatial interference cancellation. Specifically, the residual interference power for each node from partially canceled interferers is characterized as a function of Doppler frequency and the number of DoF for interference cancellation is shown to decrease with the Doppler frequency. The adaption of spatial interference cancellation to mobility is observed to significantly improve the network performance in terms of both outage probability and capacity compared with the case without adaptation. [C338]

"A New Way of Generating Actuating Signals for Fuze Board"

In order to completely test the working conditions of fuze board in some type, an actuating signal with adjustable frequency and amplitude is needed. This paper shows a new idea which is based on DSP+FPGA+RAM+D/A to generate the signal, that can be explain as: the arbitrary waveform sampling data are transmitted from the PC to DSP through COM, then to RAM after being calculated and processed by DSP, FPGA controls the schedule of RAM to put the recovering wave out. The length and the number of waveform are being controlled. The waveform is arbitrary and the operation is flexible. The experiment shows that to actuate signal by this method is more flexible compared to the traditional DDS way, and it may be used in fuze circuit test much better and reduces the cost a lot. Thus it's strongly practical and promotional. [C339]

"Simulation modelling and analysis of a realistic radio channel model for V2V communications"

Realistic radio channel models are crucial for the success of vehicle-to-vehicle (V2V) system investigations. In this paper, we describe the important parameters for V2V channel modelling and summarize relevant measurement campaigns. Also, we develop and evaluate an ns-3 simulation model of a realistic V2V channel model that is based on measurements in Sweden. The channel model incorporates the effects of obstacles between the transmitter and the receiver. We show that the resulting path loss is very different compared with available models. [C340]

"Long range detection using a PDR sensor combined with MIMO antenna"

The Pulse-Doppler radar (PDR) is a radar system capable of not only detecting the location of a fixed object, but also measuring its radial velocity by using the Doppler Effect. Taking these abilities, in this paper, we introduce a new PDR sensor which is combined with a Multiple-Input-and-Multiple-Output (MIMO) antenna system in order to enhance the detection range up to 120m. In the experiments at Kookmin University, the proposed sensor performed well to detect moving car at distance 130m-further than we had expected. [C341]

"Wall-collision broadening of Gas absorption lines in nanoporous materials"

The main broadening mechanisms of absorption lines in free gas are known to be the pressure-and-Doppler broadening. However, with gas trapped within nanoporous materials, wall-collision broadening may become non-negligible. We present and discuss experimental data which show the effect of wall-collision broadening and its applications. [C342]

"Bit-interleaved Doppler diversity for LTE-Advanced system"

Time-varying channel degrades the performance of LTE-Advanced system due to the Intercarrier Interference (ICI) and imperfect channel estimation. In this paper, we propose a practical strategy by bit-interleaving preprocessing in transmitting part for Doppler diversity in high-speed scenario. Time-varying channel frequency

response and effect of coding rate to this algorithm are analyzed. In addition, to evaluate the performance of the proposed strategy, it is implemented into LTE-A system and simulated. The results show that the strategy can achieve significant performance enhancement in high-speed scenario. [C343]

"Second-Order Properties for Wireless Cooperative Systems with Rayleigh Fading"

Second-order statistical parameters of wireless channels, such as level crossing rate (LCR) and average fade duration (AFD), determine how frequent and the burst length of the channel in bad conditions, so they play an important role in the performance of wireless communication systems. For user-cooperative wireless systems, due to the interactions of multiple channels, it is non-trivial to determine the LCR and AFD of the received signals, which is an open issue. In this paper, we develop an analytical framework to quantify the LCR and AFD of the amplify-and-forward (AF) cooperative system using selection combining (SC) over Rayleigh fading channels. We first analyze the statistics of the two independent fading paths, the AF relay path with a mobile-to-mobile (M2M) channel and a mobile-to-fixed (M2F) Rayleigh fading channel, and the direct path with a M2F Rayleigh fading channel. Then, we derive the expressions of the second-order statistical parameters of the AF cooperative system with SC. Numerical results verify the correctness of our model. The analytical and simulation results reveal the different effect of the motions of the source and the relay nodes, and they can be used to select better relay nodes and assist the design and optimization of error control mechanisms in different layers in wireless cooperative networks. [C344]

"Investigation into the Doppler Component of the IEEE 802.11n Channel Model"

Simulations show that the Doppler component of the IEEE 802.11n channel model results in a dramatic decrease in transmit beamforming gain within only 20 ms delay, even though the model is intended for indoor WLAN environment with stationary devices. However, new measurements collected in an office environment show that degradation to transmit beamforming gain is much less sensitive to delay. With normal environmental conditions in the office environment, it was found that on average there was only a 22% decrease in transmit beamforming gain after 200 ms delay. Even with highly exaggerated motion, reasonable gain is maintained with over 100 ms of delay. Measurements with a moving device were also conducted with resulting sensitivity to delay similar to the 802.11n model. The measurements indicate that the Doppler component of the 802.11n channel model is more comparable to a moving device rather than a stationary device. The use of transmit beamforming in an indoor WLAN environment is more practical than simulations based on the IEEE 802.11n channel models would imply. [C345]

"Estimation of channel temporal auto-correlation and coherence time based on propagation paths"

In this contribution, we investigate the applicability of using multiple propagation paths to estimate the temporal auto-correlation function and the coherence time of wireless propagation channels. The Space-Alternating Generalized Expectation-maximization (SAGE) algorithm is applied for extracting the paths from measurement data. It is found that the channel auto-correlation function and coherence time computed based on the path parameters are biased. A simple method is proposed for correction of the biases. Experimental investigations are conducted to evaluate the effectiveness of the method. [C346]

"A new channel simulation model for fast moving terminals"

In the current broadband multimedia applications, researchers and practitioners have mainly focused their designs on coping with static or slowly evolving traffic demands. Even though many such applications involve fast moving terminals, fast moving traffic conditions have not yet been taken into account which results in unrealistic simulations. It is therefore imperative to design a new channel simulation model in the fast moving scenario for systematic performance evaluations. Existing models for simulation of fast fading channels use only maximum Doppler frequency to represent the effect caused by the maximum moving speed of the terminal without considering the effect of the changes in the magnitude and the direction of motion. Such simplified assumption is in strong contrast with real-world communication systems in which the velocity of a moving terminal may change in both magnitude and direction in the duration of transmission. We propose in this paper a novel model for the simulation of Rayleigh fading channel in fast moving scenario. The model is based on the sum-of-sinusoids method and accounts for the fresh channel characteristics due to the changes in the magnitude and direction of the terminal's velocity on an instant-by-instant basis. The statistical analysis of the proposed channel model demonstrates that the proposed model not only is more suitable for simulating fast moving scenario, but also can be considered as a more general model for Rayleigh fading channels. The simulation results demonstrate the advantages and the efficiency of the proposed model for characterizing more practical communication systems. [C347]

"Doppler estimation based on signal phase matching principle in wideband OFDM"

Major problem in applying OFDM to underwater channels is the motion-induced Doppler distortion which creates non-uniform frequency offset in the case of a wideband acoustic signal. And the loss of orthogonality due to the Doppler effects must be compensated before the demodulation with discrete Fourier transform. This paper proposes a novel Doppler estimation technique for OFDM communications over an underwater acoustic channel. We exploit the intrinsic structure information of OFDM signals to derive a Doppler estimator based on signal-phase-matching (SPM) principle. Simulation results show that the main advantages of the proposed technique are its computation simplicity and high accuracy. [C348]

"Simulation of Doppler ultrasound blood flow signals from stented sidewall aneurysm"

Endovascular stent has an increasingly important application in the treatment of aneurysms. This study is to simulate Doppler ultrasound blood flow signals from a stented sidewall aneurysm based on a computational fluid dynamics model. For comparisons, a stented and non-stented sidewall aneurysm models are constructed respectively. Firstly the blood flow velocity distribution in the area of the sidewall aneurysm is calculated using the finite element method. Then the corresponding Doppler ultrasound blood flow signals are simulated using the cosine summation method. Finally the simulated signal spectrum is analyzed to estimate the mean frequency variation. Results show that the stented sidewall aneurysm model has substantially different mean frequency of simulated signals in the area of sidewall aneurysm from the non-stented model. Flow activities within the stented sidewall aneurismal area are markedly diminished and become stable. The mean frequency of simulated Doppler ultrasound blood flow signals from the stented sidewall aneurysm changes smoothly. These phenomena show that the endovascular stent can ease the vortex of the sidewall aneurysm effectively and attenuate the aneurysm rupture risk. At the same time, this study shows that the stent mesh spacing is an important factor for the effective treatment. [C349]

"OFDM Signal Sensing over Doubly-Selective Fading Channels"

Cyclostationarity based sensing methods are appealing for OFDM signals under low SNR areas. However, such methods are sensitive to doubly-selective fading channels. In this paper we develop a new sensing method by exploiting the cyclostationarity incurred by the spread of autocorrelation due to the Doppler effect in doubly-selective fading channels. First, we model the doubly-selective fading channel with basis expansion model (BEM). Then we analyze the relationship between cyclostationary statistics of transmitted and received OFDM signals, hence derive the cyclostationary statistics of the received signal. Based on the new cyclostationary signatures of the received OFDM signal spread by the Doppler effect, more suitable cyclic frequencies can be chosen to detect cyclostationary features when signal experiences doubly-selective fading. Simulation results demonstrate that the proposed sensing method provides substantial improvement on detection performance. [C350]

"Frequency-Domain Oversampling for Zero-Padded OFDM in Underwater Acoustic Communications"

Although time-domain oversampling of the received baseband signal is common for single-carrier transmissions, the counterpart of frequency-domain oversampling is rarely used for multicarrier transmissions. In this paper, we explore frequency-domain oversampling to improve the system performance of zero-padded OFDM transmissions over underwater acoustic channels with large Doppler spread. We use a signal design that enables separate sparse channel estimation and data detection, rendering a low complexity receiver. Based on both simulation and experimental results, we observe that the receiver with frequency-domain oversampling outperforms the conventional one considerably in channels with moderate and large Doppler spreads, and the gain increases as the Doppler spread increases. Although a raised-cosine pulse-shaping window can be used to improve the system performance relative to a rectangular window at the expense of data rate reduction, the performance gain is much less than that brought by frequency-domain oversampling in the considered OFDM system for Doppler spread channels. [C351]

"Amplify-and-Forward Relay Selection with Outdated Channel State Information"

We study the effect of outdated channel estimation on the outage performance of amplify-and-forward (AF) relay selection, where only one out of the set of available relays is activated. In particular, we derive closed-form expressions for the outage probability of two variations of AF relay selection, namely best relay selection and partial relay selection, when the selection is based upon outdated channel estimates. Numerical results manifest that the outage performance of both schemes under consideration is highly dependent on the level of imperfection of the channel estimates. It is further shown that it may be preferable, in terms of outage probability, not to include links in the relay selection process that experience high maximum Doppler shifts. [C352]

"Zero-Forcing Based Decode-and-Forward Cooperative Relaying Scheme over Doubly Selective Fading Channels"

This paper evaluates the performance of a decode-and-forward scheme using orthogonal frequency-division multiplexing (OFDM) over both time-selective and frequency-selective fading channels. We consider a simple detection based on the zero-forcing (ZF) principle to eliminate inter-carrier interference (ICI) caused by high mobility and to combine signals received from the source and the relay for high spatial diversity at the destination. The symbol error rate (SER) of the ZF-based cooperative relaying scheme is derived and validated by computer simulations. Various results show the superiority of cooperative relaying to direct transmission under same transmission power and bandwidth efficiency for any relay position, signal-to-noise ratio (SNR), path-loss exponent, and normalized Doppler frequency. [C353]

"Equalizers for Multi-Scale/Multi-Lag Wireless Channels"

Equalizer designs for digital communications over wireless channels exhibiting both multi-lag and multi-scale are investigated. Such channel models are well-suited for underwater acoustic communications and may have impact on the design of systems for vehicle-to-vehicle communications. First, the implications of the multi-scale, multi-lag model on equalizer design are highlighted. In particular, equalizers are time-varying as a function of symbol index. Three suboptimal, low complexity block equalizers (partial, truncated, and path combining) are compared to that of the full block equalizer and shown to offer a good tradeoff between complexity and performance. These four equalizers significantly outperform a simple matched filter which performs no equalization. [C354]

"Blind Channel Equalization for Fast Moving Terminals in Prioritized Spatial Multiplexing MIMO Systems"

A prioritized spatial multiplexing scheme has recently been developed for the transmission of scalable video coded (SVC) video over MIMO systems. One unique feature of this scheme is its capability to channelize the sub-channels according to the importance of the individually transmitted data streams. We consider in this research a challenging task of providing high quality multimedia services over MIMO systems with fast moving terminals. With fast moving terminals many existing approaches for MIMO channel estimation and equalization cannot be applied as most of them rely on the help of periodic pilot signals. When the terminals are travelling in high speed, the undesired Doppler effects prevent the existing approaches from efficient use of pilot signals for channel estimation and equalization. Although existing blind channel estimation and equalization schemes are able to avoid the problems associated with pilot signals, these schemes cannot be directly adopted for the prioritized spatial multiplexing MIMO system for video streaming in which data streams under different modulations need to be transmitted through sub-channels. In this paper, we develop a blind constant modulus algorithm (CMA)-based channel equalization (CMACE) scheme to track the fast time-varying channel without the requirement of pilot signals. We show that the transmitted signal in each sub-channel can be modulated with different symbol constellation, and delivered at different rate according to their importance. Simulation results demonstrate that the proposed scheme is effective for channel equalization with fast moving terminal in the prioritized spatial multiplexing MIMO systems. [C355]

"Low Complexity Block Processing Algorithms for Adaptive Channel Estimation in OFDM Systems"

For pilot-aided channel estimation in orthogonal frequency-division multiplexing (OFDM) systems, adaptive algorithms enable tracking of a time-varying channel. Using several subcarriers for the update step in the adaptive algorithm, i.e., performing block processing, improves the robustness and convergence speed of the adaptation. To decrease the complexity of these algorithms, simplified versions are deduced as well as versions with real-valued filters. In the latter case the number of required arithmetic operations can be reduced significantly not only in the adaptive algorithm but also in the filtering process itself, which represents a dominating part regarding the complexity due to the huge amount of subcarriers of practical OFDM transmission schemes. Simulation results show that gains w.r.t. the convergence behavior can be achieved by real-valued filters compared to complex-valued filters-even in scenarios where real-valued filters are theoretically suboptimum. [C356]

"Computation of partitioning of coherent pulse group that minimizes time of estimation of higher derivatives of Doppler-beat frequency"

The maximally realistic method of estimation of higher derivatives of Doppler frequency on the basis of coherent pulse group due to its partitioning has been developed. Dependencies of time of optimization and probability of anomalous errors as functions of a number of fragments, parameters of the pulse group and signal-to-noise ratio have been obtained. The optimal number of fragments has been found. The obtained results have been verified

with the simulated data. [C357]

"Versatile new generation muzzle velocity radar"

The results of compact MMW muzzle velocity radar development and research are presented. The radar is intended to measure the speed of shells and mortar shells of 20 to 200 mm caliber within 50 to 2000 m/s. [C358]

"The microwave transmitting module for doppler navigator equipment (DISD-FG) of "Phobos-Grunt" program"

The results of the development of the transmitting module M45224 of Doppler speed and range measuring device (DISD) are presented. This module is designed to work in the ASC "Phobos-Grunt" movement measuring lander during the final approach and landing segments. M45224 Transmitter Module is designed by FSUC "Istok" for Doppler velocity and range measuring device (DISD). It consists of two identical solid-state microwave generators (main and backup) with a frequency modulation and microwave radio frequency unit, which includes a switch for five outputs-channels (signals from four channels are received at the antenna, while the fifth one is a control channel, and a signal from this channel is given to the receiving module), a power combiner and a directional power coupler for the heterodyne signal receiver formation. The module is intended to work in ASC "Phobos-Grunt" spacecraft for the lender movement measuring on segments of the final approach and landing on Phobos. [C359]

"Efficiency of narrow band Doppler selection of the signal in presence of the scattering from the sea"

Efficiency of narrow-band Doppler selections has been considered. Characteristics of detectors with adaptation of a threshold and rank at various polarizations of radiation and reception are estimated. [C360]

"A new real time Range-Doppler imaging algorithm"

This paper firstly describes the processing of Range-Doppler imaging algorithm and FFT interpolation for range cell migration correction, and then forms a improved range-doppler algorithm for SAR imaging with combining the two methods, which has much less computation time. In order to eliminate computation further, the Pruning FFT technique is used. [C361]

"A novel UKF based scheme for GPS signal tracking in high dynamic environment"

Unscented Kalman filter (UKF) based methods have been developed for the tracking of GPS L1 signal. Optimal Kalman filtering theory makes it possible to maintain locking with large Doppler frequency shift when the receiver works in high dynamic environment. A novel UKF based carrier tracking loop with high accurate tracking performance is put forward, where a frequency fast pull-in technology is performed to ensure the filter converge fast and another two different carrier amplitude estimation methods are included to make the dynamic model complete. The relationship between the noise parameter of UKF and the equal loop-bandwidth is also studied. Based on this novel loop and carrier-aiding technology, a joint carrier aiding and code phase extracting from the estimation results of the UKF for code tracking is analyzed. Simulation results show that the carrier tracking loop works steady in high dynamic situations, and the pseudo-code tracking precision is improved significantly. [C362]

"Multifrequency signals with Golomb and Costas frequency distribution"

The problem of exclusion of ambiguity in range and frequency is actual for burst signals. Distribution of frequencies in multifrequency signals can be based on the theory of Galois fields of prime numbers. Present report is devoted to calculation and analysis of ambiguity functions of multifrequency bursts signals with Golomb and Costas distribution of frequencies. [C363]

"Design of Multi-channel Ultrasonic Flowmeter Based on ARM"

A multi-channel ultrasonic flowmeter was designed in this paper which is composed of supersonic transducer, electron circuit, flow rate indication and integral calculation system. Based on the concept of liner concentration of coal logs in pipeline and characteristics of Doppler frequency drift of coal particles and coal logs moved in pipeline, the measuring method of supersonic wave and the transportation principle of coal slurry-coal log pipeline were discussed and a multi-channel ultrasonic flowmeter was designed for measuring the total quantity of coal transported by pipeline. The Doppler signal was measured and analyzed by using mixed-frequency technique and FFT, and some designed circuits and signal measurement process were also offered. [C364]

"The Spatial MIMO Channel Implement on FPGA"

The MIMO channel simulator for signal transmit-receive system is needed to research the signal multipath effect in mobile environment and the small scale Rayleigh fading channel mathematical model in real hardware environment. The paper designs a pipelining infrastructure on Field-Programmable Gate Array (FPGA) to imitate the stochastic spatial MIMO channel. At the end, some important parameters of MIMO channel, including Doppler spread, angle spread of arrival and departure and channel capacity of different angle spreads, etc, are emulated and analyzed. The simulation results are very close to theoretical values. The pipelining infrastructure is proved to be fit for structure base of the MIMO hardware simulator in experimental environments. [C365]

"Spread Spectrum Signal Acquisition in the Presence of Fractional Doppler Frequency Offset"

In high dynamic environment, the spread spectrum signal acquisition is one of the most challenging step in the process of DS/SS systems Synchronization. A novel twin- frequency-cell detection method using the locally optimum (LO) test statistic is addressed for spread spectrum signal acquisition in the presence of fractional Doppler frequency offset (FDFO) under Doppler frequency searching. In the twin-cell detection, To alleviate the correlation value reduction due to the FDFO, two consecutive correlator outputs under consecutive estimated DFO are combined to form the decision variable. The computer simulation results show that the proposed scheme offers superior acquisition performance over the conventional scheme based on the one cell estimated DFO detection. [C366]

"ISAR Ship Imaging Based on Reassigned Smoothed Pseudo Wigner-Ville Distribution"

According to the difference of motion characteristics between ship targets and the targets that move stationary, the application of a time-frequency distribution-Reassigned Smoothed Pseudo Wigner-Ville Distribution (RSPWVD) in ISAR imaging spectrum at ship target is studied. The high resolution instantaneous Doppler frequency spectra at a certain time instant is obtained by processing the radar echo data with RSPWVD, then the instantaneous ISAR image from that time instant is obtained. Results of real data show the validity of the method. [C367]

"Estimating Indoor Walking Velocity Profile Using a Software Radio-Based Radar"

Radar is an attractive technology for long term monitoring of human movement as it operates remotely, can be placed behind walls and is able to monitor a large area depending on its operating parameters. A radar signal reflected off a moving person carries rich information on his or her activity pattern in the form of a set of Doppler frequency components produced by the specific combination of limbs and torso movements. Deploying radars in indoor environments poses however challenges for the interpretation of signals reflected off a moving object due to multipath propagation. Two strategies for the estimation of human walking velocity profile in indoor environments are suggested and discussed. The accuracy of the strategies are evaluated and compared in a field experiment using a flexible and low-cost software defined radar platform. The results obtained indicate that both methods are able to estimate the velocity profile of the person's translational movement with less than 10% error. [C368]

"Realization of Time Delayed Wireless MIMO Channel"

In this paper, we summarized all kinds of wireless MIMO channel and analyzed their time space model of MIMO channel model. In order to evaluate the MIMO effectively, a new time delay MIMO model was proposed. Based on 3GPP TR25.996 protocol, a new method for simulation time delay MIMO channel was proposed according to average arrival angle, extended angle of signal and structure of transceiver antennas. By computer simulation, the performance of the time delay MIMO channel was verified. [C369]

"The Research on RIC-ISAR Image of Ship Target Based on High-Order Match-Phase Transform"

Due to the constantly changing motion of a ship target, high order phase terms which cannot be neglected and results in bad azimuth focusing are generated. In this condition the RD algorithm is not a very effective way for ISAR imaging. In fact, the azimuth position of target scattering point can also be illustrated by the instantaneous chirp rate of received signal not just by the Doppler frequency. In this paper, a new approach is proposed, which is based on Product High-Order Matched-Phase Transform (PHMT) to estimate the value of the changing rate of chirp rate, chirp rate, central frequency and amplitude, thus the high quality range-instantaneous chirp rate (RIC) ISAR image of the object can be obtained. At last, the simulation results prove the effectiveness of the method proposed. [C370]

"A simulated method of modeling wireless channel based on CDL"

Rapid development of wireless communications gives prominence to simulation. Simulated methods of modeling wireless channel are of significance to wireless communications simulation on both link and system levels. There have been quite a lot of theoretical models which have accurately described the characteristics of wireless channel. However when it comes to the realization of wireless channel in simulation, there seem no accurate enough methods and conclusions. Current simulated methods are mostly built up based on TDL, which is a common framework to model micro fading and mainly focused on micro fading. As to macro fading, Doppler-effect and polarization of electromagnetic wave, this method behaves not well enough, and other statistical approximations is indispensable, such as shadow fading, Doppler power spectrum density and so on. To the question existed, this paper proposes a simulated method to accurately model wireless channel under given wireless environment, on the basis of cluster delay line. This method is highlighted with comprehensive consideration of macro and micro fading, Doppler, multi-path and polarization effect. Analysis and simulation results on characteristics of wireless channel such as signal envelope, coherent time and bandwidth, validate the proposed model. [C371]

"Analysis of Return Signal Mechanism in Ship-Board Radar"

This paper analyzes interactions between return signals and ship-board radar. The corresponding theoretical model proves that the first-order, Bragg sea-wave spectrum's widened width in ship-board radar coincides with the theoretically spreading width analyzed in our model, creating a foundation for the research of signal resolution and clutter background statistics in ship-board radar. [C372]

"Research on ISAR Imaging Method of Parameter Estimation Based on Optimal Imaging Period"

A clear ISAR image could not be acquired by conventional Range-Doppler (RD) method due to the non-uniformly of angular motion of ships as scatterers caused by the sea save, thus the method for solving the problem by applying Range-Instantaneous Doppler (RID) methods are used. However, though each scatterer could be resolved from the echoes, such methods suffer from heavy calculation burden due to the searching process. An ISAR imaging method of parameter estimation based on optimal imaging period is proposed. The method chooses optimal data from all received echoes, and then achieves imaging by parameter estimation according to each range bin's Doppler data. The effects of choosing imaging period on parameter estimation is analyzed, and the steps of accomplishing the proposed method are developed. The result of estimation on real data manifests that better ISAR image can be acquired by applying the method proposed. [C373]

"Tri-iterative Three-Dimensional Space-Time Adaptive Processing Based on Correlation Matrix for Airborne Radar"

Because of employing elevation adaptivity, three-dimensional space-time adaptive processing (3D STAP) can achieve better performance than conventional two-dimensional (2D) STAP at the cost of higher computational load and sample support requirement. To overcome these shortcomings, a tri-iterative 3D STAP method based on correlation matrix for airborne radar is developed. In the proposed method, the quadratic cost function used in the optimum STAP is converted into three quadratic functions by using submatrices of the space-time correlation matrix, and the full dimension weight vector can be separated into three lower dimensional weight vectors. By iteratively optimizing these lower dimensional weight vectors, the proposed method can significantly decrease the computational load and training samples requirement. Experiment results using both simulated data and measured radar data demonstrate the effectiveness of the proposed method. [C374]

"Measurement of the Location of Impact Point in Bombing Systems"

In this paper, an effective method is presented to measure the location of impact point in bombing systems. With supposition that the motion of bomb in terminal trajectory can be approximated as a motion with constant acceleration, the trajectory equation of the bomb is constructed and the relation between distance-delay of the echo signal and the parameters of the bomb trajectory is derived. Simultaneously, the relation between Doppler frequency and the parameters of the bomb trajectory is also derived. Based on these relations, the measurement of the location of impact point can be easily solved as a nonlinear least square fitting problem of distance delay and Doppler frequency. Finally, simulation results show the effectiveness of the proposed method. [C375]

"Optimum Path Based Differential Coherent Integration Algorithm for GPS C/A Code Acquisition under Weak Signal Environment"

Differential Coherent Integration method is an effective method for weak GPS acquisition. But the traditional differential method has a problem that the coherent integration time could not be too long and can hardly acquire

very weak GPS signal. This paper introduces an improved differential coherent integration algorithm based on optimum path method, which can find the path of the maximum sum of differential blocks by estimating every possible product of the adjacent navigation data bits. So it could overcome the influence of navigation data bit transition and the long time coherent integration can be used in the differential method. Another advantage of this new method is that the loss of the square is reduced, because of the differential operation. Simulations show that, in the weak signal environment, if the same C/N0and processing data length are provided, the performance of the new method is much better than the legacy half-bits method and full-bits method. With the increasing of the processing data length, the advantage of the new method on signal to noise ratio improvement is more significant. [C376]

"A Detector of DTTB Based Passive Radar Using FRFT and Hough Transform"

Detecting weak moving targets is an important task for digital television terrestrial broadcasting (DTTB) based passive radar. The cross ambiguity function (CAF) suffers from the range and Doppler frequency migrations caused by the velocity and acceleration of the targets. The integration gain can't increase anymore. A new detector is proposed for this problem. In this detector, the fractional Fourier transform (FRFT) is used to compensate the Doppler frequency migration, and the Hough transform is utilized to accumulate the echo of the moving targets during the long integration time. The block diagram and the procedure of this detector are given. Simulation results show that the proposed method can detect weak moving targets effectively. [C377]

"GPS Signal Acquisition Methods Using Sample-Based Shifting and FFT"

This paper describes a GPS (Global Positioning System) signal acquisition method using sample-based shifting and FFT (Fast Fourier Transform). Before the digital IF (Intermediate Frequency) signal is processed with the correlation algorithm, an averaging algorithm is applied to reduce the FFT operation. The principle of sample-based shifting is presented and its influence on the maximum correlation value is also simulated and analyzed. The result of simulation indicates that this method can increase the maximum correlation value and reduce the number of correlation operations. [C378]

"Channel characterization including path loss and Doppler effects with sea reflections for mobile radio propagation over sea at 2 GHz"

Maritime communication plays an important role in marine activities, but insufficient knowledge of radio channel characteristics over sea limits the development of wideband wireless communication systems for maritime applications. Therefore a land-to-ship (L2S) radio channel measurement assignment has been performed in Trondheim, Norway. In this paper we have focused open sea propagation environments, and results of the channel characterization from measurements are presented, such as path-loss, channel correlation and Doppler effects due to sea reflections, along with the reflection coefficient of the sea surface. The received signal level (RSL) has been compared to the Okumura-Hata model, the COST 231-Hata model and the ITU-R P.1546-2 model, and it has been found that the ITU-R model for open cold sea corresponding to field-strength value exceeded at 50% of the locations fits the measurement results best. By using two receiver antennas with 1.865 m spacing, partly channel correlation has been revealed when the distance between the transmitter (TX) and receiver (RX) is within 2 km, while the two channels are found to be highly correlated when the boat is further away from the shore. When the distance between the TX and RX is within the range 3 km to 12 km, a fading beat frequency is found to be 0.16 Hz, i.e. about 0.16 Hz Doppler shift caused by the sea movement. Finally, the reflection coefficient of the sea surface turns out to be about 0.11 in the same range, which does not comply with the Kirchhoff theory for effective reflection coefficient. [C379]

"The correction of spaceborne satellite's yaw steering law based on the star tracker high-precision measurement"

This paper presents a successful example of how the yaw steering law used in the satellite project. Otherwise in the synthetic aperture radar satellite, the theoretic parameter of the yaw steering law can be obtained and optimized on the track, then the expected Doppler centroid will be gotten. [C380]

"Study on bandwidth of Optical filter in beacon sub-system of Satellite Optical Communications"

In this paper, we present an optimal bandwidth of Optical filter in beacon sub-system of Satellite Optical Communications considering Doppler Effect between the different orbit satellites by using matched filter method. To satisfy the requirements of beacon sub-system, the relation of the normalized SNR of signals and optical filter bandwidth is analyzed and the optimum bandwidth is derived. Based on the optimum bandwidth, the optical filter can improve the performance of the Satellite Optical Communications systems effectively. [C381]

"Iterative intercarrier interference reduction for mobile OFDM systems"

For mobile applications of Orthogonal Frequency-Division Multiplexing (OFDM) systems, channel time-variations during one OFDM symbol interval results in the loss of orthogonality among subcarriers, and thus leading to intercarrier interference (ICI). This paper addresses the problem of ICI reduction for mobile OFDM systems. By rearranging the frequency-domain channel matrix, ICI can be effectively reduced by half at each iterative procedure. The advantages of the proposed scheme are shown through simulations. [C382]

"Spectral Simulation Analysis of Doppler Ultrasound Blood Flow Signals from Local Expansion Artery"

A simulation approach was proposed to analyze the spectra of Doppler signals in local expansion artery, which can provide a useful guidance for detecting the formation and growth progress of the aneurysms using the Doppler ultrasound technology and forecasting the size of aneurysm. Firstly, by solving Navier-Stokes equations, the velocity distributions in the vessels with various expansion degrees are calculated. Secondly, power spectral density (PSD) of the Doppler signals is estimated according to the relationship of velocity profiles and power spectral density. Finally, Doppler signals are generated using cosine-superposed methods. The results show that the spectra of Doppler signals are similar to those found in practice. Therefore, the proposed approach is useful for simulating the spectra of Doppler ultrasound signals. [C383]

"Utilizing a channel emulator with a reverberation chamber to create the optimal MIMO OTA test methodology"

4G mobile wireless radio technologies are focused on delivering higher levels of throughput through the use of Multiple Input, Multiple Output (MIMO) technology. MIMO systems use multiple transmit and receive data paths to provide significant increases in data throughput by exploiting the characteristics of the radio channel. Thus, MIMO system performance is directly related to the propagation environment in which the device is operating. Full system test with all components in place, including the antennas, is critical to performance testing of MIMO transmissions. This paper will explore a new solution for over-the-air MIMO testing that combines a channel emulator with a reverberation chamber to achieve MIMO throughput performance testing and enable an accurate wireless device performance prediction. [C384]

"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. [C385]

"Detection and States Estimation of Multiple Mobile Targets in Wireless Sensor Network"

By introducing a wireless fading model, we rebuild the perception model of a wireless sensor network. The profiles of a multi-target and multi-sensor mixing matrix at each frequency are estimated as samples of the spectrum superposition of multiple targets. A differential evolution approach is employed to separate multiple targets, at the same time, to decouple path fading and Doppler shifts in the frequency domain. Each column of the mixing matrix preserves the waveform that is formed by the effects of corresponding targets on nodes. Based on this modeling, the states of multiple targets, including the location, velocity, and motion direction are estimated. [C386]

"Investigation of optical detector geometry influence in laser Doppler blood flowmetry in biological tissue by Monte-Carlo method"

The mathematical model of the biological tissue is constructed. A number of numerical experiments by a Monte-Carlo method is spent. Influence of geometry of experiment and optical detector on frequency shift of back scattering laser light is investigated. [C387]

"Study on Defocus compensation using variable pulse repetition time stepped-frequency waveform"

In this paper, a new technology for compensating the defocus due to the velocities of multiple moving targets is presented. By using this technology, the blur produced by defocus can be compensated when the velocities are unknown. And a method is proposed to solve the range-Doppler coupling caused by the multiple targets. The effectiveness of the algorithm is illustrated with simulation results. [C388]

"Simulation implementation of the aeronautical channel in dynamic environment with low elevation angle"

The high dynamic vehicle, a hotspot in the military research currently, has an important strategic value. TT&C and communication system is the core of information guarantee for the vehicle. To assess the performance and reliability of the communication links, aeronautical channel model in dynamic environment is required. In this paper, a stochastic channel model for the TT&C and communication system with low elevation angle is discussed and its digital implementation scheme is proposed, based on which a channel simulation platform is established. The channel simulator proposed involves the channel delay spread, Doppler spread, angle of arrival and angle spread etc. It can simulate the correlation properties of channel in time domain, frequency domain and space domain, which is useful for the analysis and simulation of the aeronautical links or relative applications. [C389]

"Doppler estimation and data detection for underwater acoustic ZF-OFDM receiver"

A new scheme for Doppler estimation and data detection for OFDM underwater acoustic communications is derived in this paper. We design the OFDM symbol as a concatenation of two sub-blocks. The first one is shorter and carries out few data with few subcarriers whereas the second one contains both informative and pilot symbols. The first sub-block serves to estimate the Doppler scaling factor while the pilots in the second sub-block are used for estimating the equivalent channel. Both estimation approaches are based on high resolution methods for solving harmonic retrieval problems in time and frequency domains respectively. Each sub-block contains a cyclic suffix, which allows having more data to be processed. The effectiveness of the proposed scheme is evaluated by means of simulation results. [C390]

"Sensitivity of channel estimation using B-splines to mismatched Doppler frequency"

In this paper, we investigate the pilot assisted maximum likelihood (ML) and minimum mean square error (MMSE) channel estimators using B-splines in time-variant Rayleigh fading channels following Jakes' model. The analytical mean square error (MSE), including noise-free modeling error and statistical estimation error, of the channel estimators is derived. We also derive the overall MSE of the MMSE channel estimator with mismatched estimation of the Doppler frequency. The results show that the MMSE estimator using B-splines has little sensitivity to overestimation of the Doppler frequency. However, when the Doppler frequency is underestimated, even slightly, its performance degrades significantly and becomes much worse than that of the ML channel estimator. [C391]

"Analysis of ICI compensation for DVB-T2"

This paper analyzes the impact of inter-carrier interference (ICI) compensation on the physical layer of DVB-T2, the new digital terrestrial television standard. We compare the performance of a well-known low complexity soft demapper for different time-interleaving depths and code rates in several realistic mobile scenarios. This paper further presents an iterative receiver design that exchanges extrinsic information between the low-density parity-check (LDPC) decoder and the ICI canceller in order to improve performance. Provided simulation results show that the proposed ICI cancellation algorithms can be necessary in several DVB-T2 transmission modes when the length of the time interleaver is limited. [C392]

"Extended orthogonal space-time block coded transmission with quantised differential feedback"

Extended orthogonal space-time coding can use feedback of channel state information to increase the diversity gain of the transmission. This paper calculates the maximum attainable gain, and shows the effect that quantisation in the feedback channel has on the system performance. We demonstrate that for slow-fading channels, differential coding with a single feedback bit can achieve near-optimum performance and exceed the performance of non-differential feedback with higher word length. We also comment on combining differential encoding with channel estimation. Simulation results compare this approach to state-of-the-art systems with standard quantised and unquantised feedback. [C393]

"Radar polarimetry for security applications"

We analyse micro-Doppler techniques and the improved performance that fully polarimetric radar techniques can add. We perform fully polarimetric measurements of the varying micro-Doppler signatures of humans as a function of elevation angle and azimuthal angle in order to try to optimize this type of system for the detection of arm motion, especially for the determination of whether someone is loaded. We determine that polarimetric measurements can isolate and highlight the arm motion for a classification as loaded or unloaded. Second, the azimuthal angle of the motion is a critical parameter to consider in ground-based systems. For choke-point

observations where the direction of motion is more controlled, polarimetric radar has the potential to determine who is not loaded inappropriately and who should be checked. [C394]

"Optimal sensor placement for multi-bistatic ISAR imaging"

Inverse Synthetic Aperture Radar (ISAR) images are typically used for target recognition and identification purposes. The target projection on the ISAR image plane depends on the target's own motions and on the relative position of target and radar. Since targets of interest are often non-cooperative, the first condition is not under the radar's control. Nevertheless, the relative radar-target position can be somehow controlled or predicted in some cases. Moreover, the use of multiple receivers enhances the likelihood that a desired radar-target position occurs during radar measurements. In this paper, the theoretical aspects of optimal sensor positioning for obtaining desired ISAR image projections are detailed. A mathematical tool will be presented that is able to predict the optimal sensor positions for maximising the probability of obtaining a desired ISAR image. Real data will be used that demonstrate the effectiveness of the proposed tool. [C395]

"Study on velocity estimation of MCPC signal in wideband radar"

This paper presents a novel scheme for velocity estimation in wideband Multi-Carrier Phase-Coded (MCPC) radar, which has drawn considerable attention recently as a new generation of radar. Conventional narrowband Doppler processing preserves the phase relationship of the received pulses, thus not only increases the Signal-to-Noise Ratio (SNR), but also obtains reliable extraction of the Doppler parameters. However, the rangewalk of moving target due to the wide bandwidth makes things difficult. Additionally, it is a question of interest to researchers that is resolving velocity ambiguity within a single burst. Based on separated processing of subcarriers in MCPC echo signals, we can estimate the radial velocity of the target without ambiguity by Least Squared (LS) algorithm over the linearity curve of Doppler spectrum. The simulation results verify that this scheme can be applied to the fast-moving target efficiently. [C396]

"An extended NLCS algorithm for Bistatic fixed-receiver SAR imaging"

Imaging of Bistatic fixed-receiver SAR which is azimuth-dependent, is rather different from monostatic SAR, because the relative position between the transmitter and the receiver is slow-time dependent. In this paper, the Range Cell Migration (RCM) characteristics of Bistatic fixed-receiver SAR are analyzed firstly. Then the nonlinear chirp scaling (NLCS) algorithm is presented and the residual phases caused by the NLCS processing are analysed as well. An extended NLCS algorithm based on sub-aperture approach is proposed to handle the case in which the residual phases cannot be ignored for Bistatic fixed-receiver SAR. Finally, a simulation with typical parameters is performed to verify the correctness of the extended NLCS algorithm. [C397]

"Fast acquisition of GPS signal using extended multiple correlator based on FPGA"

This paper presents a detailed design of GPS signal fast acquisition system using the method of extended multiple correlator in FPGA. A 12-channel GPS signal acquisition system is implemented and an extra noise-monitoring channel is used to provide an adaptive threshold. Programming the system on FPGA development platform, results show that the system can acquire GPS signals faster than traditional receivers without great complexity. This design has high practical value, which can be directly used in GPS receiver, and also can extend its using in other direct sequence spread-spectrum receivers. [C398]

"Comparison of target detection schemes in Doppler radar with PSK signals"

The aim of this article is to test the effectiveness of the known CFAR processors in order to detect moving targets in the frequency domain of real records. The purpose is to be chosen optimal CFAR detector for moving target detection. The data are obtained by portable, surveillance, Frequency Modulated Continuous Wave (FMCW) radar with Low probability of Intercept (LPI). In the paper are studied and compared CA, OS, SO, GO CFAR processors. [C399]

"Radar probing of steep gravity waves. wave tank experiment"

Results of wave tank experiment on radar probing of steep gravity waves are discussed. It was shown that Ka-radar backscatter signal from cm -dm steep surface waves is connected with gentle breaking and parasitic capillary ripples generation; backscatter signal from dm-m surface waves is connected with strong breaking and free ripples generation. [C400]

"Joint model for fine synchronization and adaptive LMMSE channel estimation in uplink OFDMA"

In this paper parametric tracking of channel and synchronization errors for an adaptive multi-dimensional channel estimator for uplink Orthogonal Frequency Division Multiplex Access (OFDMA) communication systems is proposed. The estimator consists of a two-dimensional LMMSE filter. In real world scenarios, channel estimation should work not only in a wide range of terminal velocities and delay spread but it is also confronted with time and frequency synchronization errors affecting the channel estimation and thus limits the performance of both the coherent receiver and overall OFDMA system. We jointly track channel statistics and synchronization errors so that LMMSE filter coefficients closely reflect the current statistics of the channel. Through simulations it is verified that the proposed channel estimator outperforms the robust LMMSE estimator in the presence of synchronization errors and varying channel conditions. [C401]

"Coronary flow reserve in mice: Effects of age, coronary disease, and vascular loading"

Mice are now commonly used as models of human cardiovascular diseases and conditions, but it is challenging to measure blood flow velocity in small vessels such as coronary arteries. Accordingly, we have developed a method using a 2 mm diameter 20 MHz pulsed Doppler probe applied to the chest of an anesthetized mouse to measure left main coronary blood flow velocity noninvasively. We also found that coronary flow velocity could be increased from baseline (B) to hyperemic (H) levels by changing the concentration of isoflurane gas anesthesia from 1% to 2.5% in oxygen and that the H levels are similar to or higher than those induced by adenosine. We used the ratio H/B to estimate coronary flow reserve (CFR) in young, adult, and old mice and in mice with atherosclerosis, coronary occlusion, pressure overload, and angiotensin infusion. We found that H/B increases with age from 2.4 (young) to 3.6 (old) and is reduced by all forms of coronary and vascular disease to as low as 1.1 by pressure overload. We conclude that CFR can be measured noninvasively and serially in mice as their cardiovascular systems adapt and remodel to various imposed or natural conditions, and that left main coronary flow reserve may be a good index of global cardiac function. [C402]

"Noninvasive transthoracic and transesophageal Doppler echocardiographic measurements of human coronary blood flow velocity: In vitro flow phantom validation"

Coronary angiography is limited in assessing the hemodynamic significance of a coronary lesion or the state of the coronary microcirculation. Noninvasive transthoracic (TTE) and transesophageal (TEE) Doppler echocardiography have been used to measure coronary blood flow velocity and coronary flow reserve and thus the physiology of the coronary vasculature (normal, stable or unstable lesions). A fundamental, in vitro validation of these methods with a tissue and blood mimicking flow phantom has not been reported. Accordingly, Bland-Altman 95% confidence levels for precision (repeated measures) and accuracy (comparison with time collection) were determined for both TTE and TEE measurements of simulated coronary diastolic blood velocities in 2 mm and 4 mm vessels at the normal in vivo depths of 40 mm and 60 mm. The Doppler angle was set at 45 degrees and flow velocities were varied within a normal in vivo range of 0- 150 cm/s. Confidence levels for precisions and accuracies were similar between TTE and TEE and ranged from ±6 cm/s to ±13 cm/s or approximately 10-15% over the range of the measured velocities. These in vitro results in a controlled flow phantom suggest that technically adequate TTE and TEE can be used to reliably measure epicardial coronary conduit artery blood flow velocities. [C403]

"Flow model with vessel tree for segmentation and registration with color Doppler ultrasound and CT"

Numerous phantoms for human organs are commercially available or designed for scientific purposes. None of these combine the imaging possibility with color Doppler ultrasound (CDU) and computer tomography (CT) while providing vessel branches with bifurcations as natural landmarks. We designed, built and evaluated a flow model with vessel tree which can be imaged with CDU and CT. It aims at development and reproducible evaluation of segmentation and registration work under realistic conditions. The colored representation of vessels in CDU compared to grayscaled representation in B-Mode simplifies and stabilizes the necessary segmentation process. The used tube construct with several bifurcations represents a simplified vessel tree and can be operated with various blood mimicking fluids. The usability and practical value of the model with respect to flow characteristics and visibility of bifurcations were tested and confirmed in experiments with state-of-the-art CDU and CT equipment. [C404]

"Doppler based identification of uterine artery and umbilical artery for monitoring pregnancy"

In this paper, we present an algorithm to identify umbilical and uterine arteries from a set of four different maternal and fetal arteries using their Doppler signatures. To distinguish these arteries, we use 132 Doppler signals collected from pregnant women with gestational ages between 24 to 40 weeks. Initially we filter them to remove noise; spectrograms are generated to extract good cycles, which are then analyzed to derive

independent features that could uniquely represent an artery. A non-linear classification technique using k-NN (k-nearest neighbor) classifier is further applied to identify umbilical and uterine arteries. The proposed algorithm achieves sensitivity and specificity of above 95% and 97% for identification of uterine artery and above 63% and 80% for umbilical artery. [C405]

"Impact of Interpolation Techniques on Statistical Properties and Speed of Fading Channel Simulators"

Interpolation filters are considered to be computationally intensive sections of fading channel simulators. They can be implemented by using linear interpolation or zero-padding followed by low-pass IIR or polyphase filtering. In this work, we will investigate how different interpolation techniques affect statistical properties and speed of the simulator. We will show that use of linear interpolation results in 3 to 6 times improvement in simulation speed while there is negligible degradation in desired statistical accuracy. We will validate this claim by designing a fading channel simulator that uses the above mentioned three interpolation techniques and observing their impact on its first order (probability density functions) and second order (correlation functions) statistical properties. We will also compare the impact of interpolation techniques on the level crossing rate (LCR) and bit error rate (BER) of the fading signal. Finally, we will emphasize our claim by using an advance multiple-tap channel model (gsmTUX6C1) with our simulator (using linear interpolation) and showing that its performance is comparable to corresponding Matlab model that uses polyphase interpolation. We will conclude this work with a recommendation to use linear interpolation for efficient and statistically correct fading channel simulators. [C406]

"Evaluation of the Channel Properties for a DRM+ System and Field Tests in the VHF-Band III (174-230 Mhz)"

In this paper we present an evaluation of the channel properties for a DRM+ system in the frequency Band from 174-230 MHz (VHF-Band III). Simulations of the system performance at different frequencies and with different receiver velocities are shown. Other aspects that have an effect on the system performance at higher frequencies are analysed. Additionally, measurements in the VHF-Band II and III are presented to analyse and compare the performance in the real-world. The theoretical work show that reception is possible up to receiver velocities of around 200 km/h in Band III. The measurements show similar results for Band II and III. [C407]

"A Novel Velocity Estimation Algorithm of Narrow-Band Mobile Communication Channels"

Maximum Doppler spread or, equivalently, the vehicle velocity, can be estimated to improve handoff algorithms and tune parameters for systems when channel conditions change. This paper presents a new mobile station velocity estimator based on the normalized auto-covariance of the Rician fading signal and that of the squared envelope respectively of the received signal. The proposed algorithm is based on such a truth that estimation from auto-covariance function of received signal is more accurate than that from squared envelope when LOS component is not strong (K is small), and the conclusion is contrary if K is large. Compared to previous approaches, the proposed algorithm is shown to have better performance in a microcellular /macro cellular propagation environment, which can be characterized by no isotropic scattering and/or a specular component of unknown strength. Simulations show that the proposed algorithm is robust in both microcellular and macro cellular environments. [C408]

"Hidden state dynamics in laser Doppler vibrometery measurements of the carotid pulse under resting conditions"

A laser Doppler vibrometer (LDV) is used to sense movements of the skin overlying the carotid artery. Fluctuations in carotid artery diameter due to variations in the underlying blood pressure are sensed at the surface of the skin. Portions of the LDV signal corresponding to single heartbeats, called the LDV pulses, are extracted. This paper introduces the use of hidden Markov models (HMMs) to model the dynamics of the LDV pulse from beat to beat based on pulse morphology, which under resting conditions are primarily due to breathing effects. LDV pulses are classified according to state, by computing the optimal state path through the data using trained HMMs. HMM state dynamics are compared to simultaneous recordings of strain gauges placed on the abdomen. The work presented here provides a robust statistical approach to modeling the dependence of the LDV pulse on latent states. [C409]

"Maximum Doppler shift frequency estimation using Autocorrelation Function for MIMO OFDM systems"

In this paper, a method for estimating the maximum Doppler shift frequency is presented for Multiple Input Multiple Output (MIMO) Orthogonal Frequency Division Multiplexing (OFDM) systems. This method uses the

Autocorrelation Function (ACF) for estimating frequency shift that induces ICI between adjacent OFDM subcarriers. The simulation results investigate the BER performance of OFDM system that achieves transmit and receive diversity by using Alamouti/MRC, as well as the BER performance of MIMO linear detectors Zero Forcing (ZF) and Minimum Mean Square Error (MMSE) under the effect of a Doppler spread channel. [C410]

"Joint-decision adaptive clutter filter and motion-tracking adaptive persistence for Color Doppler processing in ultrasonic systems"

Color Doppler processing is one of the most important utility in the ultrasound imaging systems. Color Doppler imaging is mainly used to observe the blood flow in the region of interest. The desired blood signal will be greatly affected by the clutter and speckle noises, and it is the major design issues to eliminate these two kinds of noises effectively. In this work, we proposed a (1) joint-decision clutter filter and (2) motion-tracking adaptive persistence for effectively eliminating the clutter and speckle noises, respectively. The proposed two filters have individually 2~3 dB better performance than the referenced algorithms, and the proposed adaptive clutter filter and persistence can also work together in the same system to obtain even better performances. [C411]

"Measurement of tendon velocities using vector Tissue Doppler Imaging: A feasibility study"

We have developed a vector Doppler ultrasound imaging method to directly quantify the magnitude and direction of muscle and tendon velocities during movement. The goal of this study was to evaluate the feasibility of using vector Tissue Doppler Imaging (vTDI) for estimating the tibialis anterior tendon velocities during dorsiflexion in children with cerebral palsy who have foot drop. Our preliminary results from this study show that tendon velocities estimated using vTDI have a strong linear correlation with the joint angular velocity estimated using a conventional 3D motion capture system. We observed a peak tendon velocity of 5.66±1.45 cm/s during dorsiflexion and a peak velocity of 8.83±2.13 cm/s during the passive relaxation phase of movement. We also obtained repeatable results from the same subject 3 weeks apart. Direct measurements of muscle and tendon velocities may be used as clinical outcome measures and for studying efficiency of movement control. [C412]

"Denoising embolic Doppler ultrasound signals using Dual Tree Complex Discrete Wavelet Transform"

Early and accurate detection of asymptomatic emboli is important for monitoring of preventive therapy in stroke-prone patients. One of the problems in detection of emboli is the identification of an embolic signal caused by very small emboli. The amplitude of the embolic signal may be so small that advanced processing methods are required to distinguish these signals from Doppler signals arising from red blood cells. In this study instead of conventional discrete wavelet transform, the Dual Tree Complex Discrete Wavelet Transform was used for denoising embolic signals. Performances of both approaches were compared. Unlike the conventional discrete wavelet transform discrete complex wavelet transform is a shift invariant transform with limited redundancy. Results demonstrate that the Dual Tree Complex Discrete Wavelet Transform based denoising outperforms conventional discrete wavelet denoising. Approximately 8 dB improvement is obtained by using the Dual Tree Complex Discrete Wavelet Transform compared to the improvement provided by the conventional Discrete Wavelet Transform (less than 5 dB). [C413]

"Effectiveness of Laser treatment at acupuncture sites compared to traditional acupuncture in the treatment of peripheral artery disease"

Cardiovascular diseases are the main causes of mortality, not only in Brazil, but around the world. The use of acupuncture as a complementary and alternative treatment for cardiovascular diseases has been suggested for animals as well as human beings. Possible advantages in using acupuncture are the low cost of treatment and low risks of collateral damage from a combination of acupuncture with other medical treatments. The purpose of this study is to assess the effect of traditional acupuncture with needles and laser acupuncture on arterial pressure and peripheral circulation of inferior limbs in patients with circulatory deficiency. Ten acupuncture points were stimulated in 40 individuals, being that 20 were stimulated by Aluminum gallium arsenide (AlGaAs) laser with emission in the red spectral region (650 nm) using an energy density of 2,4 J/cm2, and 20 were stimulated by systemic acupuncture needles. The analysis of peripheral circulation was performed based on the measurement of arterial pressure of the ankle and arms, using sphygmomanometer and Doppler equipment. The variance of the revascularization index of the laser acupuncture group was 0,057, and 0.030 for the needles group with p= 0,006. These results show that only those treated with laser acupuncture exhibit a significant increase in systolic pressure of their lower limbs, with a consequent improvement of the Revascularization Index, suggesting that different stimuli on acupuncture points generate different variations of peripheral resistance of lower limbs. is column. [C414]

"Understanding the vascular environment of myofascial trigger points using ultrasonic imaging and computational modeling"

Myofascial pain syndrome (MPS) is a common, yet poorly understood, acute and chronic pain condition. MPS is characterized by local and referred pain associated with hyperirritable nodules known as myofascial trigger points (MTrPs) that are stiff, localized spots of exquisite tenderness in a palpable taut band of skeletal muscle. Recently, our research group has developed new ultrasound imaging methods to visualize and characterize MTrPs and their surrounding soft tissue. The goal of this paper was to quantitatively analyze Doppler velocity waveforms in blood vessels in the neighborhood of MTrPs to characterize their vascular environment. A lumped parameter compartment model was then used to understand the physiological origin of the flow velocity waveforms. 16 patients with acute neck pain were recruited for the study and the blood vessels in the upper trapezius muscle in the neighborhood of palpable MTrPs were imaged using Doppler ultrasound. Preliminary findings show that symptomatic MTrPs have significantly higher peak systolic velocities and negative diastolic velocities compared to latent MTrPs and normal muscle sites. Using compartment modeling, we show that a constricted vascular bed and an enlarged vascular volume could explain the observed flow waveforms with retrograde diastolic flow. [C415]

"High altitude thermal sounding using doppler modulated gas correlation"

A measurement technique is presented that demonstrates the ability to thermally sound the atmosphere from cloud-top in the troposphere to the upper mesosphere with nadir observations using a Doppler modulated gas correlation (DMGC) approach. It is shown that DMGC measurements of CO2emission at 15 μm can achieve an effective spectral resolution of <;0.002 cm-1, which can be used to generate averaging kernels from nadir observations with 4-12 km vertical resolution to 95 km. The S/N required for such measurements is achievable with adequately cooled (≤ 50 K) HgCdTe (MCT) detector arrays. A High Altitude Thermal Sounder (HATS) using this approach could provide global temperature fields with the information content necessary to observe and quantify gravity waves throughout the stratosphere and mesosphere. [C416]

"Processing for airborne interferometric SAR data with high squint"

A novel approach for the highly squinted airborne InSAR data processing is presented. Using the IMU data to resolve the PRF ambiguity and moving azimuth windows according to the Doppler centroid varying in the different range, as well as combining the auto-registration imaging algorithm, such approach not only can compensate the squint effect and motion error directly at the imaging processing stage, but also can improve the coherence and restrain the interferometric phase error of the image-pair. The simulative and practical results indicate that the proposed approach is very suitable for the processing of the data with a high squint for a dual-antenna airborne InSAR system with its efficiency in improving the image quality and enhancing the interferogram and coherence. [C417]

"A novel range migration algorithm of GEO SAR echo data"

The key problem of the imaging processing in geosynchronous earth orbit (GEO) SAR system is the space-variance of the Doppler parameters, which will result in the defocus of the SAR image with classical imaging algorithm. In this paper, a Modified Range Migration Algorithm (RMA) is proposed to overcome the space-variance of Doppler parameters by compensating the velocity change along the location of the target. Furthermore the simulation results fully verify the effectiveness of derived algorithm after velocity compensation. [C418]

"Spread E, F layer ionospheric clutter identification in range-Doppler map for HFSWR"

Wide range covering, strong intensity, time-variant, fluctuation and irregular distribution of the spread E, F layer ionospheric clutter badly affects the system performance of High Frequency Surface Wave Radar (HFSWR). A spread E, F layer ionospheric clutter identification method is proposed based on the region segmentation results and region characteristics of the clutter. First of all, convolution template is used for locating the edge of the clutter, then the ratio of the number of the samples belonging to some segmented region and the total number of the samples in the region of interest (ROI) is used for setting the determinative threshold of the clutter region. Experiments with real data manifest that the proposed method can describe the effect of the spread ionospheric clutter to HFSWR. The quantitative analysis is consistent with the real data observation. The result can be used as a worthwhile reference for clutter mitigation, carrier frequency selection or radar system evaluation. [C419]

"A MIMO technique for enhanced clutter selectivity in a multiple scattering environment: Application to HF surface wave radar"

The significance of multiple scattering processes whereby unwanted Doppler-spread energy can contaminate HFSWR remote sensing measurements has recently been reported. In this paper we present the results of quantitative calculations of the extent of the contamination, and then outline a solution based on the adoption of MIMO radar concepts which have been applied successfully in HF skywave radars. [C420]

"Successive cancelation approach for Doppler frequency estimation in pulse Doppler radar systems"

In this paper, a successive cancellation approach is proposed to estimate Doppler frequencies of targets in pulse Doppler radar systems. This technique utilizes the Doppler domain waveform structure of the received signal coming from a point target after matched filtering and pulse Doppler processing steps. The proposed technique is an iterative algorithm. In each iteration, a target that minimizes a cost function is found, and the signal coming from that target is subtracted from the total received signal. These steps are repeated until there are no more targets. The global minimum value of the cost function in each iteration is found via particle swarm optimization (PSO). Performance of this technique is compared with the optimal maximum likelihood solution for various signal-to-noise ratio (SNR) values based on Monte Carlo simulations. [C421]

"Tidal current measurement with TerraSAR-X Along-Track Interferometry"

In this paper we describe new achievements of surface current measurements obtained by space-borne Along-Track Interferometry (ATI). We show how tidal currents can be mapped using the TerraSAR-X satellite and adequate dual-channel SAR data processing techniques. We present results from tidal currents at the Orkney Islands that clearly demonstrate the potential and suitability of the method. [C422]

"Compressive sampling and adaptive multipath estimation"

In many signal processing problems such as channel estimation and equalization, the problem reduces to a linear system of equations. In this proceeding we formulate and investigate linear equations systems with sparse perturbations on the coefficient matrix. In a large class of matrices, it is possible to recover the unknowns exactly even if all the data, including the coefficient matrix and observation vector is corrupted. For this aim, we propose an optimization problem and derive its convex relaxation. The numerical results agree with the previous theoretical findings of the authors. The technique is applied to adaptive multipath estimation in cognitive radios and a significant performance improvement is obtained. The fact that rapidly varying channels are sparse in delay and doppler domain enables our technique to maintain reliable communication even far from the channel training intervals. [C423]

"A new OFDM lattice structure: Toroidal-lattice on the time-frequency plane"

We introduce a new frequency division multiplexed (FDM) system where multiple orthogonal Hermite-Gaussian carriers are used as a transmission basis and investigate the performance of the proposed system. The toroidal waveform in a rectangular OFDMA system is constituted by using multiple Hermite-Gaussian functions. The proposed work outperforms the transmission scheme where only single Gaussian pulses are used as the transmission base in the sense of bandwidth efficiency. We investigate both theoretical and simulation results of the proposed method. [C424]

"Airborne Doppler Wind Lidar investigations of western Pacific typhoon genesis and evolution"

The first ever extensive study of tropical cyclones using Doppler Wind Lidars (DWL) was conducted in 2008 within the THORPEX Pacific Asian Regional Campaign. More than 100 hours of DWL profiles were obtained with an average spacing of 3 km. These wind profiles along with dropsonde temperature, moisture and wind profiles are being used to study the genesis and evolution of tropical cyclones. Initial investigations are focused upon the impact the DWL profiles have on numerical weather prediction. [C425]

"Compressed sensing on ambiguity function domain for high resolution detection"

In this paper, by using compressed sensing techniques, a new approach to achieve robust high resolution detection in sparse multipath channels is presented. Currently used sparse reconstruction techniques are not immediately applicable in wireless channel modeling and radar signal processing. Here, we make use of the cross-ambiguity function (CAF) and transformed the reconstruction problem from time to delay-Doppler domain for efficient exploitation of the delay-Doppler diversity of the multi-path components. Simulation results quantify the performance gain and robustness obtained by this new CAF based compressed sensing approach. [C426]

"Scansar signal processing and image quality enhancement with fitted-geometry doppler surface"

In this paper, an efficient and relatively high quality ScanSAR processor is implemented based on SPECAN algorithm. The role of the accurate Doppler parameter estimation is described with regard to the processed SAR images. A method of extracting the essential Doppler parameters with high precision is introduced and its performance is verified. For this purpose, we have adopted a Doppler surface fitted-geometry method and demonstrated how it can contribute to the improved Doppler parameter estimation. [C427]

"CASA dual-doppler system"

Conventional radar networks are limited at warning against low-altitude wind hazards such as tornadoes and micro-bursts due to the combined effects of their long range, far spacing, and Earth's curvature. The Collaborative Adaptive Sensing of the Atmosphere (CASA) Engineering Research Center aims to solve these limitations through dual-Doppler systems operating in densely-spaced short range radar networks. The CASA test bed radar network incorporate the Distributed Collaborative Adaptive Sensing (DCAS) model in order to optimize scanning and retrieval for fast Doppler wind field products. Under the DCAS environment, fast coordinated sector scans are made by each radar based on weather detection and competitive end-user needs. The retrieval subsystem then makes the best pair selection for dual-Doppler synthesis based on optimal beam-crossing angles for target areas. Together, they create a fast, accurate, and robust dual-Doppler system suitable for weather emergency warnings. [C428]

"Optimal sensor positioning for ISAR imaging"

ISAR imaging is a powerful signal processing that allows obtaining images of non-cooperative targets. Such images are often used as input to classification and recognition systems since they contain useful two-dimensional features. Nevertheless, the interpretation of ISAR images remains problematic since the image plane cannot be defined by the user but it depends on the target's own motions and on the relative position of it with respect to the radar. In this scenario, the only degree of freedom that is controlled by the user is the position of the sensor. In this paper, the problem of selecting an optimal position of the sensor to maximise the probability of obtaining a desired image projection plane is addressed. Moreover, mathematical tools are derived that may assist the user in deciding where to place an ISAR sensor given a priori knowledge of the scenario. [C429]

"Range-Doppler ambiguity mitigation via closed-loop, adaptive PRF selection"

In this paper, we present a method of calculating and updating target probabilities in ambiguous range-Doppler cells along with an adaptive pulse repetition frequency (PRF) selection technique based on mutual information (MI). We approach the problem of updating the probability in multiple ambiguous cells by using a multiple hypothesis test for the target state. The probability ensemble is then used to determine which PRF will maximize MI on the next update. Since MI is a measure of the reduction in entropy of the ensemble, it indicates the amount of information the radar stands to learn about the channel due to the selected PRF. We compare the results of MI-based PRF selection to two other PRF selection methods and demonstrate how blind zones and clutter aliasing can be seamlessly integrated into our PRF-selection procedure. [C430]

"Real-time road traffic monitoring using a fast a priori knowledge based SAR-GMTI algorithm"

Radar systems operating on high altitude platforms can provide traffic information over wide areas, independent of sunlight illumination and weather conditions. In the paper, a novel a priori knowledge based ground moving target indication (GMTI) and parameter estimation algorithm applicable on single- as well as on multi-channel synthetic aperture radar (SAR) data is presented. Only the intersection points of the moving vehicle signals with the a priori known road axes, which are mapped into the range-compressed data domain, are evaluated. The algorithm needs low computational load and is hence well suited for real-time traffic monitoring applications. [C431]

"Potential and limitations of forward-looking bistatic SAR"

Bistatic synthetic aperture radar (SAR) operates with spatially separated transmit and receive antennas that are mounted on separated platforms. Provided that there is an overlap of both antenna footprints, the platforms can move with different velocities in arbitrary directions. A special configuration is given, when the receive antenna looks in forward direction, which is called bistatic forward-looking SAR. Besides the well known advantages of bistatic SAR like the increased information content of the data because of different RCS and scattering characteristics, such a configuration enables high resolution imaging in forward direction, which is not possible with conventional monostatic SAR systems. This paper analyzes a bistatic forward-looking configuration and

demonstrates the capability and feasibility of imaging in forward or backward direction using the radar satellite TerraSAR-X as transmitter and the airborne SAR system PAMIR as receiver. [C432]

"Interpolation techniques for OFDM channel estimation"

Receivers used conventional estimation methods assume a timeinvariant for the channel during one OFDM symbol, but in fading channels with very high mobility, the time variation of channel over an OFDM symbol results in a loss of subchannel orthogonality which leads to ICI. In this study, interpolation methods are used for pilot symbol assisted channel estimation for OFDM systems. Selection of interpolation method effects the performance and complexity of the system. Performance of selected methods was investigated and compared by means of simulations. [C433]

"A new SAR sensor designed for micro-satellites"

Micro Satellites (µSATs) are good opportunities for small countries. This paper describes a new design of a SAR for a µSAT. The centre frequency and the SAR processing were optimized in a way to allow the realization of a simple but capable system that provides many interesting opportunities for researchers and allows participating to international environmental monitoring and control activities. The major points of the design are a frequency that allows some penetration through vegetation and a relative small antenna in length and width. A new SAR processing concept allows a medium swath-width and an acceptable resolution. A patent is pending. [C434]

"A tracking algorithm for GNSS reflected signals on sea surface"

The observation of the ocean surface using electromagnetic sources of opportunity (GNSS signals for instance) has been a green research topic for several years. The Global Navigation Satellite System (GNSS) presents a powerful and useful technology for remote sensing, ocean surface monitoring and oceanography. Many experiments have been conducted to show the efficiency of the Global Positioning System (GPS) in applications such as ocean surface altimetry, wave height, surface current measurements, and current direction estimation [1]. Considering the GPS link as a passive sensor for ocean monitoring, we study in this paper the possibility of tracking GPS signal reflection footprints on the sea surface to improve the acquisition and the extraction of this signal. As an analogy to the classical problem of moving targets Radar tracking, we develop a tracking algorithm based on Kalman filtering. [C435]

"Radar observations of wave field in littoral zone"

The dissipation of the wave energy in the littoral zone is significant for the coastal hydro- and sediment dynamics. In this presentation, a recently developed method is presented about the separate, simultaneous measurements of wave propagating field and of wave breakers' velocity, based on ground based, Doppler, X-band Radar observations. The kinetic energy of the wave field is calculated for the last 2 km of the N. Sea towards the shore, with high spatial resolution (7.5 m) and the rate of the dissipated is estimated. [C436]

"Measurements of microwave backscatter from sea surface using L-band multi-channel receiver"

The authors conducted a sea clutter trial using a DSTO (Defence Science and Technology Organisation, Australia) built, vertically polarised, L-band, 16-channel receive array in May 2008 on the Kangaroo Island, South Australia. This paper studies some properties of the collected sea clutter, with an emphasis on observations of the interaction of electromagnetic waves with changes of the sea surface due to changes in observation direction and/or variation of wind. [C437]

"KOMPSAT-5 spotlight SAR processor using FSA with calculation of effective velocity"

In KOMPSAT-5 program, Korea Aerospace Research Institute has made SAR imaging chain analysis tool to evaluate imaging system of KOMPSAT-5. The tool consists of a simulator and a processor. The simulator simulates observation of a scene by the operational mode of KOMPSAT-5 and generates SAR raw data. The processor generates an image of the scene. This paper is about the second part of processing the simulated raw data that is acquired by the step steering sliding spotlight mode of KOMPSAT-5. For this observation mode, dechirp on receive is operated in receiving the echoes. So, extended frequency scaling algorithm is used to process the raw data in order to directly handle the dechirped data. This paper mainly contributes for the accuracy of effective velocity. The effective velocity criterions for range and azimuth processing allows that the processor uses only one scene center effective velocity in range processing and several ones in azimuth processing. In this paper, a method to increase the accuracy of calculation of effective velocity is also proposed. Simulation result shows that the proposed method is valid. [C438]

"Radar-based human detection and characterization with non-linear phase modeling"

Many current radar-based human detection systems employ some type of Doppler or Fourier-based processing, followed by spectrogram and gait analysis to classify detected targets. However, in Fourier-based techniques the maximum output signal-to-noise ratio (SNR) is given by targets whose target phase is linear. On the contrary, the phase variation of the human target response is nonlinear. This difference causes a significant loss in SNR, and therefore detection performance. In this paper, two novel, nonlinear phase detector designs based on human modeling are presented. In the first method, only the human torso reflections are modeled and unknown model parameters computed using Maximum Likelihood Estimation. In the second method, the entire human body is modeled as a different parametric model. The expected radar response for each combination of parameter values is stored in a database. An optimal sparse approximation to the data is found using Orthogonal Matching Pursuit. The performance of the proposed techniques and optimal space-time adaptive processing algorithm is compared and target characterization applications examined. [C439]

"Development of a signal processing subsystem for a spaceborne rotating, fan-beam scatterometer"

This paper introduces an on-board signal processing subsystem of a spaceborne rotating fan-beam scatterometer in China. The subsystem processes returned signal after downconversion to intermediate frequency. To reduce the data stream downlinked from the satellite, the final data bins are summed into 34 energy slices, each with a range resolution of 10 km. Then a simulation process is adopted to analyze the Doppler effects due to the motion of the spacecraft, and to generate the Doppler compensation table and the bin summation table. This method is also used to analyze the measurement variance Kpcof each detected slice. Finally, the coefficients of the expression of Kpcare presented. [C440]

"Dual-polarized, coherent microwave backscatter from rough water surfaces at low grazing angles"

We show that at low grazing angles, breaking wave effects are very important in HH polarized microwave backscatter from the ocean but less so at VV polarized backscatter. When the ocean surface is disturbed only by wind, breaking wave effects in VV backscatter are much smaller than Bragg scattering, even at low grazing angles. For HH polarization, on the other hand, breaking wave effects are very important at low grazing angles. In the presence of surface current gradients set up by internal waves, HH cross sections can exceed those at VV by as much as 10 dB near internal wave crests, indicating enhanced breaking wave effects that cannot be described as specular. Breaking effects are nearly as strong as Bragg effects in VV backscatter under these conditions. Spectral comparisons confirm these conclusions. [C441]

"Investigation on moving target detection and velocity estimation with Triple-Channel MIMO-SAR"

Triple-Channel SAR system can detect moving target, and estimate its range velocity. However, the problems of blind velocity and velocity ambiguity still exit. To resolve these problems, Triple-Channel Multi-Input Multi-Output SAR (Triple-Channel MIMO-SAR) system, with a displaced phase center antenna (DPCA) and interferometry method based on matched Fourier Transform (MFT), is proposed in this paper, which could combine detection and estimation results of different working frequencies and obtain accurate Doppler frequency modulated rate estimation. Using this method, we can not only detect moving target and estimate its range velocity, but also resolve the problems of blind velocity and velocity ambiguity and get accurate azimuth velocity estimation. The effectiveness of this approach is validated by the computer simulation results. [C442]

"A new bistatic doppler measurement system with reduced contamination by sidelobe echoes"

A new bistatic Doppler measurement system with an array receiving antenna is proposed. In this system the spacing of receiving array elements is more than a wavelength (e.g. 10 wavelengths), and it leads to forming many sharp grating lobes. With these sharp lobes (beams) and some signal processing techniques like a digital beam forming, it can be expected that the effect of sidelobe contaminations, which is a serious problem of bistatic measurement, can be effectively reduced. [C443]

"Doppler processing of coherent radar backscatter for ocean surface wave measurements"

The technique for extracting wave period and wave direction from a navigation radar backscattering intensity is well developed but the determination of spectral density or wave height is hindered by the complex nature of the modulation transfer function. In contrast to backscattering intensity, Doppler velocity from coherent radar is the radial velocity of the scattering objects. Its oscillatory component is contributed by ocean waves. The spectral peak component of Doppler velocity is close to the peak wave period measured by a nearby buoy and the significant wave height can be accurately calculated. With radar range coverage on the order of ten dominant

wavelengths, reliable assessment of peak wave period and significant wave height is achievable with radar data as short as one second. Wave direction can also be determined with a scanning system. [C444]

"IMage formation algorithm for bistatic forward-looking SAR"

The conventional monostatic SAR shows a limitation of achieving a high azimuth (angular) resolution if a forward-looking geometry is used. Bistatic SAR offers a possibility of the forward-looking formation image, e.g. one platform operates as a separated illuminator while another works in a forward-looking mode. In this special bistatic configuration, the forward-looking beam will introduce two problems. The first one is the significant Doppler shift, which will produce the range-azimuth coupling. The second one is that the targets located at symmetrically about the flight path of the forward-looking platform have the same antenna-to-target range which would cause the range migration ambiguity of the receiver. This paper will develop a mathematical model to describe the Doppler characteristic of bistatic forward-looking SAR (BFLSAR). Based on this model, the previous bistatic point reference spectrum (BPTRS) can be applied. Using the BPTRS, a modified range-Doppler algorithm is proposed to handle the two problems and focus BFLSAR data in the azimuth-invariant configuration. Finally, simulation experiment is used to validate the proposed model and processing approach. [C445]

"Swell effect in shallow underwater acoustic communications"

The need for monitoring underwater sensors, communications between submarines or sonar, makes underwater acoustic communications an important field of research. Electromagnetic waves are quickly attenuated in this medium and thus acoustic waves are the best option for communications. When two buoys are present, one acting as the emitter and the other as the receiver, it is crucial for the communication system to know the response of the channel. This paper presents a study of the underwater channel and proposes a model developed in Matlab where physical phenomena like attenuation, absorption and the swell effect are considered. This latter effect causes a Doppler spread in the signal, and a time-varying impulse response. [C446]

"Two-dimensional frequency shift track based on geometric moment invariants"

A novel ultrasonic flow velocity estimation method employing the two-dimensional (2-D) frequency shift track is proposed. By representing the backscattered echoes from human blood in the 2-D frequency domain, this paper shows that the velocity profile measurement using pulsed-wave Doppler ultrasound and the moving target track in image processing are isomorphic problems. Therefore, feature template matching based on geometric moment invariants can be used to track the 2-D frequency shift from which the velocity is estimated. Then we discuss the characteristics of the moment invariants and present correlation coefficient as a tracing strategy. The experimental results show the method can overcome the disadvantage caused by frequency-dependent attenuation and get better effect in velocity profile estimation. [C447]

"Doppler blood flow signal analysis meets traditional Chinese pulse diagnosis"

In traditional Chinese pulse diagnosis (TCPD), diseases of internal organs can be detected by recognizing pulse waveform patterns of wrist radial arterial. However pulse waveform analysis, for which Doppler diagnosis is a powerful tool, is limited to cardiovascular diseases. This paper tries to fill the gap between TCPD and Doppler diagnosis by applying signal analysis and pattern recognition technologies to Doppler blood flow signals (DBFS's) of wrist radial arterial, which are recorded from both hands of healthy people, gastritis and cholecystitis patients. DBFS's are classified using the features proposed by an L2-soft margin support vector machine (L2-SVM): five clinical Doppler parameters (DP), wavelet energies (WE), wavelet packet energies (WPE), and piecewise axially integrated bispectra (PAIB). 5-fold cross validation is used for performance evaluation. The sick are differentiated from the healthy with an accuracy of about 80% using DP, WE and WPE, while the classification rate between gastritis and cholecystitis reaches 100%. Using PAIB, ether two groups of subjects are classified with accuracy greater than 93%. Gastritis is more accurately recognized than cholecystitis, while the latter is recognized with a higher accuracy on data from the left hand than right. Though the sample size is relatively small, we still argue that the methods proposed here are effective and could serve as an assisstive tool for TCPD. [C448]

"Free placement trans-skull Doppler system with 1.0MHz array ultrasonic probe"

This paper describes a trans-skull ultrasonic system that measures the blood flow velocity through the brain's blood vessel under skull. In this system, we use an ultrasonic array probe with the center frequency of 1.0MHz. The system determines the blood flow by Doppler effect. This Doppler effect is examined by the center of gravity shift in the frequency domain. We test the system in the condition of the water flow in silicon tube under the cow scapula. The experimental result shows that the system detects the flow velocity by Doppler effect and confirms the usefulness of the method under skull. [C449]

"Research and the hardware design of the UE-LMS compensation method for the Doppler frequency shift in the OFDM system"

The new compensation method called the UE-LMS method for the Doppler frequency shift in the OFDM system is studied. The phase offset unbiased estimation and the LMS filter is used to implement the compensation method. Moreover, the influence of the Doppler frequency shift and the compensation steps are introduced. Lastly, the compensation method is designed on the FPGA platform and the compensation ability is obtained through the hardware simulation. The simulation results indicate that the UE-LMS compensation method can effectively compensate the Doppler frequency shift in the OFDM system. Besides, the method can save lots of signal resource during the compensation process. [C450]

"Reverberation suppression based on FrFT in the detection of targets on the seabed for moving sonar"

A method for reverberation suppression based on fractional Fourier transform was brought up to detect targets on the seabed for moving sonar. The emission signal was reconstructed by measuring the velocity of sonar. The optimum fractional order and the position of narrow band filter were calculated though reconstructed signal. Reverberation noise containing target echo was transformed to fractional Fourier domain and filter by narrow band filter, and then we can recover target echo and filter out reverberation noise through inverse fractional Fourier transform. The results show that the method, can effectively suppress reverberation noise. [C451]

"The database of radar echoes from various targets with spectral analysis"

In this paper we describe a database, noted as RadEch Database, containing radar echoes from various targets. The data has been collected in controlled test environments at the premises of Military Academy-Republic of Serbia. Our goal is to provide a balanced and comprehensive database to enable reproducible research results in the field of classification of ground moving targets (pattern recognition). A time-frequency analysis of radar echoes has been performed, in order to identify the main features of the various targets. The RadEch Database is freely available for download and we hope that our database provides researchers with a valuable tool to benchmark and improve the performance of classification algorithms. [C452]

"Design and characterization of piezoelectric inkjet for micro patterning of printed electronics"

A design verification system based on multiphysics modeling and micro-electro-mechanical systems (MEMS) fabrication has been established to develop piezoelectric inkjet printheads for micro-patterning on printed electronics. Piezoelectric printheads have been fabricated with silicon and silicon on insulator (SOI) wafers by MEMS fabrication and post-processing package. Transient displacements of a piezoelectric actuator according to voltage waveform are measured by Laser Doppler Vibrometer (LDV), and compared with numerical predictions by the three-dimensional piezoelectric-structure interaction modeling. Key issues in design and fabrication of piezoelectric inkjet printheads are investigated: printhead configuration, input voltage waveform, hydrodynamic and structural crosstalks, acoustic wave propagation (or effect of limited compressibility), and meniscus instability at high frequency. The present design verification system has shown its promising applicability to novel-concept designs of inkjet printheads for wide range of printed electronics and bio-applications. [C453]

"C2X communications overview"

Mobile communications is usually understood as phoning while moving, with the link via a base station. The success of mobile communications stimulated the idea of direct mobile to mobile communications in and with vehicles. In the last few years regulation authorities made the necessary spectrum in the 5.9 GHz frequency range available and set up preliminary rules. These are the basis for R&D in this wide area. In this paper the basic ideas and primarily the communications channel are discussed. [C454]

"Study on the Time-Frequency Two Dimensional CFAR Algorithm for Moving Targets on Ground in PRC-CW Radar"

PRC-CW radar is mainly used to detect moving targets on ground. Ground clutter heaves fiercely, and its distribution is complex, which makes it difficult to detect targets correctly from time domain. The characteristics of moving targets and ground clutter differ in frequency domain. And the spectrum of targets may change with time, so, this paper designs the time-frequency two dimensional constant false alarm rate(CFAR) algorithm. Based on the analyze of pulse compression and moving targets detection(MTD) of this type radar, the two-dimensional CFAR algorithm is proved to be feasible via simulation. The results of simulation show that, the algorithm can measure the velocity and range of targets correctly. The clutter and noise are also restrained effectively. [C455]

"Analysis of fading statistics based on geometrical and statistical channel models"

Introduction of antenna arrays in high speed wireless communication systems has made researchers to propose numerous scattering models like circular, elliptical and eccentro scattering models. These and their derived models provide angle of arrival distributions for macro, micro and Pico cellular environment using uniform and Gaussian distributed scatterers around BS and MS. In this paper, we analyze these scattering models using their second order statistics like level crossing rates, average fade durations, coherence distance and auto covariance. Effect of the Doppler spread on these statistics is also elaborated. The models are also compared quantatively on the basis of multipath shape factors like the angle spread, angular constriction and direction of maximum fading. [C456]

"Characterization of benign and malignant solid breast masses using vascular morphology in 3D power Doppler ultrasound images"

Angiogenesis is a popular issue and indicator in the assessment of tumor's growth and metastasis. Three-dimensional (3-D) power Doppler ultrasound images could characterize benign and malignant breast masses. Therefore, this study extracts the features vascularization from 3-D ultrasound images and selects seven morphological features to diagnose benign and malignant breast tumors by using support vector machine (SVM). These features are trained by the Az value under the receiver operating characteristic (ROC) curve to distinguish the more important features from others. The simulations evaluate 30 benign and 30 malignant breast tumor cases by using the morphological features. The classification performance of the proposed method in term of Az value for the ROC curve of the features derived from 3-D power Doppler is 0.8423. The result shows that the vascular morphology in 3-D power Doppler ultrasound images could be used to diagnose benign and malignant breast tumors. [C457]

"Evaluation of optical Doppler variance as a new erythrocyte aggregation index"

We propose frequency (spectral) domain Doppler optical coherence tomography to qualitatively measure red blood cell aggregation. Variance/standard deviation of the Doppler frequency spectrum in Doppler variance imaging of flowing blood under shearing conditions was developed as a new aggregation index. [C458]

"Coded transmission for ultrasound Doppler detection using truncated long code"

When applying the spread spectrum technology into the pulse-echo ultrasound system, the code selection is critical, as the duration time of the transmission pulse is normally short. It is difficult and as the mater of fact almost impossible in a nonlinear application like in the human body to have a good correlation property using a relatively short code excitation. A truncated long code idea is introduced in this paper, in which the coding time is extended to as long as the parameter estimation time window allows. The transmitted pulses are coded using different short codes from burst to burst and all the echoes are organized together coherently in the later estimation process to form a long code modulation. Very good correlation property can be achieved. The idea is applied to the ultrasound Doppler detection system for the blood velocity measurement in human body. [C459]

"Implementation of cellular neural networks in image preprocessing for left ventricular filling velocity evaluation"

Beside the measurement of flow velocity through mitral valve by pulsed Doppler, and measurement of velocity of myocardium by tissue Doppler imaging, estimation of diastolic function of left ventricle can also be made by measuring velocity of propagation of vortex using color Doppler M-mod imaging. Automated measurement has not become a practice yet because different methods produce different results and there has not been achieved a consensus about method to be applied. The goal of our research is to investigate the possibility of enchancement in automated estimation of propagation of left ventricular filling by implementing cellular neural network (CNN) in image preprocessing phase. [C460]

"Doppler effect and compensation in a Rotating Fanbeam Spaceborne Scatterometer"

Spaceborne Rotating Fanbeam Scatterometer, RFSCAT, has a wider continuous swath that can provide a large number of independent samples of Sigma0 for wind speed and direction retrieving. But the large swath and footprint result in a wideband Doppler frequency shift. For a low earth orbiting satellite, the maxim Doppler bandwidth between forward and backward echoes will be about 500 KHz. Even in a single echo of RFSCAT, the Doppler bandwidth is about 90 KHz, while in a pencil beam scatterometer the Doppler bandwidth is almost a single tone. A method of Doppler frequency compensation both on center frequency of transmitted pulses and signal processing section of the echoes are carried out and evaluated. [C461]

"Analysis on PN code acquisition performance in DS-SS over multipath environment"

In this paper, an acquisition algorithm is proposed to solve the problem of long PN code acquisition in direct-sequence spread-speactrum (DS-SS) communications over multipath environment. The algorithm is the combination of partial correlation, cumulation and average of power spectrum density (PSD). Through partial correlation, we can get a sinusoidal signal which reflects the Doppler shift, and then by averaging the cumulative PSD, we can detect the multipath signal at lower SNR. This paper gives the multipath DS-SS signal model, and analyzes the acquisition performance of the proposed algorithm over multipath environment, and compares the acquisition effect over multipath and single-path environment by simulation. [C462]

"Subimage fusion for high-resolution ISAR imaging"

With the improvement of resolution in the inverse synthetic aperture radar (ISAR) imaging, the effect of the rotational motion of the target is much larger than ever before. In this letter, we propose a novel subimage fusion method to compensate for the large rotational motion in high-resolution ISAR imaging. By dividing the large rotational motion into several small ones, the subimage formation can be realized easily with current ISAR imaging algorithms. At the same time, with the increasing of the number of the subimages, the change of the aspect angle during the coherent processing interval can be very large, and high resolution can be achieved. Moreover, because the whole processing is achieved with Fast Fourier Transforms and vector-multiplication operations, the proposed approach is computationally efficient and has no interpolation operation. Numerical examples are provided to demonstrate the performance of the proposed approach. [C463]

"A measurement method for Doppler frequency rate-of-change with coherent pulse train"

The information of target's acceleration is reflected in the Doppler frequency rate-of-change of the received radar signal. Limited in target's velocity, the information of Doppler frequency rate-of-change is very subtle. This information is quite difficult to measure precisely since it is very subtle and the pulse duration is very short. Therefore, a precise method is proposed to measure this information based on Morlet wavelet transform. Morlet wavelet transform has low signal-to-noise ratio (SNR) threshold. According as auto correlating the wavelet transform coefficient of radar signal, the Doppler Frequency rate-of-change is enhanced and phase ambiguity is unwrapped. By exploiting the coherent property of pulse train, the observation time is extended equivalently and so the measurement precision is improved greatly. The simulation study shows that this method has low SNR threshold and obtain the parameter measurement fast and accurately. [C464]

"Characterization of interference effects in multiple antenna GNSS receivers"

The understanding and mitigation of the effects of narrowband interference on the operation of global navigation satellite system (GNSS) receivers are crucial to maintaining a satisfactory performance of these systems. The carrier to noise density ratio (C/N0) is a measure of the strength of the received signal relative to the noise (including any interference present) and is therefore an important indicator of the achievable performance. Thus a significant amount of work has been done in the case of single antenna receivers to characterize the impact of the narrowband inteference on the C/N0, leading to the introduction of the Spectral Separation Coefficient (SSC). In this work, we extend these concepts to antenna arrays and introduce the Spectral and Spatial Separation Coefficient (SSSC). In addition to the Doppler separation, the SSSC takes into account the spatial dimension of the antenna array in order to quantify the effect of the interference on the quality of the received signal of interest. As the SSSC increases, the effect of the interference on the desired signal decreases and consequently the C/N0improves. We derive closed formulae for both the SSSC and effective C/N0in the case of a single narrowband interference and evaluate them using simulations. [C465]

"On the state-of-the-art of real-time GNSS signal acquisition-A comparison of time and frequency domain methods"

This paper summarizes what is needed to achieve a real-time -157 dBm GPS C/A signal acquisition sensitivity in ASIC and software receiver implementations for a cold and a warm start. Two receivers (one ASIC receiver working in the time domain and one PC software receiver working in the frequency domain) are implemented in a highly efficient way. The algorithms are outlined here and are tested with a GNSS signal simulator. Both use the same RF front end, operate on identical 2-bit samples and produce identical correlation results. The sensitivity comparison is completed by including some new commercial GPS chip evaluation boards in the test runs. We demonstrate the importance of narrow band and strong signal interference mitigation and investigate the role of the coherent integration time length as an important trade-off parameter. [C466]

"A novel method of resolving velocity ambiguity in the pulse doppler radar"

In this paper, a novel method of resolving velocity ambiguity in the pulse Doppler (PD) radar is proposed. By using multi-carrier-frequency waveform and Chinese Remainder Theorem (CRT), this method is able to overcome the velocity ambiguity. Furthermore, a modified algorithm with better robustness is deduced and its performances are analyzed in detail. Specific conclusions are verified with some simulation results. [C467]

"Fetch limited sea scattering spectral model for HF-OTH skywave radar"

Sea Normalized RCS, and Doppler spectra have been revised for HF-OTH Clutter Modelling. The Hasselmann model is firstly introduced to predict the sea directional spectrum of fetch-limited sea and results have been compared with the Pierson-Moskovitz model used for large scale ocean remote sensing. Results show that the closed fetch-limited sea has lower NRCS compared with ocean for similar wind intensity and direction. For this reasons RCS and Doppler spectra must be predicted taking into account of the fetch dimension. In future work we will generalize this interesting approach to fetch-limited wind, time-limited pulse, in order to show the waveform effect on Doppler spectrum. [C468]

"Signal analysis of downward-looking and forward-looking array FMCW SAR"

Downward-looking and Forward-looking (DL & FL) array Synthetic Aperture Radar (SAR) can image scene beneath and in front of the platform that can not be realized by side-looking (SL) SAR. According to curve sketch of equidistance and euqi-Doppler, blind zone beneath the platform and ambiguity symmetrical to the track of SL SAR are analyzed, and DL & FL array Frequency Modulated Continuous Wave (FMCW) SAR signal model is established. By virtue of signal model, expansions of range course in different forms are applied in analyzing Doppler characteristic and Range Cell Migration (RCM). Parameters affecting cross-track resolution, such as array length, target position and platform height are analyzed combing with effective array aperture. Simulation results show optimization and effectiveness of the parameters, which can provide reference for parameter design of array SAR. [C469]

"Channel estimation in OFDM systems based on comb-type pilot arrangement over doubly-selective channels"

The time and frequency selectivity in doubly-selective channels corrupt the orthogonality between different subcarriers in an orthogonal frequency-division multiplexing(OFDM) symbol and induce significant inter carrier interference(ICI). To mitigate this effect, many channel estimation and equalization based ICI mitigation schemes had been proposed. However, most of them are based on pilot pattern different from comb-type arrangement, therefore not applicable for many widely applied standards of which pilot tones are equispacedly spread in each symbol, such as DVB-T. For these systems, we resort to an two-stage estimation schemes to obtain accurate channel impulse response. In this paper, three fine estimation schemes are proposed and compared. Simulation results indicate that our proposed schemes can substantially reduce the mean squared error (MSE) of channel estimation in doubly-selective channels. [C470]

"DVB-T passive radar for vehicles detection in urban environment"

Passive radar systems exploit non-cooperative transmitter to detect targets in areas of interest. Some of the main advantages of such systems with respect to conventional radars include low cost architectures, low energy requirements and potentially null probability of intercept. In this paper a low-cost solution for vehicles detection making use of passive radar concept is presented. A Software Defined Radio (SDR) solution and commercial antennas have been used to realize a DVB-T passive radar demonstrator. An analysis of the DVB-T signal is firstly presented together with a study of its capability as radar waveform. Afterwards an experimental setup is presented and analysed and finally some results of targets detection are shown. [C471]

"Mixed doppler compensation for near-field focused beamforming of forward looking sonar"

When the forward looking sonar (FLS) is working at close quarters, both the near-field focused beamforming and the compensation of doppler effect caused by the moving platform will bring heavy computing load, and make it difficult for real-time processing. Aiming at this question, mixed doppler compensation (MDC) is brought forward, it combines full doppler compensation (FDC), which is accurate and half doppler compensation (HDC), which is relatively inaccurate but fast. HDC offers a balance between accuracy and speed. The effectiveness of this algorithm is testified through a simulating experiment. [C472]

"Non-LTE modeling and simulations for spectroscopic analysis of stainless steel Z-pinch Plasma"

We have developed a collisional-radiative spectroscopic model that combines the completeness of highly averaged Rydberg states models with the accuracy of detailed models for all important excited states. Our model includes an abundance of levels and atomic structure data as well as collisional and radiative processes including excitation, ionization, and recombination level couplings. This approach was used to generate a Stainless-Steel (SS) atomic model to analyze the implosion dynamics of an array of SS wires on the Z and/or refurbished Z accelerator at Sandia National Laboratories. We investigate the ionization dynamics and generate K- and L-shell spectra using the conditions characteristic of the peak emission in the Z accelerator, as calculated by a 1D non-LTE radiation hydrodynamics model. The non-LTE populations are obtained by generating the detailed atomic data for Fe, Ni, and Cr ions, the primary constituents of SS. The simulations self-consistently include the effects of radiation transport and line broadening. Our atomic data includes level-specific dielectronic recombination (DR) data for recombination from H to He-like ions in order to investigate the Lyalphasatellite lines that are useful for diagnosing Doppler broadening in a Z-pinch plasma at stagnation. [C473]

"The adaptive RBFNN equalizer for nonlinear time-varying UMTS channel"

The paper presents an adaptive RBFNNE (radial basis function neural network equalizer) of nonlinear time-varying UMTS channel; the architecture of the RBFNNE implements the Bayesian decision function. Centers of hidden layer neurons, equal to the channel states, are determined by an unsupervised classification algorithm based on the rival penalized competitive algorithm. To determine the other parameters (spreads of hidden layer neurons and connections weights), the gradient descent algorithm applying the on-line and offline training modes is used. The mobile communication channel UMTS, is generally modeled by a tapped delay line (TDL) model, where the coefficients implement the delay profile and the Doppler effect of the doubly-selective channel. Furthermore, a nonlinear distortion is added to the transmitted symbols; good performance results are obtained as compared to the classical equalizers i.e. minimum mean-squared error equalizer (MMSE) and the decision feedback equalizer (DFE) are obtained for the case of nonlinear time-varying UMTS channel. [C474]

"Study on Chaotic Sequence for Shallow Sea Acoustic Networks"

Underwater acoustic communication channels are generally characterized as seriously time-space-frequency variant channels with strong multi-path interference, limited bandwidth, severe environment noise and Doppler effect. Taking into account the hostile transmission condition of underwater acoustic channel, underwater communication is one of the most challenging communication technologies. Frequency-Hopping underwater acoustic communication system is drawing more and more attention for its good performance under serious noise and multi-path interference condition. To a great extent, The performance of Frequency Hopping system depends on the the choice of pseudo random(PN) sequence. In this paper, chaotic sequence are investigated and their performance compared with the conventional PN sequences. Systems having chaotic behaviour can be noise like, broadband in nature and ergodic but as well deterministic. Chaotic sequence can therefore be used in underwater acoustic communication system. [C475]

"Beam-plasma interaction in presence of dissipation in finite external magnetic field"

Summary form only given. Plasma-filled microwave sources on relativistic electron beams have essential advantages as compared to vacuum ones. Their operation is based on stimulated emission of the oscillations of plasma-filled waveguide by the beam electrons. They operate at higher beam current and the output frequency might be gradually changed by changing plasma density. With increase in beam current the character of the beam-plasma interaction (BPI) changes. Up to now theory of plasma- filled microwave devices is developed mainly in strong external longitudinal magnetic field. Such approach substantially simplifies the analysis. However, its applicability conditions may be violated in real experiments especially in short wavelength range. Description of devices based on cyclotron emission from beam electrons (i.e. based on anomalous Doppler effect) is impossible at all. There is a necessity in theory of microwave devices in finite external magnetic field. Now specific problems of this theory are begun to be considered. Plasma-filled microwave devices correspond to cylindrical waveguide with thin annular plasma and spatially separated coaxial thin annular e-beam. Along with maximal exhibition of the advantages of plasma filling this configuration provides development of beam instability (BI) caused by growth of negative energy beam wave (NEBW). Its growth rate attains maximum under collective (instead of usual) Cherenkov resonance. In these conditions the role of dissipation increases as it also leads to growth of NEBW. The trends of increasing output frequency leads to decreasing of the skin depth in the walls of resonators. Their quality factor Q decreases and actually dissipation increases. With increase in level of dissipation the BI becomes of dissipative type. In the configuration of microwave devices even small dissipation leads to a new type of dissipative BI with inverse proportional dependence on dissipation. Its properties and conditions of development-are important additional factors that should be taken into account upon design of the devices. Present investigation substantiates the new type dissipative beam instabilities in finite external longitudinal field. It is shown that the new type of dissipative beam instability, presented in, develops also in finite

external magnetic field and can essentially influence on operation of the devices. [C476]

"GPS time transfer smooth using discrete wavelet"

Time service is the precondition of precise navigation in radio navigation system, the cesium atomic clock of high stability is used in this system as frequency reference and GPS time receiver is used. To solve the problem of system synchronize error caused by satellite movement, Doppler frequency shift, ionosphere refraction, etc. sliding window method and discrete wavelet method are introduced in this paper. The results of calculation indicate that discrete wavelet transform can decrease the error caused by GPS time receiver jitter effectively. [C477]

"A novel approach to improve Doppler tolerance of polyphase code"

Polyphase codes have a large mainlobe-to-sidelobe ratio in matched filter processing. However, the conventional matched filter processing of polyphase codes suffer severe signal loss in performance under large Doppler environment. The basic approach for overcoming the Doppler effect is to use a bank of Doppler-matched filters. Each of the Doppler-matched filters is designed to match a different Doppler frequency. However, the brute force method causes heavily computed burden. This paper proposed a novel correlator based on partial match filter (PMF), followed by the FFT and maximum output selector. The method can simultaneously search all possible Doppler frequencies. The processing scheme can cancel the phase rotation resulted from Doppler frequency, therefore, improve Doppler tolerance when detecting polyphase codes. The performance for the Doppler tolerance improves with decreasing of size of partial correlator and FFT. The scalloping loss can be compensated by zero-padding FFT. [C478]

"Effect of range ambiguity on space based AMTI clutter suppression and mitigation method"

Air moving target indication (AMTI) using space based radar (SBR) is attractive. In order to detect airborne target in clutter and measure the target's range at the same time, SBR usually use medium PRF waveform. Theoretical analysis and experimental results show that range ambiguity cause target's range ambiguity and clutter's range foldover. Range ambiguity significantly degrades the clutter suppression performance. A method based on orthogonal waveform for mitigating the range ambiguity effects is presented in this paper. The orthogonal waveform is launched in sequence. Then multi-channels matched filter is used to receive the replay pulse. Experimental results illustrate that the method is effective. [C479]

"A Study of Characteristics and Processing Method of Broadband Doppler Velocity Log Echo"

Broadband Doppler velocity log (DVL) measures velocity relative to sea bottom according to Doppler effects and has been used in the navigation of multiple carriers. It improves the measurement accuracy compared to narrowband technique by phase coded technique and pulse-pulse correlation technique. To study the characteristics of the echo and increase accuracy further, echo model is established, the envelope and auto-correlation of echo are analyzed, and the results show that processing the echo illuminated by the whole beam will obtain higher accuracy in high signal to noise ratio. The data of lake experiment are analyzed, and the results prove the conclusion. At last, digital simulation is done, the simulating results are in agreement with the conclusion and processing methods in different SNR are supposed. [C480]

"Time interleaving study for an OFDM long-haul HF radio link"

Communication with remote places is a challenge that in most cases is solved by means of satellites. However, for low-rate data transmission from remote sensors placed in Antarctic stations, this solution, a part from being too costly is of disadvantage since the geostationary satellite visibility is poor. In such scenarios, Skywave ionospheric communication systems represent a practical alternative to satellites. HF communications suffer from impaired propagation, i.e. long delay spread, medium Doppler values, high level of attenuation and high level of interference. To cope with some of these impairments, in this paper, a study of the time interleaving effect applied to OFDM symbols transmitted through a multipath time-varying long-haul ionospheric channel is studied. [C481]

"3D finite element analysis and experiment on the piezoelectric ultrasonic transducer motion"

Investigating the displacement motion of the piezoelectric ultrasonic transducers plays an important role for bonding process in package technology. Mechanical vibration and electrical performance analysis of the transducer is a great concern. The commercial 3D ATILA software is used for simulation first. Best resonance frequency of the transducer is verified and tested via LCR impedance meter and laser Doppler velocity meter experimentally. Both 3D finite element simulation and experimental results reach similar transducer's tip motion

behavior for future study. [C482]

"Green-pumped CW singly resonant optical parametric oscillator based on MgO:PPLN with frequency stabilization"

This paper shows that it is possible to build a stable cw optical parametric oscillators from MgO doped periodically poled lithium niobate pumped at 532 nm by a single-mode DPSS (diode-pumped solid-state) laser. The ring cavity is resonant for the signal wave and one mirror is mounted on a piezo-actuator for scanning and controlling the cavity length. The temperature controlled, 40 mm-long MgO:PPLN crystal is placed between the mirrors. An uncoated glass etalon inside the resonator allows for frequency fine tuning. To prove the stability of our cw SRO we performed Doppler-free saturation spectroscopy of the 133Cs D2 line at the signal wavelength of 852 nm by scanning the cavity length over 1.2 GHz .Hence, results indicate that MgO:PPLN can be considered an appropriate material for green-pumped cw SROs. [C483]

"Symbol Synchronization Algorithm Based on Pseudo-superimposed Zadoff-Chu in Advanced-LTE"

In LTE system, maximum likelihood algorithm based on cyclic prefix is used to accomplish the symbol and slot synchronization. Zadoff-Chu sequences finish frame synchronization and cell search. But in low signal-to-noise ratio AWGN channels and multi-path fading channels, the maximum likelihood peak values are not stable in the right place due to high noise effects, multi-path delays and Doppler effects respectively. In this paper a Pseudo-superimposed Zadoff-Chu sequence has been proposed. Zadoff-Chu sequence is inserted equip-spaced as reference signals in frequency domain, after IFFT reference signals have been transformed into several periodic sequences in time domain. These sequences have good auto-correlation as well as in frequency domain. In contrast to existing synchronization schemes, the proposed architecture has the advantage of better synchronization accuracy and higher data throughput since it doesn't need extra superimposed data in frequency domain or in time domain. [C484]

"A high resolution anharmonic λ/2 fringe spacing interferometer"

Here we present an interferometer where the fringe spacing is reduced by a factor of two and where the width of a fringe can be extremely narrow, leading to potential applications in very precise displacement measurement. Our interferometer is based on elementary aspects of atomic physics. The laser wavelength is tuned to an atomic transition (i.e. two-fold degenerate two level system). The laser field is initially polarized at 45Aring and sent to a polarizing beam splitter. Vertical and horizontal polarizations experience a relative phase shift and are recombined at the output. We present an experimental demonstration of such an interferometer by exciting a sodium vapour cell on the D1line. The problem posed by the hyperfine structure is solved by exciting the whole Doppler-hyperfine transition by means of a dye frequency-shifted feedback laser delivering a 3 GHz broad and continuous spectrum. Both the lambda/2 periodicity and the anharmonic behaviour have been recorded on the fluorescence signal. [C485]

"Performance of an Acoustic Doppler Velocity Estimation Method Based on the Mixed Scattering Model"

The acquisition of vessel's speed by using acoustic Doppler velocity log (DVL) is a well-known method. It depends on the estimation of Doppler-shift between the DVL and the seabed. Due to scattering from many different scatterers, a Doppler signal is received with a large variance. The Pulse-pair method estimates the first moment of the Doppler-shift and the result is a robust and accurate estimation method with a very low bias. In order to verify this performance, a mixed scattering model is proposed, where effects from different scatters can be taken into account. This mixed scattering model is then used for synthesizing data with known parameters. These synthesized data makes it possible to quantify the accuracy and performance of estimation based on the pulse-pair method. [C486]

"Comb-referenced spectroscopy with quantum cascade lasers"

In our recent activity we have performed absolute frequency measurements on Doppler-broadened and sub-Doppler CO2transitions around 4.3 and 4.4 mum wavelength with DFB QCLs, by referencing their mid-infrared radiation to a near-infrared optical frequency-comb synthesizer. This experiment has pointed out the benefits coming from a frequency stabilization of the QCL and has allowed improvement of the precision of frequency measurements to the kHz level. In particular, we set-up a double-balanced detection technique, both to increase the S/N ratio of the acquired spectra and to erase the residual Doppler-broadened background. The result is a Doppler-free dispersion-like signal with a S/N ratio comparable to that obtained with standard wavelength modulation techniques and lock-in first derivative detection, but with no modulation of the laser and filtering of

the detected signal. We have recorded Doppler-free signals narrower than those obtained in our previous experiment based on a standard first-derivative technique. The absence of any modulation and filtering effectively makes the PS signal the ideal candidate as dispersive- like error profile for large bandwidth frequency stabilization of our QCL. [C487]

"User requirements for HEO SATCOM for ATM in high latitudes"

It is currently a significant ongoing effort worldwide to develop the future air traffic management (ATM) system. As part of this work, a satellite communication system may ease the congestion problem for ATM services in high density airspace, and in addition provide coverage in oceanic, remote and polar (ORP) areas. For coverage over polar areas, satellites in highly elliptical orbits (HEO) are particularly suitable. In this paper, an overview of user categories is given and the channel characteristics of an aeronautical satellite channel are considered. Both Molniya and Tundra orbits are included. Curves show how parameters like elevation angle, free space path loss and Doppler shift vary as function of satellite movements. In addition, atmospheric effects due to signal propagation through the ionosphere and the troposphere is considered, and finally the effect of multipath propagation due to signal reflections by the aircraft surface and ground. [C488]

"Space-Time Clutter Simulation and Characteristics Analysis for SBR"

In order to develop clutter mitigation techniques, clutter simulation and characteristics analysis is very important. By introducing the clutter model of space based radar (SBR) and discussing the earth's rotation effect to Doppler frequency, we get the space-time clutter spectrum of SBR. For illustration clutter characteristics, we plot clutter space-time spectrum and clutter angle-Doppler traces for two pulse repetition frequency. Simulation results show that range ambiguity and Doppler ambiguity degrade the performance of clutter mitigation techniques for SBR. [C489]

"Practical considerations for indoor wireless optical system implementation using OFDM"

This paper describes the implementation of OFDM (orthogonal frequency division multiplexing) for optical wireless systems using non-coherent light. In particular, light emitting diodes (LEDs) and photodiodes (PDs) are considered. The paper shows how classical OFDM is adapted to optical system constraints. Several key OFDM design issues are studied. In this context it is demonstrated that the impact of the cyclic prefix (CP) length on power and bandwidth efficiencies is negligible. Similarly, the effect of the Doppler frequency shift on intensity modulation with direct detection (IM/DD) optical transmission is discussed. The challenge of a high peak-to-average power ratio (PAPR) OFDM signal in the presence of LED nonlinear behavior is highlighted. An approach to estimate the overall signal-to-noise ratio (SNR) of the system and to determine the required analog-to-digital converter (ADC) resolution to achieve a target system SNR is introduced. [C490]

"Observation of doubly dressed states in ladder-type electromagnetically induced transparency system"

Doubly dressed states in a ladder-type two-photon, three-level coupling system are observed in our system. The quantum nature of the EIT system significantly suppresses Doppler broadening. The experiments were performed on a room-temperature atomic cesium cell .The cesium atoms are excited by two linearly polarized fields with parallel polarization. The spacing of the EIT doublet is strongly consistent with the theoretical description of the Mollow spectrum, and the numerical simulation demonstrates that Doppler broadening can be greatly reduced using this detection technique. [C491]

"Gamma Reaction History for the NIF"

In this paper, bang time and gamma reaction history measurements are fundamental components of diagnosing ICF implosions and will be essential contributors to diagnosing attempts at ignition on the National Ignition Facility (NIF). Fusion gammas provide a direct measure of fusion interaction rate without being compromised by Doppler spreading. Gamma based Gas Cherenkov Detectors that convert fusion gamma rays to optical Cherenkov photons for collection by fast recording systems have been developed and fielded at Omega. [C492]

"Robust AMC Scheme Against Feedback Delay in Vehicular Environment"

Adaptive modulation and coding (AMC) scheme suffers performance degradation with the signaling feedback delay, as channel state information (CSI) is outdated with time variant channel. In this paper, we propose a robust AMC scheme to mitigate the effect of signaling feedback delay, especially in vehicular environments. Channel information estimated in current time interval is utilized to obtain the distribution of channel fading in upcoming time interval. Average block error rate (BLER) for given modulation and coding scheme (MCS) is

derived. Simulation results indicate that the proposed scheme guarantees reliable performance even in a vehicular environment with maximum Doppler frequency shift of 300 Hz. [C493]

"Performance Analysis of Cooperative Communication Systems with Imperfect Channel Estimation"

This paper investigates the effects of channel estimation errors on the symbol-error-rate (SER) performance of a cooperative communication system operating in an amplify-and- forward (AF) mode. A pilot symbol assisted modulation scheme with linear minimum mean square estimation (LMMSE) is used for the channel estimation. An accurate and easy-to-evaluate SER expression is presented for uncoded cooperative communication systems with quadrature amplitude modulation (QAM) and phase-shift keying (PSK) constellations. Numerical simulations are conducted to verify the correctness of the proposed analytical formulation. It is shown that the performance loss caused by channel estimation errors increases mainly with the normalized maximum Doppler frequency. [C494]

"Description of Si-O bond breakage using pair-wise interatomic potentials under consideration of the whole crystal"

We extend the McPherson model in a manner to capture the effect of the whole surrounding lattice on the silicon-oxygen bond-breakage energetics. It is shown that the Mie-Gruneisen potential with the constants used in the original version of the model is not suitable under the consideration of the whole crystal. Other empirical pair-wise interatomic potentials, namely TTAM and BKS have been tested for the analysis of the bond rupture energetics. It is shown that the secondary minimum corresponding to the transition of the Si atom from the 4-fold to the 3-fold coordinated position occurs in a different direction with a rather high activation energy (~6 eV). The tunneling of the Si ion between the primary and the secondary minima has been treated within the WKB approximation. We demonstrate that the contribution of neighboring SiO4tetrahedrons substantially decreases the breakage rate, making bond rupture by means of an electric field alone practically impossible. Therefore, the common action of an electric field and another contribution (bond weakening by hole capture, structural disorder and energy deposited by particles) is essential for Si-O bond-breakage. [C495]

"Carrier frequency offset compensation using radial basis networks for OFDM systems"

This paper proposes a technique for compensating the effect of the carrier frequency offset (CFO) in the orthogonal frequency division multiplexing (OFDM) systems using radial basis networks (RBN). The simulation results show that using the proposed technique to compensate the CFO in OFDM causes a compromise performance between the other considered techniques, namely; the virtual-subcarrier (VSC) based estimator and the Cramer-Rao lower bounds, in all considered channel models, namely; Rician, Rayleigh and TU6 channels models. [C496]

"Superluminal in Doppler broadened two-level atomic systems in magnetic field"

A method to control the group velocity of light is proposed. It shows that by changing the magnetic field intensity and vapor temperature, the group velocity of light can be controlled in an appropriate region. [C497]

"A Twi-Serial-Parallel Correlator with FFT Approach for Long Code Acquisition in Spread Spectrum Communication System"

In this paper, the representation of Doppler effect on code acquisition performance is analyzed and the principle of combining serial-parallel correlator with FFT is given based on the discrete-time signal processing. The improved code acquisition architecture by combining twi-serial-parallel correlator with FFT for the long PN code spread spectrum communication system is designed and realized in FPGA and DSP. This architecture provides a very good trade-off between acquisition performance and complexity. Application results show this architecture is very attractive for the long PN code spread spectrum communication system. [C498]

"Correlative Coding Based Channel Estimation for Practical OFDM Systems over Time Varying Channels"

OFDM systems encounter performance degradations in mobile environments due to inter-carrier interference (ICI) caused by Doppler spread. We find that previous studies using pilots to track the channel time variations always regard the ICI on pilots as additive white noise, which actually increases the estimation errors. As an enhancement of our previous studies on uneven pilot-assisted time-varying (TV) channel estimation (CE) for practical OFDM systems, to further improve the estimation precision, this paper employs the correlative coding to compress the ICI from data to pilots. Simulation results show that by using such a simple coding method, the ICI coefficient is reduced greatly and the estimation Mean Square Error (MSE) dropped by 3 dB. It is proved that the

correlative code based TV CE method is feasible for practical mobile OFDM systems with good performance and bandwidth efficiency. [C499]

"A Model for Switching Traps in Amorphous Oxides"

Negative Bias Temperature Instability (NBTI) is frequently suspected to arise from a delicate interplay between some sort of hole trapping and an interface generation mechanism. In a recently suggested model the E' center along with its second form as an Si-Si dimer are supposed to play a key role. Despite of its successful application to a large amount of experimental data, this model relies on a classical determination of the bandedge energy diagram and the carrier concentrations. The occurrence of subbands in the inversion layer shifts the initial energy level for charge trapping and may thus strongly impact the trapping dynamics. We evaluate the new model against measurement data in order to investigate the impact of quantization effects on the model parameters. [C500]

"Acquisition of spread spectrum codes with consecutive correlator outputs in the presence of fractional Doppler frequency offset"

A novel code acquisition scheme is proposed for the acquisition in time of spread spectrum codes in the presence of fractional Doppler frequency offset (FDFO). In the proposed acquisition scheme, the decision variable for detection is formed by combining two consecutive correlator outputs so that the influence of the reduction in the correlation peak due to the FDFO can be alleviated. Numerical results show that the proposed acquisition scheme can offer better mean-time-to-synchronization performance than the conventional scheme based on the cell-by-cell detection. [C501]

"Simple series form formula of BER performance for DBPSK/OFDM signals in time selective nonlinear fading channels"

This paper proposes a simple series form formula of the bit error rate (BER) for DBPSK/OFDM signals under time selective nonlinear fading channels. The proposed approach derives the theoretical BER in the presence of non-linear distortion and time selective fading effects. Since the BER is represented by the simple series form formula, the proposed approach frees us from the time-consuming computer simulations. The validity of the proposed approach is confirmed by the agreement with the computer simulation results under various kinds of system parameters such as the input back-off (IBO) and the normalized maximum Doppler frequency. [C502]

"A Novel ICI Self-Cancellation Scheme for OFDM Systems"

Orthogonal frequency division multiplexing (OFDM) is a promising technique for fourth-generation (4G) broadband wireless communication systems. However, it suffers from intercarrier interference (ICI) due to its sensitivity to the frequency offset caused by Doppler frequency drift. In this paper, we investigate the self-cancellation techniques to mitigate ICI for OFDM systems and a novel ICI self-cancellation scheme is proposed to mitigate the ICI effects. The performances of ICI self-cancellation schemes are analyzed in terms of the carrier-to-interference ratio (CIR) and bit error rate (BER). Simulation results demonstrate that the proposed ICI self-cancellation scheme outperforms other existing self-cancellation methods and robustness to large frequency offset. [C503]

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

In order to solve the problem of chaff jamming recognition for end-guidance radar, average gray correlation degree (AGCD) is introduced here to analyze the difference of time-domain correlation characteristic between vessels' echo and clutter. A novel recognition method called position matching is presented making use of the difference of spatial position between vessels and chaff cloud. Finally, recognition method based on microDoppler effect is provided according to the difference of movement. Simulation experiment and theory study indicate the effectiveness of the three methods. [C504]

"Research on Bandwidth of Optical Filter in GEO-LEO Laser Communication"

In this paper, we present an optimal bandwidth of optical filter in GEO-LEO laser communication considering Doppler Effect between the different orbit satellites by using matched filter method. To satisfy the requirements of communication system, the relation of the normalized SNR of signals and optical filter bandwidth is analyzed and the optimum bandwidth is derived. Based on the optimum bandwidth, the optical filter can improve the performance of the laser satellites communication systems effectively. [C505]

"Planning a mobile DVB-T network for Colombia"

The TV evolution and the need of better quality and new services for the users have accelerated the migration from analogue to digital TV, forcing a renovation process in all fields of this communication system. Most of the DVB-T networks deployed in the world have been designed for fixed rooftop reception. The countries where it has not yet deployed the DTT network can introduce technological advances to planning DVB-T network for fixed and mobile reception and use the MPEG-4 video compression to provide high definition TV. This paper describes the technical solutions proposed in order to provide mobile DVB-T services to public transportation systems: antenna diversity, hierarchical modulation, and application layer forward error correction (AL-FEC). These solutions compensate the negative effects caused by the mobility of the receivers, such as fading in the signal due to Doppler shift and the poor coverage at ground level. Furthermore, this paper describes the methodology carried out to evaluate the improvements in mobile reception of the DVB-T network in Colombia by using these techniques. [C506]

"Algorithm-Architecture Co-Optimization of Bit-Loading Algorithm for Delay Constrained Adaptive Wireless Systems"

Demands for higher throughput and performance along with increasing system and terminal constraints (bandwidth, battery, regulatory spectral-masks etc.) are pushing not only for the usage of efficient algorithms with minimal complexity but also for adaptive on-the-need basis usage of system resources to meet the time-varying channel constraints. adaptive modulation (Bit-Loading in discrete terms) has long been proposed as a technique to counter the time and frequency selective nature of the wireless system. For more than a decade, huge amount of research-work has been dedicated to improve the convergence time of discrete bit-loading algorithms for optimal allocation of bits to different sub-carriers of a multi-carrier system with respect to the channel response. However, no study as to our knowledge has been performed in quantifying the algorithm complexity in actual time for a given underlying architecture with respect to the coherence-time constraints of a real channel scenario. In this paper, we first explore the relationship between the coherence-time constraint of a real wireless system scenario (WiMax channel with varying Doppler) and the quantified complexity in time for different bit-loading algorithms with different underlying architecture profiles. We also propose a genetic algorithm based methodology for the selection of the optimum (on-the-need basis) architecture profile that meets the system constraints. [C507]

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

Under the sea wave, ship target experiences three-dimensional rotations and its echo Doppler frequency changes complexly. In order to improve the quality of ship image, a new algorithm based on S-distribution is proposed. The instantaneous ISAR image can be obtained by calculating the S-distribution of each range bin. In comparison with the classical time frequency distribution, S-distribution produces high concentration at the instantaneous frequency for arbitrary signals, its cross-term interference can be easily removed by recursive method, and its calculation is effective. The simulation results demonstrate the effectiveness of this imaging method. [C508]

"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. [C509]

"Receiver comparisons on an OFDM design for Doppler spread channels"

Underwater acoustic channels induce large Doppler drifts that render intercarrier interference (ICI) for OFDM transmissions. Assuming that after proper Doppler compensation the residual ICI is limited to only direct neighbors, we propose an OFDM signal design that decouples channel estimation and data demodulation. We investigate eight receivers that are categorized into three groups: (i) three receivers that ignore the residual ICI, (ii) three receivers that are based on a basis expansion model (BEM) and pursue channel estimation independently along each basis, and (iii) two receivers that are based on discrete-path modeling. The receiver performance is compared based on data from the SPACE experiment conducted off the coast of Martha's Vineyard, Massachusetts, October 2008. The receiver based on the discrete-path modeling and a basis pursuit algorithm achieves the best performance while the receiver based on BEM and least-squares channel estimation performs the worst. The performance differences among different receivers drastically increase as the channel's

Doppler spread and the signal constellation size increase. Interestingly, the BEM based receivers are often inferior to the ICI-ignorant counterparts, implying that the ability of ICI compensation could be limited by the estimation accuracy of the much increased number of model parameters. [C510]

"Sparse channel estimation for multicarrier underwater acoustic communication: From subspace methods to compressed sensing"

In this paper, we present various channel estimators that exploit the channel sparsity in a multicarrier underwater acoustic system, including subspace algorithms from the array precessing literature, namely root-MUSIC and ESPRIT, and recent compressed sensing algorithms in form of Orthogonal Matching Pursuit (OMP) and Basis Pursuit (BP). Numerical simulation and experimental data of an OFDM block-by-block receiver are used to evaluate the proposed algorithms in comparison to the conventional least-squares (LS) channel estimator. We observe that subspace methods can tolerate small to moderate Doppler effects, and outperform the LS approach when the channel is indeed sparse. On the other hand, compressed sensing algorithms uniformly outperform the LS and subspace methods. Coupled with a channel equalizer mitigating intercarrier interference, the compressed sensing algorithms can handle channels with significant Doppler spread. [C511]

"The Spanish Institute of Oceanography (IEO) Coastal Observing System at the southern Bay of Biscay, new real-time development: The ocean-meteorological AGL Buoy"

From 1991, shelf and slope waters of the Southern Bay of Biscay are regularly sampled in a monthly hydrographical line north of Santander to a maximum depth of 1000m, as part of the IEO Radiales project. From 2003, a deep hydrological standard sections (part of the VACLAN project) is occupied twice a year extending the Santander section 90 miles offshore. Measurements include CTDO2, nutrients and currents from vessel-mounted ADCP and LADCP. The data base in the area hold by IEO is complemented with a current meters line moored in 2003 at 43deg48'N, 3deg 47'W sampling temperature, salinity and currents at the core of Central, Mediterranean and Labrador Sea water. On June 2007, an ocean-meteorological Buoy was moored at the Santander Section, 22 miles north of Santander at about 2850m depth, to complete the ocean information with the ocean-atmosphere interaction. The Santander section and AGL Buoy data highlight that heat and salt show a quite different behaviour in terms of their balance in the upper layers of the Bay of Biscay. At interannual and seasonal timescales temperature is mainly determined by the atmospheric forcing while salinity is more closely linked to advection processes. Finally, a severe storm developed in the Bay of Biscay on January 24, 2009 is described. The AGL buoy registered an individual maximum wave of 26.1m, the largest ever recorded by the Spanish buoy Networks. [C512]

"A design of motion compensation for high resolution imaging of missile-borne SAR"

The accurate motion compensation is important for gaining high resolution of imaging for some characteristics of missile-borne SAR, such as high speed, motion pose errors, high real-time and so on. The paper first introduces the two types of errors of missile-borne SAR and their effects to image. Subsequently, the first class of error, including normal face error and error along flight route, is described in details due to its serious effects to imaging. At the same time, the corresponding compensation algorithms are also showed. Finally, the paper gives the simulation results that the phase compensation to Doppler phase errors resulting from slant distance can improve the imaging resolution effectively. In the meantime, the phase compensation to Doppler modulation frequency errors resulting from speed error ameliorates Doppler mismatching. The resolution of the system reaches two meter. [C513]

"Observation of medium scale travelling ionospheric disturbance using GPS SUGAR"

Medium-scale travelling ionospheric disturbances (MSTID) is one of the most common ionospheric phenomena that generally induce the perturbations of ionospheric total electron content (TEC). Observation of MSTID at Low Latitude over Sumatra has been done by studying of TEC fluctuation associated with MSTID. In this paper, a short term observations of MSTID are provided by using Sumatran GPS Array (SUGAR). The two-dimensional maps of detrended TEC (DTEC) obtained from SUGAR have been used on May 16, 2004 investigations of medium-scale TID. The results show a propagation of MSTID in southeast-ward direction. Cross-correlating analysis of DTEC measurements between two receivers is used to obtain propagation parameters and found velocities of MSTID around 118 ms-1 without including relative movement GPS satellite and receiver (Doppler effect). [C514]

"Multiuser navigation and telemetry performance issues in shallow water environments"

Achieving robust and reliable acoustic position fixing and telemetry performance in shallow water is complicated

by the highly dispersive nature of the medium. This dispersion manifests as both time and frequency spread by virtue of the acoustic multipath phenomenon, which presents at a macroscopic (geometry influenced) and microscopic (forward scattering) scale. Platform dynamics in conjunction with the intrinsic variability of ocean propagation and forward scatter mechanisms lead to variations in both the macroscopic and microscopic behaviour of multipath. It is both the extent and the variability of shallow water multipath which makes reliable acoustic measurement and telemetry so challenging in these environments. Signal design has a key role to play, both in terms of waveform time-bandwidth product, and waveform intrinsic correlation properties in such environments. However, in practical shallow water channels, multipath and Doppler conspire to undermine favorable correlation properties, and so good signal design must go hand in hand with other techniques and methods to address the de-correlative effects of Doppler and which mitigate multipath and multi-user interference in both navigation and telemetry applications. This paper explores the technical issues, trade offs and associated computational complexity associated with the practical implementation of these techniques as a means to improve shallow water detection, navigation and telemetry decoding performance for dynamic point to point data links and multiuser data links. It is shown that whilst computational complexity can quickly scale for applications requiring robust waveforms, with high Doppler tolerance and multi-user capabilities, the associated real time processing overhead is within the capabilities of current generation fixed point digital signal processing devices (DSP) when supported by an efficient, scalable signal processing architecture. In order to demonstrate this capability, field trials w- ere performed using a high performance transceiver signal processing platform, in conjunction with enhanced wideband waveform designs, Doppler tolerant receiver processing, and adaptive multi-element spatial-temporal beamforming to demonstrate robust, multi-user detection, navigation (range Doppler-bearing) and data telemetry in shallow water between dynamic parties at variable data rates up to several kbps. Results are presented summarizing the performance of the system when operating in a shallow water channel (20 m) under, noisy, multi-aspect, dynamic conditions (+/-5kts) with range depth ratio varying from approximately 1:1 to 50:1 out to the geographical limitations of the test site (1.5 km). Metrics for detection, navigation parameter estimation and telemetry command decoding performance are presented and discussed. The results demonstrated high detection (95%) and associated telemetry command decoding success rate (94%) evaluated over the two day test period. This included transmissions received at poor aspect and transmissions received at low signal to (platform) noise). The high detection rate coupled with associated improvements in parameter estimation fidelity, notably range, Doppler and bearing estimation, demonstrates a particularly robust solution for shallow water navigation and position fixing applications. Associated telemetry streaming performance, demonstrated characteristic range-data rate trade off with rates of several kbps achieved under good to moderate channel conditions at good signal to noise, with lower data rate modes providing high reliability performance under reduced signal to noise and more challenging channel conditions. It is concluded that with appropriate signal design and supportive signal processing, high reliability multi-user, position fixing, navigation and telemetry is achievable for dynamic platforms in shallow water over extended ranges. The signal processing overhead, although not trivial, is well within the capability [C515]

"Ship surveillance by joint use of SAR and AIS"

The detectability of ships on synthetic aperture radar (SAR) images is validated by coastal (live) AIS and space AIS. The monitoring area chosen for surveillance is mainly the German coast and the Panama Canal. The detectability in respect to environmental parameters like wind field, sea state, currents and changing coastlines due to tidal effects is investigated. In the South Atlantic tracking of the German research vessel Polarstern has been performed. Issues of piracy in particular in respect to ships hijacked at the Somali coast are discussed. Possibilities and limitations of a near real time service are evaluated. As images from the SAR sensor do not only contain information on intensity, but as well on the phase of the returned signal, ship speed can be derived from Doppler effects. The ship wakes contain additional information on ship speed and type of ship. Some examples using the ESA satellites ERS and ENVISAT, that provide large coverage (up to 400 km) at moderate resolution (30 meters) are given together with high resolution images from TerraSAR-X. [C516]

"Fully software OFDM modulation in vehicular, highly time-variant channels. An implemented technology and its results"

Transferring large amounts of information to fast moving vehicles on the highway has always been difficult task for any employed wireless transmission system, due to channel's heavy double time / frequency selectivity. Still, the possibility to make such delivery both possible and cost-efficient remains highly interesting for applications including, but not limited to, traffic data delivery, broadcasting of passenger-aimed informational video content. Currently, in-car information / entertainment systems suffer from a heavy limitation: they can only be fed by GPS navigation data (i.e. no realtime traffic status information) and by local multimedia content stored within the car (i.e. no live multimedia broadcasting). In this paper we present an implemented and tested Software Defined Radio technology which we developed bottom up from scratch, aimed at video and data distribution over low coherence time, Doppler effect affected, frequency selective, vehicular highway channels. On-field testing

outcomes obtained using such technology are also presented in detail pointing out achieved results in terms of reliable wideband communication as well as still open research and development lanes. [C517]

"TCP performance on a railway satellite channel"

High-speed rail is emerging in the world as an increasingly popular and efficient means of transportation used by a lot of people, who may also need a broadband Internet connection while travelling for their business and leisure. Satellite systems for their intrinsic characteristic, such as global coverage, reduced impact of Doppler effect due to link geometry and flexible bandwidth management, represent an excellent solution to provide broadband services in the identified scenario. Some problems specific of the railway propagation channel such as frequent signal outages due to the periodic electrical trellises, tunnels and steel covered bridges affect TCP/IP performance due to frequent packet losses occurring in bursts. In this paper, performance of TCP-based applications and error recovery mechanisms are investigated and the use of a new transport protocol named TCP-Noordwijk is introduced. TCP-Noordwijk leverages on a burst transmission and is particularly suited for the harsh satellite links. Results show that TCP-Noordwijk outperforms the other analyzed TCP versions. [C518]

"Impact of Doppler on UWB-based rotor-telemetry signal"

Most of the typical applications based on the UWB-technique are used on environments, where the channel is time invariant or very slow variant. This paper introduces a new scenario based on UWB-technique for transmission of data, which is the rotor-telemetry. The rotor-telemetry is a special type of a radio-telemetry, where measuring data of physical parameters like pressure or temperature are captured by sensors predominantly on rotating objects such as shafts or gear parts, transmitted over special on the rotor mounted along-moved antennas and received by static antennas. A new problem appears with this scenario: since such systems become faster and faster, the impact of Doppler rises significantly. The consideration of the effect of Doppler in UWB-signals is different than in narrowband signals. In narrowband systems, the Doppler shift is almost equal for all frequencies, so that the compensation is simple by translating the spectrum proportional to the carrier frequency. This assumption is no more fulfilled in UWB-systems, since the low frequencies of the band suffer from less Doppler shift than the upper ones. [C519]

"Non-perfect channel estimation in OFDM-MIMO-based underwater communication"

The main focus in this publication is on the mean square error of underwater acoustic channel estimators as function of the delay and Doppler spreads of the channel, and the effect this estimation error has on the bit error rate performance of the system both using conventional single antennas (SISO) and when using multiple antennas (MIMO). It is investigated at which delay and Doppler spreads the decoding of the signal in the receiver becomes erroneous. It is assumed that there is no non-uniform Doppler shift. The radio communication standard IEEE 802.16e is modified to match underwater communication conditions. The system parameters are taken from measurements conducted in the Trondheim harbour in Norway in 2007. The channel estimator used is not optimal in the Wiener interpolator sense. Hence, the estimator is sub-optimal, but shows good performance and has relatively low complexity. For the described communication system to perform well the results indicate that movements in the water should be less than 0.01-0.1 m/s, and delay spreads should be less than 0.05-0.5 ms. In systems where the main problem is large Doppler spread, the number of sub-carriers should be small. In systems where the main problem is large delay spread, the number of sub-carriers should be large. The use of MIMO makes the system more robust against estimation errors. The density of pilot symbols may be increased to reduce the channel estimation error somewhat, at the expense of reduced efficiency. Considering the Trondheim harbour channel measurement results and their variability throughout the year, we find that the tested system copes well with the summer conditions while the winter conditions seems to be more challenging. [C520]

"Direct geolocation of stationary wideband radio signal based on time delays and Doppler shifts"

Contrary to the suboptimal (two-step) geolocation procedures, we propose a maximum likelihood estimation for the position of a stationary transmitter which its delayed and Doppler shifted signal is observed by moving receivers. The position is estimated based on the same data used in common methods. However, it is performed in a single step by maximizing a cost function that depends on the unknown position only. [C521]

"Design of OFDM System for High Speed Underwater Communication"

The performance of underwater acoustic communication system is influenced on channel characteristic. Especially, an important feature of the underwater acoustic communication is multipath propagation and Doppler spread cause by the surface and bottom reflections. In this paper, we study the application of high speed data transmission in underwater to use the OFDM (orthogonal frequency division multiplexing) technique for robust

the reverberation and multi-path. We use the clipping method for overcome the performance reduce in high PAPR (peak-to-average power ratio). We confirm the performance of communication in underwater to use the model for actually underwater channel simulation model and experiment in small water tank. As a result of experiment in small water tank, we acquired the BER of modulation techniques. [C522]

"Performance evaluation of an IEEE802.15.4 standard based wireless sensor network in Mars exploration scenario"

Born as data networks for personal areas (WPAN), wireless sensor networks (WSN) have rapidly gained a growing importance in many other contexts. One of the most interesting and innovative field of application of WSN is represented by the planetary exploration context; taking into account the actual scopes of NASA and ESA, the aim of this paper is to present the performance evaluation of an IEEE802.15.4 standard based network in Mars exploration context. Thanks to an analysis of the Martian geomorphologic, atmospheric and eolian features, a characterization of five most representative frequency channels will be given. Considering such analysis, an evaluation of the performance of an IEEE802.15.4 standard based network is obtained, performing simulation processes with Simulinkregand OMNET++. [C523]

"Effects of underwater communication constraints on the control of marine robot teams"

We address the effects of the aquatic communication channel constraints on the control performances of marine robot teams. The aquatic acoustic channels suffer from significant frequency and distance dependent attenuation, extensive time-varying multipath, motion-induced Doppler distortion and extreme channel latency due to the low speed of sound. Therefore, the available bandwidth is strongly limited and distance dependent. Due to all these limitations, the introduction of intra-vehicle exchanged information in the control loop of marine robots can degrade the overall system performance. We give an overview of the communication needs in the control of a marine robotic team. A realistic model of the aquatic communication channel is considered, and different limitations of the channel are addressed, e.g., message error rate and communication delays. An overview of the experimental test-bed that is used to study the communication characteristics of the aquatic channel is presented. Finally, we report on an extensive simulation study on the performance of a controller for a marine surface vessel which relies on an acoustic communication channel for information sensed at a distance. [C524]

"One-handed gesture recognition using ultrasonic Doppler sonar"

This paper presents a new device based on ultrasonic sensors to recognize one-handed gestures. The device uses three ultrasonic receivers and a single transmitter. Gestures are characterized through the Doppler frequency shifts they generate in reflections of an ultrasonic tone emitted by the transmitter. We show that this setup can be used to classify simple one-handed gestures with high accuracy. The ultrasonic doppler based device is very inexpensive-$20 USD for the whole setup including the acquisition system, and computationally efficient as compared to most traditional devices (e.g. video). These gestures, could potentially be used to control and drive a device. [C525]

"Identifiability and performance concerns for location estimation"

Common localization approaches require a large amount of information to be available in order to achieve identifiability, when the signal propagates in a strictly Non-Line-of-Sight (NLOS) environment. Furthermore, even if they achieve identifiability, they usually perform poorly. In this contribution we investigate the conditions that must be met for identifiability to be feasible and for performance to be adequate. Through basic theorems and simple numerical examples, we study the benefit of exploiting additional information, if such is available and we provide intuitive conclusions that can be proved useful for any localization scheme. [C526]

"Performance Analysis of OFDM System Over Time-Selective Fading Channels"

In fast moving environment, the inter-carrier interference (ICI) due to Doppler spread will degrade the performance of OFDM system severely. Using Jakes' model for the Doppler power spectrum and linear model for time-varying channel during an OFDM symbol interval, the analytical closed- form expression of ICI power, signal-to-interference ratio (SIR) and signal-to-interference-plus-noise ratio (SINR) are given without assumption on the statistical characteristic of ICI. Moreover, the effect on bit error probability (BEP) performance by the number of concerned interfering subcarriers is analyzed, which helps to choose the number of concerned interfering subcarriers according to the Doppler spread to greatly reduce the complexity of ICI mitigation method with little performance penalty. The simulation results show that the ICI analysis and SIR expression are efficient, and the concerned number of interfering subcarriers should be more with the increase of Doppler spread when ICI mitigation is adopted. [C527]

"Uplink Channel Estimation in WiMAX"

WiMAX is an emerging and powerful technology in broadband wireless communications in that it can simultaneously provide high-speed broadband services over large distances. However, signal distortion due to channel fading, noise, and Doppler can limit the overall transmission data rate and coverage. To minimize the impact, channel estimation must be performed to remove the effects of the channel. In this paper, we present uplink channel estimation algorithms for WiMAX PUSC and AMC and analyze their performance under different channel conditions. Our results show that the performance of each algorithm depends largely on the channel delay spread and signal-to-noise ratio. [C528]

"Gigabit wireless personal area networks: Motivation, challenges and implementation"

Demands in file size and transfer rates for consumer products are escalating, requiring gigabit rates for applications such as uncompressed streaming video. A number of wireless technologies are attempting to meet the gigabit-plus rates required for these applications. The most promising of these wireless solutions is found to be the use of the 60 GHz band. This technology can provide the needed bandwidth for the most demanding application-even with modest modulation and coding implementations. The objective of this work is to provide an up to date overview of gigabit wireless systems with a focus on wireless personal area networks. [C529]

"Optimized detection of spatially extended fixed objects in clutter"

Range-spread Doppler-spread signals in interference are readily discernable via the application of classical algorithms and architectures presented by Van Trees [1], and more recently by Kay [2] and others. However, when these returns emanate from stationary objects, the Generalized Inner Product (GIP) offers a unique tool for detection and discrimination processing. This paper offers insight into how the GIP may be applied to optimize the detection of spatially extended fixed objects in clutter. [C530]

"Short wavelength technology and the potential for distributed networks of small radar systems"

The NSF Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere (CASA) is advancing a new approach to radar network design based on dense networks of short-range radars. The center's concept is to deploy small radars atop communication towers, rooftops, and other elements of the infrastructure as a means to comprehensively map winds, rainfall, and other atmospheric and airborne objects throughout the atmosphere with resolution, low-altitude coverage, Doppler wind vector measurement, and other capabilities that are substantially beyond the current state-of-the-art. The technology has the potential to supplement-or perhaps replace-the large long-range civil infrastructure radars in use today. [C531]

"Ambiguity function analysis for the Hybrid MIMO Phased-array Radar"

The hybrid MIMO phased array radar, or HMPAR, is a notional concept for a multisensor radar architecture that combines elements of traditional phased-array radar with the emerging technology of multiple-input multiple output (MIMO) radar. A HMPAR comprises a large number, MP, of T/R elements, organized into M subarrays of P elements each. Within each subarray, passive element-level phase shifting is used to steer transmit and receive beams in some desired fashion. Each of the M subarrays are in turn driven by independently amplified phase-coded signals. This paper derives a version of the radar ambiguity function that is appropriate for this radar architecture. The ambiguity function is a function of time delay, Doppler frequency shift, and two or more spatial variables. An illustrative example for a particular MIMO signal set is given. [C532]

"Motion effect modeling in multipath configuration using warping based lag-Doppler filtering"

The estimation of the impulse response (IR) of a propagation channel is necessary for a large number of acoustic applications: underwater communication, detection and localization, etc. Basically, it informs us about the distortions of a transmitted signal in one channel. This operation is usually subject to additional distortions due to the motion of the transmitter-channel-receiver configuration. This paper points on the effects of the motion while estimating the IR by matching filtering between the transmitted and the received signals and introduces a new motion compensation method. Knowing the transmitted signal, the ldquoapparentrdquo speed of each propagation path can be estimated using wideband ambiguity function. Indeed, some interference appears in the wideband ambiguity plane because of the multipath propagation. A warping-based lag-Doppler filtering method is proposed allowing us to accurately estimate the IR of the channel. [C533]

"Subspace tracking of fast time-varying channels in precoded MIMO-OFDM systems"

This paper presents a blind subspace-based tracking scheme for precoded MIMO-OFDM systems over rapidly

time-varying wireless channels. Subspace-based tracking is normally considered for slow time-varying channels only. Thanks to the frequency correlation of the wireless channels, the proposed scheme is able to collect data not only from the time but also from the frequency domain to speed up the update of the required second-order statistics. After each update of the statistics, the subspace information is also updated using orthogonal iteration, and then a new channel estimate is computed. The proposed algorithm is verified in 3GPP-SCM suburban macro scenario, in which a mobile station is allowed to move in any direction with a constant speed of 100 km/h. The simulation results show that the root mean square error of the channel estimates converges to the level of 2 times 10-2within less than 5 OFDM symbols even for such a high Doppler rate. [C534]

"Using wavelet analysis to characterize effects of different head positions on blood flow"

Poor postures not only affect the neck muscles and make the shoulder stiff, but also may induce a burden for cardiovascular system. Laser Doppler flowmetry (LDF) was used to measure real-time cutaneous blood perfusion. This present study aimed to examine the effect of different head positions on skin blood flow and use of Morlet wavelet to process Doppler blood flow signals for blood flow measurements. Three mechanical neck pain volunteers (2men and 1 women, age: 22.1plusmn2.3 year) were recruited. Five head positions were tested: neck neutral(NL), full neck extension, full neck flexion, right rotation, left rotation. Sympathetic nerve may more activity at neck extension position than other positions (p>0.05). Head and neck positions may have effect on sympathetic activity and skin blood flow modulation. [C535]

"A Proposal of Wide-Band Air-to-Ground Communication at Airports Employing 5-GHz Band"

Recently, the frequency resource for a future wide-band communication system in Air Traffic Control (ATC) at advanced airports has become a vital issue of aeronautical industry, many studies on new frequency bands coupled with high-bit-rate- transmission schemes have been carried out. However, almost all evaluations were done by theoretical analysis and computer simulations. But in this paper, an air-to-ground channel characteristic in a new and wide band, in 5-GHz, is studied for ATC communication in all periods when aircraft was near the airport by practical experiments and measurements. These periods include takeoff/landing, taxi and parking. First, the path-loss and fading-channel models have been studied for each period; then, the performance of MC-CDMA system employing the studied channel characteristics at these periods are evaluated. MC-CDMA has shown its robustness in a high Doppler shift and deep multi-path fading channels during these periods of flight. This paper provides a wide-band communication system in 5-GHz band that is essential for air traffic control communication at any advanced airport. [C536]

"Single Carrier Frequency Domain Equalizer for Underwater Wireless Communication"

Single carrier modulation with frequency domain equalizer is proposed for underwater acoustic channel. An unique training sequence, viewed as cyclic prefix, is inserted into transmitted sequences so that low complexity minimum mean square error (MMSE) frequency domain equalization (FDE) is used for combating the inter-symbol interference in the receivers. Maximum likelihood estimation for robust initial phase error and Doppler shift are derived by using training sequence. The receiver estimates the initial phase error, Doppler shift and underwater acoustic channel block-by-block. Compare to zero padding or cyclic prefix of single carrier modulation, training sequence has the potential to provide more accurate estimation than decision-directed methods and alleviate the time-scale effect caused by significant Doppler shift for wideband acoustic signal. The proposed UWA communication system with single transmitter and single receiver has been tested in practical South China Sea on June 2007. At a distance of 30 km, the data rates of 450 bps and 900 bps are achieved with uncoded bit error rates of 4 out of 8333 (BPSK) and 103 out of 16666 (QPSK). [C537]

"Range sidelobe suppression in a desired Doppler interval"

We present a novel method of constructing a Doppler resilient pulse train of Golay complementary waveforms, for which the range sidelobes of the pulse train ambiguity function vanish inside a desired Doppler interval. This is accomplished by coordinating the transmission of a Golay pair of phase coded waveforms in time according to the 1's and -1's in a biphase sequence. The magnitude of the range sidelobes of the pulse train ambiguity function is shown to be proportional to the magnitude spectrum of the biphase sequence. Range sidelobes inside a desired Doppler interval are suppressed by selecting a sequence whose spectrum has a high-order null at a Doppler frequency inside the desired interval. We show that the spectrum of the biphase sequence obtained by oversampling the length-2MProuhet-Thue-Morse (PTM) sequence by a factor m has an Mthorder null at all rational Doppler shifts thetas0=2pil/m, where lne0 and mne1 are co-prime integers. This spectrum also has an (M-1)th-order null at zero Doppler and (M-h-1)thorder nulls at all Doppler shifts thetas0=2pil/(2hm), where lne0 and mne1 are again co-prime and 1leshlesM-1. [C538]

"Feedback cancellation method based on the convex combination algorithm for T-DMB repeaters"

This paper presents a feedback cancellation method (FCM) for T-DMB repeaters. The conventional FCM applicable to T-DMB repeaters has a good feedback cancellation performance but may distort the out-band spectrum. This distortion is a crucial obstacle for commercializing T-DMB repeaters. The FCM with pre-whitening filters (PWFs) could be considered to compensate the out-band spectrum distortion. However the severe performance degradation occurs when the feedback channel varies rapidly with Doppler effects. To compensate the out-band spectrum distortion and cope with the variation of feedback channel, we propose an FCM based on the convex combination algorithm (CCA). Simulation results show that the proposed FCM not only removes the out-band spectrum distortion of the recovered signal but also improves the feedback cancellation performance. [C539]

"Acoustic Doppler Velocity Log's Echo Simulation, Velocity Estimation and Performance Statistics Based on Ellipse Scattering Model"

The received signal by acoustic Doppler velocity log (DVL) is the seabed reverberation signal, in accordance with the seabed scattering model for modeling and signal processing. In this paper, ellipse scattering model is proposed, which can carry on the signal-level simulation for DVLpsilas echo. And based on simulated signals, the Monte Carlo statistics of the pulse-pair method is carried on. Statistical analysis shows the simulation results and experimental results with a better consistency. The correctness of the ellipse scattering model is verified, so it is both a useful theoretical tool and a simulation method for further research and analysis on acoustic Doppler velocity measurement. [C540]

"Pilot-Aided Channel Estimation Methods for ICI Reduction in Mobile OFDM Systems"

In a time-varying mobile channel, the Doppler effect causes intercarrier interference (ICI) in an OFDM system. Some researches have been found to mitigate the ICI effect in order to improve the system performance. However, ICI reduction algorithms usually require the information of the channel impulse response (CIR) even on each sample. In this paper we study several channel estimation algorithms for CIR estimation, including the frequency-domain and the time-domain approaches. We have shown that the time-domain Kalman filter channel estimator has better performance than others because it can estimate CIR sample by sample Simulation results also show that a proposed ICI mitigation algorithm incorporating the time-domain Kalman channel estimator achieves better BER performances at different mobile speeds. [C541]

"Modeling and Denoising Wigner-Ville Distribution"

Due to the bilinear nature of Wigner-Ville and other time-frequency distributions, they produce poor results in the presence of additive noise. Though smoothed versions of the Wigner-Ville distribution (WVD) such as smoothed pseudo Wigner-Ville distribution (SPWVD) can suppress the noise effect, they still contain considerable noise. In this paper, we introduce a novel noise suppression method for WVD and its smoothed version, SPWVD, based on non-linear, non-Gaussian modeling of these distributions. We demonstrate that these distributions have significantly non-Gaussian statistics that are appropriately described by two-dimensional generalized autoregressive conditional heteroscedasticity (GARCH) model. Then, we apply a maximum a-posteriori (MAP) estimator for estimating the clean distributions based on GARCH modeling. Furthermore, we apply denoised distributions for estimating the instantaneous frequency (IF) of signals such as radar's Doppler frequency. Experimental results demonstrate the efficiency of proposed method in denoising WVD and SPWVD and also in IF estimation. [C542]

"The use of Iridium's satellite network for nanosatellite communications in Low Earth Orbit"

Nanosatellite communication in low Earth orbit (LEO) is limited by line of sight twice a day transmissions that last a total average of 15 minutes. Using Iridium's satellite network as a gateway, satellites in LEO may achieve near continuous communications with Earth. This paper discusses the use of the Iridium network for nanosatellite satellite communications by NASA's Florida Space Grant Consortium funded researchers at Florida International University (FIU). Specifically, the paper focuses on FIU's Florida University SATellite (FUNSAT) IV competition award winning payload submission, named PicoPanther, orbiting in a sun synchronous polar orbit. An introduction to the network and hardware is presented as well as simulation results. An analysis of cost, Doppler effect shifts and possible uses are also performed. [C543]

"Analysis of joint Doppler, phase noise effects on OFDM systems in time varying channels"

Orthogonal frequency division multiplexing (OFDM) is an effective modulation scheme to improve the performance of a communication system over wireless multipath fading channels. However transceiver hardware

non-idealities combined with channel limits the performance. In this paper we study the effect of local oscillator phase noise in slow time varying channels considering realistic phase noise power spectral density (PSD) function. Carrier to Interference ratio (C/I) expression for individual subcarrier is derived for the additional intercarrier interference (ICI) due to the joint effect of Doppler and phase noise. Realistic phase noise PSD and Jakes Doppler PSD are used to quantify these OFDM system performance metrics. Analytical expression of upper bound on the system performance is obtained. Unlike Gaussian time invariant channels, in time varying channels, OFDM system performance is upper bounded by the ICI due to joint effect of Doppler and phase noise rather than Doppler alone. Numerical and simulation results are included which supports these derived theoretical results. [C544]

"Mode-based MIMO antenna channels for diversity, gain and bandwidth"

Information channels supported by orthogonal radiation modes in a coupled antenna system are ideal choices to form MIMO signal channels. Due to their orthogonal nature in radiation, it can potentially result in coupling free and correlation free channels regardless of antenna size and spacing. Those channels can be used toward enhancements of diversity, gain and bandwidth for the benefit of the system capacity. This paper provides an overview on the full potential of a coupled antenna system in terms of its mode-based antenna channels. [C545]

"Design bottlenecks of TC & TM spread spectrum links in UAVs"

In this paper, we propose a structure for communicating TC and TM data streams in up and down links, respectively. Then we discuss about some bottlenecks which have been resolved in our structure. These bottlenecks are produced because of using spread spectrum technique and presence of Doppler frequency. The proposed method for synchronization has solved complexities of demodulation of SS signals due to requirements of precise synchronization, picking up accurate carrier and very low SNR. Then our method can de-spread signal in low SNR and high frequency offset. Techniques employed in design, optimize the receiver and the results of simulation show that synchronization was successful. [C546]

"Simulation of the Doppler signals at 24 GHz from a walking person"

For the simulation of the Doppler signals the geometry of a walking person is determined for discretized time steps fulfilling the Nyquist theorem. For each time step a field simulation with the physical optics (PO) and the geometrical optics (GO) approximation is done. Both approaches are based on a neglect of multiple reflections on the scattering object. After simulation the time varying field is displayed in time-frequency domain. For the PO-approximation only the total scattered field can be evaluated. With GO-approximation the path for different scattering points can be extracted and evaluated individually. Although both approaches give comparable results, the extraction of scattering centers gives a much better insight to the physical phenomena of scattering in the high frequency case. [C547]

"On GPS signal multipath modeling in dynamic environments"

This paper examines multi-path propagation modeling in moderate and highly dynamic multi-path environments. An enhanced multipath model is proposed with emphasis on conversion from the multi-path Doppler shifts into their code delay shifts. Analytical derivation of the conversion mechanism is related to two simplified scenarios of aligned transmitter, reflector and receiver. The model is further applied to a set of processed IF samples to try to explain peculiarities of some of urban environment measurements, and of partially unresolved urban-canyon and aviation landing measurements performed by others. [C548]

"MPE-FEC performance in function of the terminal speed in typical DVB-H radio channels"

The detailed network planning of DVB-H requires understanding about the regional differences and their effects on the functionality of the system performance. A deep city center contains various radio components whereas rural area normally consists of a single line-of-sight signal resulting differences in the error behavior in the DVB-H reception. In the city area, the terminal velocity is normally limited to pedestrian and relatively slowly moving vehicular speeds. On the other hand, the Doppler shift might be the limit of DVB-H performance in the motorways across rural areas due to the higher velocities. This paper presents a radio interface quality analysis methodology based on the erroneous frames and bit error rates. A selected set of field and laboratory test cases and respective results of the performance analysis is presented. The results can be used as a basis for balancing the MPE-FEC rate and capacity of DVB-H during the related in-depth radio network optimization. [C549]

"Software configurable 5.8 GHz radar sensor receiver chip in 0.13 μm CMOS for non-contact vital

sign detection"

A direct conversion 5.8 GHz radar sensor chip with 1 GHz bandwidth was designed and fabricated. This radar sensor chip is software configurable to set the operation point and detection range for optimal performance. It integrates all the analog functions on-chip so that the output can be directly sampled for digital signal processing. Important design issues for direct conversion non-contact vital sign detection sensors, such as the effect of baseband flicker noise and gain budget, have been discussed. Experiments have been performed successfully in lab environment to detect the vital signs of human subject seated at a distance of up to 1.5 meter. [C550]

"Doppler spread estimation for nonRayleigh fading channel"

A method for estimating the Doppler spread in mobile orthogonal frequency division multiplexing (OFDM) systems is described. The estimation is based on phase message of time domain channel estimation over several OFDM symbols. In OFDM systems, channel estimation is popularly performed in frequency domain. Channel frequency response estimates are affected by noise and inter-carrier interference (ICI). As a result, Doppler estimation is useful to improve CIR performance. In this paper, methods of partial maximal path and path tracing have been presented. Furthermore estimation bias is analyzed and error correcting modified method is advised to reduce estimation precision. All of these measures improve the estimator and the performance can not be influenced by signal-to-noise ratio (SNR). The algorithm is verified with digital terrestrial multimedia broadcast (DTMB) platform and simulation results show good estimation performance. In addition, this estimator is of robust in a wide range of Doppler spread and SNR. [C551]

"The second-order monostatic HF radar cross section incorporating antenna barge motion"

The second-order HF radar ocean cross section is derived for the case of the transmitting and receiving antenna undergoing platform (i.e. barge) motion. The derivation for electromagnetic patch scatter begins with a general expression for the bistatically received second-order electric field. Based on an assumption that the ocean surface can be described as a Fourier series with coefficients being zero-mean Gaussian random variables, the second-order monostatic radar cross section is developed. The derivation for the hydrodynamic patch scatter follows from an earlier first-order analysis. The second-order HF radar cross section is found to consist of Bessel functions, and no singularity exists in the new electromagnetic coupling coefficient. Simulation results depict the effects of barge motion under a variety of sea states. It is evident that first-order effects spread into the second-order region and thus could have detrimental effects on wave measurement schemes. [C552]

"Statistics of Si-O Bond-Breakage Rate Variations Induced by O-Si-O Angle Fluctuations"

The McPherson model for the Si-O bond-breakage has been extended in a manner to capture the effect of O-Si-O angle variations on the breakage rate. Using a distribution function of the O-Si-O bond angle, a series of breakage rate probability densities has been calculated as a function of the applied electric field. Using such a distribution function we have calculated the mean vale and the standard deviation of the breakage rate and compare them to the nominal rate corresponding to the fixed angle of 109.48deg observed in crystalline alpha-quartz. It is shown that the mean value of this rate is substantially higher than and the standard deviation is comparable with the nominal rate. Obtained dependencies demonstrate a linear trend in a log-fin space, thereby validating the thermo-chemical model for the time-dependent-dielectric breakdown also in the case of non-uniform O-Si-O angle distribution typical for amorphous silica. [C553]

"Doppler ultrasound signal denoising based on Grey relational analysis technique"

In this study, Grey relational analysis technique proposed by J.L. Deng has been applied to spectrogram images of clinical mitral valve Doppler signals. A threshold level has been determined to plot maximum frequency envelope from denoised sonogram image using this technique. It is seen that, signal to noise ratio has been improved through Grey relational analysis technique. A software has been realized to support Doppler ultrasound device to diagnose vascular disease. This system has many advantages that are reducing the computation time, ergonomic, cheapness. [C554]

"A new geometrical channel model for vehicle-to-vehicle communications"

We have presented a new analytical model of the Doppler spectrum in the V2V environment based on scattering objects distributed along both sides of the roadway. Comparisons with examples of measured spectra from the suburban environment show improved agreement with the shape of the spectra compared to the double-ring model. We believe the new model could be beneficial for both wireless emulators and network applications. For example, the model would improve the accuracy of wireless emulators, in turn making more accurate hardware

performance evaluations (such as BER) possible. Similarly, an accurate physical level channel model allows the evaluation of different MAC protocols under realistic conditions. [C555]

"An OFDM-based channel sounder system"

In this paper we have presented an OFDM-based channel sounder system. We can use commercial VSG (with arbitrary waveform generator) and real time VSA to conduct channel measurements. The requirement is that both VSG and VSA should have stable oscillator during the time of measurement and the frequency offset between these two equipments can be known in advance. Because the time offset was not calibrated, the power delay profile (PDP) measured does not give the absolute time delay but the relative time delay of multipath components. The frequency offset between the VSA and VSG has little effect on the measurement of single PDP, but will give a constant frequency offset for the Doppler measurement. If the frequency offset is known in advance, the offset can be compensated and the Doppler spectrum can be obtained. [C556]

"Numerical and experimental verifications of digital correlator model for random noise radar"

Design theory and efficient digital correlator model of a random FM noise radar was presented. The correlator model was developed with System generator blocksets in Simulink environment to include the discrete time base and quantization effect if it can be implemented by using the FPGAs available in the markets. Numerical simulation was conducted with the virtual noise signal and moving target signal generators, and the obtained results show good agreements with the expected values. For an experimental examination, a mm-wave random FM noise radar was implemented based on the obtained design parameters, and a field test was made for detecting a high-speed moving target. With the logging data, an off-line correlation and Doppler processing was made, and the obtained information was very close to the estimated one again. All the results fully validate the design theory and the developed digital correlator model. [C557]

"Frequency estimation method for measuring time-varying single frequency from digitized waveform"

A frequency estimation method (ZFM: zero-crossing fitting method) for measuring time-varying single frequency is applied to determine the velocity of the mass for a space scale. The difference between the ZFM and conventional zero-crossing method used in typical electric frequency counters is discussed. The velocity derived from estimated Doppler frequency is evaluated with considerably lower level of noise using the ZFM instead of the conventional method for the same downsampling ratio. [C558]

"An improved simulation of HF channel with Gaussian random time delays and doppler shifts"

An improved high frequency (HF) channel model with random time-delays and random frequency shifts is proposed, on the basis of Watterson model. A software HF channel simulator is implemented using the proposed model. The frequency domain method is used to design the low-pass linear filter that generates the complex baseband tap-gain function with Gaussian spectrum density, representing the Doppler spread of HF channel. The time-delays and Doppler frequency shifts are both modeled as random variables with Gaussian distributed function. Simulation results prove the validity of the proposed HF channel simulator and provide some new insight into the time-varying properties of the HF channel. The proposed model can be used into the simulation of adaptive HF communication system and is much helpful to the design of hardware-based simulator. [C559]

"Analysis of a Strong Tornado in the Outer-Region of the Super Typhoon "Sepat" in 2007"

When the super strong typhoon Sepat came immediately close to the Fujian coastline on the night of August 18, 2007 (coded as 0709 in Chinese convention), a vigorous tornado was derived from the typhoon at 2307 ~ 2320 BST that appeared at the Longgang town, Cangnan county of the Wenzhou region about 300 km away in the forward direction of the typhoon, damaging heavily the life and properties of the inhabitants. Through the analysis of the situation for the tornado and composite reflectivity, vertical wind shear and the storm-relative radial velocity from Doppler observations some typical properties are revealed of the destructive tornado, together with such localized characteristics of the tornado investigated as peninsular topographic effect, land-sea thermal contrast as well as a network of densely distributed rivers that produce local dynamic and thermal effects to intensify the derived tornado. [C560]

"Impact of Doppler on High Speed UAV OFDM System"

To implement the large-capacity data traffic on unmanned aerial vehicle (UAV), sufficient research on UAV communication channel and its effect on OFDM communication system must be performed. This paper analyzed

the communication channel models of UAV under several scenarios, and gave the impact of ICI on performance of OFDM system in different scenarios. Moreover, this paper analyzed the relationship between ICI and subcarriers interval, which can help designer to develop new way of channel equalization and eliminating ICI. [C561]

"Micro Rain Radar measurements of rainfall in Madrid"

A vertically pointing Doppler radar at 24.1 GHz, or Micro Rain Radar (MRR), has been installed at Universidad Politecnica de Madrid as part of the experimental set-up for propagation measurements that includes a tipping-bucket rain gauge and a disdrometer. The Doppler spectra measured by the MRR are converted into profiles of drop size density distributions. The MRR provides equally profiles of radar reflectivity, rainfall rate or terminal velocity, which can be useful to identify and analyse propagation effects produced by rain, once its behaviour has been assessed. With this aim, a study of MRR measurements is being performed. The analysis of MRR data corresponding to two different rainfall events, whose results are presented here, reveals characteristics in agreement with the stratiform or convective type of event. [C562]

"Airport channel measurements at 5.2GHz"

A new technology based on IEEE 802.16e should be applied for airport data link applications. To determine the most adequate parameters for the physical layer system design, it is important to consider the propagation channel characteristics. The paper presents results of the channel measurement campaign at Munich airport, in the C band. Using a test signal of 120 MHz bandwidth, large number of channel transfer functions were recorded and the channel characteristics evaluated in terms of number of uncorrelated multipath components, delay spread, total Doppler spread, coherence bandwidth and time. [C563]

"Angular Doppler characterization in indoor channels"

This paper addresses directional properties of the Doppler effect of the measured MIMO radio channel in indoor environments. The evaluation of the data is based on spectral analysis in angular and Doppler domains of the estimated MIMO channel transfer function represented using tensors. The analysis is conducted separately for the specular and the diffuse scattering components of the measured propagation channels. It is shown that such analysis yields an estimate of the velocity of a mobile terminal, assuming that the movement of the terminal is the only (or at least the dominant) cause for temporal variation in the channel. The analysis presented in this paper is useful for the purposes of channel modeling, indoor localization as well as antenna and array design. [C564]

"Recursive least-squares doubly-selective MIMO channel estimation using exponential basis models"

An adaptive MIMO channel estimation scheme, exploiting the oversampled complex exponential basis expansion model (CE-BEM), is presented for doubly-selective fading channels where we track the BEM coefficients. The time-varying nature of the channel is well captured by the CE-BEM while the time-variations of the (unknown) BEM coefficients are likely much slower than that of the channel. We apply the exponentially-weighted and sliding-window recursive least-squares (RLS) algorithms to track the BEM coefficients subblock-by-subblock, using time-multiplexed periodically transmitted training symbols. Simulation examples demonstrate its superior performance over the conventional block-wise channel estimator. [C565]

"Baseband estimation and compensation of joint TX/RX I/Q imbalance in SC-FDE transceivers"

Previous work on I/Q imbalance in SC-FDE transceivers investigates the effect of receiver I/Q imbalance but does not consider Doppler effects due to mobility. SCFDE in doubly-selective channels is studied without considering I/Q imbalance. In this paper, we derive an equivalent channel model for SC-FDE in the presence of both joint Tx/Rx I/Q imbalance and mobility and present an effective low-complexity digital baseband compensation scheme. Furthermore, we propose a novel joint channel and I/Q imbalance parameter estimation scheme for SC-FDE transceivers. [C566]

"Shallow underwater communication with passive phase conjugation and iterative demodulation and decoding"

We propose passive phase conjugation (PPC) with iterative demodulation and decoding for communication over the shallow underwater acoustic channel. PPC mitigates inter-symbol interference (ISI) caused by multipath in the channel. A soft-input, soft-output (SISO) differential BPSK (DBPSK) demodulator and a SISO irregular repeat accumulate (IRA) channel decoder arranged in an iterative dasiaturbopsila structure improve the bit error rate

(BER) at higher symbol rates. A linear estimator tracks channel phase variations arising from Doppler effects and wave motion. The system was tested at Lake Pend Oreille in Idaho over a distance of 1.78 km in shallow water with BERs below 10-5at 2,500 information bits per second. [C567]

"BER Analysis of STBC-OFDM Wireless Systems with RF Impairments and Imperfect Channel Estimation with Application to IEEE 802.16e"

In this paper, we investigate the effects of RF impairments and imperfect channel estimation (ICE) on the performance of Orthogonal Frequency Division Multiplexing (OFDM) wireless systems with transmit diversity for Space-Time Block Codes (STBC) employing Nt: Ntisin [2,3,4] transmit antennas and one receive antenna in a Rayleigh fading environment. The bit error rate (BER) expressions of the OSTBC-OFDM system is derived for each transmit-receive antenna configuration in the presence of phase noise and channel estimation errors. With emphasis on complex signal constellations, we further investigate the effect of doppler on the performance of OSTBC- OFDM for different code rates R: 1/2 les R les 1, including maximal-rate OSTBC codes. To illustrate the extent of system degradation due to these impairments on a proposed practical system, the presented results are verified through simulations by making use of the system parameters from the IEEE802.16e standard. [C568]

"Doppler Frequency and Noise Insensitive Sampling Frequency Offset Estimation Method for DVB-T/H Systems"

A precise estimation of SFO (Sampling Frequency Offset) is an important issue in OFDM (Orthogonal Frequency Division Multiplexing) system. However, the conventional method causes serious performance degradation of SFO estimation in low SNR (Signal to Noise Ratio) or large Doppler frequency environment. Therefore, in this paper, we propose a SFO estimation method which can achieve stable operation in low SNR and large Doppler frequency environment. The proposals for SFO estimation /compensation are mainly based on DVB (Digital Video Broadcasting) system, and we verified that the proposed method has a good performance and stable operation through extensive simulation. [C569]

"An Anti-Jamming GPS Receiver Based on Subspace Decomposition Method"

Code delay and Doppler shifted frequency would not captured using the conventional GPS receiver in the strong interference case because the received GPS signals which traveled a long distance were very weak. In the paper design of an anti-jamming GPS receiver is proposed. First, the interferences in the received signals are canceled through subspace projecting technique and the resulting interference-free signals are processed by a weight vector which maximizes signal-to-noise ratio. Finally, the simulation result has shown that the method is valid. [C570]

"Computations of radar returns of wind turbines"

Up to now, all previous studies have focused on the influence of moving objects such as wind turbines on aeronautical and maritime radars that normally operate in the L/S band or in the X-band respectively. We have used both UTD methods as well as simplified methods to quantize the effects. Not many moment method solvers are capable of dealing with moving objects (creating Doppler shifts) in a fully consistent way, but with UTD it is within easy reach of the modern computers. However, for some particular applications, the procedures can be simplified to quantize efficiently the near-fields around moving objects. After a description of the general phenomena, two simplified methods will be compared. The first consists in a physical optics based method and the second makes use of the flat wedge approximation. [C571]

"Fabrication and vibration analysis of micro-cross beams"

In this investigation, the micro-cross beam is fabricated by the method of silicon bulk micromachining. The first torsion natural frequency included a torsion factor and the second bending natural frequency can be derived by using the characteristic of the first two decoupled vibration modes of the micro-cross beam. The Poisson's ratio included a torsion factor and a frequency ratio can be defined in a simple form by setting the ratio of the length-width of long beams and short beams is designed to be equal. The frequency ratio can be obtained by using the measurement and simulation. In the measurement, a micro Laser Doppler Vibrometer with 20 MHz bandwidth and 0.1 nm resolution is used by using the resonant method. Effects of input voltages on the vibration at the tip point of long beams are also discussed. Measured dimensions of the fabricated microcross beam can be used as the information of input to simulate frequency ratio of the beam. The first torsion and the second bending modes can be constructed and the Poisson's ratio can be obtained from the simulation results. A good agreement between the theoretical outcomes and experimental results is found. [C572]

"Modeling and Simulation of Broadband Acoustic Doppler Current Profiler Echo"

Broadband acoustics Doppler current profiler (BBADCP) uses the repeated phase-coded signal. It has higher range and velocity resolution, compared with narrow band acoustics Doppler current profiler (NBADCP). The character of BBADCP echo is different in different ocean environment. It is necessary to establish corresponding model for analyzing the effects of different echo on measurement precision. Therefore the broadband characteristic of BBADCP, scattering characteristic of scatterers and nonuniformity characteristic of scatterers are synthesized, and BBADCP echo model in the nonideal conditions is established. On this basis, digital simulation has been done, the influence brought by different characteristics of echo on the precision of velocity measurement is analyzed. [C573]

"Ambiguity function study for UMTS Passive Radar"

Passive Radar systems, also referred to as Passive Coherent Location systems (PCL),exploit reflections from illuminators of opportunity in order to detect and track objects. Over the last few years there has been an evolution of mobile networks towards the third generation radio wireless communications (3G) as UMTS (Universal Mobile Telecommunications System). The UMTS is the European standard for 3G wireless communication and it has been developed by 3gpp (3rd Generation Partnership Project). The downlink signal transmitted from the UMTS base-station (or Node B) presents interesting properties that induced us to verify the usability of the UMTS signal as opportunity signal for passive radar systems. In order to obtain some performance evaluations, we have studied the ambiguity function of UMTS signal through a Simulinkreg model based on the WCDMA library. The simulations have proven that the UMTS signal has good properties in term of range and Doppler resolution. In the last section the bistatic geometry effects on the ambiguity function has been studied. [C574]

"Spotlight SAR processor by using extended frequency scaling"

Frequency scaling algorithm (FSA) is generally used as a spotlight synthetic aperture radar (SAR) processor. FSA can directly process dechirped raw data. However, the plain algorithm itself is purposed for a single target because the formula of the algorithm is for a target. This paper presents a method to process a sliding spotlighted scene with FSA. Extended frequency scaling algorithm (EFSA) is used for focusing a point target in this paper. In order to get a focused scene of high quality image, effective velocity and Doppler centroid need to be very accurate for each target. Test has been done with a step steering sliding spotlight simulated raw data. [C575]

"GSOC's Scatterometry GNSS receiver for ocean remote sensing: Design and initial results"

The department of Space Flight Technology at the DLR's German Space Operations Center (GSOC) is currently developing a new Reflectometry/Scatterometry GNSS receiver for ocean remote sensing. This new instrument is being designed to be used in several conditions ranging from terrestrial applications to spaceborne GNSS experiments. One of its key features is the ability to compute at different scales a Delay Doppler Map (through time multiplexing the Doppler space) on one reflection event at a time using a 3Г‘В—3 fully digitally steerable antenna array. Another feature is to perform digital beamforming of the incoming downconverted digitized GPS signal after IF carrier and C/A demodulation. This significantly reduces the technical requirements and costs of the analog RF front-end chain and the computation bandwidth at the FPGA respectively. A prototype version of this Scatterometry GNSSR receiver is being developed as a proof of concept, using the Namuru II board as development platform. [C576]

"SAR altimeter retracker performance bound over water surfaces"

This paper provides the theoretical limit for the performance of a Maximum Likelihood Estimation (MLE) DDA re-tracker for different Significant Wave Height (SWH) conditions based on Cramer-Rao Lower Bound (CRLB) analysis. [C577]

"A smart repeater for weapon location radars based on time-frequency analysis"

The smart repeater is a transportable test set for the weapon location radar to evaluate its artillery-locating capabilities without having to use live artillery fire. It retransmits a radio frequency echo that represents the radar return from a shell following the simulated ballistic trajectory when it is triggered by the radar beam. In order to synthesize the echo accurately, we propose time-frequency analysis method combined with pseudo pulse compression to estimate the pulse parameters of the subject radar. Time-frequency distribution is the optimal analysis technique for a linear frequency modulation signal since it will concentrate the signal energy along its instantaneous frequency, while dispersing noise among many frequencies. Therefore we integrate time-frequency

analysis with pseudo pulse compression to estimate the parameters of radar pulse such as centroid frequency, frequency modulation rate, amplitude and phase. For the sake of improving the estimation accuracy in the presence of noise and radar electromagnetic environment, both blind deconvolution and power detecting approaches are used. We preprocess the signal by blind deconvolution to extract the raw radar signal from the convolution between the raw signal and electromagnetic environment. The power detecting technique is applied to extract the peak ridge of time-frequency transformation of the signal from interference terms between the signal and noise. After the estimation, a novel method is presented which use digital modulation technique to synthesize the radar echo by inserting the proper delay, Doppler frequency and radar cross-section effects according to the locality and velocity of the simulated shell. Processing steps of the estimating and synthesizing are given in detail. Simulation results validate the effectiveness of these approaches. Development of this smart repeater has been completed and it can provide a quick, thorough performance check of the weapon location radars and minimize-the need for expensive. [C578]

"ERS-ENVISAT Tandem cross-interferometry coherence estimation"

ERS-ENVISAT cross-interferometry is a unique tool for a number of applications since it combines a short repeat-pass interval (28 minutes) with a long perpendicular baseline (2 km). Temporal decorrelation effects are limited and the sensitivity to topographic features is strongly enhanced. In this contribution the focus is on problems encountered during the coherence estimation in ERS-ENVISAT cross-interferometry. Because of the ERS-2 Doppler Centroid variations the azimuth common band available is often only a relatively small fraction of the PRF. Similarly, in the case of not ideal baselines, the common range bandwidth is often much smaller than the chirp bandwidth. Furthermore, high phase gradients in the cross-interferograms can significantly affect the coherence estimates. In our contribution we propose methodologies to reduce these problems in the coherence estimation. [C579]

"The effects of multi-path scattering on the SAR image of cylinder cavity"

In this paper, the effects of multi-path scattering mechanisms on SAR image is deduced through range Doppler algorithms (RDA). The conclusion that the cloud phenomenon appeared due to the multi-path scattering mechanisms is detained. Through the analysis, the cloud caused by the multi-path in the down range is corresponding to focus mechanisms and the cloud appeared azimuth is non-focus. At last, the shooting and bouncing ray (SBR) technique is employed to calculate the scattering of the cylinder cavity and by combining with range Doppler algorithms (RDA), the SAR image of a cylinder cavity with underside closed is precisely given, considering the effects of the multi-path scattering mechanisms in different azimuth. [C580]

"Switching oxide traps as the missing link between negative bias temperature instability and random telegraph noise"

Due to the ongoing reduction in device geometries, the statistical properties of a few defects can significantly alter and degrade the electrical behavior of nano-scale devices. These statistical alterations have commonly been studied in the form of random telegraph noise (RTN). Here we show that a switching trap model previously suggested for the recoverable component of the negative bias temperature instability (NBTI) can more accurately describe the bias and temperature dependence of RTN than established models. We demonstrate both theoretically and experimentally, that the recovery following bias temperature stress can be considered the non-equilibrium incarnation of RTN, caused by similar defects. We furthermore demonstrate that the recoverable component is solely constituted by individual and uncorrelated discharging of defects and that no diffusive component exists. Finally it is highlighted that the capture and emission times of these defects are uncorrelated. [C581]

"A Geometry-Based Stochastic Model for Wideband MIMO Mobile-to-Mobile Channels"

In this paper, based on the tapped delay line (TDL) structure, we propose a geometry-based stochastic model (GBSM) for wideband multiple-input multiple-output (MIMO) mobile-to-mobile (M2M) Ricean fading channels. The proposed wideband model is the first GBSM that has the ability to study the impact of the vehicular traffic density (VTD) on channel statistics for different time delays, i.e., for every tap in our model. From the proposed model, the space-time (ST) correlation function (CF) and the corresponding space-Doppler (SD) power spectral density (PSD) are derived. Excellent agreement is achieved between the theoretical Doppler PSDs and measured data, demonstrating the utility of the proposed model. [C582]

"Cooperative Transmission with Continuous Phase Frequency Shift Keying and Phase-Forward Relays"

We propose in the paper the concept of phase forward (PF) as a possible relay strategy for cooperative communication involving CPFSK modulation in a "fast" fading environment. The technique enables the relay nodes to maintain constant envelop signaling without the need to perform decoding and signal regeneration. To further reduce complexity, we adopt noncoherent discriminator detection at the destination node. A semianalytical expression for the bit error probability (BEP) of this phase forward non-coherent CPFSK cooperative transmission scheme is derived in the paper. The analysis is general in the sense that it can accommodate different Doppler frequencies and signal-to-noise ratios in the various links. It was found that PF can provide a strong diversity effect, especially when the signal-to-noise ratio in the source-relay link is substantially stronger than those in the source-destination and the relay-destination links. Furthermore, from a BEP stand point, phase forward is better than conventional decode-and-forward (DF) under typical channel conditions. It can also attain the same performance as amplify-and-forward (AF) when fading is static. Finally, we found that the concept of PF applies equally well to PSK modulations. [C583]

"Observing littoral waves by Doppler radar"

The offshore observation of the wavefield with coherent radar systems consist a common practice for the study of the electromagnetic waves probing the sea surface waves and for the extraction of information of the sea waves. In this investigation, a Dopplerized, horizontally polarized, nautical radar is utilized for the monitoring of the wavefield evolution in the littoral zone. The radar datasets are globally unique and cover different geophysical conditions; therefore the impact of the bathymetry on the Doppler spectra is discussed, the horizontal velocity towards the shore is calculated and the properties of the radar deduced quantities are compared with in situ measurements. [C584]

"On the characterization of time-scale underwater acoustic signals using matching pursuit decomposition"

We investigate a characterization of underwater acoustic signals using extracted time-scale features of the propagation channel model for medium-to-high frequency range. The underwater environment over these frequencies causes multipath and Doppler scale changes on the transmitted signal. This is the result of the time-varying nature of the channel and also due to the relative motion between the transmitter-channel-receiver configuration. As a sparse model is essential for processing applications and for practical use in simulations, we employ the matching pursuit decomposition algorithm to estimate the channel time delay and Doppler scale change model attributes for each propagating path. The proposed signal characterization was validated for sparse channel profiles using real-time data from the BASE07 experiment. [C585]

"Measuring current profiles on a moored buoy through an acoustic window"

The National Data Buoy Center (NDBC) operates and maintains a network of over one hundred data buoys that provide real time meteorological and oce?anographie data to the National Weather Service (NWS) for use in forecast and prediction models. Traditional measurements have included wind speed and direction, barometric pressure, air temperature and humidity, sea surface temperature and waves. Initiatives through the Integrated Ocean Observing System (IOOS) funded the enhancement of these platforms to include current profiles and salinity measurements. Early efforts at integrating the Acoustic Doppler Current Profilers (ADCP) into the buoy systems through the use of an in-line mooring cage yielded intermittent performance, with the majority of the failures being attributed to mechanical abrasion and fatigue of sensor cables across the bridle-mooring interface. Additional failures resulted from severed cables due to fishing gear entanglement and similar issues. These failures resulted in loss of real-time data pending availability of a service vessel and frequently damage to the equipment. Additionally, persistent bio-fouling would often require more frequent overhauling of the ADCP. The end result was poor long-term current profile data availability. To improve operational efficiency and data availability, NDBC applied the concept of an acoustic window to the buoy platform. Acoustic windows are used effectively on research and naval vessels. The window was developed in conjunction with a simultaneous development of an NDBC Standard Buoy which was being designed to streamline the buoy design across the major programs within the organization. Initial concerns with the buoy-mounted acoustic window were the effect of near surface bubbles on data quality and depth attenuation due to the presence of the window. The prototype was developed to determine the operational trade-off between weather-dependent data availability and reduced range of the acoustic window versus the po- ssibility of complete data loss and a vulnerable instrument. The prototype was deployed on an engineering test buoy with an RD Instruments 300 KHz Sentinel This paper evaluates these trade-offs by examining several months of hourly data near Point Conception, Calif. In particular, the effect of sea state, wind speed, concentration of backscatters and buoy motion on data quality will be explored. The effective range of the ADCP in this new configuration is determined and compared to ranges determined from past deployments and configurations. Additionally, the design details of the acoustic well will be presented and discussed, including acoustic well-specific test procedures. [C586]

"Golay complementary waveforms for sparse delay-Doppler radar imaging"

We present a new approach to radar imaging that exploits sparsity in the matched filter domain to enable high resolution imaging of targets in delay and Doppler. We show that the vector of radar cross-ambiguity values at any fixed test delay cell has a sparse representation in a Vandermonde frame that is obtained by discretizing the Doppler axis. The expansion coefficients are given by the auto-correlation functions of the transmitted waveforms. We show that the orthogonal matching pursuit (OMP) algorithm can then be easily used to identify the locations of the radar targets in delay and Doppler. Unambiguous imaging in delay is enabled by alternating between a Golay pair of phase coded waveforms at the transmission to eliminate delay sidelobe effects. We then extend our work to multi-channel radar, by developing a sparse recovery approach for dually-polarimetric radar. We exploit sparsity in a bank of matched filters, each of which is matched to an entry of an Alamouti matrix of Golay waveforms to recover a co-polar or cross-polar polarization scattering component. [C587]

"Channel estimation of OFDM system for high data rate communications on mobile environments"

One of the main challenges of the 4th generation wireless systems is to provide high data rates in mobile environments. In these 4G products, WiMax (worldwide interoperability for microwave access) and LTE (long term evolution) will be the platform technologies. The rapid development of the Internet with new services and applications has created new challenges for the development of mobile communications systems. Many wireless systems offer high data rate services (IEEE 802.11n, IEEE 802.15.3 and IEEE 802.16). Possible migration of 3G to 4G (LTE) will increase data rates throughput in the range of 100 Mbps. These high data rate applications may be difficult to support with the required quality-of-services (QoS) in high mobility environment. For example, the mobile WiMax can be used at mobile speeds of 60 km/h to 120 km/h sufficient for car applications but not for high speed trains. One possible solution is to use a main router for each coach connected with a single antenna to the external broadband network and to distribute the signal inside the coaches thanks to a repeater. An other architecture consider direct transmission to mobile cellular telephone networks using the 3G technology such as the HSDPA (High Speed Downlink Packet Access) and HSUPA (High Speed Uplink Packet Access) allow high-speed data rates, opening the door to a range of mobile usage. All these future and advanced systems are mainly based on orthogonal frequency division multiplexing (OFDM) known to be resistant to various impairments in the mobile channels. In this paper, a transmission system based on OFDM technique and a solution for channel estimation is proposed. The main results will be presented in the case of high mobility context. [C588]

"A modified statistical system model and an accelerated Monte Carlo simulation for a silicon detector based Compton medical imaging system"

The objective of this research is to demonstrate a modified statistical system model and an approach of accelerated Monte Carlo simulation for studying the capability of a dual-planar Compton medical imaging system constructed with silicon and NaI detectors to image 364.4 keV energy photons emitted from I131. The Compton imaging system is a potential medical imaging instrument for effectively observing the process of radionuclide cancer treatments. Since decoupling the tradeoff between spatial resolution and detection efficiency inherent to the absorbing collimation of conventional Anger Camera, the Compton imaging system provides improved imaging performance in both detection efficiency and spatial resolution especially for higher energy photons. In the study, a modified statistical system model of the Compton system was developed considering all factors in the Compton process including Doppler broadening, energy resolution and spatial resolution of the scattering and absorbed detectors in addition to the Compton image formation process. To conquer the limitation of low simulation speed when employing the existent allpurpose Monte Carlo simulation platform due to low Compton interaction cross-section inside of the silicon detector, the developed Monte Carlo simulation involves the techniques of force detection and variance reduction to speed up the simulation. It is proved that two promotion approaches are of benefit to performance analysis and image reconstruction for the Compton imaging system. [C589]

"1 cm2 and 3 cm2 Multi-Linear Silicon Drift Detectors for 2D X-ray spectroscopic imaging and Compton scattering"

Multi-Linear Silicon Drift Detectors (ML-SDDs) are a recent evolution of silicon drift detectors, in which the signal electrons generated by the interaction are confined within parallel drifting columns and transported towards point-like anodes by the electrostatic field. ML-SDDs can be operated both in integrate-readout and in free-running mode and are able to provide 2-D position sensing capability combined with spectroscopic energy-resolution. Therefore ML-SDDs open the way to time-resolved imaging and spectroscopy of X-rays and Compton electrons in addition to charged particle tracking. The excellent energy resolution and the relatively small Doppler broadening of silicon makes a ML-SDD detector an ideal candidate to reconstruct the original location of the gamma-ray with sub-millimeter position resolution. Novel designs of 1 cm2and 3 cm2ML-SDDs have been

carried out and first detectors prototypes were produced at the Halbleiterlabor of the Max Planck Institut in cooperation with PNSensor GmbH. In this paper we will discuss the main detector performance in terms of position, energy and time resolution. [C590]

"Evaluation of synchronicity in heart motion by elucidating intersection index from successive echocardiograms"

The expertise and experience are required for an examiner to diagnose using echocardiogram. To evaluate the synchronicity of motion in the heart, the tissue Doppler imaging (TDI) technique is popular but it has anisotropy in motion detection. Therefore, we have developed software to recognize the synchronous motion of heart by calculating intersection points between the instantaneous velocities of ventricular wall flow from successive echocardiograms. In addition, we defined intersection index to evaluate synchronous motion of heart by dividing echogram into small regions to calculate distribution of intersection points. Finally we introduced gravity point of the distribution and calculated its trajectory through a heart-beat. As the result, fluctuation of the gravity point in heart disease patients was clearly observed where the trajectory of the gravity point was stable in normal subjects. [C591]

"Temperature and current dependence of doppler SNR in a VCSEL based self-mixing sensor"

This paper proposes a method for maintaining the maximum signal-to-noise ratio (SNR) of the signal obtained from the self-mixing sensor based on a Vertical-Cavity Surface-Emitting Laser (VCSEL). The SNR of the Doppler self-mixing signal was investigated experimentally as a function of laser driving current and ambient temperature. It was found that the locus of the maximum SNR in the current-temperature space can be well approximated by the simple analytical model based on the temperature behaviour of the VCSELs threshold current. A self-mixing Doppler signal was acquired from the variation in VCSEL junction voltage rather than from a conventional variation in laser optical power to reduce the complexity of the system. It was found that the optimum sensor performance over a wide range of ambient temperatures can be achieved by tuning the laser current according to the proposed model. This enables the sensor to operate without temperature stabilisation making it attractive for mobile applications and applications with limited power supply. [C592]

"Wi-Fi in high-speed transport communications"

We discuss in this paper the performance of the present Wi-Fi system in a high-speed environment where Doppler effect is taken into account. The performance is reported in both 802.11a and its future MIMO version 802.11n. Simulations are taken in use of Jakes' model in diffeГ‚Bïrents speeds contexts and WiFi system is found weak facing Doppler effect. In order to reduce the Doppler impact, we present a feasible and easy channel coefficients estimation processing towards a more robust system in high-speed utilization. A pilots-based tracking method is also proposed by interpolation in frequency domain to update the channel state information. [C593]

"Improving Ambiguity Function of Costas signal"

This paper presents the effects of modifying Costas signal in time and frequency to improve ambiguity function (AF). The effect of adding frequency spacing, linear frequency modulation, constant space time, and variable space time between sub-pulses of Costas signal are presented and compared. It is shown that a considerable reduction of side-lobe and better Doppler resolution is achieved by using variable spacing between sub-pulses of Costas signal. [C594]

"Iterative architecture of low complexity of equalization, estimation, and decoding for the multi-channels ways with fast evanescence"

An initialization process with a new sequence of periodical learning for turbo equalization including the estimation and the decoding of channels were proposed for the multichannels ways with fast evanescence. In this article, the equalization is completed by a canceller of interferences and the estimation of channels is realized by using the method of Valenti and Woerner. As for the converter, this last one is of type LDPC in which the matrix of parity is generated from the circular permutations of a matrix of predefined identity. To insure the adaptation between the equalizer and the decoder, we determined analytically the expression of the extrinsic information has the entrance of the decoder. An adaptive equalizer using a function of not linear cost was proposed to offer a low rate of error for the initialization. The proposed architecture is of low complexity and allows to reduce considerably the effects of selectivity both on fr-equencies and temporal for channels of multi-Rayleigh ways for the normalized Doppler frequencies. f_m=f_D T_s=O.02 and 0.04. [C595]

"On the design of Doppler filters for next generation radio channel simulators"

Real-time wireless channel simulators are necessary for radio prototyping. Doppler filter is one of the basic building blocks in correlation-based channel simulators. Enormous computational complexity of channel models for new wireless standards like MIMOs prohibit their software realizations (which have traditionally been the case). In first part of this work, we dimension and compare two alternative implementations of the Doppler filter, one using FIR and the other using IIR. Next we provide hardware implementations to come up with area and power requirements for Doppler filters for channels as complicated as 10 ГґВ— 10 MIMOs to conclude that 5thorder IIR filters with 32-bit fixed-point MAC provide near optimum accuracy, area and power consumption and become a logical choice for hardware implementations for wireless channel simulators. We also provide FPGA implementation of our design to indicate their strength and potential role in future simulators. Finally we extrapolate our results to indicate future trends in wireless channel simulator implementation. [C596]

"Spatial resolution of multi-head Si/CdTe Compton camera for medical application"

The next generation of Compton Camera based on Si and CdTe semiconductor has been developed in Japan for cosmic gamma-ray observation in space. Angular resolution and hence sensitivity of Compton Cameras are improved by employing the imaging semiconductors with good energy and spatial resolution. Moreover, for the energy range from several tens keV to a few MeV, silicon is suitable for the scattering part of the Compton camera since Compton cross-section is relatively large in Si, compared with the photo absorption cross section. Also effects of Doppler broadening is small. On the other hand, CdTe is suitable for the absorbers because of its high photoabsorption efficiency for gamma rays in this energy region. The high angular resolution and high energy resolution of the Si/CdTe Compton camera is very attractive features for medical applications. In the previous simulation study, we reported that the Compton camera has a low spatial resolution along the longitudinal direction, but it can be improved by using two camera heads. In the present work, we measured the spatial resolution of the Compton camera, especially for the longitudinal direction. The spatial resolutions are compared with the simulation study. The longitudinal resolution is measured to be about 27 mm and the lateral one is about 5 mm at the distance of 6 cm from the surface of the top detector. The simulation result and the experimental one agree well with each other. Moreover we demonstrate the capability of three-dimensional imaging by using multi-head system consisted of plural Compton cameras. The spatial resolutions are consistent with the simulation result. These results implies that clear 3D-image can be realized by using a multi-head system of Compton cameras. [C597]

"Classification of convective and stratiform types of rain and their characteristics features at a tropical location"

The effect of rain attenuation in high frequency signals need proper understanding of the variation of drop size distribution (DSD) separately in convective and stratiform rain due to different characteristics. This paper presents the analysis of variation of vertical rain rate profile for these two types from micro rain radar observations as well as the variation of DSD at ground using disdrometer, of an event observed over Ahmedabad. The bright band signature in vertical rain rate profile is used for rain classification as well as the rain classification based on ground based DSD model is also attempted. The results highlight a rain classification scheme based on lognormal DSD parameter. It is also found that large drops size is more in convective cases associated with high rain rate. It is also observed that for lower rain rates, convective cases have smaller number of bigger drops than stratiform types of rain of same rain intensity. The information will be of importance for classification for rain and rain attenuation study. [C598]

"Mapping Received Envelope Power into Fading Characteristics"

In this paper, we present characterization of multipath propagation channel for 2.4 GHz carrier. The effect of relative movement between transmitter and receiver and its effect on channel characteristics in terms of Doppler spread in frequency domain are also discussed. Based upon this, a model is explored, which enable us to map the fading characteristics into the received envelope power and hence a way to estimate maximum Doppler spread is obtained. The variation caused by values of sigma is also estimated. Combining the former two estimations for a fixed received power the graphical relation between sigma and maximum Doppler shift is obtained. [C599]

"A low complexity iterative receiver with joint channel estimation and ICI cancellation for multi-antenna OFDM systems"

For a multiple-input multiple-output (MIMO) orthogonal frequency division multiplexing (OFDM) system, time-varying multipath fading of channel destroys the orthogonality among subcarriers and leads to serious intercarrier interference (ICI). The system performance degrades more severely as normalized Doppler frequency increases.

In order to mitigate the effect of time-varying fading, a low-complexity iterative receiver with joint ICI cancellation and pilot-assisted channel estimation is proposed. The initial channel state information (CSI) is estimated by performing time-domain interpolation and least-square (LS) method on the received pilot symbols. The soft outputs are obtained from the decoders after low-complexity linear minimum mean-square error (LC-LMMSE) detection. In the following stages, the soft outputs are feedback to update the CSI estimation. Furthermore, a Г‚Вїlinear statistics combiningГ‚Вї (LSC) technique is used to improve the performance of the proposed equalizer by combining the outputs of LC-LMMSE and parallel interference canceler (PIC) with weighting coefficients estimated by maximizing the signal to interference-plus-noise ratio (SINR) at the output of LSC. The complexity of system is significantly reduced by restricting the interference to neighboring subcarriers and employing the LC-LMMSE by limiting the frequency-domain CSI into diagonal region. The simulation results show that the proposed iterative receiver with estimated CSI approaches the ICI-free bound even at very high mobility scenarios. [C600]

"An iterative channel estimator for fast-varying channels using successive OFDM symbols"

This paper deals with pilot-based channel estimation for fast varying channels in Orthogonal Frequency Division Multiplexing (OFDM) systems. Due to the variation of the channel during one OFDM symbol, one-tap channel estimation and the corresponding equalization is no longer the optimum solution and such a variation results in inter-carrier interference (ICI). One of the possible approaches to predict this interfering effect is to use basis expansion model (BEM) with which the variation of the channel can be approximated successfully. However, as the pure BEM does not solve completely the problem, we investigate the estimation problem using decision feedback to enhance the performance. In particular, we propose a simple algorithm based on using two successive OFDM symbols to filter channel coefficients and improve not only the convergence of pure decision feedback based estimation but also the system performance. Simulation results based on Jake's channel model with a high Doppler spread and a practical high data rate system sustain our claims. [C601]

"Virtual MIMO schemes for downlink space-frequency coding OFDM systems"

In this paper we investigate the performance of single-relay cooperative scheme, where the source is equipped with a 2-antenna array and both the relay and destination with a single antenna. We consider Amplify-and-Forward, Decode-and-Forward and Selective Decode-and-Forward relaying protocols and a space-frequency block coding designed for DL OFDM based systems is employed. Signals expressions are derived for each relay protocol under various scenarios, considering power constraint imposed on cooperating nodes. The aim of this work is to evaluate this Virtual MIMO scheme in realistic scenarios (e.g. correlated antennas, precise channel models, Doppler effects) for implementation purposes in a system with LTE based parameters and considering channel turbo coding. The coded performance of the proposed Virtual MIMO scheme is evaluated, and compared against non-cooperative OFDM based systems, for typical pedestrian scenarios based on LTE specifications. The proposed cooperative scheme outperforms the co-located MISO and MIMO for some scenarios. [C602]

"Noncontact ultrasonic particle manipulation for a long distance in air using a bending vibrator and a reflector"

Ultrasonic manipulation of small particles, including liquid droplets, over long distances is discussed. We used an experimental setup consisting of a 605-mm-long duralumin bending vibrating plate and a reflector. Two bolt-clamped Langevin transducers with horns were attached to both sides of the vibrating plate to generate flexural vibrations along the plate. A plane reflector with the same dimensions as the vibrating plate was installed parallel to the plate at a distance of approximately 17 mm to generate an ultrasonic standing wave between them and trap the small particles at the nodal lines. The acoustic field and acoustic radiation force between the vibrator and reflector were calculated by finite element analysis to predict the positions of the trapped particles. The sound pressure distribution was measured experimentally using a scanning laser Doppler vibrometer. The flexural wave was excited along the vibrator at 22.5 kHz. A lattice standing wave with a wavelength of 35 mm in the length direction could be excited between the vibrator and the reflector, and polystyrene spheres with diameters of several millimeters could be trapped at the nodal lines of the standing wave. The experimental and calculated results showed good agreement for the relationship between the driving phase difference and the positions of the trapped particle. Noncontact transportation of the trapped particles over long distances could be achieved by changing the driving phase difference. The position of the trapped particles could be controlled to an accuracy of 0.046 mm/deg. An ethanol droplet could also be trapped and moved. [C603]

"A theoretical combination of frequency modulation and Doppler Effect"

This paper presents a theoretical combination of frequency modulation and Doppler effect. We consider a single frequency source which moves on a path depending on a message and we will show in the simulation results

that a receiver which is sufficiently far away from the source receives the FM wave corresponding to the message. We discuss on two of the most important possible paths in detail. These two paths are linear path when the message controls the source's velocity and circular path when the message controls the angel of movement. Also we show the simulation results of these two states and from these results, the modulated message in both states is the same as the modulated message in other common ways, however modulation in this way is directive and could be done in low power and these could be considered as some advantages of this method. [C604]

"An Improved Algorithm for Fast Bit Synchronization Based on π/4-DQPSK in Underwater Acoustic Communication"

This paper draws on a bit synchronization algorithm used for terrestrial wireless communications π/4-DQPSK modulation mode and shapes the algorithm based on the characteristics of the Doppler effect of underwater acoustic channel. Simulation results show that the improved algorithm is more robust against the Doppler effect of underwater acoustic channel while maintaining the good performance of the original algorithm. [C605]

"Wideband discrete transformation of acoustic signals in underwater environments"

We propose the use of discrete time-scale transformations of acoustic signals to characterize the wideband effect of underwater environment propagation. The representation depends on the Mellin transform, and it can be used to efficiently process the effect of the underwater environment. For sparse environments, we also consider a new approach with reduced computational complexity. The approach is based on a warping lag-Doppler filtering technique in the wideband ambiguity function plane to separate ray paths and estimate their parameters. We validate the signal representation and filtering approach using real experimental data from the BASE07 experiment. [C606]

"Laser-induced fluorescence diagnostic for ions or atoms"

The laser-induced fluorescence (LIF) diagnostic is a powerful non-intrusive tool to obtain velocity distribution function of ions or atoms, with a good time (≈ μs) and space (≈ 0.1 mm) resolution. LIF uses the optical pumping of an ion or atom transition by a laser frequency shifted by Doppler effect: if ωLis the laser frequency, ω0the ion or atom transition frequency at rest, and V the ion or atom velocity along the laser beam v = 2πc ωL-ω0/ωL. The level of LIF emitted by ions or atoms inside the probed volume is recorded, and by scanning the laser frequency we obtain a fluorescence signal proportional to the number of pumped ions or atoms, i.e. at the resonant velocity and consequently the velocity distribution function along the laser beam for the probed species. [C607]

"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. [C608]

"Performance of coded CS-CDMA/CP with iterative detection over multipath fast fading channels and its comparison with W-CDMA"

This paper studies the impact of fast fading on the performance of coded convolutional spreading CDMA with cyclic prefix (CS-CDMA/CP) combined with iterative detection, which was originally proposed for multiuser interference-free (MUI-free) downlink transmission over a quasi-static multipath fading channel. We show that the CS-CDMA/CP system in conjunction with a single pilot, with zero-correlation-zone code from an M-sequence (M-ZCZ), and with iterative detection works also well for fast fading, and the impacts of Doppler spreads can be made negligible without bandwidth efficiency loss by the employment of excess channel spread configuration and iterative partial multiuser detection. We compare the proposed system and the standard W-CDMA system for downlink transmission by simulation and show that both systems enjoy time-diversity effects of fast fading and that, although the W-CDMA system performs better for a small number of users, the CS-CDMA/CP system performs much better for the number of users from moderate to as large as processing gain. [C609]

"Analysis on Starting Probability of Pseudo-Random Binary-Phase-Coded Fuze under Noise AM

Jamming"

The impact of noise AM jamming on starting probability of pseudo-random binary-phase-coded fuze (PRBPCF) is researched in this paper. Analysis model of the starting probability is set up, and the starting probability of the PRBPCF is deduced under noise AM jamming. Factors influencing the starting probability are discussed. The simulation results show that the starting probability is affected not only by jamming to signal ratio (JSR) of reaching receiver and interference bandwidth, but by pseudo-random code period, code-element width, receiver bandwidth, Doppler frequency, and comparator threshold. The starting probability of fuze is an important anti-interference performance indicator, anti-interference performance of fuze can be assessed by studying it. [C610]

"EXIT chart analysis for the bit-interleaved turbo frequency domain equalization under fast fading environments"

Time variation of wireless fading channels introduces interference in block-based transmissions such as orthogonal frequency division multiplexing (OFDM) or single-carrier frequency domain equalization (SC-FDE). The interference, called inter-carrier interference (ICI) in OFDM or residual inter-symbol interference (ISI) in SC-FDE, impacts the bit error rate performance resulting in an error floor. In this paper, we investigate the performance of the bit-interleaved turbo frequency domain equalization (Bi-TFDE) over frequency-selective fading channels with the residual ISI. We focus on the impact of the residual ISI on the convergence signal-to-noise ratio (SNR) threshold using the extrinsic information transfer (EXIT) chart. We first show that the Gaussian assumption of the soft information within the TFDE corrupted by the residual ISI can accurately track the flow of the extrinsic information in the iterative procedure. Then, we demonstrate the accuracy of the EXIT chart in predicting the transfer function of the equalizer. Hence, the convergence behavior of the TFDE, with the residual ISI, is parameterized by the product of the symbol block length and Doppler spread. The accuracy of our EXIT chart prediction is verified by simulation. [C611]

"Imaging the auditory system: A new application of high-frequency ultrasound"

This work describes an ex-vivo imaging study of the auditory system using high-frequency ultrasound. Tissue structures relevant to hearing disorders were imaged using a realistic in-vivo approach and a custom built 50 MHz annular-array imaging system. Images were generated of the middle ear and features of the tympanic membrane and ossicles could be visualized. Images were also generated of the inner ear where the basilar membrane could be visualized. The comparison of ultrasound images with Г‚Вїpost-imagingГ‚Вї microscopic photos showed that features of the ossicles and the cochlea agreed with the ultrasound images. A 1 mm diameter Doppler probe has also been fabricated and pulsed-wave Doppler measurements were performed through the round window membrane on a fresh in-tact temporal bone as sound was applied to the ear canal. [C612]

"Investigation of target altitude estimation in skywave OTH radar using a high-resolution ionospheric sounder"

This paper presents selected results from a novel ionospheric sounding experiment aimed at exploring the multipath propagation effect that is the basis for target altitude estimation in skywave OTH radar. To date the multipath propagation models that underpin altitude estimation algorithms have not been experimentally validated and it is believed that this accounts for instances of poor algorithm performance. As a first step in remedying this situation, measurements were made of the oblique skywave propagation channel between an OTH radar and an aircraft target at altitude over the sea. This experiment was conducted using an aircraft-borne transmitter and a ground-based HF sounder receiver. Resulting high resolution oblique ionograms are presented which demonstrate E-mode range-resolved altitude multipath. Examples are shown where raw ionogram data is processed to successfully estimate the aircraft altitude by using a simple E-mode multipath propagation model. [C613]

"Radar high resolution range & micro-Doppler analysis of human motions"

In radar imaging it is well known that relative motion or deformation of parts of illuminated objects induce additional features in the Doppler frequency spectra. These features are called micro-Doppler effect and appear as sidebands around the central Doppler frequency. They can provide valuable information about the structure of the moving parts and may be used for identification purposes [1]. Previous papers have mostly focused on ID micro-Doppler analysis [2-4]. In this paper, we propose to emphasize the analysis of such "non stationary targets" using a 2D imaging space, using both the micro-Doppler and a high range resolution analysis. As in 2D-ISAR imaging, range separation enables us to better discriminate the various effects caused by the time varying reflectors. We will focus our study on human motion. We will see how micro-Doppler signature can be used to extract information on pedestrians gait. We will show examples on simulated and experimental data.

[C614]

"Effect of bubble interaction on contrast agent destruction behaviour under repeated insonation"

The controllable destruction of ultrasound contrast agents plays an important role in quantitative molecular imaging, perfusion estimation, and drug delivery applications. In general, repeated insonation is required to destroy all microbubbles (MB) present. It is expected that MB destruction will depend on MB concentration due to MB interaction and varying attenuation. While attenuation is expected to reduce destruction rates for high concentrations, microbubble interaction may lead to the increased destruction of bubbles during a single pulse sequence. Therefore, we investigate the dependency of the rate of destruction events on the concentration of hard shelled MB to analyze the influence of microbubble interaction. To immobilize the MB during the repeated insonation, microbubbles were embedded in gelatine. Destruction events of single, stationary bubbles can be visualized in Doppler images. This allows the quantification of events in a sequence of frames and thus offers a possibility to analyze destruction rates. Four phantoms with concentrations ranging from 6Г‚В·104to 1.5Г‚В·106MB/ml were imaged with a Vevo770 system and a RMV 707B scanhead (Visualsonics) in Power Doppler mode. From the total number of colored pixels the number of destruction events was calculated. These were then normalized to the total number of events for a frame sequence to allow comparison of the different concentrations. The results show that the relative decrease of destruction events is slower for lower concentrations. Thus, the results indicate that for high concentrations the destruction threshold of MBs is lowered by neighbouring bubbles. [C615]

"Frequency stabilization of a radio frequency excited CO2 laser using the photoacoustic effect"

Frequency stabilization of a RF excited CO2laser on the peak of the Doppler broadened gain curve using the photoacoustic effect generated from the laser itself is achieved. The photoacoustic signal is directly coupled from a RF discharge chamber using a condenser microphone into an amplifier and a lock-in stabilizer. The frequency stability is estimated to be better then 3Г‚ВґВ—10-8. [C616]

"Vehicular communication system for vehicle safety using RFID"

Vehicular communication system is a key part of intelligent transportation system (ITS) while vehicle safety communication (VSC) is a major target of vehicular communication. The use of radio frequency identification (RFID) system for vehicular communication has been proposed for pedestrian-safety. In this paper, an extended RFID system and infrastructure for vehicle safety communication through co-operative routing of information on vehicles' sudden motion and direction changes and warning messages for post-accident scenarios is proposed. It also provides a demonstration on the structure of warning codes and flow of information within the system and the vehicular ad-hoc network (VANET) for the vehicle safety. This paper also includes the simulation results for line-of-sight (LOS) communication and a special non-line-of-sight communication (NLOS) to observe the co-operative distance covered by co-operative routing and the related bit error rates (BERs). Doppler shift effect is also considered in the simulation. [C617]

"Fine air turbulence characterization by airborne weather radar"

Airborne weather radars have a specific Doppler mode for atmospheric turbulences avoidance. Indeed, turbulent areas may be encountered where classical reflectivity measurements do not indicate special hazards. Usually, the severity of turbulences is assessed from the measurement of the radial velocity variance of the wind field ahead, assuming that the turbulence has isotropic statistical properties. However, this measurement is not sufficient because the effect, in term of g-load on the aircraft, also depends on the spatial autocorrelation function of the wind field. This paper deals with an accurate method of turbulences assessment, even with low SNR, because the available power for such radars is limited. [C618]

"The ultrasound brain helmet for 3D transcranial Doppler imaging"

Transcranial Doppler imaging with contrast enhancement is a promising approach for visualizing a variety of cerebrovascular diseases requiring rapid treatment to minimize long-term effects. To address the time-sensitive nature of these diseases, we present a real-time 3D ultrasound scanner capable of simultaneously acquiring two trans-temporal volumes with color and spectral Doppler capabilities. To improve the clinical value of these scans, we also present fused, rendered 3D volumes and a rapid technique for registering these volumes. In an in vivo study, we were able to visualize blood flow in the internal carotid arteries, encouraging further development of this system. When combined with presented techniques for phase correction and instrumentation improvements, we envision these visualization techniques may potentially provide clinicians with a rapid, definitive tool to aid in diagnosis. [C619]

"Free-hand 3d optoacoustic imaging of vasculature"

Optoacoustic techniques allow imaging of tissue structures with optical contrast and acoustical resolution. This modality is ideal for visualization of blood vessels since haemoglobin is one of the best-absorbing tissue chromophores. It therefore can provide vasculature images with much higher contrast than pure ultrasound. If compared with standard techniques for blood imaging such as Doppler ultrasound, the major advantage of optoacoustic imaging is scalability allowing a resolution down to several Г‚Вїm. The availability of biologically conjugated nanoparticles further allows using this technique for molecular imaging where a precise localization of the abundance of biomolecules is desired in 2d and 3d. The strong spectral dependence of blood absorption properties will potentially allow multispectral optoacoustics for investigation of oxygenation level. While the location and size of vessels can be obtained with optoacoustic b-scans, the understanding of the network requires 3d data. We propose the use of a stereo-camera in order to track the transducer position for fast and convenient acquisition of 3d optoacoustic data. [C620]

"Complex shear modulus of thermally-damaged liver"

The complex shear modulus of fresh and thermally damaged porcine liver has been measured, in vitro, using an ultrasonic shear wave imaging technique. Measurements were compared to two constitutive models, Kelvin-Voigt and Zener, to estimate the complex modulus of liver for shear wave frequencies between 50 and 300 Hz. An axially vibrated needle placed in the liver excites harmonic shear waves that are imaged using a pulsed Doppler technique. Liver heated to 47Г‚В°C for 90 min was found to have little measurable cellular damage, and yet the elastic shear modulus increased by a factor of two and the viscous shear modulus increased by a factor of three in this frequency range. These observations imply that elastic properties, especially the viscous shear modulus, may be a sensitive indicator of thermal damage. Also, within the testing bandwidth for shear waves, the Zener model represented the data better than the Kelvin-Voigt model. [C621]

"Bandwidth Doppler Tissue Imaging (BDTI)"

Doppler Tissue Imaging (DTI), as used at present, is angle-dependent. in that it only measures the velocity component along the ultrasound beam direction. There is an ongoing need in cardiology for imaging and measurement techniques which are angle-independent. Bandwidth Doppler techniques as have been described for blood flow have potential for angle-independent tissue motion measurement. Results are presented of BDTI signals from a tissue phantom and in vivo myocardium. [C622]

"Characterization of 3-D flow structures in the stenosed carotid bifurcation with plaque ulceration"

Carotid plaque ulcerations, or irregularities in plaque surface morphology, have been identified as an independent risk factor for ischemic stroke. Our previous studies using Doppler ultrasound (DUS) have indicated significant flow disturbances distal to ulceration in the atherosclerotic carotid bifurcation, as characterized by parameters such as turbulence intensity (TI). Additional tools are needed to understand the implications of such flow abnormalities on the risk of thrombogenesis and cerebral ischemic events. Numerical simulations using computational fluid dynamics (CFD) can supplement experimental DUS studies, providing higher resolution, time-resolved models of 3-D flow fields. CFD is also able to quantify hemodynamic factors that indicate thromboembolic or plaque rupture potential. We report a CFD analysis of an ellipsoidal ulcer model and a matched non-ulcerated model in a moderately stenosed carotid bifurcation, with the same vessel geometries and flow conditions used in our previous DUS studies. The CFD models used a spatial finite element discretization of over 160,000 quadratic tetrahedral elements to adequately resolve the flow field. Pulsatile flow simulations with boundary conditions and flowrate waveforms matching DUS experimental conditions were iterated for ten cardiac cycles. Turbulence intensity was calculated for the CFD models and compared with DUS experimental results. The CFD models were able to capture differences in flow patterns between cardiac cycles. As observed in the empirical DUS results, the CFD ulcer model displayed higher levels of TI in the post-stenotic region than the CFD non-ulcerated model. The extent and magnitude of TI was comparable to the DUS results, after modeling for the effects of sample volume geometry, intrinsic spectral broadening, and a high pass filter. Furthermore, the CFD results indicate that sampling volume size and location have an effect on DUS quantification of TI in the post-stenotic carotid artery. Sma- ll elevations in maximum shear stress, transit time, shear exposure and level of threshold activation were observed in the ulcerated model, as compared to the non-ulcerated model. CFD facilitates the comparison of hemodynamic parameters between ulcer models and may help to demonstrate the risks of embolism or plaque rupture posed by ulcerated atherosclerotic plaques in the carotid bifurcation. [C623]

"Refracto-vibrometry for visualizing ultrasound in small-sized channels, cavities and objects"

A novel method for measuring and visualizing actually invisible ultrasound in transparent media was developed

and tested by the authors. This non-contact method is based on a conventional Scanning Laser-Doppler Vibrometer (SLDV). As measuring effect the variation of the optical refractive index n of transparent media, caused by ultrasound, is used. This justifies the denomination Г‚Вїrefracto-vibrometryГ‚Вї. The method can be applied to measuring and visualizing ultrasound fields in gases, liquids or pellucid solid objects even in small-sized dimensions. The paper summarizes the theoretical fundamentals of the method and describes the technical equipment and the know-how required for effective measurements. As examples the propagation, reflection and absorption of ultrasound in narrow channels with perpendicularly arranged branch lines, in cavity resonators and in cm-sized Perspex objects are presented. [C624]

"Candidates for estimating carrier frequency offset in MIMO systems"

In wireless communication, the mismatch between the transmit and receive oscillators and Doppler effect result in carrier frequency offset (CFO) which has a big effect on communication systems. Estimation of frequency offset is becoming an important, urgent, and practical issue needed to be cared for, especially in multiple input-multiple output (MIMO) systems. The fact shows that an inaccurate frequency offset estimate will reduce the accuracy of other system parameter estimates, which diminishes the expected spectral efficiency of the MIMO antenna system. Regarding to this problem, two algorithm candidates are presented to estimate carrier frequency offset exactly in a MIMO system in this paper. While the first one focus on matrix algorithm, the second one which is more complicated is a subspace-based approach called MUSIC (MUtilple SIgnal Classification) to overcome the limit of DFT resolution. [C625]

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

Wind turbines may degrade the quality of the hydro-meteorological data obtained by weather radars. This degradation is difficult to estimate, and it is necessary to develop a procedure to obtain accurate results of the reflectivity values from the wind turbines and the affected area. This contribution outlines a methodology to estimate the clutter generated by a specific wind farm on a weather radar. The methodology is based on the estimation of the RCS of each wind turbine of the wind farm, and includes the filtering and data processing stages of the weather radar. The proposed method has been applied to a specific case. [C626]

"Model based approach for time-varying channel estimation in DS-CDMA systems using non-isotropic scattering environment"

This paper deals with the estimation of rapidly time varying non isotropic Rayleigh fading channels in synchronous direct sequence spread spectrum (DS-CDMA) systems. The effects of non isotropic scattering can be captured by using Von Mises distribution for the angle of arrival (AOA) of the scattered waves at the receiver. Kalman Filter based on higher order autoregressive (AR) model is used for tracking and estimation of the non isotropic Rayleigh channel. The proposed algorithm works much better than AR(1) based algorithms in tracking time varying channel especially on high Doppler spreads in directional scenarios. However, it is observed, the computational cost of the proposed algorithm increases when the AR model order increases. [C627]

"Doppler ICI cancellation for space-time trellis coded MIMO-OFDM systems"

In MIMO-OFDM systems, the time-varying fading of channel can destroy the orthogonality of subcarriers. This causes serious intercarrier interference (ICI), thus leading to significant system performance degradation, which becomes more severe as the normalized Doppler frequency increases. In this paper, we propose an effective scheme to eliminate ICI for space-time trellis-coded (STTC) systems. By restricting the interference to the limited number of neighboring subcarriers, the computational complexity of our proposed receiver can be significantly reduced. Simulation results show that the proposed MIMO-OFDM receiver can effectively mitigate the effect of ICI and approach the ICI-free performance over time-varying frequency-selective fading channels. [C628]

"Tissue vibration pulsatility for arterial bleeding detection using Doppler ultrasound"

Trauma is the number one cause of death among Americans between 1 and 44 years old, and exsanguination due to internal bleeding resulting from arterial injuries is a major factor in trauma deaths. We have evaluated the feasibility of using tissue vibration pulsatility in arterial bleeding detection. Eight femoral arteries from four juvenile pigs were punctured transcutaneously with a 6 or 9-French catheter. Also, 11 silicone vessels wrapped with turkey breast were placed in a pulsatile flow phantom and penetrated with an 18-gauge needle. The tissue vibration pulsatility was derived as a ratio of the maximum spectral energy from 200 to 2500 Hz of tissue vibration in systole over a baseline value in diastole. Then, the tissue vibration pulsatility index (TVPI) was defined as the maximum tissue vibration pulsatility value for each experimental condition. Both in vitro and in vivo results showed that the TVPI from injured vessels is significantly higher ($p<0.005$) than that of intact vessels. In addition, we constructed the 2D map of tissue vibration pulsatility during in vitro studies and found

that it could be used for spatial localization of the puncture site. Our preliminary results indicate that the tissue vibration pulsatility may be useful for detecting arterial bleeding and localizing the bleeding site. [C629]

"Radar techniques for human gait automatic recognition"

In this paper we extend the investigation on the use of Doppler signatures for human motion detection. As it is well known, human movements generate additional Doppler frequencies on top of the main Doppler carrier. In recent times research has been trying to exploit this effect for dynamic feature extraction and, consequently, automatic target recognition. Here a simulation tool is developed and measurements are presented as a term of comparison. Several scenarios that model arbitrary trajectories and multiple targets are analyzed. Finally we provide an insight into the potential using more than one sensor. This may improve dramatically the performance of the system as it does in many other radar applications. [C630]

"Radar micro-doppler for long range front-view gait recognition"

We seek to understand the extraction of radar micro-Doppler signals generated by human motions at long range and with a front-view to use them as a biometric. We describe micro-Doppler algorithms used for the detection and tracking, and detail the gait features that can be extracted. We have measurements of multiple human subjects in outdoor but low-clutter backgrounds for identification and find that at long range and front-view, the probability of correct classification can be over 80%. However, the micro-Doppler signals are dependent on the direction of motion, and we discuss methods to reduce the effect of the direction of motion. These radar biometric features can serve as identifying features in a scene with multiple subjects. Ground truth using video and GPS is used to validate the radar data. [C631]

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

This paper quantitatively describes the detection performance of the airborne pulse Doppler Radar (PDR) in Integrated Electromagnetic Environment (IEE). It is significant to benefit the aircraft in anti-jamming, which is a necessary condition to fight for the information dominance in the air combat. It discusses how to construct a real-time detection model framework of the airborne PDR, and models the noise, clutter and active jamming to simulate the effects in a real IEE. The model may precisely exhibit the detection performance with all kinds of jamming modes. Its real-time ability completely meets the limit of the step time (500 ms) in the HLA federation. [C632]

"Analysis of sea clutter in distributed shipborne OTH radar"

In distributed shipborne high frequency (HF) surface wave over-the-horizon radar (DS-OTHR) system, the movement of radar can make the system more complex. In this paper, we analyze the geometrical change of the distributed shipborne system with the T-Rnmechanism and its effect to the echoes of target and sea. Then we discuss the method to get the range and velocity of target in this dynamic system, make a detailed analysis on the broadening spectrum of first-order sea clutter. Moreover, we study the space-time distribution characteristics of first-order sea clutter and research the azimuth difference of the target and sea clutter with the same Doppler frequency. Finally, simulation proves the correctness of the analysis of the first-order sea clutter in this system. [C633]

"The multi-path scattering characteristics in SAR image of cylinder cavity"

In this paper, the shooting and bouncing ray (SBR) technique is employed to calculate the scattering of the cylinder cavity and by combining with range Doppler algorithms (RDA), the SAR image of the cylinder cavity is accurately obtained. Furthermore, the results reveal the effects of multi-path scattering mechanisms happened in the cavity, and also we give a detail explanation of the interference of multi-path scattering mechanisms on SAR imagery. And we point out for the first time that the cloud phenomenon in the down range is corresponding to focus mechanisms, which is totally different from that in the across range. Our present quantitative investigation provides guidelines for the SAR target recognition. [C634]

"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. [C635]

"BER performance of OFDM system with channel impairments"

This paper analyzes the bit error rate (BER) performance of orthogonal frequency division multiplexing (OFDM) system. We derive the BER performance of OFDM system, and quantify the effects of channel impairments such as Doppler shift due to user mobility and high-power amplifier (HPA) distortion when amplifying the transmitted OFDM symbol. It is shown that the resulting inter-carrier interference (ICI) generated by these impairments becomes very significant in OFDM system, and severely degrades its BER performance. Simulation results match well and verify the analysis. [C636]

"Study on jamming effect of pseudo-random binary-phase-coded fuze based on starting probability"

Under radio frequency (RF) noise jamming, jamming effect of pseudo-random binary-phase-coded fuze (PRBPCF) is researched based on its starting probability. Analysis model of starting probability is set up, and the starting probability of the PRBPCF is deduced under RF noise jamming, Factors influencing the starting probability are discussed. The simulation results show that jamming effect of the PRBPCF is affected not only by jamming to signal ratio(JSR) of reaching receiver and interference bandwidth, but by pseudo-random code period, code-element width, receiver bandwidth, Doppler frequency. Theory and practice prove starting probability is practicable to be used to evaluate jamming effect of the PRBPCF, and can be applied to engineering practice. [C637]

"Modeling of wideband HF ionosphere channel and research on its equivalent characteristics"

This paper starts with a brief introduction of the ITS channel model. Based on its mathematic and modeling structure, a wideband HF (WBHF) random time-varying ionosphere channel is modeled, and its equivalent characteristics are theoretically analyzed and verified by studying the measured data and computer simulations. With such equivalent characteristic of the channel, identical parameters can be obtained. The parameters not only contain the channel's natural information, but also the information of the two communication sides. Therefore, the study of the identical characteristic is valuable in information conveying field. [C638]

"Experimental characterization of a vector doppler system based on a clinical ultrasound scanner"

We have developed a vector Doppler system using a clinical ultrasound scanner with a research interface. In this system, vector Doppler estimation is performed by electronically dividing a linear array transducer into a transmit sub-aperture and two receive sub-apertures. The receive beams are electronically steered, and two velocity components are estimated from echoes received from the beam overlap region. The velocity vector is reconstructed from these two estimates. The goal of this study was to characterize this vector Doppler system in vitro using a string phantom with a pulsatile velocity waveform. We studied the effect of four parameters on the estimation error: beam steering angle, angle of the velocity vector, depth of the scatterer relative to the beam overlap region and the transmit focus depth. Our results show that changing these parameters have minimal effect on the velocity and angle estimates, and robust velocity vector estimates can be obtained under a variety of conditions. The mean velocity error was less than 0.06 times pulse repetition frequency. The velocity estimates are sensitive to the Doppler estimation method. Our results indicate that vector Doppler using a linear array transducer is feasible for a wide range of imaging parameters. Such a system would facilitate the investigation of complex blood flow and tissue motion in human subjects. [C639]

"The theoretical study of wave propagation along the coaxial waveguide filled with moving magnetized plasma"

Theoretical study on the theory of wave propagation along the coaxial waveguide filled with moving magnetized plasma (MMPCW) is presented in this paper. The discussion about the eigen values of the waves and studies on the fields are carried out. Numerical calculations show that because of Doppler Shift effect, the eigen values of the modes is quite different from those of the stationary magnetized plasma (MPCW). And discussions on the dispersion characteristics are presented. [C640]

"Terahertz wave generation using the Doppler effect in photoexcited semiconductors"

Doppler frequency up conversion using optically generated electron-hole plasma in a planar transmission line

has been investigated as a potential means for generating high power terahertz waves. Experiments performed at millimeter wavelengths have clearly proved that the Doppler frequency conversion with a frequency up conversion ratio of more than five can be achieved in a slotline with an optically excited silicon substrate. [C641]

"Simulation of NLOS WiMAX-IEEE 802.16e Physical Layer Using MIMO Doppler Channel Model with Imposed Comb Pilots"

WiMAX being the first standard based on OFDM/OFDMA and MIMO technologies with extensive IP capabilities. Here in this paper we have attempted to simulate the physical layer that takes into consideration vehicular mobility associated and time based changing effects for a typical WiMAX IEEE 802.16e-2005 channel-environment. In the first phase, we have mainly considered the NLOS WiMAX link and then developed a channel model that incorporates Doppler effect and simulated the whole link. The results of the simulations depicts that effects of doppler being not very serious for single carrier transmissions, however, during multi-carrier transmissions the effect are serious and requires more rigorous modeling especially with MIMO and study to estimate the channel response. The mentioned channel effects, perturb the orthogonality (amongst the carriers) as the sub-carriers being very close to each other. While, in the second phase of our study, issues related to estimation at the receiver end (processing) have been dealt with vis-agrave-vis, fast fading and frequency selective effects (due to vehicular mobility) in frequency domain, frequency domain power spectrum estimation methods (most changes are observed in frequency domain). To estimate a time varying, MIMO Doppler channel using spectrum estimation methods, a imposed pilot pattern is used as this consumes minimum spectrum and lesser power though it differs from the standard. Through this simulation study, channel estimation issues are investigated, discussed and presented. [C642]

"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. [C643]

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

New scalable and flexible waveforms offer a great number of new opportunities for object- or environment-tailored signal processing. The paper will discuss two classes of such flexible waveforms, i.e. single carrier waveforms with orthogonal modulations and multiple carrier coded waveforms. These waveforms may for instance be used for the benefit of scalable resolution, fast unambiguous Doppler assessment, two-channel code-orthogonality supporting to measure the full back scatter matrix in radar polarimetry, and message transfer in a network by radar. [C644]

"Comparison between Pseudomeasurement and DD2 filters in exoatmospheric Ballistic Missile engagement"

This paper deals with the problem of exoatmospheric tracking of a Ballistic Missile (BM) from an interceptor (or pursuer) moving towards the ballistic target. During the terminal guidance phase of the engagement, the on-board seeker provides noisy measurements of range, azimuth, elevation and range rate (or Doppler). Using the available seeker observations, the position and the velocity of the target can be estimated by a nonlinear tracking filter. Filter initialization is realized by means of a ground radar that tracks the ballistic target until the first measurement from the seeker becomes available. Then a proportional navigation guidance law is applied in order to guide the path of the interceptor towards the intercept point of the purser and the BM. The performance of the interceptor missile guidance system is influenced by the seeker and the autopilot dynamics that, in this paper, are both modeled with single lag transfer functions. Effects of different kinds of nonlinearities (i.e. saturation of lateral acceleration and saturations at the seeker) in the guidance loop are considered as well. The Extended Kalman Filter (EKF) has probably been the most widely used estimation technique for this complex nonlinear filtering problem. Nevertheless it is known that the EKF, which is based on a first order Taylor approximation of the equation of motion and/or the measurement equation, has a bias in its estimate and could in addition have convergence problems; both of these drawbacks are due to the underlying approximations. In this paper two filters are compared for the problem of tracking a BM during its exoatmospheric portion of flight: the Pseudomeasurement filter and the second order divided-difference filter (DD2 filter). A full three-dimensional engagement scenario has been simulated to assess the performance of the two considered estimation techniques and to determine the miss distance accurately. The simulation results show that both filters have adequate perfo- rmance for the proposed problem. [C645]

"Computer simulation of the RF system effects on a millimeter-wave Doppler radar for human vital-signal estimation"

A detailed modeling and analysis for the effect of the RF system on the human vital-signal estimation by a 60-GHz millimeter-wave Doppler radar has been developed. The simulation scheme uses the root-MUSIC algorithm to calculate the frequency error ratios of the estimated heartbeat and breathing signals by the radar detection system. From the simulation results, it is found that root-MUSIC method is robust to analyze the effects of phase noise on the frequency estimation of the detected heartbeat and breathing signals. The simulation result will be very useful for the RF system design specifications for the millimeter-wave Doppler radar. [C646]

"Performance assessment techniques for doppler radar physiological sensors"

This paper presents a technique for assessing the performance of continuous wave Doppler radar systems for physiological sensing. The technique includes an artificial target for testing physiological sensing radar systems with motion analogous to human heart movement and software algorithms leveraging the capabilities of this target to simply test radar system performance. The mechanical target provides simple to complex patterns of motion that are stable and repeatable. Details of radar system performance can be assessed and the effects of configuration changes that might not appear with a human target can be observed when using this mechanical target. [C647]

"Verification of a non-contact vital sign monitoring system using an infant simulator"

In this paper, experimental result using a 5.8 GHz Doppler radar to monitor the variations of vital signs of an infant simulator under different medical conditions is presented. The infant simulator can mimic cardiovascular derangements seen in critically ill infants. The result demonstrates the system is capable of tracking a majority of the changes in heart rate and respiratory rate. Analysis suggests possible techniques for further improvement, such as direct coupling circuit, carrier frequency tuning and spectral analysis. [C648]

"Comparative analysis of seismocardiogram waves with the ultra-low frequency ballistocardiogram"

Simultaneous seismocardiogram (SCG) and ultra-low frequency ballistocardiogram (BCG) signals are recorded. Preliminary results from the BCG helped tag which waves on the SCG are related to the rapid systolic ejection and aortic valve closure events. These results agreed with and further confirmed previous findings using the echocardiogram. This is the first reported work on comparisons of SCG and BCG signals and provides a setup to study the effects of arterial circulation on the morphology of the SCG signal. [C649]

"Non-contact respiratory rate measurement validation for hospitalized patients"

This paper presents the first clinical results for validating the accuracy of respiratory rate obtained for hospitalized patients using a non-contact, low power 2.4 GHz Doppler radar system. Twenty-four patients were measured in this study. The respiratory rate accuracy was benchmarked against the respiratory rate obtained using Welch Allyn Propaq Encore model 242, the Embla Embletta system with Universal XactTrace respiratory effort sensor and Somnologica for Embletta software, and by counting chest excursions. The 95% limits of agreement between the Doppler radar and reference measurements fall within +/-5 breaths per minute. [C650]

"SINR Improvement in OFDM Systems Using VSB-VBL Technique for High Mobility Applications"

OFDM based wireless system provides high spectral efficiency but they are very sensitive to Doppler shift. High mobility causes the channel to be fast fading channel. The rapid variation of the channel can induce inter carrier interference (ICI). ICI due to carrier frequency offset can be mitigated by accurate frequency synchronization but ICI due to fast fading channel is more difficult to handle. Thus ICI reduces the throughput and increases the BER. In this paper we proposed an OFDM system which will use variable sub carrier bandwidth (VSB) with variable bit loading (VBL) to minimize the effect of ICI due to high mobility. We investigate the performance of such VSB-VBL OFDM system with fixed sub carrier bandwidth (FSB-OFDM) system based on signal interference to noise ratio (SINR). [C651]

"Mainlobe Width Reduction Using Linear and Nonlinear Frequency Modulation"

High range resolution can be achieved by various methods in a radar system. Simple pulse systems are narrow band, easiest and least expensive to maintain, but one can achieve only limited resolution. To achieve good range resolution pulse compression technique giving low range sidelobes is employed in radar and sonar. Pulse compression is accomplished by employing phase modulation and frequency modulation. Bi-phase coded waveform employs phase modulation techniques. The Barker codes are the only known bi-phase codes with

minimum sidelobes. In this paper, linear frequency modulation (LFM) and nonlinear frequency modulation (NLFM) are introduced in the bi-phase coded waveforms and their effect on the sidelobe levels, mainlobe width, Doppler tolerance are studied. [C652]

"Respiratory monitoring using a doppler radar with passive harmonic tags to reduce interference from environmental clutter"

A harmonic tag was designed and fabricated to show the feasibility of sensing cardiopulmonary related Doppler shift in the received second harmonic signal. A fundamental frequency of 2.45 GHz was transmitted at a target and a quadrature homodyne receiver used to sense the received signal from a tag on the target. The setup was used to successfully isolate periodic motion from a tag on a programmable mechanical target and to sense respiratory motion of a human subject, even when the targets were in close proximity to other moving objects. [C653]

"Ground moving target indication for MIMO-SAR"

The multi-input multi-output synthetic aperture radar (MIMO-SAR) is an innovative concept, which can bring high degrees of freedom for SAR system with limited transmitting/ receiving (T/R) elements. In this paper, ground moving target indication (GMTI) for MIMO-SAR is studied based on reasonable usage of the space-time equivalent samplings. Furthermore, this paper gives a deep insight of the azimuth Г‚Вїspurious peaksГ‚Вї effect, caused by the periodically modulated error signal due to the radial velocity of moving target. Also, the compensation method is given to suppress the unwanted Г‚Вїspurious peaksГ‚Вї. Finally, the numerical experiments are also provided to demonstrate the effectiveness of the MIMO-SAR GMTI. [C654]

"New development of ECS algorithm for SAR imaging processing"

Traditional extended chirp scaling (ECS) algorithm, after RCMC in the range signal/Doppler domain, can not equalize the FM rates of targets in the same range gate. In this paper, a novel approach for high squint missile-borne SAR data processing using a modified extended chirp scaling algorithm is proposed. A non-linear chirp perturbation function (CPF) is presented and can be applied to each range gate to equalize the targets FM rates before azimuth compression, which can accommodate azimuth compression and improve precision of algorithm. Comparison between this development named modified ECS with traditional ECS algorithm is implemented and several simulations of point targets demonstrate the validity. [C655]

"New SIMO single-carrier waveform designing for interference mitigation and high Doppler multipath environment"

In this paper, we present a single-carrier (SC) waveform with smart antenna and frequency domain equalization (FDE) technologies to effectively combat both urban multipath and radio interference. It is designed to be power efficient, spectrally efficient, high quality, and capable of operating at vehicular speeds with long range. It can work on a small form factor device to support transport of streaming video as well as command and control messaging. [C656]

"Research on FMCW SAR signal characteristic and improved azimuth matched filtering algorithm"

Theory and application study of Frequency Modulated Continuous Wave(FMCW) Synthetic Aperture Radar(SAR) imaging has gained more attention nowadays. Based on Range Doppler Algorithm(RDA), signal characteristic of FMCW SAR was analyzed in details, and aiming at the azimuth matched filtering problem a method named Scene Range Cell Covering Algorithm(SRCCA) was proposed. Simulation results indicate that accurate imaging can be achieved with no effect on calculation load for the scene of large swath. The proposed SRCCA is effective for azimuth compression. [C657]

"Range-Doppler measurements based target locating for active radar seekers"

This paper focuses on the estimation of the missile-target relative position using range-Doppler measurements. Firstly, we analyze the observability of the relative position for different trajectories in depth, and arrive at a very interesting conclusion: the missile must have the acceleration component `not aiming at target' to obtain the 3-D relative position of the target. Secondly, the relative position estimation methods, using measurement series, is presented. Through the computation of Cramer-Rao Lower Bound, we can see the effects on the location errors of the observation series length, the initial missile-target range, the cross-range and radial velocity of the missile, and the cross-range acceleration of the missile, respectively. [C658]

"Novel evaluation method of jamming effect on ISAR based on target detection"

Study on evaluation methods of ISAR jamming effect is to be an important research problem in electronic countermeasures (ECM). Up to now there is no generally accepted progress and objective criterion published. In this paper, on the basis of studying the image model of ISAR point target used the most classical range-Doppler(R-D) algorithm, equivalent jamming-to-signal ratio (EJSR) is utilized, and then the relation between image quality, jamming and jamming effect is built, and the evaluation index via recognition probability of point target is put forward. In the end, aiming to three kinds of typical blanket jamming modes, radio frequency(RF) noise jamming, frequency modulation(FM) jamming and amplitude modulation(AM) jamming, through simulation and analysis, the results indicate the validity and feasibility of the proposed method. [C659]

"On the design of a modern broadband communications waveform for tactical air-to-ground links"

Tactical air-to-ground channels present a number of challenges for physical (PHY) layer waveform design including: (i) airborne platform dynamics (i.e., Doppler, frequency offset, jerk, etc.), (ii) benign to severe ground-level multipath, and (iii) partial to full blockage of the line-of-sight (LOS) path. Legacy military waveforms are not sufficiently robust to operate effectively in these severe channels while providing the data rates required for modern tactical communications. This paper presents a waveform design incorporating flexible low-density parity-check (F-LDPC) forward error correction and a bandwidth efficient continuous phase modulation (CPM) that provides the required robustness and throughput for use in broadband tactical air-to-ground links. The proposed waveform employs per-survivor processing (PSP) and adaptive iterative detection (AID) in order to mitigate multipath and platform dynamics effects. It is demonstrated via simulation that the proposed waveform reliably delivers data rates of 1.3 Mbps over a single 1.2 MHz bandwidth channel and over 5 Mbps utilizing four 1.2 MHz carriers in both representative air-to-ground channels and other tactically relevant scenarios. Developed with the digital signal processing and RF front-end constraints of current software defined radio (SDR) platforms in mind, the proposed waveform is an excellent candidate for delivering robust, broadband connectivity in air-to-ground links. [C660]

"Kaiman filter based non-isotropic channel estimation in space-time coded DS-CDMA systems"

This paper deals with the estimation of rapidly time varying non isotropic Rayleigh fading channels in Space-Time (ST) coded direct sequence spread spectrum (DS-CDMA) systems. The effects of non isotropic scattering can be captured by using Von Mises distribution for the angle of arrival (AOA) of the scattered waves at the receiver. In order to benefit from the spatial diversity of ST coding, we need to have perfect channel information at the receiver. Kalman Filter (KF) with higher order autoregressive (AR) model is used for tracking and estimation of the non isotropic Rayleigh channel. The proposed algorithm outperforms the AR(1) based algorithms in tracking time varying channel especially under high Doppler spreads in directional scenarios. The effect of different Doppler rates and user loading on bit error rate (BER) performance of the proposed system are also studied. [C661]

"A fast fading channel estimation scheme for OFDM with sparse and scattered pilot symbols"

OFDM (orthogonal frequency division multiplexing) can utilize one-tap equalization for multipath (frequency selective) fading and is widely used in many wireless systems today. However, according to the demand for high-mobility communication and the use of higher carrier frequency, the influence of time selectivity of fading is increasing. Therefore, an accurate channel estimation of time and frequency selective fading is important for OFDM systems. To achieve this requirement, we have proposed a fading estimation scheme FFT to scattered pilot symbols in OFDM. However, the estimation accuracy of this scheme changes by the estimation order of the time and frequency direction, maximum Doppler frequency, and delay spread of fading. Therefore, in this paper, we propose an efficient fast fading channel estimation scheme for OFDM with an adaptive order switching. The performances of the proposed scheme are evaluated by computer simulations. [C662]

"An alternative index for monitoring microcirculatory blood flow: The beat-to-beat microcirculatory blood flow variability"

Objective: Cardiovascular variability analysis, such heart rate variability or blood pressure variability, provides important information about activities of various regulatory mechanisms for the cardiovascular system. Aim of the present study is to use the laser Doppler flowmetry (LDF) measurement to study the correspondent changes between the beat-to-beat microcirculatory blood flow (MBF) and its variation (MBFV). Methods: 17 trials were performed on 5 male healthy volunteers. For each experiment, we applied local heating (LH) stimulation and recorded a 20-minute heating-effect data sequence. For each pulse, DCflux (average LDF flux) was calculated, and CV (coefficient of variation) of DCflux (DCCV) was then calculated to evaluate the beat-to-beat MBFV. Results: The slope between DCCV and DCflux was negative with $R2>0.7$ ($p<0.01$ by F-test). Conclusion: Our

results suggest that by providing an alternative solution to overcome the major drawback for LDF measurement of lacking quantitative evaluation, MBFV parameters calculated from the beat-to-beat LDF waveform may have meaning in improving the evaluation for the LH response of the MBF perfusion. [C663]

"OFDM carrier offset estimation based on signal phase matching principle"

One of the major problem in applying OFDM to underwater channels is that it is vulnerable to carrier frequency offset (CFO) caused by transceiver mismatch and/or Doppler shifts. And the loss of orthogonality due to the CFO effects must be compensated before the demodulation with discrete Fourier transform. This paper proposes a novel CFO estimation technique for OFDM communications over an underwater acoustic channel. We exploit the intrinsic structure information of OFDM signals to derive a CFO estimator based on signal-phase-matching (SPM) principle. Simulation results show that the main advantages of the proposed technique are its computation simplicity and high accuracy. [C664]

"A Doppler bins elimination algorithm in a GPS signal acquisition system"

A Doppler bins elimination algorithm for a global positioning system (GPS) signal acquisition system is proposed. We use a two-step digital down conversion scheme in which an estimated Doppler frequency corresponds with two frequencies in the received signal. The Doppler bins are eliminated to 50% of the conventional scheme. Simulation results showed that the average acquisition time can be reduced to 50% under normal GPS signal condition. [C665]

"Effect of directional antennas at both ends of the radio link on the Doppler Power spectrum"

This paper presents the Doppler Power spectrum density (PSD) of a cellular mobile channel when directional antennas are deployed at both ends of the radio link. A macrocellular environment is modeled by assuming Gaussian and uniform scatter density around mobile station. The statistics of angle of arrival are used to explain the Doppler power density spectrum for macrocellular environment. Results are shown for various scenarios and the impact of the beamwidth of the directional antennas as well as the direction of motion of the mobile on Doppler PSD is investigated. [C666]

"An improved passive location algorithm based on UKF"

With the merits as far responding distance, hiding receiving and easy-deploying, the single observation passive location has a broad application in military domain and plays an important part in passive radar, navigation and aerospace, etc. With the information of phase-difference, phase-difference rate of change and Doppler frequency rate of change, a new algorithm called PFRC, based on EKF, is proposed. Compared with two popular passive location methods which are bearing-only (BO) and phase-difference rate of change (PRC), the PFRC has good performance in that it has higher precision and higher speed. However, the linearization processing of the EKF introduces truncation error, which degrades the estimation precision. In order to reduce the error, based on the PFRC and the unscented transform, an improved passive location algorithm is proposed. Simulation results show that the proposed algorithm has better estimation precision. [C667]

"Multi-parameter estimation of underwater acoustic channel based on fractional Fourier transform"

A novel estimation algorithm for multipath number, time delay and the Doppler shift in the underwater acoustic multipath channel is proposed. A double-chirp signal with a fixed time interval T is sent. And the fractional Fourier transform (FRFT) is applied to analyze the received signal. So at a specific order, a series of peaks will appear in the corresponding u domain. The relationships between the channel parameters with the intervals among the peaks are induced. Besides, it's not necessary to search for the order of the received signal as the result of the invariant characteristic of the chirp rate, which greatly improve the algorithm efficient. The simulation results show the effectiveness of the algorithm. [C668]

"Secrecy extraction from correlated fading channels: An upper bound"

The reciprocal nature of wireless radio channels can be well employed to extract a secret key between two terminals. The maximum size of a key that can be shared is characterized by the mutual information between the observations of two radios. We consider a correlated fading channel and a closed form for the mutual information is derived. It is found that the secrecy capacity is largely limited by the maximum Doppler frequency. [C669]

"Improve spaceborne SAR geometric accuracy using DORIS"

The paper analyzes the effects of the orbit position errors in terms of the geometric accuracy of the space-borne SAR based on the Range-Doppler method. The paper gives the simulation experiment results of the space-borne SAR geometric accuracy using DORIS, GPS and MADRAS. The results show the space-borne SAR geometric accuracy is 1 meter using DORIS, 80 meter higher than using MADRAS, and 50 meter higher than using GPS. [C670]

"Motion measurement errors in bistatic spotlight SAR"

This paper introduces a general approach to analyse the effect of the motion measurement errors (MMEs) on the bistatic spotlight synthetic aperture radar (SAR) images. The effect of MMEs is comprised of space-variant shift error and defocus. The space-variant shift error can be obtained by comparing the positions of the corresponding points with the same central range and Doppler centroid in the measured and actual geometry. And the defocus can be obtained by comparing the compensating phases of the corresponding points. The presented simulation demonstrates the general approach. [C671]

"An RLS channel tracking algorithm with an ordered selection technique for MIMO-OFDM systems in time-selective fading channels"

In this paper, we propose an ordered selection technique to improve the performance of the decision-directed RLS adaptive channel tracking algorithm in 2 ГґВ— 2 spatial-multiplexing MIMO-OFDM systems under high mobility. The proposed technique uses the decision of high reliability order during MIMO signal detection and then selectively activates the RLS adaptation only when less interference and error will be generated if a wrong decision is still made. Simulation results show that the channel tracking accuracy of the proposed approach outperforms the 2D-RLS algorithm and the conventional linear interpolation algorithm. Moreover, we also show that both ordering and selection are effective and necessary to greatly suppress the error propagation and coefficient misadjustment. With the proposed technique, the system performance has obvious SNR improvements. [C672]

"Touch-less heartbeat detection and cardiopulmonary modeling"

This paper presents a contact-less heartbeat detection system and a cardiopulmonary modeling. Using a vector network analyzer, our proposed microwave system shows the ability of detecting the heartbeat signal at different frequencies, as well as at different output power levels. Based on parameters extracted from real measurements, a model representing the heartbeat and the respiration signals is presented. Different processing techniques are used in order to separate the heartbeat and the respiration signals. For different signal to noise ratios, wavelet filters show higher accuracy over classic filters in determining both the heartbeat rate and the heart rate variability. [C673]

"Analysis of phase noise effect on noncooperative wideband bistatic receiver"

Noncooperative narrow-band coherent processing techniques have been developed, however, this capability for wideband signals processing require to investigate further. Of all the obstacles preventing coherent reception techniques from making transition into the optical domain, phase noise caused by system imperfections is one of them. This kind of phase error will defocus discrete scattering centres in the range-Doppler image, which will preclude target identification and analysis. The amount of phase noise in signal is directly related to its so-called bandwidth, the 3 dB line width of its power spectrum. Numerous investigators have studied the effects of laser phase noise. We will examine the effects it has on the performance of this receiver. Both theory and application of this original work is extended in this paper. The research defined a system configuration and assessed its potential performance via modelling. It was developed to support pulse compression of wideband waveforms for applications. The associated implementation issues introduced by electro-optical component characteristics were discussed. Coherent detection was used to implement difference mixing for subsequent digital processing. [C674]

"The empirical verification of the location method based on the doppler effect"

This paper deals with the new location method of radio wave sources, based on the Doppler effect. This unique approach was worked out on the ground of analytical solutions, that describe Doppler frequency in free-space propagation. In this method, position of the radio signal source is calculated on the basis of momentary frequency measurements taken by mobile receiver. Theoretical and simulating analysis of the presented methodology was made before empirical verification process was introduced. This analysis enabled to evaluate technical capabilities, precision and distance working range of this new location method. Following problems are discussed in this presentation: the review of present methods of radio signals sources location, general outline of the method on the basis of the Doppler effect and preliminary empirical verification results. [C675]

"Kaiser-bessel window weighting function for polyphase pulse compression code"

This paper discusses and shows how the range-time sidelobes of P4 pulse compression waveform can be substantially reduced by applying Kaiser-Bessel amplitude weighting function. Also, a comparison is made with classical amplitude weighting function (i.e. Hamming window) applied to the receiver waveform of 100 element P4 code. Effects of weighting on the Doppler performance of the P4 code are presented. [C676]

"Practical aspects of the doppler effect in mobile communication systems"

The purpose of this paper is to conduct theoretical analysis and calculation of transmitter motion influence on received signal parameters. The form of the straight electric field and the Doppler frequency is the result of the theoretical analysis presented in this paper. To solve of the wave equation we have made use of integral transformations i.e. the Laplace transform (in relation to normalized time variable) and the Fourier transform (in relation to space variables). Finally, the practical time aspects of the location signal source measurement on the basis of the frequency Doppler is presented. [C677]

"Experimental study of the ion thermalization at a Z-pinch at stagnation"

Summary form only given. The time-history of the ion-kinetic energy Ekionthroughout the stagnation phase of a neon-puff, 500 ns, 600 kA, Z-pinch implosion was determined. The X-ray spectroscopic system provides a resolving power of 6700 and four consecutive time gated (~1 ns) spectra. A simultaneous axial imaging allows for studying the ion kinetic energy at 0.1-mm-resolution along the pinch column. Ekionin the stagnating plasma is obtained from the Doppler contribution to the line shapes of the Lyalphasatellites, verified to be optically thin. The line shapes give the ion velocity distribution just before stagnation (non Gaussian) and throughout the 10-ns-long stagnation (Gaussian-like). Ekionwas found to be sime12 keV early at stagnation, dropping down during the stagnation to the electron thermal energy (sime300 eV). The time scale of ion-kinetic energy loss is longer (cong2 ns) than expected from the ion and electron collisional thermalization time (cong0.1 ns). A plausible explanation of the data is that upon reaching the pinch axis, the stagnating plasma develops a turbulent flow, in which most of the implosion energy is stored. The turbulent motion then dissipates into ion heat more slowly than the ion-electron energy equilibration time, which causes Tionto be low, resulting in a slowing down of the ion energy transfer to electrons and to radiation. Detailed study of the experimental line shapes is used to examine this explanation. Axially-resolved measurements of the time-dependent stagnating-plasma properties, and the absolute total neon K radiation show that, within the experimental uncertainties, the observed total ion-kinetic energy accounts for the total radiation emitted from this plasma. These findings, and assuming the explanation given above, can be used to discriminate between the thermal and the turbulent ion kinetic energies throughout the stagnation.-- Results on the thus-inferred Tionwill be presented. Comparisons will be made to implosion velocities and time-resolved line-widths observed in wire-array implosions on the Z machine. [C678]

"Rapid joint semi-blind estimation algorithm for carrier phase and timing parameter"

Multi-path effect in HF communication not only changes the amplitude, but changes the phase of receiving signal as well. The rapid and random movement of ionospheric causes the oscillation of the phase. It could be viewed as the Doppler shift of high-frequency carrier caused by ionospheric. The shift of frequency should be corrected because it brings difficulty in recovering the carrier. The non-blind method needs much quantities of training (or pilot frequency) sequences at the cost of system recourse (bandwidth). However, the blind estimation will wildly encounter the vague phase. In this paper, a semi-blind parameter estimation method is introduced which uses few training sequences to distinguish the carrier. In this way, the carrierpsilas phase and timing parameter could be recovered rapidly. Besides, this algorithm is easy to implement in hardware platform. [C679]

"Performance analysis of cooperative FMCW radar distance measurement systems"

In recent years, cooperative frequency-modulated continuous-wave radar based ranging and positioning systems attained significant attraction. In this paper, we present a novel analysis approach of the performance of these incoherent systems, with a special focus set on phase noise effects. We show the behavior in different signal to noise ratio conditions and compare two competing evaluation concepts. The results are verified on real measurement data, taken with a prototype ranging system in the 5.8 GHz ISM band. [C680]

"An intelligent through-the-wall recognition system for homeland security"

The increasing demands for homeland security boost the development of an intelligent recognition system for through-the-wall sensing. A novel intelligent through-the-wall life recognition engine based on support vector machine (SVM) is provided herein. In this system, micro-Doppler signatures detected from through-the-wall radar

are extracted and fed into a SVM classifier. Micro-Doppler effect has great potential for life recognition of human activities, nonhuman but vital subjects, and lifeless targets. Due to time-varying non-stationary characteristic of micro-Doppler feature and its high dimensionality, the SVM classifier is found effective in achieving both computation efficiency and accuracy for this application. Simulation results show that high classification performance is achieved using the proposed recognition system. [C681]

"Performance analysis of Cross Ambiguity Function-Direction Finding technique in multipath environments"

In this paper, recently proposed cross ambiguity function-direction finding (CAF-DF) array signal processing technique, which make use of the cross ambiguity function calculation, is compared with the multiple signal classification (MUSIC) and space alternating generalized expectation maximization (SAGE) techniques. The CAF-DF estimates direction of arrival (DOA), time delay, Doppler shift and amplitude corresponding to each impinging signal onto a sensor array in an iterative manner. Performances of the algorithms are tested on synthetic signals in terms of root mean squared error (rMSE) for different signal-to-noise ratio (SNR) values based on Monte Carlo trials. For statistical comparisons Cramer-Rao lower bound is included. Obtained results show that CAF-DF technique is superior to its alternatives for medium and low SNR values. [C682]

"Time-domain adaptive channel estimation for OFDM-based WLAN with multiple-antennas"

In this paper, an adaptive time-domain (TD) channel estimation scheme, based on recursive least squares (RLS) algorithm, is proposed for multiple-input multiple-output (MIMO) orthogonal frequency division multiplexing (OFDM) based wireless local area networks (WLANs). The estimator is then extended to perform decision-directed (DD) channel tracking during data transmission. The channel is assumed to be constant during one OFDM symbol but evolves in time according to the first-order Markov process. Different training rates at different Doppler frequencies were investigated. Simulation results show that the proposed estimation scheme has excellent performance measured in terms of the mean squares error (MSE) and the bit error rate (BER), provided that the forgetting factor of the RLS algorithm is optimally selected. [C683]

"Performance Evaluation of Broadband WiMAX Services over High Altitude Platforms (HAPs) Communication Channel"

First, this paper describes a prediction of Rice factor (K factor) estimation for a high altitude platforms (HAPs) wireless channel. Estimation is based on experimental data which was collected from an object floating above the ground and carrying transmitter apparatus to perform as a HAPs. This experiment is intended to study multipath channel behaviour represented by K value for a wireless communication using HAPs. We use moment-based method estimator to characterize HAPs-channel in a wide interval of elevation angle. Secondly, the performance of WiMAX (IEEE802.16e) high speed transmission is simulated over the predicted HAPs channel. It is also shown how Doppler effect and K factor which is governed by elevation angle can contribute to the performance. We found that WiMAX services, which require high level requirement, fail to achieve an acceptable performance over HAPs channel if the elevation angle is lower than 40 degrees. [C684]

"Long distance optical frequency transfer over fiber: Predicting the frequency stability from the fiber noise"

We have recently demonstrated the coherent transfer of an optical signal over a 251 km link of optical fiber by use of the standard Doppler-cancellation approach to remove the effects of the fiber-link noise. The fundamental limit to the frequency instability on the transmitted optical frequency is set by residual phase noise on the optical frequency resulting from the unavoidably imperfect Doppler cancellation of the fiber-link noise. Here we demonstrate that it is possible to quantitatively predict the phase noise and instability of the Doppler-cancelled transmitted optical frequency directly from the measured fiber-link noise. The ability to predict the frequency instability from the measured fiber noise can be a useful tool in evaluating whether a coherent fiber optic link is operating at its fundamental limit, or whether there is additional excess noise from the measurement system present in the link. [C685]

"Theoretic study of improving the sensitivity of fiber optic gyroscope using slow light"

With the spectral hole-burning effect resulting from coherent population oscillation in the homogeneously broadened material, the ultraslow light propagation phenomenon is used at room temperature in a fiber. One-dimensional wave equation for envelopes light propagation is derived. We present an electronic circuit which simulates wave propagation in dispersive media. Fiber optic gyroscope which improves structure using slow light technique was designed and its principles analyzed. In a new optic gyroscope that allows relative motion

between fiber medium and source, detector, dispersive drag coefficient can influence the Sagnac fringe shift. Principle is analyzed of gyroscope based on special relativity and Doppler effect. The structure of fiber optic gyroscope could increase scale factor 107-8times. The detection of travel-time difference between two counter-propagating light could obtain angular velocity. [C686]

"New method to measure flow velocity based on short time power spectrum analysis of pulp consistency noise"

Pulp flow velocity is acquired according to time frequency analysis of consistency signal which is measured by consistency sensor during the paper-making process. The method theoretically verifies Doppler Effect of pulp consistency system noise, and detailed procedures to the analysis and processing of pulp consistency signal are proposed. Firstly, the system noise signal is separated from pulp consistency signal. Then it is estimated by the short time power spectrum. Finally the pulp flow velocity is obtained according to the expansion or contraction of time frequency scale. It shows that the method is feasible with high precision and fine dynamic performance, and it can be applied to the occasions of quick velocity fluctuation and high precision. [C687]

"Optical Intersatellite hybrid network links based on WDM technology"

Optical intersatellite hybrid networks, make it possible high speed communication with the advantages of small size and weight, low power consumption, high immunity to interference. We present an optical intersatellite network based on wavelength division multiplexing technology; the system is composed by one fixed node, a HAP, high altitude platform, in a quasistationary position at an altitude of 30 km from Earth surface, and a mobile node, on a LEO orbit which communicates with HAP and other eight LEO microsatellites. The choice of microsatellites number guarantees a good coverage of a target area and a continuous data transfer from slave nodes to master, with the consequent increase of communication capacity. HAP motion makes it possible to configure an ad-hoc network for monitoring of natural and man-made disaster, or every emergency application. Main constraints affecting the system performance concern on Doppler effect suffered by the signal, due to relative motion between satellites. The optical subsystem is composed by semiconductor laser, transmitting on ITU grid, an EDFA preamplifier and a direct detection receiver scheme. Signal to noise ratio will be evaluated as a function of the optical received power, EDFA gain, distance between satellites, for two different modulation formats, OOK and DPSK. [C688]

"Post-processing phase noise mitigation performance comparison in a coherent distributed passive radar system"

Phase noise in a radar system propagates through processing algorithms and affects the quality of the output radar data products by making targets harder to detect from noise and potentially confounding multiple targets. Usually referred to as autofocus algorithms, techniques for mitigating the effects of phase noise in these images have been proposed and studied in other applications including terrestrial telescope imaging and synthetic-aperture radar. We examine the effectiveness of autofocus algorithms as they attempt to mitigate phase noise in a coherent distributed passive radar system. We also propose an alternate technique based on deconvolution of power spectral densities, which has produced better results as well as requiring far less computation since no optimization problem exists within this method. [C689]

"A Rapid Joint Semi-blind Estimation Algorithm for Carrier Phase and Timing Parameter"

Multi-path effect in HF communication not only changes the amplitude, but changes the phase of receiving signal as well. The rapid and random movement of ionospheric causes the oscillation of the phase. It could be viewed as the Doppler shift of high-frequency carrier caused by ionospheric. The shift of frequency should be corrected because it brings difficulty in recovering the carrier. The non-blind method needs much quantities of training (or pilot frequency) sequences at the cost of system recourse (bandwidth). However, the blind estimation will wildly encounter the vague phase. In this paper, a semi-blind parameter estimation method is introduced which uses few training sequences to distinguish the carrier. In this way, the carrier's phase and timing parameter could be recovered rapidly. Besides, this algorithm is easy to implement in hardware platform. [C690]

"The Doppler effect-an evolutionary critical cue for the perception of the direction of moving sound sources"

Objects that are about to confront us are crucial for prospective actions. Even if we are not able to see what is approaching, the processing of auditory information enables us to identify the direction of moving sound sources. Various mechanisms allow us to accomplish this task most effectively. To date all of the mechanisms that have been widely discussed are based on sound-level differences or on timing aspects of incoming sounds. We

considered sound sources which move radially towards or away from the listener emitting signals with constant amplitudes. If objects are too far away from us to produce any perceivable level differences, we have to rely on other acoustic cues. In an experiment using synthesized sounds in a virtual environment, we show that the so-called Doppler effect, which shifts the frequency of the direct sound and its reflections, is sufficient to identify correctly whether a moving sound source approaches or recedes. [C691]

"Research of cathode plasma during a S-band relativistic magnetron operation"

Summary form only given. We report results on spectroscopic research of the explosive emission plasma which is formed at the cathode surface during the operation of a S-band relativistic magnetron with microwave power of ~100 MW powered by Liner Induction Accelerator (4 kA, 300 kV, 120 ns). Plasma parameters (density, temperature, expansion velocity and uniformity) were studied with time- and space-resolved framing images of the plasma by fast framing camera, fast photo-diode with narrow band interference filters and visible spectroscopy. The plasma ion temperature was determined using the Doppler broadening of different spectral lines (Halpha, Hbeta, CII, CIII, and CIV) and the plasma electron density were determined using the Stark broadening of Halphaand Hbetaand the comparison of the Halpha/Hbetaand different CII, CIII, and CIV population ratios with results of collisional radiative modeling. [C692]

"Laser Doppler Vibrometry system using the synthetic-heterodyne interferometric demodulation scheme implemented on a CMOS DSP camera"

A laser Doppler vibrometer (LDV) is described which uses a CMOS digital camera, incorporating a digital signal processor, to carry out real-time signal processing of the interferometer output to allow multipoint LDV to be implemented. The synthetic-heterodyne technique is used to overcome the interferometric fading effect due to slow environmental changes. Vibration frequencies up to 100 Hz were detected successfully. [C693]

"Characterisation of the Satellite-to-Indoor Propagation Channel"

Reliable propagation models are required for the design of satellite broadcast to mobile or satellite navigation systems at S-band in the indoor environment. In particular, these models will support the development of hybrid satellite systems including complementary ground components. Apart from the effects of shadowing and multipath encountered in LMS (land mobile satellite) urban and suburban environments, the satellite-to-indoor channel is affected by high building penetration losses, but also lower Doppler spread due to static or quasi-static situation of the user terminal. Results from a measurement campaign simulating a satellite-to- indoor link are presented. Cluster-based wideband measurements were carried out with a channel sounder placed inside several buildings (airports, shopping mall, office buildings...), receiving the signal from the transmitter located in a helicopter hovering over the building at different (azimuth, elevation) combinations in igloo configuration. The measured data has been analysed with direct methods and iterative super-resolution algorithm in order to derive building penetration losses, time spreading and angle-of-arrival information. Super-resolution techniques make it possible to identify rays and clusters of rays, and thus give added value to the development of models. The super-resolution information is effectively used for evaluation of inter-cluster and intra-cluster azimuth angle of arrival distributions. The availability of spatial information in MIMO and SIMO measurements helps developing and validating site-specific models based on ray-tracing techniques given that the measured echoes are fully characterized in terms of amplitude, phase, delay and angle of arrival. Furthermore, the parameters corresponding to a directional statistical channel model have been extracted for each scenario thanks to the availability of this type of information. The results obtained contribute to a better characterisation of the satellite-to---indoor propagation channel. [C694]

"A Study of Critical Baseline Performance Characteristics for IEEE 802.16e-2005"

In this study we present our findings of important IEEE 802.16e-2005 performance characteristics. This study is part of our ongoing study of wireless communications technologies for the FRA and provides details about our approach to modeling various channel effects, such as Doppler shift and Rician fading, details of the effect of link quality conditions, expected throughput and distance characteristics, as well as the impact of multi-hop and multi-user scenarios. Based on our simulation model we can find a maximum throughput of approximately 69 Mbps and a maximum distance of 31 miles, making IEEE 802.16e-2005 a promising candidate of addressing many critical requirements for large-scale deployments in environments such as the railroad industry. Our goal is to provide a comprehensive analysis that will assist others in understanding 802.16e-2005 performance and guiding future network deployments. [C695]

"Laser Doppler flowmetry in healthy rats: impact of isoflurane anesthetic on signal complexity"

Laser Doppler flowmetry (LDF) technique is an optical tool used in clinical investigations to monitor

microvascular blood flow. Recent preliminary works have shown that LDF signals recorded in young healthy human subjects are weakly multifractal. Such an information is important as it could lead to a better knowledge of the underlying optical processes giving rise to the signals. In the present work, our goal is to analyze the behavior of LDF signals in anesthesia conditions. For this purpose, we herein study the possible modifications brought by isoflurane, an anesthetic commonly used in clinical practice, on the complexity of LDF signals. In order to conduct our work, twenty LDF signals from anesthetized healthy rats are processed. Anesthesia is performed by using doses of isoflurane varying between 1.5% and 3%, which leads to very light and very deep anesthesia, respectively. The signal processing approach is carried out with two different methods, a parametric generalized quadratic variation based estimation method and a Hurst rescaled range analysis. The results show that extreme doses of isoflurane lead to no distinguishable modification on the characterization of LDF signals based on the two above approaches. These findings infer that, if isoflurane changes the microvascular tissue optical properties, these modifications have no influence on LDF signals complexity measured by the two signal processing approaches used herein. [C696]

"Optimal radio emitter location based on the Doppler effect"

Differential Doppler is a common technique for emitter localization in which the signal of a stationary emitter is intercepted by at least two moving receivers. The frequency difference between the receivers is measured at several locations along their trajectories and the emitterpsilas position is then estimated based on these measurements. This two-step approach is suboptimal since each measurement is performed independently, although all measurements correspond to the same position. Instead, a single step maximum likelihood approach is proposed here for known and unknown waveforms. The position is determined directly from all the observations by a search in the position space. Simulations show that the proposed method outperforms the differential Doppler method for weak signals while both methods converge to the Cramer Rao bound for strong signals. Also, in some cases of interest the proposed method inherently selects reliable observations while ignoring unreliable data. [C697]

"Research on the error model of INS/DVL system for Autonomous Underwater Vehicle"

The paper studies a method in order to promote the accuracy of the control and simulation system of AUV (autonomous underwater vehicle) under the help of the error models of INS (inertia navigation system)/DVL (Doppler velocimeter log) integrated navigation system. Time series models are given in this paper, which describe the longitude error and latitude error of the INS/DVL integrated navigation system in AUV. The models have been tested and prove to be effective in error prediction and fitting. They are applied to the AUV simulation system to ameliorate the control arithmetic, which show a good effect on improving the control precision of the simulation systems of AUV. [C698]

"On the Capacity Bounds of Beamforming over MISO Time-Selective Channels with Estimation Errors and Feedback Delay"

We examine the ergodic capacity of beamforming over a multiple-input single-output (MISO) time-selective channel with channel estimation error and delayed limited feedback. At each frame, the receiver obtains the minimum mean squared error estimation of the channel, chooses a transmit beamforming vector, according to the error channel estimation, from a codebook based on random vector quantization design, and feeds back the corresponding index to the transmitter using a finite number of bits. We derive the bounds on the capacity, and show that the tightness of the lower and upper bounds, and the bounds decreasing with the increase of channel estimation error or normalized Doppler spread. [C699]

"An experimental study of back scattering of UHF signal spectra at the multifrequency remote sensing of water and petroleum surfaces"

Influence of surface-active substance (SAS) on some parameters of Doppler spectra of signals of centimeter and millimeter ranges back scattering by the disturbed water surface in laboratory and natural conditions is experimentally appraised. The use of these effects for the detection and selection of anthropogenic slice is discussed. [C700]

"Performance Analysis of ICI Elimination by Information Aid for Aviation Mobile Broadband Communication"

A new method, ANTI-D(ANTI-Doppler by information aid), aiming at eliminating ICI (inter-channel interference) caused by DFO (Doppler frequency offset) to improve the performance of AMBC (aviation mobile broadband communication), is presented with a view to the characteristics of the large DFO of aviation channel and the

aircraft as a platform of AMBC. The strong ICI caused by large DFO, degrades the performance of AMBC badly. For there are many kinds of equipments, such as navigation equipments and surveillance equipments on an aircraft, as the platform of AMBC, the information of position and the vector of velocity of the aircrafts or ground stations around, called aid information, can be get in real time or near real time, to compute the DFO, according to which the compensation can be done. The simulation results show that ANTI-D based on aid information, resolves the ICI caused by DFO effectively, and makes AMBC get better performance in Enroute phase, and a method combined ANTI-D and channel estimation makes AMBC performance better in Arrival phase as well. [C701]

"Impact of the Angular Velocity on the Signals Spectrum and Performance of Antenna-Array Receivers"

Tremendous effort was previously made to estimate the location of moving sources with large angular velocities. However, to the best of our knowledge, no previous work has thoroughly investigated the effect of the combined angular velocity and mobile speed on the spectrum of the signal received by an antenna-array. In this contribution, we address this issue in the particular context of wideband CDMA transmission. We first show both by theoretical development and by simulations that the maximum frequency shift is the sum of the conventional Doppler term and a new term due to angular speed and that it is a linear function of both. We also show that the additional frequency shift due to the angular speed increases channel identification errors and thereby degrades the performance of antenna-array receivers. This performance loss becomes even higher at a larger number of antennas in the array. [C702]

"Diversity-Multiplexing Tradeoff with Arbitrary Doppler Spectrum"

The original diversity-multiplexing tradeoff work by Zheng and Tse assumes multi-input-multi-output (MIMO) systems with frequency flat, spatially independent, and temporally block fading. Several following works have extended the tradeoff to either frequency selective or spatially correlated channels. However, all of them assume that fadings are temporally block. Compared with block fading assumption, it is more realistic to model Rayleigh temporal fadings as a zero-mean stationary complex Gaussian random process . Correspondingly, its power spectral density (or Doppler spectrum) is a sufficient description of the random process, because the correlation between two arbitrary fadings can be calculated through the Fourier transform of the Doppler spectrum. The main contribution of this paper is to derive the diversity- multiplexing tradeoff in frequency flat single-input-single-output (SISO) channels with arbitrary Doppler spectrum. Moreover, the derivation process itself, which is based on the spike sharpening effect, may be extended to facilitate other more complicated diversity-multiplexing tradeoff works. [C703]

"A Novel OFDM Symbol Synchronization Algorithm Based on Cyclic Prefix in DVB-T"

Van de Beek presented the joint maximum likelihood estimator of time and frequency offset in OFDM systems. In most situations, its' performance suffices in an acquisition mode. But in low signal-to-noise ratio AWGN channels and multi-path fading channels, the maximum likelihood peak values are not stable in the right place due to high noise effects, multipath delays and Doppler effects respectively. Some samples of cyclic prefix have been polluted by ISI. A new improved solution based on cyclic prefix in DVB-T system is proposed in this paper, which chooses different methods according to signal-to-noise ratio and multi-path delay depth. Averaging the maximum likelihood function in several consecutive symbols, dynamic regulation correlation slide windows and enlarging observation vectors are the key optimized points. It is shown that the proposed method can get sharp peak values and improve the symbol precision compared with the existing methods both in AWGN channels and in multipath channels. [C704]

"A new separation method for Micro-Doppler information of a target with rotating parts"

The classical range-Doppler algorithm canpsilat obtain clear ISAR image of a target with rotating parts. In spectrogram, the micro-Doppler information of the rotor blades is represented as the sinusoidal frequency modulation, whereas the information of main body is depicted as the form of straight lines. So the extraction of micro-Doppler is transformed to the separation of the sinusoids and straight lines. Based on this idea, a simple method of spectrogram cancellation is proposed, which can quickly achieve the purpose of separation and get clear ISAR image of main body. The effectiveness of the algorithm is proved by the simulation results. [C705]

"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. [C706]

"An improved narrowband high frequency channel model"

An improved narrowband high frequency (NBHF) channel model is presented based on the ITS wideband high frequency (WBHF) channel model. Through proper simplification, an implementation method fits for computer simulation is provided. This new simulation model eliminates one of the limitations of the Watterson NBHF channel model. It can be applied to a wide range of channel conditions. [C707]

"Doppler Spread Suppression Technique for an L-Band Digital Radio Broadcast System"

The orthogonal frequency division multiplex (OFDM), which is at the heart of many digital broadcasting and wireless standards, is very sensitive to Doppler spread induced by time variations of the mobile channel. This undesirable effect can be particularly detrimental to system performance when such a system is used for vehicular reception at high frequency bands since the maximum Doppler frequency fdmaxis proportional to the radio frequency of the received signal and vehicle speed. In this paper we propose to study the performance of a dual-antenna Doppler spread mitigation technique applied to a mobile digital radio broadcast system (Canadian DAB system in mode IV). This technique uses a linear antenna array, parallel to the direction of motion of the vehicle, and estimates the received signal at a virtual point by using space domain minimum mean square error (MMSE) type interpolation. Laboratory test results show that this scheme can effectively reduce bit error degradations caused by the spread of the Doppler spectrum at high vehicle speeds. Field tests have been performed and analysis of the collected data is underway to validate the proposed technique for an L-band DAB system. [C708]

"New method to measure pulp flow velocity based on time-frequency analysis of pulp consistency noise"

A novel method of measuring flow velocity is put forward, which need no equipment or hardware. Utilizing the Doppler-effect that pulp flow velocity (PFV) causes effect upon pulp consistency noise signal, we can determine PFV carrying out time-frequency analysis of the noise of pulp consistency signal on the basis of pulp consistency measurement. The detailed calculating steps are proposed, firstly, noise signal is separated from pulp consistency signal, then it is analyzed by means of the short time power spectrum (STPS) or wavelet transform (WT), finally the PFV can be obtained according to the scale change of STPS or the period change of WT. The corresponding tests show that the measurement method is feasible with high precision. [C709]

"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. [C710]

"Wireless blood velocity spectra measurement system for healthcare evaluation: Reference data"

The aim of the present study was to determine the blood velocity and its indices in common carotid artery (CCA) as reference value for clinical and healthcare application using the constructed portable wireless Doppler blood flow velocimeter system. Evaluation of CCA blood velocity waveforms was performed in 202 healthy volunteers in the age range of 20 to 69 years. Multivariate analysis was used to determine the relationship between the fixed factor and the outcome hemodynamic variables after adjustment for the related covariates. Results show a general age-related decrease in flow velocities and change in the velocity waveform. There is also a gender difference in velocity indices, except for peak systolic blood velocity. Gender difference is also found in systolic and pulse blood pressures. The findings suggest that waveform indices provide a more reliable evaluation of effects of aging and gender on CCA flow. In conclusion, normal CCA blood velocity parameters are determined in a total of 202 healthy volunteers between the third and seventh age decade after adjustment for gender and exercise effects. Findings may contribute to improved means of healthcare monitoring and clinical evaluation. [C711]

"Spectral analysis on the microcirculatory laser Doppler signal of the acupuncture effect"

We aim to analyze the frequency content of skin blood flow signals recorded on Hoku following acupuncture

stimulation (AS). Each experiment involved recording a 20-minute control-data sequence and two effects data recorded 0-20 and 50-70 minutes after stopping AS, respectively. 4-level Haar-wavelet transform was performed on the measured LDF signals, and periodic oscillations with five characteristic frequency peaks were obtained within the frequency interval: 0.0095-0.021, 0.021-0.052, 0.052-0.145, 0.145-0.6, and 0.6-1.6 Hz, respectively. Band proportion and DC component of the flux signal were calculated to elucidate the effects following AS. At Hoku, the DCflux was significantly increased, the band proportion of the 1st and the 2nd frequency band were significantly decreased, and that of the 5th band was significantly increased following AS. Our results facilitate a non-invasive method to evaluate sympathetic control of peripheral vascular activity between the acupoint and non-acupoints, which may be important for studying the therapeutic effects of AS. [C712]

"Anti-RGPO method based on memory tracking"

The range gate pull off (RGPO) results in a disaster to radar target tracking. It is assumed that the jamming (i.e., RGPO measurement, the following are the same) pulls the range gate backwards in the conventional methods. However, the RGPO for some radar, e.g., linear frequency modulation radar, can pull onwards by modulating the Doppler frequency to the returned signal. Whatpsilas more, in conventional methods targets were modeled as point targets. Nevertheless, further studies are required when the target and jamming are extended in real-world environment. Previous researches failed to consider the lasting time of the anti-RGPO process, which is crucial under a certain condition. To avoid these drawbacks, a method based on memory tracking is studied. The method can detect the existence of RGPO and recognize the pulling-off direction of the jamming; and the method can make the jamming get out of the range gate earlier than the true target, thus the RGPO has little effect on the tracking. Some important factors in the method are analyzed. Experiments show that the total time of the anti-RGPO process is short. [C713]

"Human identification experiments using acoustic micro-Doppler signatures"

Active acoustic scene analysis is a promising approach to distributed persistent surveillance in sensor networks. We report on the design of bandpass sampling technique for an acoustic micro-Doppler sonar to reduce the data rate to as low as 85 kbps. We then explore the use of Gaussian mixture models for human identification. We compare the classification performances using different feature vectors and from different sampling schemes. We show that the use of differential cepstral vectors of context length 2 improves the classification accuracy. We also show that the classification performance of the bandpass sampling system with an 8-bit resolution is still over 90% on a database consisting of 160 gait signatures from 8 individuals. [C714]

"Level shifts and gate interfaces as vital ingredients in modeling of charge trapping"

We present a detailed modeling study of charging and discharging traps in dielectrics used in modern semiconductor devices. Existing descriptions of charge trapping are often restricted to charge injection from the substrate and ignore the presence of the gate contact as a source/sink of charge carriers. This assumption loses its justification when the gate dielectric shrinks into the nanometer range. Furthermore, a novel picture of tunneling into and out of defects has emerged from first principles calculations which questions the conventional concept of fixed trap levels irrespective of their charge state. Consequently, focus is put on the development of a novel rigorous model merging both effects into one general description of charge trapping. [C715]

"DC information preservation for cardiopulmonary monitor utilizing CW doppler radar"

Direct conversion RF receivers introduce large DC offsets, reducing the dynamic range of the baseband signal. Coupled with the relatively small time varying signals in human vital sign monitoring using CW Doppler radar, extraction of cardio-pulmonary information becomes difficult. Previous DC offset compensation techniques utilizing AC coupling have proven detrimental to the performance of the system and the integrity of the low-frequency cardiopulmonary signals. A proposed system utilizing digitally controlled voltage feedback and center finding preserves the important DC information for optimal extraction of phase information in the quadrature system. [C716]

"Accounting for Wind Effects on Fixed Wireless Channels in Suburban Macrocell Environments"

Based upon coherent (amplitude and phase) received signal strength data collected over fixed wireless macrocell channels at almost 100 locations in residential, campus and open area environments near the University of British Columbia, we have shown that Thoen's model for fixed wireless Doppler spectra fits observed Doppler spectra remarkably well. This allows us to extract the equivalent maximum Doppler frequency for such channels and determine both: (1) its marginal distribution, which is surprisingly narrow, and (2) its joint distribution with Ricean K-factor and wind speed in typical suburban macrocell environments. Incorporating wind effects into the model helps us to improve the accuracy of the model by helping us account for the differences between the

wind speed distributions observed during the measurement campaigns and those observed over the long term. [C717]

"Radio Channel Measurements and Characterization inside Aircrafts for In-Cabin Wireless Networks"

This paper presents a measurement campaign conducted inside a large Airbus A340-300 aircraft for the development of in-cabin wireless networks. The measurements were conducted in three different frequency bands in order to provide various services. It was found that the path loss factor along the aircraft corridors varies between 2.0 and 2.7 depending on frequency. The average K-factor in the aircraft aisles was found between 9.5 and 10.1 dB, for line-of-sight (LoS) conditions, and between 3.7 and 5.0 dB for non-line-of-sight (NLoS) cases. The average dynamic range of fading varies between 12 and 14 dB for LoS, and between 25 and 28 dB for NLoS situations respectively. The maximum Doppler spread was calculated between 15 and 17 Hz, whereas the coherence time was found between 25 and 29 ms for a reference level of -3 dB. [C718]

"Performance Analysis of Different Pilot-Symbol Patterns in Underwater Acoustic OFDM System"

The underwater acoustic channel is very complex where Doppler frequency offsets, narrow bandwidth, serious multi-path time delay interference and frequency selective deep fading obstruct the development of high speed and fidelity underwater data transmissions. Orthogonal Frequency Division Multiplexing (OFDM) is a kind of novel paralleling transmission technology. In this paper, we mainly discuss three different pilot structures in channel estimation in OFDM underwater acoustic communication system and analyze the performance of channel estimation based on different pilot structure by simulation. [C719]

"Modelling and simulation of a stepped frequency radar system based on LabVIEW"

In the radar system, modelling and simulation can guarantee the high reliability and correctness of system design, shorten designing period and reduce development cost. This paper discusses signal processing system of the SFR (stepped-frequency radar), especially the several key processing steps to get the HRRP (high resolution rang profile). The system simulation has done based on LabVIEW (Laboratory Virtual Instrument Engineering Workbench) platform, estimates the range and velocity of the target, and gets the real HRRP, The results validate the feasibility and correctness of the system. [C720]

"Wideband OFDM pulse burst and its capabilities for the Doppler processing in radar"

The use of multicarrier (MC) signals could support a new generation of radar that would provide simultaneously RF agility and Doppler processing. Easy to generate in digital signal processing (DSP), the well-known orthogonal frequency division multiplexing (OFDM), originally a communication waveform, is a first choice candidate. Its flexible structure makes both radar concepts of continuous and pulse burst waveforms, compatible. In this paper, the focus is on the pulse burst. The novelty of the paper is to investigate capabilities for Doppler processing of the OFDM pulse burst in both narrowband and wideband cases. Since the waveformpsilas bandwidth-time (BT) product is high, the analysis starts with the narrowband approximation (very low speeds) and rapidly moves on to the true wideband version (higher speeds) of the Doppler effect, in an elementary scenario with a single point target. [C721]

"Impact of Wireless Channel on VoIP QoS and Admission Regions in IEEE 802.11g WLANs"

In this paper, we evaluate the impact of the wireless channel and physical layer parameters on the performance of VoIP traffic in IEEE 802.11g networks. The wireless channel is modeled using a finite state Markov chain based on an adaptive modulation and coding scheme. The transition probabilities encompass the effects of the time-varying wireless channel, such as the Doppler frequency and the operating SNR, and the physical layer target packet error rate. This model is implemented inthe NS-2 tool and used to analyze the QoS (delay and packetdrop rate) of real-time multimedia traffic in realistic wireless channels. Numerical results showing the physical layer impact on the number of supported VoIP calls in an 802.11g network are presented. We also demonstrate that the admission region in the presence of mixed VoIP and data remains linear, even after considering the complex wireless channel effects. [C722]

"Adaptive detection of Doppler frequency shift using ac non-steady-state photo-EMF effect"

Adaptive velocimeter based on the AC non-steady state photo-EMF effect induced by oscillating interference pattern has been investigated. The possibility to detect very low velocities (micrometer per second) using photoconductive polymer based detector was demonstrated. [C723]

"A simple antenna combining framework for Doppler compensation in mobile OFDM systems"

In OFDM systems, Doppler spreading due to the mobility of the receiver distorts the orthogonality among the subcarriers, and results in intercarrier interference that degrades the performance. In this paper, we investigate how Doppler spreading can be mitigated by using multiple antennas. In this context, we propose a novel antenna combining framework exploiting the correlation among the time varying channels seen by the multiple antennas. Depending on the computational complexity requirements, the scheme can take the form of beamforming, beamforming with frequency offset correction and simple time-varying combining schemes. We derive the optimum combining scheme in each context, and show that by using the proposed combining schemes, the performance of the mobile OFDM systems can be greatly enhanced. [C724]

"Turbo equalization in high doppler mobile environments: Channel estimation, fast algorithms and adaptive solutions"

High Doppler effects resulting from fast time varying dispersive channels represent the most critical impairment to channel equalization techniques in block transmissions. In multicarrier systems, it gives rise to the so-called intercarrier interference (ICI), whose modeling for correct data recovery is paramount. Considering a practical scenario where the designer has no control on the transmitter side, we present a novel turbo equalization scheme based on recent frameworks for the time varying channel parametrization via its derivatives. This includes a fast method for estimating the channel derivatives running on a decision-directed turbo equalization scheme that can be implemented at either symbol or bit level. Unlike recent approaches, the derivatives estimation is adaptive, in the sense that at each turbo estimation it incorporates information on previously estimated parameters. [C725]

"A novel approach to the estimation of acoustic Doppler signals"

This paper presents a novel approach for frequency estimation of acoustic Doppler signals for use in speed and distance estimation of acoustic sources. The basis of the proposed approach is a nonlinear adaptive algorithm capable of tracking the amplitude, phase and frequency of nonstationary sinusoids. The approach provides a real time estimation of instantaneous frequency with very high time-frequency resolution and has a high level of noise immunity. This offers advantages over traditional Fourier-based methods as well as current Wigner-Ville based approaches seen in the literature. Examples using simulated and real signals will be shown to demonstrate the capabilities and strengths of this approach; comparisons to existing techniques are presented. [C726]

"Frequency offset estimation for multi-static radar system"

Bi-static and multi-static radar requires synchronization between transmitter(s) and receiver(s) due to their separated locations. Especially, for the target Doppler estimation, the carrier frequency offset occurred by the discord between the transmit and the receive ends should be estimated before the processing. In this paper, the system model for multi-static radar is provided as a similar form of multi-input multi-output (MIMO) communication system. However, unlike the MIMO case the frequency offset for each receiver is not identical to each other which makes the modeling and problem complicated. Based on the system model, the joint maximum likelihood (ML) solution and the suboptimal estimation is presented for frequency offset compensation. In this approximated approach, each receiver frequency offset is decoupled to others and the computational complexity becomes extremely low while it provides reasonable error performance for small frequency offsets and high signal to noise ratio (SNR). [C727]

"On transceiver optimization for time-varying multipath channel estimation"

We address the problem of estimating doubly-selective channels using pilot clusters that are time-division multiplexed with the data. Channel estimation is carried out using different basis expansion models (BEMs), and direct MMSE channel estimation using the channel statistics. For a fixed number of pilot symbols, we attempt to optimize the power and placement of the pilot symbols used in transmission, and the number of BEM coefficients used in channel estimation, in the sense of minimizing the mean-square estimation error (MSE) that includes modelling error, which is normally neglected in existing work. Simulation results confirm that for a wide range of SNR and Doppler spread values, this optimization greatly reduces the MSE and the bit-error rate, and that modelling error should be taken into account when optimizing training. The effects of uncertainly in the channel statistics are also studied. [C728]

"Recursive least-squares doubly-selective channel estimation using exponential basis models and subblock-wise tracking"

An adaptive channel estimation scheme, exploiting the over- sampled complex exponential basis expansion model (CE- BEM), is presented for doubly-selective channels where we track the BEM coefficients. We extend/modify the subblock- wise tracking method using time-multiplexed (TM) training recently proposed by S. He and J. K. Tugnait (2007). Two finite-memory recursive least- squares (RLS) algorithms, including the exponentially-weighted and the sliding-window RLS algorithms, are respectively applied to track the channel BEM coefficients. Simulation examples illustrate the superior performance of our scheme to the conventional block-wise channel estimator, and demonstrate its improvement on our previous work in. [C729]

"Optimum Pilot Placement for Chunk-Based OFDMA Uplink: Time Direction Scenario"

In this paper, we investigate the optimum pilot placement along time direction for the chunk-based OFDMA uplink. The proposed optimization is performed within a single chunk, where the channel estimation is based on the least-square linear interpolation. Unlike the state-of-the-art optimum pilot placements, the proposed scheme takes into account the impact of interpolation error in addition to the noise. It is established that in the presence of the large Doppler shift, the impact of interpolation error shows the dominative effect in the large SNR range, the optimum pilot spacing should be 1/radic3 of the chunk length regardless of the channel realization. However, in the most practical scenarios, the impact of the interpolation error is too small to affect the overall performance compared to the noise. Therefore, the optimization of pilot placement should be focused on minimizing the noise. [C730]

"A Study of the Relative Speed and Doppler Effects in Space-Based Networks"

In many space network architectures, such as those intended for the military, there will be numerous types of air, ground and sea terminals communicating with each other over a complex system consisting of both geostationary earth orbit (GEO) and low earth orbit (LEO) satellites. These architectures would require highspeed communication links to be established between GEO satellite pairs, and even a GEO and a LEO satellite. With relative speeds approaching or exceeding 8 km/sec, Doppler effects can play a significant role in SONET timing and synchronization, especially when one takes into account satellite repositioning, inclinations, and other perturbations and anomalies. [C731]

"Doppler Effect in High Speed"

This paper presents Doppler effect formulation with two trajectories; first we use the solution in low speedy density function which is general for this case, second we use the solution in high speedy density function for the first time with the use of the relativity speed in modern physics. [C732]

"Link Layer FEC in DVB-RCS: Performance Evaluation in nLoS Conditions"

The paper investigates coding and encapsulation techniques for the possible extension of the digital video broadcasting-return channel satellite (DVB-RCS) to ensure a global coverage for mobile terminals. specifically, link layer- forward error correction (LL-FEC) appears to be a reliable solution, allowing to improve the C/N performance and to counteract the Doppler effect typical of mobile channels, avoiding scalability and latency issues of Automatic Repeat reQuest (ARQ) approaches. In the paper we evaluate LL-FEC performance when applied to the railway environment. It is shown how this scenario deeply affects the LL-FEC code performance both in the multi protocol encapsulation (MPE), and the generic stream encapsulation (GSE) cases. In order to counteract this performance reduction two different approaches are considered. In the first case, we increase the number of rows of the LL-FEC Reed Solomon (RS) matrix. In the second case we exploit the sliding encoding mechanism. We also introduce a modified version of GSE that shows reduced overhead and improved performance. Results show that DVB-RCS can greatly benefit from LL-FEC RS coding in reducing residual errors that cannot be counteracted at the physical layer for efficiency reasons. [C733]

"Intercarrier Interference Suppression for OFDMA Uplink in Time and Frequency Selective Rayleigh Fading Channels"

This paper investigates inter-carrier interference (ICI) suppression for the uplink of an orthogonal frequency division multiple access (OFDMA) system in a time and frequency selective Rayleigh fading channel. In such a doubly selective channel, channel variation within each OFDMA block disrupts the orthogonality among subcarriers, leading to ICI. We formulate the signal model for OFDMA uplink in a doubly selective Rayleigh fading channel, and then propose a MMSE and a MMSE successive detection (MMSE-SD) scheme to suppress ICI. It is shown that the MMSE scheme is the optimal linear scheme in terms of achievable data rate, while the MMSE-SD scheme is able to further remove ICI and exploit the Doppler diversity embedded in time-varying channels. Simulation results are presented to illustrate the performance improvements that can be obtained from using the proposed suppression schemes. [C734]

"Doppler Compensation by Using Dual Antenna for Mobile OFDM Systems"

The performance of OFDM systems is compromised in mobile environments due to Doppler spreading. In this paper, we investigate how Doppler spreading due to the mobility of the receiver can be mitigated by using dual antenna. In this context, we propose two simple antenna combining schemes, namely, simple beamforming (SB) and beamforming with frequency offset correction (BFOC), and investigate the ICI mitigating capability of these methods. We show that by using appropriate antenna spacing, beamforming coefficients and frequency offset correction, the performance of the OFDM systems can be greatly improved in high mobility scenarios. [C735]

"Validation of Exposure Time for Discharge Measurements made with Two Bottom-Tracking Acoustic Doppler Current Profilers"

Previous work by Oberg and Mueller of the U.S. Geological Survey in 2007 concluded that exposure time (total time spent sampling the flow) is a critical factor in reducing measurement uncertainty. In a subsequent paper, Oberg and Mueller validated these conclusions using one set of data to show that the effect of exposure time on the uncertainty of the measured discharge is independent of stream width, depth, and range of boat speeds. Analysis of eight StreamPro acoustic Doppler current profiler (ADCP) measurements indicate that they fall within and show a similar trend to the Rio Grande ADCP data previously reported. Four special validation measurements were made for the purpose of verifying the conclusions of Oberg and Mueller regarding exposure time for Rio Grande and StreamPro ADCPs. Analysis of these measurements confirms that exposure time is a critical factor in reducing measurement uncertainty and is independent of stream width, depth, and range of boat speeds. Furthermore, it appears that the relation between measured discharge uncertainty and exposure time is similar for both Rio Grande and StreamPro ADCPs. These results are applicable to ADCPs that make use of broadband technology using bottom-tracking to obtain the boat velocity. Based on this work, a minimum of two transects should be collected with an exposure time for all transects greater than or equal to 720 seconds in order to achieve an uncertainty of plusmn5 percent when using bottom-tracking ADCPs. [C736]

"Dual-RiverSonde Measurements of Two-Dimensional River Flow Patterns"

Two-dimensional river flow patterns have been measured using a pair of RiverSondes in two experiments in the Sacramento-San Joaquin River Delta system of central California during April and October 2007. An experiment was conducted at Walnut Grove, California in order to explore the use of dual RiverSondes to measure flow patterns at a location which is important in the study of juvenile fish migration. The data available during the first experiment were limited by low wind, so a second experiment was conducted at Threemile Slough where wind conditions and surface turbulence historically have resulted in abundant data. Both experiments included ADCP near-surface velocity measurements from either manned or unmanned boats. Both experiments showed good comparisons between the RiverSonde and ADCP measurements. The flow conditions at both locations are dominated by tidal effects, with partial flow reversal at Walnut Grove and complete flow reversal at Threemile Slough. Both systems showed complex flow patterns during the flow reversals. Quantitative comparisons between the RiverSondes and an ADCP on a manned boat at Walnut Grove showed mean differences of 4.5 cm/s in the u (eastward) and 7.6 cm/s in the v (northward) components, and RMS differences of 14.7 cm/s in the u component and 21.0 cm/s in the v component. Quantitative comparisons between the RiverSondes and ADCPs on autonomous survey vessels at Threemile Slough showed mean differences of 0.007 cm/s in the u component and 0.5 cm/s in the v component, and RMS differences of 7.9 cm/s in the u component and 13.5 cm/s in the v component after obvious outliers were removed. [C737]

"Iterative Receiver for MIMO-OFDM Systems with Joint ICI Cancellation and Channel Estimation"

In MIMO-OFDM systems, the time-varying fading of channel can destroy the orthogonality of subcarriers. This causes serious intercarrier interference (ICI), thus leading to significant system performance degradation, which becomes more severe as the normalized Doppler frequency increases. In this paper, we propose a low-complexity iterative receiver with joint frequency-domain ICI cancellation and pilot-assisted channel estimation to minimize the effect of time-varying channel. At the first stage of receiver, the interference between adjacent sub-carriers is subtracted from received OFDM symbols. The parallel interference cancellation (PIC) detection with decision statistics combining (DSC) is then performed to suppress the interference from different antennas. By restricting the interference to the limited number of neighboring subcarriers, the computational complexity of our proposed receiver can be significantly reduced. Furthermore, channel parameters estimated with pilot symbols placed in equispaced groups on FFT grid are used to improve the system performance during iteration. Simulation results show that the proposed MIMO-OFDM iterative receiver can effectively mitigate the effect of ICI and approach the ICI-free performance over time-varying frequency-selective fading channels. [C738]

"Performance of space-time-coded OFDM with sectorized antenna reception"

Diversity is a well-known means to counter the detrimental effect of fading. Against this background, space-time codes have been designed to facilitate transmit diversity with a suitable receiver. Furthermore, space-time codes combined with OFDM allow for the utilization of frequency selective channels. However, a general assumption underlying the design of space-time codes is the time-invariance of the channel, which is violated in a high mobility environment. Large Doppler spread causing rapidly time-varying channels can be compensated at the receiver by sectorized antennas, which restrict the angle of incidence of imping waves to a finite range. Compared to an omnidirectional antenna, the resulting Doppler spread of a sector antenna and the channels time-variance are reduced. In this paper, we demonstrate the benefits of Doppler compensating sectorized antennas for space-time coded OFDM. [C739]

"Clutter Modelling for Space-Time Adaptive Processing"

The presence of clutter can be highly detrimental to detection of targets. STAP attempts to alleviate the problem by exploiting angle-Doppler inter-relationships to suppress clutter. The simulation of clutter data that is suitable for the application of STAP is considered in this paper. Examples of clutter generated using the ELMBAARC program in bistatic applications and forward facing and sideways facing monostatic applications are provided. Modelling of internal clutter motion is considered, together with its effect on the clutter domain in angle-Doppler space. [C740]

"A Least Squares Approach to Inverting Doppler Beam Data to World Coordinates"

Doppler profilers measure velocity components along the axis of three or four diverging acoustic beams. Instrument firmware combines these measured components to determine the underlying three component velocity profile relative to the instrument. By correcting for instrument attitude and velocity, these instrument referenced velocities are transformed into a "world" coordinate system and averaged. In the presence of corrupted data, some instrument referenced velocity estimates will be invalid and profiles can only be generated if a sufficient number of acceptable raw profiles remain. This paper presents an alternative approach to averaging data that does not require the transformation of data to instrument referenced profiles. The individual velocity estimates from each beam are treated as discrete measurements along a unique orientation. A least squares algorithm is then used to solve for the underlying velocity field. The advantage of this approach is that even if data from only one beam is accepted as accurate, that measurement can be incorporated into the final velocity estimate. As a result, the method will work on sparse data sets: uncertainties are explicitly calculated so that the accuracy of the velocity estimates is quantified on a profile by profile basis. The method is applied to data collected in a region of extremely high fish concentrations (at times in excess of 1 fish per cubic meter). By appropriately choosing threshold parameters it is possible to extract both the fish and the water velocity from the same data. [C741]

"Channel Prediction by Doppler Frequency Estimation with Simplified AR modeling"

A channel prediction method using the estimation of Doppler spectrum is proposed and investigated to predict channel state information in time varying channel. Because the Doppler frequency is one of main features for time varying channel characteristics, the autoregressive model for the Doppler spectrum could be employed to get reliable channel prediction coefficients. For the IIR approximation of Doppler spectrum, we propose cascade filter of digital Biquad and low pass filter with simple modification. In the cascade filter, we need only two parameters, and we can get higher order channel prediction by cascading same filter as many as we want. [C742]

"FPGA Implementation of 3Mbps Single Carrier Mobile Wireless System with 1MHz Bandwidth"

In this paper, we present a FPGA implementation of single carrier (SC) wireless system with frequency domain equalization (FDE) to overcome the effects of multipath fading channels. We propose a new packet format for this wireless system to reduce the error of channel estimation that occurs in the last part of the packet caused by time fluctuation of the channel. Our targets are veracity 15 km/h and 3 Mbps data rate under 1 MHz bandwidth. Simulation results show that our proposed system can work in severe multipath fading with 33 Hz Doppler shift (15 km/h) and 6 ppm frequency offset environment. The logic synthesis result meets the specification. [C743]

"Interaction between radar systems and wind farms"

At typical radar frequencies a wind turbine has a large radar-cross-section (RCS) and due to the movement of the blades, the wind turbine generates a Doppler spectrum. This scattering behaviour has caused concern with

radar operators, particularly those working with safety critical radar and national defence. This paper presents results from a modelling tool developed by BAE systems, advanced technology centre, which models the effect of a wind farm on a radar system. This paper discusses the development of the model and provides an example analysis using a case study, which highlights the problems associated with placing a wind farm near a radar system. [C744]

"A New Receiver Structure for DFT Spread OFDM (DFT-SOFDM) in Time-Selective Fading Channel"

The transmission of a Discrete Fourier Transform Spread Orthogonal Frequency Division Multiplexing (DFT-SOFDM) signal through a time-selective fading channel suffers from severe performance degradation due to the Doppler shifting of the transmitted spectrum. In this paper, we propose a multiple-input multiple-output (MIMO) DFT-SOFDM scheme and a new technique to overcome the adverse effects caused by Doppler shift. By appropriately interleaving the transmitted signals in space and time, our scheme allows us to use linear equalization techniques such as the zero-forcing (ZF) and minimum mean-squared error (MMSE) equalization. In addition, the use of sphere decoding algorithm (SDA) provides superior BER performance compared to the ZF or MMSE solution. Simulation results show that at a BER of 10 3, SDA provides a 13.5 dB gain over ZF solution, and a 13 dB gain over MMSE solution. The system with SDA shows negligible performance degradation when the system load in the uplink is increased: at Eb/No= 21 dB, a BER of 1.88 times 10-5is achieved when there are 2 users in the system, but degrades only to 2.19 times 10-5for a 8 user system. In addition, SDA used with our proposed signal model offers significantly lower worst case complexity as compared to the conventional DFT-SOFDM with SDA. [C745]

"Training Structure Design Optimization for Continuous Time-Varying Fading Channels"

In fast-varying faded channels the transmission can be organized into frames where the channel estimation is mainly training-based. For fast-varying fading channels the training length and training interval can be optimized jointly to maximize the throughput. The optimal balance of training and payload depends on the combination of Doppler frequency and frame length. Here we show that, depending on the degree of mobility for large enough signal to noise ratio, there is a definite advantage in fragmenting the frame with dispersed segments of training symbols of smaller length rather than having a highly reliable channel estimate by concentrating all the training symbols at the beginning of the frame. [C746]

"Channel Estimation for LTE Uplink in High Doppler Spread"

Long term evolution (LTE) systems are expected to use single carrier frequency division multiple access (SC-FDMA) for the uplink. Being very similar to the OFDMA technology, SC-FDMA is sensitive to frequency offsets, which leads to inter-carrier interference (ICI). In this paper, we propose an interpolation algorithm based on adaptive order polynomial fitting for LTE uplink channel estimation to mitigate ICI in high Doppler spread. Simulation results show that the proposed method has better performance compared to the conventional schemes. [C747]

"Simulation of WiMAX Systems"

WiMAX (Worldwide Interoperability for Microwave Access) has the potential to impact all forms of telecommunications. In a fixed wireless communication, WiMAX can replace the telephone company's copper wire networks, the cable TV's coaxial cable infrastructure while offering Internet Service Provider services. In its mobile variant, WiMAX has the potential to replace cellular networks. However, it still facing real challenge for low complexity and efficient system implementation. It supports NLOS environment with high data rate transmission and high mobility up to 125km/hr. In this paper, two main issues are discussed. The first one presents models for simulating OFDM WiMAX system in Simulink including channel estimation and equalization subsystems in MATLAB functions. Next, the effect of channel estimation error on the performance of MIMO VBLAST receivers in uncorrelated Rayleigh flat fading channels is investigated, [C748]

"Estimation of Arterial Wall Moving Velocities by Application of Hilbert-Huang Processing to Continuous Wave Doppler Ultrasound Signals: A Simulation Study"

The distension of the vessel wall, which is the variation of a vessel diameter due to the distending blood pressure during a cardiac cycle, is used in the estimation of vessel stiffness parameters. A novel approach based on the empirical mode decomposition (EMD) and the Hilbert spectrum (HS) to estimate the arterial moving velocities from continuous quadrature Doppler signals is proposed in this paper. By using this approach, the high frequency blood flow components are firstly removed by using a low pass filter. Then the bi-directional signals

are separated by using the phasing-filter technique. Each unidirectional signal is decomposed into intrinsic mode functions (IMFs) by using the EMD, and then the relevant IMFs from the wall are identified. Finally, the maximum velocity waveforms are extracted from the bi-directional Hilbert spectra. Results from simulation study show that this approach is practical for extracting the maximum velocities of the moving vessel wall correctly. [C749]

"A transceiver scheme for localized DFT spread OFDM (DFT-SOFDM) in time-selective channel"

The transmission of Discrete Fourier Transform Spread Orthogonal Frequency Division Multiplexing (DFT-SOFDM) [4] through a time-selective fading channel with a significant amount of Doppler spread suffers from severe performance degradation. A shift in frequency caused by such channel leads to a loss of orthogonality between users. In this paper, we propose a DFT-SOFDM scheme augmented by MIMO and a new technique to overcome the adverse effects caused by Doppler shift. Repeated Alamouti orthogonal space time block codes are used for transmission of localized MIMO DFT-SOFDM signal. We derive the Minimum Mean-Squared Error (MMSE) combining and estimation scheme that ensures superior BER performance compared to the conventional Maximal-Ratio Receive Combining (MRRC) scheme. The proposed receiver provides a performance gain of 8.6 dB for a 4 users system at BER= 10-3. This gain improves with increased number of users. MRRC gives an error floor due to multiple access interference, which increases with system load. [C750]

"Frequency offset compensation for OFDM receiver using rotating concyclic antenna"

OFDM can maintain good performance even in frequency selective fading environments, but the transmission characteristics of high-speed mobile communication systems are considerably degraded due to the channel time-variation caused by the Doppler effect. Lowering the velocity of the receiving antenna relative to the ground reduces this degradation. In this paper, in order to lower the speed of the antenna relative to the ground, we propose to use a rotating concyclic antenna. We confirm that time-variation of the channel is compensated by this method without pilot symbols. Simulation results show that the BER(bit error radio) can be improved by using this antenna. [C751]

"Performance of switched selection transmission diversity in FDD/DS-CDMA system"

In this paper, the performance of switched selection transmission diversity in FDD/DS-CDMA system will be investigated. This performance will be evaluated by considering the effect of space distance between the diversity antennas and the maximum Doppler frequency (fd) on bit error rate (BER) performance under optimum conditions. This performance is not clarified until now. Moreover, the effect of error on feedback antenna selection bit on uplink will be studied. Rayleigh fading will be assumed. The proposed scheme significantly decreases the average transmit power at the base station or the mobile station and shows robustness against the BER performance degradation compared with the conventional scheme. [C752]

"Doppler spread estimation for OFDM systems using Newton polynomials"

This paper presents a method of estimating the Doppler spread for OFDM systems in rapidly time-variant channels. The method utilizes an approximation of the time variation of the channel by considering a few Newton polynomials over five successive OFDM symbols. Doppler spread is estimated in the frequency domain from the off- diagonals of the approximated channel matrix. [C753]

"Acquisition systems for GNSS signals with the same code and bit rates"

In this paper we address the problem of the acquisition of GNSS signals for the next-generation systems (as Galileo, and GPS modernization), which will use signals with code rate equal to the bit rate. In this case there is a potential sign transition in each segment of the signal processed in the acquisition schemes. The search space could result greatly impaired, especially with the methods based on FFT. These methods are very efficient, but a bit transition leads to a modification of the shape of the Cross Ambiguity Function evaluated in the search space. Here we propose a method which mitigates this impairment, which fits the requirements of the new GNSS signals. We will show that the bit transition does not destroy the information on the presence of the satellite, but introduces an error in the estimation of the Doppler frequency and code delay. In fact the effect of the sign transition on the correlation peak is a splitting of the peak into two asymmetric lobes along the correct delay bin, so leading to a potential null value at the correct cell. However the integral of these lobes exhibits an invariance property, which can be exploited to recover the bit transition position, from which the acquisition process becomes feasible. In the paper we will provide the mathematical background of a method based on this invariance property and we will show some simulation results which prove the validity of the method. [C754]

"Implementing FPGA technology in ultrasound diagnostic device"

The ultrasound is the most practical and the most considerate method of the examining in this time. It is using in the examining of tender tissues in the organism. The output of these examines can be various types of visual representations. The individual parts of tissues and blood vessels are represented by the B-mode ultrasound representation. D-mode ultrasound representation is using for the representation of the bloody values. This mode is operating on the dependence of the Dopplers effect principal. There is the possibility of using FPGA technology to make the results of acquired signal from the ultrasound. This technology is allowing to realise constituted proposal with the VHDL programme language. This work continues the information about the Doppler sound processing in the ultrasonography, basic information about using the FPGA technology, the proposal and results of realization of the sound processing with developmental Xtreme DSP kit with FPGA Virtex II-Pro. [C755]

"Saturated absorption spectroscopy of C2 H2 inside a hollow, large-core Kagome photonic crystal fiber"

Saturated absorption spectroscopy in acetylene-filled, 19-cell kagome-structured hollow core photonic crystal fiber is investigated. The large core size of 70 mum allows for narrow sub-Doppler features, and the wavelength-insensitive transmission is suitable for frequency measurements. [C756]

"Doubly-selective mimo channel estimation using exponential basis models and subblock tracking"

We present a subblock-wise tracking approach to doubly-selective MIMO channel estimation, exploiting the oversampled complex exponential basis expansion model (CE-BEM) for the overall channel variations, and an autoregressive (AR) model to update the BEM coefficients. The time-varying nature of the channel is well captured by the CE-BEM while the time-variations of the (unknown) BEM coefficients are likely much slower than that of the channel. We track the BEM coefficients via Kalman filtering, based on time-multiplexed periodically transmitted training symbols. Simulation examples demonstrate its superior performance over some existing doubly-selective channel tracking schemes. [C757]

"On the problem of antenna platform motion for high frequency surfacewave radar applications"

Shore-based high frequency surface wave radars (HFSWR) have been used to monitor large areas of the coastal ocean, and there continues to be an increase in their use for estimation of marine environmental features associated with currents, waves and winds. Recently, interest has been generated in mounting the transmitting (TX) or receiving antennas (RX), or both, on ocean platforms. This provides new challenges as the motion induced in the antennas influences the phasing of the transmitted and received electric fields. Here, the development of a first-order cross section of the ocean which incorporates the effects of antenna motion is outlined. [C758]

"Fourth-Order Ambiguity Function Based on the Fractional Fourier Transform"

Second-order cross ambiguity function based on the fractional Fourier transform (CAF-FRFT-SOS) can be used in joint estimation of time delay, Doppler shift and Doppler rate of the echoes, but it can not restrain the correlated Gaussian noise. This paper presents the fourth-order ambiguity function based on the fractional Fourier transform (FRFT). It can be utilized to overcome the deficiency of CAF-FRFT-SOS and be used in the unknown correlated Gaussian noise environment. The simulations prove the efficiency of this algorithm [C759]

"Laser Doppler and Laser Speckle Techniques for Blood Flow Measurement"

Displayed special advantages on tissue blood perfusion. This paper explores the theoretical background of laser Doppler and speckle techniques. Four applications in measurement of tissue blood perfusion are introduced which are: laser Doppler flowmetry (LDF), laser Doppler perfusion monitor (LDPM), laser Doppler perfusion imager (LDPI), laser speckle contrast imaging . In this paper we will describe theses four techniques in brief separately and then we will compare them with each other and with other methods for assessment of microvascular blood perfusion. First, we will explain LDF technique in brief. Then basic principles and components of the LDPM and LDPI instrumentation are discussed. At the end laser speckle contrast imaging technique will be introduced. Some image examples are given to compare the commercialized laser Doppler technique and prototype laser Doppler contrast imager techniques. [C760]

"Detection Algorithm of Life Signals Based on Wavelet Transform"

Life detection radar is a sort of initiative life detection equipment with extensive uses. A colored Gaussian noise model and a harmonic signal are proposed by analyzing the experimental data in this paper. The capability

compare is done between wavelet filter and FIR filter about the suppression of clutter and detection of signals, the experimental signals have characters of low-frequency, semi-periods, and low SNR.. The results show the delay of wavelet filter is shorter than FIR filter and SNR is improved, so new algorithm is much validity and stability. [C761]

"Comparison of the Cloud Water Content Retrieved by Radar and from Numerical Model"

The fully elastic three-dimensional convective storm model (IAP-CSM3D) established by the Institute of Atmospheric Physics (IAP), Chinese Academy of Science was used to simulate a strong convective storm that occurred in Hunan province on Apr.23th, 2004. The reflectivity observed by the Doppler weather radar was used to retrieve the water content, and established two display modes, which are CAPPI and VCS. Calculation field is defined as the square grid area with the radar station as center, with the horizontal side length of 150 km, with the height of 30 km, and with the distinguish ability of 1 km*1 km*1 km. To retrieve the case's water content in comparison with the water content from the numerical modeling. The result as the follow is indicated: the constant value line distribution of the retrieved water content is parallel to the simulated output as a whole no matter in the development stage or in the strong stage of the storm, and the strength in the storm center as well as the height position is consistent well, that reflect the storm structure on the whole and the retrieve effect is rather perfect. [C762]

"Doppler Shift in Medium-Earth and Low-Earth Equatorial Satellites"

In this paper, Doppler shift in medium-earth equatorial (MEQ) and low-earth equatorial (LEQ) satellite constellations are investigated. Since Doppler shift changes as a function of the earth station latitude, the effect of changing the latitude of the earth station is also investigated. As the earth station latitude decreases, the instantaneous Doppler shift increases and the time interval for which the satellite is in line of sight of the earth station increases. [C763]

"A Monostatic Ocean Scattering Cross Section for the Case of Surface Wave Radar Operating from a Floating Barge"

An understanding of the parameters affecting the high frequency surface wave radar (HFSWR) cross sections of the ocean surface is essential to employing such formulations in remote sensing models. Available techniques to date have not explicitly included the effect of antenna motion on the ocean clutter spectra derived from HF Doppler radar data. Here, a model, which assumes the incident radiation to be a simple pulse and accounts for the fact that there may be antenna motion in the radar look direction, is presented. Simulations indicate that the motion of the antennas may give rise to additional, significant spectral content which cannot be ignored when the Doppler spectra are used for ocean parameter estimation. [C764]

"Detection, Synchronization, and Doppler Scale Estimation with Multicarrier Waveforms in Underwater Acoustic Communication"

We propose a novel method for detection, synchronization, and Doppler scale estimation for underwater acoustic communication using orthogonal frequency division multiplex (OFDM) waveforms. The method involves transmitting two identical OFDM symbols together with a cyclic prefix, while the receiver uses a bank of parallel self-correlators matched to different Doppler scaling factors on waveform dilation or compression. We characterize the receiver operating characteristic in terms of probability of false alarm and probability of detection, and analyze the impact of Doppler scale estimation accuracy on the data transmission performance. We have tested the proposed method with real data from an experiment at Buzzards Bay, MA, Dec. 15, 2006. Using only one OFDM preamble, the proposed method achieves performance similar to an existing method that uses two linearly-frequency-modulated (LFM) waveforms, one as a preamble and the other as a postamble. Avoiding the need of buffering the whole data packet before data demodulation, the proposed method enables online receiver operation. [C765]

"Short-range MMW PRC-CW radar utilizing Doppler compensation"

A millimeter wave (MMW) pseudo random code continuous wave (PRC-CW) radar utilizing Doppler compensation is introduced. The novel hybrid transmitted waveform used in this radar combining single frequency pulse with pseudo random binary phase-coded signal is presented which makes consequent target detection through pulse compression independent of Doppler frequency. Doppler frequencies of targets are firstly estimated based on interpolated FFT in the time span of single frequency pulse and the Doppler compensated signal can be constructed. The effect of Doppler mismatch on the correlation detection can be eliminated by processing the compensated signal using conventional pulse compression-FFT, which makes the radar capable

of short-range high-speed target detection. The theoretical analysis and simulation result demonstrate the validity of this technique. [C766]

"Methods of eliminating Doppler dispersion in synthetic wideband signal"

As the technological advances, it is possible to perform wide bandwidth signal processing for high range resolution and target identification in the modern radar systems. In order to prevent the deleterious effects of dispersion for wideband signals, a wideband signal can be synthesized by coherently combining the individual narrow band components, meanwhile, clutter mitigation, estimation and discrimination of target's velocity is enabled by performing coherent pulse train in each subband. However, the separate and independent processing using conventional Doppler filter bank in a subband can also introduce deleterious effects of target Doppler dispersion among subbands and cause the distortion on synthesized one-dimensional range profile. In this paper, we first analyze the target Doppler dispersion among subbands and deleterious effects of following recombination, and then propose an effective method to eliminate the deleterious effects of target Doppler dispersion in subbands. The method is easy to be realized and tractable and do not require an increment of computation. Its good performance is verified by simulation results. [C767]

"Orthogonal two-channel processing of hybrid coding waveform"

A novel waveform which consists of a pair of orthogonal coding waveforms transmitted in high pulse repetition frequencies (PRF) and low pulse repetition frequencies (LPRF) has been proposed. At the receiver, two signal processing channels perform the extraction of target range and Doppler information. Although two processing channels matches coding waveform, there still exists interference of the cross-correlation residues and auto-correlation sidelobes which effects the performance of the whole radar. Traditional method such as matched filter and CLEAN algorithm cannot remove the interference in an optimal way. In this paper, Orthogonal two-channel processing method is proposed to adaptively suppress the interference in the mean square error (MSE) sense and so the two signal processing channel can be thought to be completely orthogonal at every delay time. The signal processing scheme based on it is developed. Target range and Doppler information of high resolution can be extracted simultaneously. [C768]

"An inter-burst UEP-scheme for DVB-H using redundant transmission"

To address the challenges of mobile TV, the DVB project has defined a new broadcasting standard for handheld devices, known as DVB-H. The new link layer of DVB-H includes Reed Solomon forward error correction (RS-FEC), which provides additional robustness and flexibility in system design. RS-FEC is primarily designed as an equal error protection (EEP) scheme. However, it can be extended in a standard compatible way to also implement unequal error protection (UEP) schemes. In this paper we propose an UEP scheme that uses redundant transmission (RT) to spread important data over several DVB-H time slices. Basically, the base layer data is repeated in d consecutive time slices thus giving a coderate of 1/d. The time diversity gained through this inter-burst RT scheme is shown to be more effective than other proposed UEP schemes based on RS-FEC. Furthermore, this approach can be implemented in a standard compatible way. [C769]

"The algorithm for processing phase-shift keyed signals in the problem of time delay estimation"

In this work, we propose an algorithm for preprocessing of phase-shift keyed signals in the presents of the Doppler effect, which allows to avoid compensation for unknown frequency shift in the problems of determining the time delay of signals in the case of multichannel propagation. The efficiency of the proposed method is shown for short PSK signals against the background of additive noise. [C770]

"Ultra wideband technology for Micro Air Vehicles data links systems"

In this paper, an ultra-wideband (UWB) data link for the micro air vehicles (MAVs) is proposed which can be used for the low probability of intercept and detection (LPI/D) transmission of digital voice, data and high resolution video image. The achievable range-data rate performance of the reliable UWB data link for long ranges is evaluated and compared, considering direct sequence spread spectrum (DSSS) modulation in the low-data single carrier-based impulse radio system. Taking into account the Doppler effect on the wideband DSSS signal, a scale-lag Rake receiver capable of leveraging the diversity that results from mobility is studied. Novel results of this research work indicate that a reliable UWB data link for MAVs can be established by compromising between range and performance of transmission. [C771]

"Range Doppler dynamic range considerations for dechirp on receive radar"

A dechirp on receive (DoR) concept demonstrator was recently implemented on the Fynmeet radar system of the

CSIR, in an attempt to extend its high range resolution (HRR) measurement capabilities. Based on the low dynamic range observed in subsequent measurements, this paper presents detailed analysis of the effect of amplitude, phase and nonlinear distortion on dechirp on receive radars. [C772]

"Clutter mitigation using auxiliary elements for the NWRT phased array radar"

The national weather radar testbed (NWRT) has a 10-cm phased array radar that is used primarily for monitoring the weather. It is attractive compared to the current parabolic dish weather surveillance radar-88 Doppler (WSR-88D) because of its capability to electronically steer. When combined with the recently developed beam multiplexing technique that uses a small number of contiguous samples and clever spatial sampling, this radar can obtain very rapid update scans and is extremely advantageous in monitoring severe weather. However, the small number of contiguous samples makes filtering of the clutter signal problematic in the temporal/spectral domain and can limit the performance of this radar in clutter dominated conditions. By exploiting the spatial correlation of the auxiliary channel signals, the effect of clutter contamination can be reduced to overcome this problem. In this work, two spatial filtering techniques that use low-gain auxiliary receive channels are presented, and the effect of clutter mitigation is investigated using numerical simulations for a tornadic thunderstorm dominated by clutter return. Parameters under investigation include signal-to-noise ratio, clutter-to-signal ratio, number of time series samples, varying clutter spectral widths, and maximum weight constraints. [C773]

"An effective estimation of time-dependent Doppler frequency for weapon fuzing"

Proximity sensing is required for a wide range of military applications, especially for weapon fuzing. In this paper, wavelet video processing is discussed which is used for proximity sensing of objects through their time dependent Doppler shift. A continuous wavelet transform is performed on the Doppler signal, after subjecting it to a time varying window, the signal features are extracted from resulting wavelet video. This is used as input to pattern recognition neural networks. The networks are trained to estimate the time varying Doppler shift from extracted features. When the Doppler shift reaches its optimum value the warhead will be initiated for optimum detonation. [C774]

"Channel characterization using radar for transmission of communication signals"

As radar and communication systems both are RF systems, a combination of both may be possible. The communication channel between transmitter and receiver is modeled and then adapted to include a rotating narrowbeam antenna, common to radar systems, located at the transmitter side. Assuming an omnidirectional antenna at the receiving station, this channel model can help to understand the similarities, differences and possibilities of the combination of radar and communication. Then the channel capacity is analyzed using this system setup. Whether this channel capacity can be approached or not depends on the channel realization and the possible presence of Doppler. Further, this paper will discuss the effects of Doppler and a possible solution to deal with the resulting reduction in performance. Finally, the effective beamwidth of the narrow beampattern is determined, using the channel model and assuming the receiver deals with the channel (and Doppler shifts) perfectly. [C775]

"Fuzzy Based Interference Cancellation Scheme for OFDMA Systems"

Orthogonal frequency division multiple access (OFDMA) is a promising multiple access technique for future cellular wideband communication systems. In OFDMA systems, multiple access is achieved by assigning subsets of orthogonal subcarriers to individual users. Hence these systems are less sensitive to inter symbol interference. However, the orthogonality between users' codes is often disturbed by the carrier frequency offset due to the Doppler effect in fading channels, time delay due to multipath components and poor synchronization at the receiver. This offset results in interference between users in the system. In this paper, a fuzzy based multiuser interference cancellation scheme has been proposed for OFDMA systems. Monte Carlo simulations have been run to simulate the performance of the proposed interference cancellation scheme. It is observed from the results that the proposed scheme outperforms those available in the literature in terms of less bit error rate. [C776]

"Wideband ambiguity matrix of LFM-signals used in polarimetric radar allowing simultaneous measurement of scattering matrix elements"

A pair of concurrent up- and down-going Linear Frequency Modulated (LFM) wideband signals is used in a polarimetric radar allowing simultaneous measurement of all scattering matrix elements. In wideband LFM radar the ambiguity function for a selected polarization at transmit and receive and presented in the delay time versus Doppler frequency coordinate system shows a skewness. This skewness affects the accuracies in object range and velocity. The ambiguity matrix in wideband multi-polarization LFM radar can be used to study for the different orthogonal polarization states the impact of this shortcoming connected to this skewness. In this paper

the wideband ambiguity matrix is generalized. We define the time scaling so that in the ambiguity matrix the consequences of skewness are minimized. We show simulation results to demonstrate the improved potentials of this newly-defined wideband ambiguity matrix approach. The error in range (time delay) measurements for fast moving radar target becomes minimal. [C777]

"Performance comparison and system modeling of a compton medical imaging system and a collimated anger camera"

The objective of this research is to compare performance of a well modeled dual-planar silicon-based Compton imaging system with that of a collimated Anger camera for imaging higher energy photons emitted from 131I using statistical methods. The analysis uses modified uniform Cramer-Rao bound algorithms we developed and verified along with Monte Carlo calculations and system modeling. Calculations show that the effect of Doppler broadening is the limiting factor for Compton camera performance for imaging 364.4keV photons emitted from 131I. The performance of the two systems was compared and analyzed by simulating a two dimensional disk with uniform activity for the same number of detected events. The performance of the proposed Compton imaging system is superior to the collimated Anger camera especially as the desired spatial resolution is better than 12mm FWHM. The ratio of the lower bounds for the two systems at 5mm and 10mm desired point source response is 1000 and 15, respectively in favor of the Compton device. Moreover, the detection sensitivity of the proposed Compton imaging system is 15-20 times higher than the collimated Anger camera. [C778]

"TerraSAR-X Payload Data Processing: Results from Commissioning and Early Operational Phase"

TerraSAR-X, the first national German radar satellite, was launched in June 2007. It carries an X-band high-resolution synthetic aperture radar instrument featuring Stripmap, ScanSAR and, particularly, Spotlight imaging in a variety of different polarization modes. The mission completed its commissioning phase (CP) in December 2007, the provision of the SAR products for both the scientific and commercial user community was started in January 2008. One central TerraSAR-X element on ground is the pay-load ground segment PGS. From the beginning of the mission, PGS was nominally operated. About ten thousand data takes were already acquired and processed in 2007, not only for SAR verification and calibration purposes, but also for the operational ground segment validation. This paper provides the commissioning and early operational phase results from the SAR payload data processing perspective addressing data reception and SAR processing. Specifically the tuning and adjustment of the TerraSAR-X multi-mode SAR processor TMSP to meet the in-orbit data characteristics and to optimize the SAR focusing results is addressed. Relevant issues are the high-bandwidth chirp replica processing, side lobe suppression, Doppler frequency determination, processor normalization and phase-preservation. [C779]

"RADARSAT ScanSAR Wind Retrieval and Rain Effects on ScanSAR Measurements Under Hurricane Conditions"

RADARSAT-1 ScanSAR SWA images of Hurricane Katrina are used to retrieve surface wind vectors over the ocean. Collocated H*wind wind directions are used as the wind direction while the wind speed is derived from SAR sigmadeg by inversion of a C-band HH-polarization Geophysical Model Function (GMF) that is derived from the VV-polarization GMF, CMOD5, using a polarization ratio model. Because existing polarization models do not fit the ScanSAR SWA data well, a recalibration model is proposed to "recalibrate" the ScanSAR SWA images. Validated with collocated H*wind wind speed estimates, the mean difference between SAR-retrieved and H*wind speed is small and the root mean square (RMS) error is below 4 m/s. Rain effects on the ScanSAR measurements are analyzed for an incidence angle range of 22deg to 23.6deg using collocated ground-based Doppler weather radar (NEXRAD) rain measurements. [C780]

"Analysis of Effect of Sunrise on Shortwave Communication Using HF-Doppler Detection"

The propagation of the radio wave is seriously affected by the change of the ionosphere in the night. On the basis of the HF-Doppler detection of the ionosphere the basic characteristics of the Doppler frequency shift at sunrise and its effect on the shortwave communication were discussed. [C781]

"Research on the cancellation of Doppler Offset by information aid for aviation Mobile Broadband Communication"

A new method, IAADO (Information-Aided Anti-Doppler-Offset), aiming at eliminating ICI (Inter-Channel-Interference) caused by DFO (Doppler Frequency Offset) and improving the performance of AMBC (Aviation Mobile Broadband Communication), is presented with a view to the characteristics of the high DFO of aviation

channel and the aircraft as a platform of AMBC. The strong ICI caused by large DFO, degrades the performance of AMBC badly. And the DFO can be computed by the aid information, the position and the velocity vector of its own and the positions and the velocity vectors of the aircrafts or ground stations around, which is derived from equipments onboard, such as navigation equipments and surveillance equipments, in real time or near real time. According to that the compensation can be done at the receiver, although it is of uncertainty. In this paper, the performance of information-aided cancellation of ICI caused by DFO is analyzed, and the effect of the uncertainty of aid information is investigated also. The simulation results show that the combined method which combines the estimation and IAADO based on aid information with uncertainty, resolves the ICI caused by DFO effectively, and makes AMBC get better performance in high-speed movement, i.e. En_route phase and Arrival phase. [C782]

"Statistical performance evaluation and system modeling for a Compton medical imaging system for higher energy photon imaging"

The objective of this research is to study the performance of a dual-planar silicon/Anger camera based Compton imaging system for imaging higher energy photons emitted from 131-I using, and compare it with a conventional collimated Anger camera. The Compton imaging system is a potentially effective medical imaging device for monitoring radionuclide cancer treatments that can obtain greatly improved performance in both detection efficiency and spatial resolution for higher energy photons (e.g., 364keV) over conventionally collimated Anger cameras. The Compton imaging system decouples the tradeoff between spatial resolution and detection efficiency inherent to absorbing collimation. System performance is primarily determined by Doppler broadening, energy resolution and spatial resolution of the scattering and absorbed detectors (in addition to the Compton image formation process). In the study, the effective system model of the Compton imaging system was developed considering all factors involved in the Compton process including above three primary uncertainties. Based on the system model, the system performance and comparison were analyzed using the modified uniform Cramer-Rao bound we developed and verified along with the Monte Carlo calculation. From the illustrated bound curves that compare the effect of silicon detector energy resolution and system spatial resolution by simulating a 2D disk having uniform activity, the limiting factor is Doppler broadening for Compton camera performance at 364 keV. Our predictions show that performance of the proposed Compton imaging system is superior to the collimated Anger camera especially as the desired image resolution is better than the "natural" resolution of the conventional collimator. [C783]

"The compensating of medium parameters influence on 3D measurement of speed and direction of turbulent air movement"

The acoustic method of measurement of the speed and direction of motion of turbulent air is discussed. The method is based on the Doppler effect and lets us adequately measure the wind speed up to 330 m/s-the acoustic wave velocity in air. For supervising weak air turbulence it is suggested that the phase difference of the signal is measured with respect to a reference one. The analysis of errors of the measuring device is presented in the paper. The complex compensation of the influence of atmospheric conditions on the measurements is suggested. The results of phase propagation in open measuring channels are compared with the results in a channel that is protected from wind influence but has the other properties of an open channel. The phase propagation in the reference channel is assumed as the reference point. [C784]

"A SNR-insensitive Doppler shift estimator in wireless communications"

This paper presents a signal-to-noise ratio (SNR) insensitive Doppler shift estimator based on the square envelope autocorrelation function (SEACF) of mobile propagation channels, where an iterative processing is employed to eliminate the approximation error and the effects of additive noise. Both theory and simulation show a good SNR-insensitive performance in a wide range of velocities and SNRs. [C785]

"A Doppler spread estimator design for mobile OFDM systems"

In this paper, an efficient and practical design for Doppler spread estimation in mobile OFDM systems are described. A channel auto-correlation function algorithm is proposed for Doppler spread estimation. The Doppler spread estimator is based on finding the auto-correlation function of time domain channel estimates over several OFDM symbols. The estimation performance of the estimator is evaluated via computer simulation using national standard digital television system DTMB signal transmission format. Simulation results show that the proposed Doppler spread estimator can provide high estimation accuracy for a wide range of Doppler spread. Moreover, the proposed algorithm relies on periodic channel estimate and can also be applied into other OFDM systems with known pilot symbols inserted within the data fields. [C786]

"Low complexity channel estimation and tracking method for high speed mobile communication systems"

In the paper, the channel estimation and tracking method for mobile orthogonal frequency division multiplexing (OFDM) systems is developed. The channel estimation method is based on a frequency domain finite impulse response (FIR) filter, while the tracking method is based on a Kalman filter. The proposed method could effectively track the time-variant of the channel with Doppler delay spread. Moreover, the method achieves good performance with low complexity, which makes the hardware implementation facilitated. [C787]

"Detection of stiction of suspending structures in MEMS by A Laser Doppler Vibrometer systems"

Stiction as one of the most failures both in MEMS fabrication and operation has been widely studied. With the decrease in the dimension and material, the ubiquitous surface effect between the device and substrate has become more and more effective. Surface-micromachined structures formed by the wet etching of sacrificial layers are commonly plagued by problems of sticking to the substrate. This paper presents a useful diagnosis system for fully detecting and characterizing the stiction failure occurring in MEMS. The system consists of an LDV (laser Doppler vibrometer), a chamber with controllable environment such as pressure and temperature, and a diagnosis program developed by Matlab software. Full knowledge about the stiction, including its position, shape, stiction releasing configuration and probability of re-stiction can be accessed using the system. We also present an experimental way to analyze two important forces of the surface effect: the capillary force and the van der Waals force. The experimental diagnosis methodology and theoretical summary could provide a useful reference for detecting and predicting the stiction failure of micro-structures. [C788]

"Micro-Doppler extraction of frequency-stepped chirp signal based on the Hough Transform"

The micro-Doppler (m-D) effect induced by the rotating parts in a radar target or mechanical vibrations of the target body provides a new approach for auto target recognition. In this paper, the m-D effect in frequency-stepped chirp signal is analyzed. Compared with that in the traditional chirp signal, the m-D effect in frequency-stepped chirp signal appears some new characteristics. To extract these m-D characteristics and so to obtain the micro-motion information of the target for auto recognition, the extended Hough Transform is applied into detecting the parameters of the curves on the range-slow time plane after the analytical expressions of the curves deduced. Computer simulations have proved the validity of the proposed method. [C789]

"Experimental Demonstration of the Doppler Frequency Conversion in a Slot Line"

Frequency conversion from microwaves to millimetre waves using the Doppler effect in a slot line on an optically excited silicon-on-insulator (SOI) substrate has been experimentally demonstrated. Laser pulses with a wavelength of 532 nm and duration of 33 psec have generated electron-hole plasma periodically at the intervals of 1.2 mm and of 13.6 psec on the SOI surface along the slot line. The plasma acts as an rf-short which effectively moves at a relativistic velocity. The rf-short reflects counter propagating microwaves and up-shifts their frequency through the double Doppler effect. Experiments have shown that microwaves at the frequencies between 10 GHz-18 GHz in the slot line have been successfully converted to millimetre waves with a frequency up-ratio of about 3.9. [C790]

"Evaluation of frequency offset and Doppler effect in terrestrial RF and in underwater acoustic OFDM systems"

Frequency offset and Doppler effect cause loss of orthogonality in orthogonal frequency division multiplexing (OFDM), which in turn may severely degrade receiver performance. Traditionally, most of the literature dealt with non-varying Doppler effect over OFDM subcarriers. However, in terrestrial ultra-wideband (UWB) OFDM radio frequency (RF) and in high data rate underwater acoustic communication (UAC), the effect of Doppler varies considerably over OFDM band. This paper will investigate the frequency offset and the varying effect of Doppler through analysis and simulation in both domains in order to maintain orthogonality or to compensate loss of orthogonality. To the best knowledge of the authors, this type of detailed analysis is not present in these domains, and thus this paper provides a valuable contribution. [C791]

"Markov chain based models comparison and hybrid model design in IEEE 802.16E scenario"

The IEEE 802.16e is a promising technology that allows to provide wireless broadband services to a great number of mobile users. Considering this interesting scenario enriched by further presence of HAPs (high altitude platform) with the role of base stations (BSs), we have proposed a comparison between performances of a set of Markov chain based models collected by literature. These following models: MTA (Markov-based trace

analysis), Gilbert-Elliot, FSM (full-state Markov) and HMM (hidden Markov model) are designed using packet error traces (a sequence of ldquo1rdquo and ldquo0rdquo) obtained by a simulator that takes into account channel impairment effects such as path loss and Doppler effect. To compare the models performances, by each of them artificial traces are generated and then entropy normalized Kullback-Leibler distance, standard error and other statistical properties of random variable G (free error packets burst length) and B (corrupted packets burst length) of artificial traces are computed. The purpose of this work is not only to identify the model that best describes the channel error behaviour in IEEE 802.16e scenario but also to create a new one: after models comparison, a hybrid model designed to achieve excellent performance in the artificial traces generation will be presented. [C792]

"On the performance analysis of fsk using differential detection over Hoyt fading channels"

In this paper, we study the bit error probability (BEP) performance of one-bit delay differential detection of narrow-band frequency shift keying (FSK) signals transmitted over flat Hoyt fading channels and corrupted by additive white Gaussian noise (AWGN). Both the Doppler effects and the inter-symbol interference (ISI) introduced by the pre-detection filter are considered in the evaluation of the BEP performance. By assuming a Hoyt mobile-to-mobile (M2M) fading channel, numerical examples for the BEP of differential detection are depicted. Furthermore, the obtained results are compared with that of limiter-discriminator-integrator (LDI) detection, for different values of the FM system parameters and the fading characteristics. [C793]

"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. [C794]

"Left ventricular resynchronization in H.F.: Comparison of alternative optimization methods"

This paper compares the results of two different procedures, Doppler Ultrasound and Transthoracic Impedance, to monitor the left ventricular stroke volume on a group of heart failure patients submitted to electrical resynchronization therapy. The two procedures have been applied in parallel on 9 patients by changing the stimulation delays between the septal and posterior ventricular walls and the results have been compared to evaluate the correlation between the two choices, and their sensitivity to detect the optimal stimulation condition. The results demonstrated a good agreement between the data obtained with the two procedures (R=0.82), but a very limited change of the target parameter (Stroke Volume) by changing the stimulation delay. This suggests doubts on the choice of stroke volume as the best parameter to be observed for the optimization process and on the adequate sensitivity of the two procedures to highlight the process. [C795]

"Formation of sites with the lowered sensitivity a zone of revealing of the microwave sensors"

It is offered a way of formation of sites with the lowered sensitivity a zone of revealing of a microwave sensor control. [C796]

"Analysis of random radar networks"

We introduce the notion of random radar networks to analyze the effect of geometry in distributed radar systems. We first analyze unistatic systems with a single receiver selected at random from the available group. We approximate the distribution of the individual signal-to-interference-plus-noise (SINR) at the sensors and find the corresponding mean and variance. We then analyze multistatic systems and provide an upper bound on performance. We show that in order to exploit the spatial diversity available to the system, the sensors should be large enough to effectively cancel interfering sources. We underline a design tradeoff between spatial diversity and interference cancellation for multistatic radar networks. We finally provide the results of simulations to validate our analysis. [C797]

"Array steered response time-alignment for propagation delay compensation for acoustic localization"

Locating a source using direction estimates from spatially separated microphone arrays has been widely researched. The directions are traditionally obtained by steering the array to a direction that maximizes the response. A more robust approach is to directly combine the array steered responses and maximize the

resulting spatial likelihood function. However, in the atmosphere the propagation delay from source to array is typically significant, causing true source position and the estimated direction to differ. Localization methods using directional estimates that compensate this delay exist. This work proposes delay compensation for steered array responses to increase localization performance. The method is shown to improve robustness against source movement. [C798]

"Recognizing talking faces from acoustic Doppler reflections"

Face recognition algorithms typically deal with the classification of static images of faces that are obtained using a camera. In this paper we propose a new sensing mechanism based on the Doppler effect to capture the patterns of motion of talking faces. We incident an ultrasonic tone on subjects' faces and capture the reflected signal. When the subject talks, different parts of their face move with different velocities in a characteristic manner. Each of these velocities imparts a different Doppler shift to the reflected ultrasonic signal. Thus, the set of frequencies in the reflected ultrasonic signal is characteristic of the subject. We show that even using a simple feature computation scheme to characterize the spectrum of the reflected signal, and a simple GMM based Bayesian classifier, we are able to recognize talkers with an accuracy of over 90%. Interestingly, we are also able to identify the gender of the talker with an accuracy of over 90%. [C799]

"Effect of Doppler shift on performance of binary DPSK over fast Rician fading channels with diversity reception"

This paper is concerned with the effect of the Doppler shift on the bit error probability (BEP) performance of binary differential phase shift keying with differential detection over the nonselective, Rician fading channel with combining diversity reception. Space antenna diversity reception is assumed. The fading process is assumed to have an arbitrary Doppler spectrum with arbitrary Doppler bandwidth. Both optimal receiver where the Doppler shift has been perfectly compensated for and the suboptimum receiver where no estimation or compensation is made for the Doppler shift are studied. The BEP results derived are given by the exact, closed-form expressions which can show the BEP behavior as an explicit function of various system parameters. For the special case when the Doppler shift is equal to zero, the result provides a new, alternative BEP expression to those that exist in the literature. [C800]

"Adaptive pilot distribution for OFDM systems in time-variant channels"

An OFDM-based WLAN system in time-variant environment has been considered. 4-tap and 2-tap channels with a maximum delay spread of 550ns were used. Uncoded QPSK symbols were used and perfect synchronization was assumed. A more realistic assumption is to let the level of variation of the channel changes between fast and very slow. Six threshold levels of the Doppler spread have been chosen for the adaptive pilot arrangement. The simulation results in Fig. 2 show an increase in the bit rate when the channel is static or slowly varying. Whereas in the rapidly varying cases the bit rate falls down to the conventional one (24 Mbps). In Fig. 2 the bit rate has been averaged every 500 symbols. It was shown that the adaptive method increases the total capacity of the system. The gain in the throughput is noticeable for slow varying and static channels. We noticed that, by choosing proper threshold levels, the adaptive system is comparable in the BER performance with the conventional one. [C801]

"Transmit/receive filter optimization for doubly-selective underwater acoustic channels"

Orthogonal Frequency Division Multiplexing (OFDM) is receiving increased interest for use in underwater acoustic communication systems. It is well-known that OFDM decomposes linear time-invariant channels into a set of parallel (non-interfering) channels via a Fourier basis. However, underwater acoustic communication channels can suffer from significant Doppler effects; for time-varying channels, inter-channel interference occurs and may have a dramatic impact on the performance. Doubly-selective channels and block-based transmissions are examined. In contrast to much work on pulse shape design, a signal-to-interference plus noise ratio metric is considered as the metric for waveform design. Prior work is extended through the use of an alternate view of the cost function which is easier to optimize and yields improved results at high SNR. Numerical results on the mutual information reveal significant gains over classical zero-padded OFDM and the pulse shape designs of Lattice OFDM. [C802]

"On optimal resampling for OFDM signaling in doubly-selective underwater acoustic channels"

Orthogonal frequency division multiplexing (OFDM) is under strong consideration as a modulation for underwater acoustic channels. Underwater acoustic channels are wideband in nature due to the fact that the signal transmission bandwidth is comparable to the carrier frequency. Furthermore, these channels are characterized by long delay spreads, sparsity and time variation. The time-variation challenges the use of OFDM-destroying

carrier orthogonality and introducing significant inter carrier interference. Much of the current work on time varying channels assumes a single common Doppler shift for each path. As such, resampling is optimal preprocessing in such cases. The current work examines the choice of resampling factor for the case of distinct Doppler shift on each path. The optimal resampling factor is selected to maximize the Fisher information for the transmitted data; Fisher information is also used to evaluate the information loss due to resampling. The findings suggest that the optimal resampling factor is near that associated with the Doppler shift of the strongest path. It is also observed that the information loss is modest in many cases using this practical preprocessing. [C803]

"Effect of wind-duration, swell-contamination, and bimodal ocean wave spectra on acoustic doppler"

The purpose of the this paper is to apply a new time domain scattering model (not limited to small wave heights, small slopes, or plane waves) to developing seas which may be swell-contaminated and which assume a new bimodal ocean wave directionality function. This attribute of the directionality of the ocean waves is generated through nonlinear wave-wave interaction in which energy near the spectral peak feeds into both, shorter and longer wavelength components. The goal in this paper is to use these new models to further refine current estimations for the magnitude and Doppler characteristics of the acoustic scattering from the sea surface. It is hoped that these revised estimates can be used by other researchers trying to determine the characteristics of other scattering mechanisms expected to be active in the near-surface region of the sea surface. [C804]

"Low-complexity Doppler compensation in mobile SIMO-OFDM systems"

In high-mobility OFDM systems, Doppler distortions cause inter-carrier interference (ICI) that may degrade the system performance severely. Although thoroughly studied, hardly any approaches for ICI estimation and compensation exist that maintain the OFDM-specific subcarrier-wise signal processing and thus provide a solution with reasonable demands on complexity. For a multi-antenna receiver, this paper proposes such an approach which relies on optimum combining of the signals from the different receive antennas. The ICI is characterized in terms of a frequency-selective interference function, which can be estimated by simple means using common pilot signals. [C805]

"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. [C806]

"Adaptive MIMO detection of OFDM signals in an underwater acoustic channel"

Frequency and time correlation of the underwater channel are exploited to obtain an adaptive channel estimation algorithm for MIMO spatial multiplexing with low complexity and low overhead. Non-uniform Doppler compensation is performed by extending the adaptive synchronization method to multiple transmitters. Algorithm performance is demonstrated on experimental data recorded in several shallow water channels over distances on the order of 1 km. Nearly error-free performance is observed for two and four transmitters with BCH(64,10) encoded QPSK signals. We report in detail on an experiment where an information rate of 23 kbps (4 transmitters times 0.75 sps/Hz/transmitter times 2 bits/symbol times 10/64 times 24 kHz) is achieved using 2048 carriers in a 24 kHz bandwidth. [C807]

"Implementation of an inter-carrier interference self-cancellation technique for OFDM system in Altera CYCLONE II FPGA"

Frequency offset is of the main problems in Orthogonal Frequency Division Multiplexing (OFDM) system. A frequency offset between the local oscillator at the transmitter and receiver causes frequency shift in the signal, while in time-varying channel, it can cause a spread of frequency shift known as the Doppler spread. This leads to loss in the orthogonality between subcarriers and results in intercarrier interference (ICI). A simple and effective ICI self-cancellation scheme based on the signal mapper (a, -a) at k, k+1 subcarrier has been proposed

to reduce the effect of frequency offset. The aim of this project is to develop the ICI self-cancellation using 64-point FFT/IFFT (IP core from Altera) for practical OFDM transmitter and receiver system. This ICI self-cancellation is designed using VHDL for Altera FPGA device, Cyclone II. Detailed structures of each block in the ICI self-cancellation system are presented. [C808]

"Application of Complex Wavelets in radar signal processing"

The present paper discusses the complex wavelet based signal processing techniques for the meteor detection. Firstly the signal containing meteor is processed with the wavelet based noise level estimation technique, which will improve SNR of the signal and improves the probability of detection of weak meteors. Secondly, complex wavelets (constructing filter banks based on Hilbert transform concept) that allow detecting certain parameters related to different Doppler frequency components. When the parameters exceed a certain threshold, it indicates that the meteor is detected. Meteor detection function (MDF) is defined using the above stated techniques. MDF gives the meteor count, Time of occurrence, meteor scan number. MDF is a unique function and it is very useful in astronomical studies. The advantages of this method are directly derived from the limitations of the existing methods. A great improvement in the characteristics of the meteor events is observed when processed with complex wavelet based signal processing techniques. Experimental results showed an increase in the detection of meteor events compared to the traditional method-which uses the spectrum (frequency domain) data. No need of intense observation on the data for threshold setting, the effect of dasianoisepsila and dasiainterferencepsila is also reduced to a great extent. [C809]

"Simulation and bit error rate performance analysis of 4G OFDM systems"

In this paper a simulation based system developed for analysis and bit error rate (BER) performance measurement of orthogonal frequency division multiplexing (OFDM) systems. This paper involves the basics of OFDM system. In this paper bit error rate is calculated and measured with respect to Signal to Noise Ratio (SNR), Doppler Effect, and guard interval. BPSK, QPSK and 16PSK are used as modulation techniques. Additive White Gaussian Noise (AWGN) is used as a communication channel. The effect of SNR, Doppler Effect, and guard intervals on OFDM signals improves the system performance. [C810]

"Precise Simulation of Spaceborne Synthetic Aperture Radar and Its Evaluation"

Simulation technique becomes increasingly important with the development of Synthetic Aperture Radar (SAR). It can be applied for many purposes such as testing different imaging algorithms and validating different SAR system design parameters[1]. For improving the precision of simulator determination of the location (mainly refers to latitude) of satellite which illuminates the fixed scene center is reconsidered in this paper. As attitude of satellite strongly affects Doppler parameters, determination of attitude is also discussed for simulated system approaching real system. Although attitude determination based on Doppler centroid was studied in many articles[2][3], this paper utilizes the information about the footprint shape of beam, and develops the equations relating yaw, pitch and especially roll to slant range and Doppler shift of echo data. We can get the attitude of satellite by solving these equations. Then for validating and evaluating the simulated system, this paper describes a novel approach which involves imaging combination of real and simulated echo data. Doppler parameters adopted in imaging algorithm before and after combining are identical. Effect of focalizing simulated echo data indicates whether the simulated system is acceptable, and relative error of geometric distortion which appears in the SAR image reflects the approaching degree of simulated system to real system. Test was conducted by generating simulated data for RADARSAT-1, the result shows the precision of location and attitude determination and validation of this evaluation approach. [C811]

"An Empirical Study of Breaking Wave Contribution to Radar Backscatter from the Ocean Surface at Low Grazing Angle"

The anomaly of radar sea spikes, defined here as the non-Bragg scattering events with backscattering cross section of horizontal polarization exceeding that of vertical polarization, has been associated with steep wave features possibly going through wave breaking process. This property is employed for remote detection of breaking waves. The results are used to quantify the effect of wave breaking on radar returns. Large increase due to breaking is found in the Doppler velocities of both polarizations (about 50% faster with breaking). The effect of breaking on the backscattering cross section is much stronger for the horizontal polarization (with 15 to 20 dB enhancement) and relatively small in the vertical polarization (on the order of 0.5 dB fluctuations). The presence of swell reduces the impact of breaking waves on radar return in comparison to the scattering from wind seas. [C812]

"Applications for remote laser vibration sensing"

Laser vibrometry based on coherent detection techniques allows to measure vibration characteristics of objects due to the high Doppler resolution. Examples for applications in the field of defense and security such as target classification and identification including camouflaged or partly concealed targets as well as the detection of buried land mines are presented. [C813]

"Quantification of valvular regurgitation area and geometry using HPRF 3D Doppler"

It is important to accurately determine the severity of valvular regurgitation as surgery is indicated only in severe regurgitations. The evaluation of, for example, mitral regurgitation is complex and the current methods have limitations. We have developed a 3D ultrasound Doppler method to estimate the cross-sectional area and the geometry of a regurgitant jet at the vena contracta just downstream from the actual orifice. The back-scattered Doppler signal from multiple beams distributed over the area of interest was measured. The received power from these beams were then calibrated using both a-priori knowledge of the lateral extent of the beams and a reference beam which was completely enclosed by the vena contracta. The method has been implemented and verified by computer simulations and by in-vitro experiments using a pulsatile flow phantom and prosthetic valves with a range of holes. We were able to distinguish between mild, moderate and severe valvular regurgitation and also quantify the regurgitational area as well as showing the geometry of the regurgitation. [C814]

"A comparison of multidimensional flow estimation techniques using computational fluid dynamics: Speckle tracking versus vector Doppler"

Vascular territories susceptible to atherosclerosis often show regions of disturbed flow. Hence, non-invasive imaging of complex blood flow patterns can ameliorate the understanding of atherogenesis, as well as improve early diagnosis of cardiovascular disease. In this work, a simulation environment is presented, where established and experimental ultrasound imaging methods can be thoroughly investigated towards a ground truth for realistic flow patterns. By coupling computational fluid dynamics (CFD) and ultrasonic simulations (Field II), RF-signals resulting from realistic flow in a 3D carotid bifurcation model were obtained, and used for the evaluation of established and experimental velocity estimators: the 1D autocorrelation method (CFI), speckle tracking (ST), and vector Doppler (VD). Simulations showed that CFI failed to portray complex swirling flow in the stenosed bifurcation. Both ST and VD were able to resolve also the lateral velocity component for the complex flow under ideal imaging conditions. Further work will focus on an indepth investigation of the estimators, including common effects that influence estimator performance such as noise, clutter, and vessel depth and angle. [C815]

"OFDM channel estimation Algorithm based on Frequency-Selective and Time-Varying Channels"

Channel estimation based on comb-type pilot pattern has a good performance in frequency-selective channels with the help of MMSE algorithm. But MMSE is too complex for practical implementation and its performance deteriorates rapidly in time-varying channels due to extremely Doppler effects. In this paper, we present an optimized Kalman filter algorithm, which performs iteration operations within separate symbols. Optimized pilot matrices have been posted, where pilots in the special sub-carrier were inserted into rectangle pilot matrices. The modified Kalman filter estimation in the special sub-carrier refines estimation in other pilot sub-carriers. We also propose a low-pass-filter interpolation and FFT transform in time domain and frequency domain respectively. This three-step solution offers a better performance than that of MMSE algorithm. Compared with conventional Kalman estimator the proposed estimator has higher spectral efficiency, while its performance is comparable. [C816]

"Analytical performance evaluation of space time coded MIMO OFDM systems impaired by timing jitter"

An analytical approach is presented to determine the impact of time selective fading, timing jitter and AWGN on the bit error rate performance of an OFDM system with DQPSK and QPSK modulation. The expression for the conditional BER conditioned on a given timing error and fading, is derived and the average BER is evaluated. The BER performance results are evaluated for different values of fading and jitter variances. The performance of the OFDM system in Rayleigh and Rician fading channels is also compared. Analytical approach is also developed to evaluate the BER performance of a quasi-orthogonal space-time block coded (STBC) OFDM system having multiple transmitting and single receiving antennas. The analysis is extended for a MIMO-OFDM system using the ldquoselection methodrdquo for combining multiple receiving antennas, which offers significant improvement in the system performance. The effects of increase in number of OFDM subcarriers and increase in Doppler frequency are also investigated. [C817]

"Doppler ultrasound and numerical analysis for the assessment of hemodynamic disturbances in

ulcerated carotid arteries"

Carotid plaque ulcerations, or irregularities in plaque surface morphology, have been identified as an independent risk factor for ischemic stroke. Our previous studies using Doppler ultrasound (DUS) have indicated significant flow disturbances distal to ulceration in the atherosclerotic carotid bifurcation, as characterized by parameters such as turbulence intensity (TI). Additional tools are needed to understand the implications of such flow abnormalities on the risk of thrombogenesis and cerebral ischemic events. Numerical simulations using computational fluid dynamics (CFD) can supplement experimental DUS studies, providing higher resolution, time-resolved models of 3-D flow fields. CFD is also able to quantify hemodynamic factors that indicate thromboembolic or plaque rupture potential. We report a CFD analysis of an ellipsoidal ulcer model and a matched non-ulcerated model in a moderately stenosed carotid bifurcation, with the same vessel geometries and flow conditions used in our previous DUS studies. The CFD models used a spatial finite element discretization of over 160,000 quadratic tetrahedral elements to adequately resolve the flow field. Pulsatile flow simulations with boundary conditions and flowrate waveforms matching DUS experimental conditions were iterated for five cardiac cycles. Turbulence intensity was calculated for the CFD models and compared with DUS experimental results. The CFD models were able to capture differences in flow patterns between cardiac cycles. As observed in the empirical DUS results, the CFD ulcer model displayed higher levels of TI in the post-stenotic region than the CFD non-ulcerated model. The extent and magnitude of TI was comparable to the DUS results, after modeling for the effects of sample volume geometry and intrinsic spectral broadening, and by a high pass filter. Furthermore, the CFD results indicate that flow post-stenosis is likely transitional, with both disturbed and turbulent flow present. CFD facilitates the--comparison of hemodynamic parameters between ulcer models and may help to demonstrate the risks of embolism or plaque rupture posed by ulcerated atherosclerotic plaques in the carotid bifurcation. [C818]

"Vibration mode and relevant ultrasonic applications of ferroelectric single crystals Pb(Mg1/3 Nb2/3)O3 -PbTiO3 (PMN-PT)"

Electromechanical coefficients of kt, k33' and k33of (1-x)Pb(Mg1/3Nb2/3)O3-xPbTiO3(PMN-PT) single crystals were mainly investigated for various medical ultrasonic applications. The [001] poled PMN-PT wafers exhibit relatively high kt(62%), which is larger than that (49%) of conventional Pb(Zr1-x, Tix)O3(PZT) ceramics. Accordingly, the pulse wave of 2MHz TCD probe manufactured with the PMN-PT wafers show high-quality performances compared with PZT probe. The bandwidth of the PMN-PT probe is 10% broader and its sensitivity is 4dB higher than the PZT probe. The coupling coefficient k33' is a key indicator for medical linear and phase array ultrasonic transducers. Different orientations and poling directions have benn invenstiaged to optimize the properties of PMN-PT. The optimized cut types of PMN-PT for array applications were obtained and its k33' ~93%, which is larger than that (70%) of conventional PZT ceramics. The simulations for the linear array transducer show the advancements of PMN-PT single crystals. 25% increased bandwidth is expected compared with PZT arrays. Based on the longitude extension mode (k33), the PMN-PT/Epoxy 1-3 composites were modeled and fabricated. The holistic kt(> 90%) of the composites far exceeds that of the PZT ceramics (only ~50%). The relatively low acoustic impedance makes the acoustic matching to human tissue much easier. The results would be favorable for single element ultrasonic transducers, especially in Doppler blood flow imaging applications. [C819]

"A New Approach of Extended Chirp Scaling Algorithm for High Squint Missile-Borne SAR Data Processing"

In the traditional extended chirp scaling (ECS) algorithm, after RCMC in the range signal/Doppler domain, targets in the same range gate will have different FM rates for difference of the slant ranges. In the paper, a novel approach for high squint missile-borne SAR data processing using a modified extended chirp scaling algorithm is proposed. A non-linear chirp perturbation function (CPF) is presented and can be applied to each range gate to equalize the targets FM rates before azimuth compression, which can accommodate azimuth compression and improve precision of algorithm. Comparison between this development named modified ECS with traditional ECS algorithm is implemented and several simulations of point targets demonstrate the validity. [C820]

"Long-Term integration algorithm using the HPRF stepped frequency waveform"

A long-term integration algorithm using the HPRF stepped frequency waveform is presented to improve the range and Doppler resolution of moving targets. A stepped frequency radar signal is applied to realize high range resolution; a long-term integration is applied to realize high Doppler resolution. Besides, with the long-term integration, the gain from coherent integration can also be improved a lot, which is of great benefit to the detection of small targets. During this processing, a segment accumulation method is proposed to reduce the storage and computational requirements; a velocity compensation method based on the keystone transform is

presented to overcome the image aliasing due to the coupling effects of moving targets; then a synthetic high resolution image generation method is introduced to synthesize an unambiguous range-Doppler image of moving targets. Finally the performance of this algorithm is demonstrated using simulated data as well as experimental results. [C821]

"Application research of keystone transform in weak high-speed target detection in low-PRF narrowband Chirp radar"

Because of the high speed and the long repeat interval of the radar, there would be serious echo envelope migration while using low-PRF narrowband chirp radar to detect weak high speed targets. The coherent integration method of envelope migration compensation based on keystone transform is studied, the problem of Doppler ambiguity is analyzed, and the influence on the coherent integration effect of Doppler ambiguity degree error and signal band width is simulated, which helps to determine the step of Doppler ambiguity degree search step. The algorithm is introduced and finally experiments on real data are made to testify the algorithm. The results of 128 echo pulses procession show that the SNR could be enhanced by 6 dB, which confirm the effectiveness of this method and improve the ability of weak high speed target detection. [C822]

"New fast methods for moving target detection in non-cooperative bistatic pulse radar"

According to the characteristics of non-cooperative bistatic pulse radar systems and the issue that the Doppler mismatched loss of the cross-correlation detection of moving targets is serious, two fast methods for joint time delay and Doppler shift estimation of moving targets, based on segment correlation-FFT processing and modified partial segment correlation-FFT processing, are proposed, after analyzing the common methods for cross-ambiguity function processing such as direct calculation, FFT, zoom-FFT method. The processing performance of direct calculation and partial segment correlation-FFT processing of LFM pulse-series is analyzed in theory and by simulation. And the simulation shows that the weak moving target can be detected effectively and the time delay and Doppler shift can be fast estimated by the methods presented in this paper. [C823]

"A new DS-CDMA code synchronization scheme"

DS-CDMA is widely used in 3G communication systems, GPS, WLAN and some other fields that require robust resistance against narrow band interference, multi-path time spread or interception. One most challenging and important problem in DS-CDMA is code synchronization, which includes code acquisition and code track. When SNR of the received signal is low, the synchronization becomes not very reliable, which means the system will miss the correct phase of the received signal at a high probability. And therefore, more synchronization iteration is needed. If the PN code is very long, more iteration will become unaffordable because it elongates the synchronization time. In this paper, a non-coherent addition method is proposed to increase synchronization reliability. Another problem that hasnpsilat been discussed in previous literature is chip doppler. It will make the synchronization lose locked abnormally. In the paper, a PLL aid resample method is also proposed to solve this problem. LabVIEW simulation shows that above two methods are very effective. [C824]

"High resolution MIMO-HFSWR using sparse frequency waveform"

In this paper, we propose a concept of multiple-input multiple-output high frequency surface wave radar (MIMO-HFSWR) system with widely separated antennas transmitting and receiving the sparse frequency waveforms. The proposed concept obtains several advantages over the conventional HFSWR system such as finer resolutions and better flexibility. The ambiguity function (AF) was derived in detail to assess the proposed system. The impacts of Doppler effect and the geometry configuration factor are also studied. [C825]

"An Extended Chirp Scaling imaging algorithm for bistatic SAR with unparallel flight paths"

Bistatic SAR uses separated transmitter and receiver flying on different platforms, and has the ability of the exploitation of additional information contained in the bistatic reflectivity of targets. Besides of technical problems-like the synchronization of the oscillators-the processing of bistatic raw data imaging is not well studied theoretically all the same, which is a major area in bistatic SAR. This paper firstly describes the imaging of bistatic SAR with special case of parallel flight paths of transmitter and receiver, and then provides an efficient extended chirp scaling (ECS) algorithm for arbitrary bistatic SAR configure, which is based on the bistatic-to-monostatic application (BTMA). The method described is a feasible solution for the image formation of bistatic SAR with arbitrary bistatic configure. The problem of Doppler ambiguity during the ECS processing is also discussed at last. This ECS imaging algorithm is verified with a simulation experiment. [C826]

"Packet Length Optimization for MIMO Mobile Systems with Estimated CSI"

The reliability of mobile packet data transmission in multi-input multi-output (MIMO) communication systems is degraded by time-varying multi-path channel fading. This so-called Doppler-effect can be mitigated by using a shorter packet length and/or inserting more pilot training symbols and frequently tracking the channel at the receiver at the cost of additional rate overhead. A judicious choice of the packet length according to channel conditions aims at achieving a tradeoff between reliability and overhead to maximize the achievable throughput. We present an analytical framework for optimizing the packet length in mobile MIMO systems to maximize throughput taking into account channel estimation and Doppler effects. As a case study, we consider the Alamouti space-time block code (STBC) for 2 transmit antennas over Rayleigh flat-fading channels and determine the optimum packet length as a function of input SNR and Doppler rate. Furthermore, we investigate the effect of various system design parameters on the optimum packet length and achievable throughput such as signal constellation size, number of receive antennas, and receiver detection algorithm. [C827]

"Pulse design for maximizing SIR in partially equalized OFDM/BFDM systems"

Mobile wave propagation undergoes severe distortions caused by inter symbol interference (ISI) and inter carrier interference (ICI), which are due to multipath and high mobility. OFDM/BFDM techniques have a good ability to overcome ISI limiting quality effects whereas ICI can be increased for severe Doppler spreading. In this paper, we study the use of well localized time-frequency pulse shaping to reduce the effect of these interferences. The linear combination of several of the first most localized Hermite waveforms enables the design of an optimal transmit/receive pulse. By subtracting the interferences coming from some neighborhood symbols that will be treated by a partial equalization scheme, considerable gain in the signal to interference ratio (SIR) is achieved. With a reduced complexity OFDM system, partial equalization of the interference coming from 2-frequency neighbor symbols results in a gain of about 20 dB in the SIR, at high spectral efficiency and severe channel spreading. More gain in the desired ratio is achieved by optimizing the time-frequency spacing of the underlying lattice. [C828]

"OFDM interference analysis in nonlinear time-varying radio channels with frequency offsets"

Nonlinear distortions and frequency offsets are two major problems of OFDM transmission that essentially affect its reliability. In this paper, we analyze OFDM by taking into account both effects. For a wide-sense stationary uncorrelated scattering channel we derive an approximate analytical expression for the signal-to-total interference power ratio. The obtained formula directly involves maximal Doppler shift, transmitter-receiver frequency offset and characteristics of the nonlinear power amplifier (amplifier gain and linear gain). The simulation results confirm that the derived formula provides a close approximation of the exact expression for a wide range of Doppler shifts and transmitter-receiver frequency offsets. Simplicity and accuracy of the obtained expression as well as its fitting for realistic scenarios where the transmitter-receiver frequency offsets are random, makes it convenient for practical applications. [C829]

"A Mobility Support and Load Reducing Partner Selection Criterion in Cooperative Communication"

Partner selection is a critical process for maximizing the effect of spatial diversity in cooperative communications. Most studies have proposed to select a partner node with best received SNR. These algorithms can achieve maximum system throughput in practical cooperative environment, but incur frequent coupling which leads additional system load, such as power consumption and data transmission delay. Furthermore, mobility of nodes, which causes Doppler shift of received signals, is not generally considered. In this paper, we propose a novel partner selection criterion which takes both SNR and mobility into account. Our simulation results show that the proposed algorithm keeps high system throughput, while minimizing system load. [C830]

"Digital Baseband Compensation for Mobile SFBC-OFDM Systems with Receiver I/Q Imbalance"

In-phase and quadrature-phase (I/Q) imbalance is a major performance-limiting impairment for direct- conversion orthogonal frequency division multiplexing (OFDM) transceivers. I/Q imbalance degrades the signal-to-noise-ratio in an OFDM system by causing inter-channel-interference (ICI) between image subcarriers. Doppler spread due to mobility also causes ICI but mainly between adjacent subcarriers. In this work, we investigate the combined effects of mobility and I/Q imbalance in a multiple-input-multiple-output-OFDM system with the alamouti space-frequency block-coding scheme and design an effective compensation technique. Furthermore, we propose a novel pilot allocation and channel estimation scheme, and exploit the problem structure to reduce complexity. [C831]

"Channel Estimation and Mitigation Techniques for OFDM in a Doppler Spread Channel"

The performance of OFDM modulation degrades in a Doppler spread channel due to intercarrier interference (ICI). Multirate sampling theory and a detection scheme, called sequential interference cancellation (SIC), are

applied to a standard OFDM system to reduce ICI in. The increased sampling rate (upsampling) causes less ICI for the edge subcarriers. The SIC detection scheme recovers the data from the outer carriers first and then detection moves from the outer carriers to the inner carriers to lower the error floor. In this paper, SIC detection with modified time-domain interpolation estimation is presented and its performance is compared to the existing time-domain and low-pass interpolation channel estimations via computer simulation. The results show that the modified method performs better than existing estimation schemes for BPSK and QPSK modulation. [C832]

"Ranging Accuracy and Doppler Tolerance of CW Signal Based on Pseudo-Random Code Bi-Phase Modulation"

Ambiguity function method is used to study the ranging and Doppler tolerance performance of CW signal based on pseudo-random code bi-phase modulation (PRCBPM). Its ranging resolution and Doppler tolerance confine are calculated, the ranging performance and Doppler tolerance capability are simulated by using the software of Matlab and the influence factors are analyzed. The simulation results are consistent with the calculation values. The results show that the ranging precision of PRCBPM signal depends on the code width and is more improved with the narrower code width, and that the Doppler tolerance performance lies on and is inverse proportion to the product of code width and code length. [C833]

"60GHz quadrature doppler radar transceiver in a 0.25µm SiGe BiCMOS technology"

A 60GHz Doppler radar for short-range presence detection applications in the unlicensed 60GHz band is described. The 1.1times2.1 mm2SiGe:C BiCMOS IC includes a 60GHz VCO, a polyphase filter for quadrature signal generation, a low-noise amplifier with current reuse quadrature down-conversion mixer and a power amplifier. The VCO can be tuned from 59.5-61.5GHz. The receiver quadrature accuracy is better than 27dB across a plusmn10MHz IF bandwidth. With a single-ended input drive of the differential input, the receiver achieves a conversion gain of 55dB and a DSB noise figure of 22.9dB. Assuming 4dBi antenna gains, the radar IC supports up to 5m range. [C834]

"Analysis and modification for a Doppler shift estimator based on the envelope rate of minimum in wireless communications"

In this paper, the Doppler shift of the time-varying multi-path channel is estimated by calculating the rate of minimum (ROM) of the signal envelope of the channel coefficient estimates at the strongest path. Then followed by an analysis of the effect of noise, we proposed a modification to make the estimation performance robust to signal-to-noise ratio (SNR), and simulations show a great performance improvement in a wide range of velocities and SNRs. [C835]

"Delay and Doppler Shift Joint Tracking Method for OFDM Based Aeronautical Communication Systems"

The aeronautical wireless channel can be modeled as a sparse double-selective channel, which includes a strong line-of-sight (LOS) path and a weak reflected diffuse path Compared with the LOS path's, delay and Doppler shift of the reflected path are more difficult to be estimated, which are time-varying and non-stationary. With equalization using non-sufficient delay and Doppler shift estimation, OFDM system will be faced with serious inter-carrier interference (ICI). To obtain more accurate channel estimation values, we discussed the time-varying characteristic of delay and Doppler shift, and proposed a delay and Doppler shift joint tracking method based on extended Kalman filter. The simulation results show that the proposed method can track the channel parameters accurately, with fast convergence speed. Monte-Carlo simulations were also carried out to evaluate the BER performances of OFDM systems with our proposed tracking method in the typical two-ray aeronautical channel, and zero-force equalization was adopted to cancel ICI. The simulation results justified effectiveness of the joint tracking method. [C836]

"An Improved RD Imaging Algorithm for FMCW SAR"

As a kind of high resolution radar, Synthetic Aperture Radar (SAR) is very important in many military applications. Frequency modulated continuous wave (FMCW) synthetic aperture radar (SAR), combining FMCW technique with synthetic aperture imaging methods, is a newly proposed imaging radar system, and has the advantages such as small cubage, light weight, cost-effective, high-resolution, etc. However, for FMCW SAR, the platform continuously moves while transmitting and receiving signal. The duration of the transmitted pulse increases. The stop-and-go approximation is invalid. So the proper algorithms have to be used to achieve the expected results. For the peculiarity of FMCW SAR, the signal processing is deduced in detail when stop-and-go approximation is invalid, and a modification to RD is presented in order to compensate Doppler frequency shift.

The simulation results are finally presented. [C837]

"The Study on GPS Signal Acquisition Algorithm in Time Domain"

There are three signal acquisition approaches mainly: the serial search algorithm, circular correlation and the delay-and-multiply approach. The serial search algorithm searches for a satellite sequentially at each possible code delay and Doppler shift in time domain. Because only addition and multiplication operations are needed, it is easy to implement in time domain. This approach has been extensive applications. Because the serial search algorithm has to do much glide correlation in a real GPS receiver, this exhausting correlation also tends to be the main weakness of the serial search acquisition. To overcome the shortage of the serial search algorithm, the objective of the study is to shorten the amount of correlation, and a new method is given. It can decrease the amount acquisition time efficient. If this method is implemented in civil GPS receivers, the serial search algorithm will become more feasible and popular. The method aim at not only the GPS coarse code, but also the method of research is suitable for other CDMA systems. [C838]

"Analysis and Estimation of Micro-Doppler Effect in Passive Positioning System"

The micro-Doppler effect on a passive positioning system, introduced by motion of a mobile terminal in multipath fading environment, was investigated and its parameters were estimated. First micro-Doppler model under multipath propagation was presented. In addition micro-Doppler effect induced by non-uniform rectilinear motion of mobile terminal in multipath environment was analyzed. Micro-Doppler frequency offset was computed in corresponding to velocity and acceleration of the terminal, which would induce a linear frequency modulation (LFM) on the received signal. Then the fractional Fourier transform (FRFT) was operated upon the multipath micro-Doppler signal, and multiple LMF signal separating method was used to separate and estimate micro-Doppler parameters of each path one by one. The simulation results showed that using FRFT can effectively estimate and separate micro-Doppler frequency offsets of multi path components, and reduce the effect of strong path component upon weak component. [C839]

"Mean-square consistent estimators of higher-order statistics of generalized almost-cyclostationary processes"

In this paper, the problem of estimating higher-order statistics of generalized almost-cyclostationary (GACS) processes is addressed. The class of the GACS processes extends that of the almost-cyclostationary (ACS) processes and models the output of Doppler channels excited by ACS processes. The proposed estimator is shown to be mean-square consistent under mild assumptions. [C840]

"Effects of finite coefficient word length on channel estimator performance"

In this paper we investigate the impact of finite coefficient word length on channel estimator performance. A theoretical analysis of the increase in channel estimation error due to quantization of estimator coefficients is performed, and by using simulation results, the behavior of this error in different fading environments and for different filter orders is studied. Comparing the simulated results with a theoretical model we have shown that there is a relatively good agreement between results based on the theoretical model and the simulated results. We have shown that there is a closer match between theoretical and simulated results when the input signal is less correlated. Our model is restricted to a flat-fading channel with varying Doppler, and linear FIR estimators. [C841]

"Code detection at Launch and Early Orbit Phase for CDMA TT&C"

This paper reports the analysis, simulation and algorithm design of a code detection procedure for CDMA TT&C systems under robust Doppler dynamics at launch and early orbit phase. [C842]

"Medical applications of polarization-sensitive optical coherence tomography"

Optical coherence tomography (OCT) technology can generate cross-sectional images of the scattering media such as biological tissues with spatial resolution as low as 1 ~ 10 mum. OCT uses a partial coherence Michelson interferometry that produces images similar to the ultrasound B-scans. There are many types of functional OCT technologies including polarization-sensitive OCT (PS-OCT), spectroscopic OCT, Optical Doppler Tomography (ODT), etc.PS-OCT produces not only the structural cross-sectional images but the functional images related to the tissue birefringence, phase retardation and depolarization of light reflected from deep tissue regions. Because the PS-OCT is sensitive to birefringent materials such as collagen, the PS-OCT has been studied as an optical diagnosis tool in skin, bone, cartilage, and tooth. In dermatology, OCT can generate useful images such as skin topology and basement membranes. It also can produce other useful images related to skin

collagen morphologies and photoaging. We have also demonstrated that the PS-OCT can be applied to clinical problems such as wound healing monitoring of skin. Light depolarization due to multiple scattering is often considered as a negative effect during OCT image acquisition which prevents imaging of deep regions. In our study, we show that the scattering changes can be quantified using PS-OCT by measuring the axial variations of degree of polarization (DOP). Therefore, we suggest that the depolarization process can be used in a positive way. We have tested our hypothesis using various optical phantoms. Scattering changes often occur in pathologic conditions of human cervical tissues. We successfully applied our technique to in vitro diagnosis of cervical interepithelial neoplasm (CIN). It was found that the high-grade squamous intraepithelial lesions (H-SIL) including CIN-II, CIN-III, and Carcinoma in situ (CIS) can be diagnosed by DOP quantification with high sensitivity and specificity. [C843]

"Performance Improvement of DSTBC Systems Using Decision Feedback Approach"

DSTBC (differential space-time block coding) system does not require CSI (channel state information) in both transmitter and receiver sides, but its SNR (signal to noise ratio) versus BER (bit error rate) characteristic is degraded compared with original STBC scheme which utilizes CSI at the receiver. In this paper, attempting to recover this performance loss originated from the differential decoding, an improved DSTBC system is presented. In the proposed approach, data sequence after the hard decision is fed back and utilized for the channel estimation, and then the noise contained in the received signal is reduced using updated channel information before the differential decoding. Through computer simulations in fading channels assuming mobile applications, it is shown that the improved method could achieve better performance and shows higher tolerance to Doppler effect compared to conventional DSTBC. [C844]

"A two-step method to process bistatic SAR data in the general configuration"

This paper describes a two-step processing procedure which has a capacity of processing bistatic Synthetic Aperture Radar (BSAR) data in the general configuration based on the extended Loffeldpsilas Bistatic Formula (LBF). For LBF, in any configuration, equal contributions to the total azimuth Doppler spectrum are assumed, which results in the failure of LBF in the high bistatic grade configurations (e.g. spaceborne/airborne configuration and highly different squint configuration). In this paper, we consider the different contributions of transmitter and receiver to the total Doppler spectrum to extend LBF. To illustrate the character of bistatic SAR signal, the two-dimension linearization operation is used to project the quasi-monstatic (QM) and bistatic deformation (BD) terms into the 2-dimensional space (slant range and azimuth time) domain. After the linearization, it can be seen that the bistatic point target reference spectrum (BPTRS) is linearly dependent on the two-dimension space variables. The azimuth-dependent phenomenon is an intrinsic feature of bistatic SAR in the general configuration. To address the two-dimension space-dependent problem, we use the two processing procedures: one is range processing which will remove the dependency of BPTRS on the range space variable, another is azimuth processing which will eliminate the dependency of BPTRS on the azimuth time variable. For the range processing, we prefer the well-known range-Doppler algorithm to cancel the dependency (i.e. RCM). For the azimuth, an additional interpolation operation is required to remove the dependency. [C845]

"Surface estimation in bistatic radar altimetre"

It is well known that the bistatic radar altimeter have some differences with respect to a monostatic one: indeed the spatial resolution is achieved over elliptical areas. These ellipses are in general tilted with respect to the isodoppler line, as these depend on the relative direction of motion of both transmitter and receiver. We can notice that also in the bistatic altimeter the spatial resolution can be improved at least in along track direction, by synthetic aperture approach: the instruments based on this concept are called Doppler Beam Sharpening (DBS) altimeters. Moreover under usual sea conditions, the geometric optics backscattering model appears applicable and the first point of our task appears the slope "m" measurement. We can estimate the slope by considering the backscattering in the specular or reflection central point, or/and by estimation of the decreasing of the backscattering versus observation angle. The second approach appears the best (in order to leave aside from sea surface pollution), which entails the backscattering estimation in the same region from many observation angle (multilook), with uncoherent processing . Therefore a new analytical closed-form model is derived for the average power echo received by a bistatic altimeter from oceanic surface, taking into account the previous requirement not usual in Altimetry. We can notice that, if the aim of our investigation is the wind measurement, due to the models available in literature, the accuracy required in the slope measurement is the order of 10%. Because of the nonlinear interaction at the interface between the water and the air, the wave crests are more peaked than the wave troughs and this effect can be taken into account by given to the surface height probability density function a non symmetric behaviour that is a non- zero skewness coefficient. This has been also done applying an exponential non linearity to a bivariate Gaussian distribution: an update version of this model is a--

lso proposed. Moreover the backscattering model, recently developed for fractal Brownian surfaces, and applied to wind-roughened water surfaces, is also taken into account. A Software Simulator was implemented and the simulation results have validate this model. [C846]

"Effect of wind on space-based radar performance"

This paper addresses the effect of wind on target detection performance using a space based radar platform. Forests and lakes are constantly being modulated by wind, which then affects the radar pulse returns by suitably amplitude modulating the temporal returns, thus affecting the Doppler. Billingsley has modeled the windblown autocorrelations using a real symmetric function that is the sum of a constant term and a ldquoCauchy density function typerdquo term. Using a rational system approximation on the Billingsley spectrum, it is shown that a sixth order rational model containing two damped sinusoidal terms and two exponentially decaying terms can duplicate the wind spectrum up to about -80 dB in the case of low wind speed. Each sinusoidal component in the wind spectrum generates an additional clutter Doppler component and the effect of damping is shown to generate a bundle of uncorrelated returns for each such frequency, with each uncorrelated return containing a coherent sum of signals. As a result, the degradation in performance when wind is present can be attributed to the coherent returns that can not be nulled out using standard adaptive processing techniques. [C847]

"High Range Resolution (HRR) profiling within low elevation search mode"

In this paper, we describe the high range resolution (HRR) profiling technique for generating the target range profile while the radar is in the low elevation search mode. The major advantage of this concept is reuse of the moving target detection (MTD) radar data for formulating the target range profile to provide the early target classification, discrimination, and identification (CDI) decision for all targets. This technique is developed for air missile defense pulse Doppler radar in which transmitting frequency is changing within the transmit pulse width. Here, we also discuss the effects of phase variation introduced by radial target motion and address how to compensate those effects. [C848]

"SAR image formation for forward-looking radar receivers in bistatic geometry by airborne illumination"

The capabilities in imaging for forward-looking radar receivers are severely limited so far. This application gap is especially valid for monostatic radars due to their problem producing a significant Doppler shift orthogonal to the direction of illumination. So a two-dimensional resolution of an area of investigation is nearly unattainable. Here bistatic configurations with separated receiver and transmitter offer a new potential to circumvent this difficulty. In this paper selected results of a performed airborne field campaign from November 2006 are presented in which a forward-looking radar receiver was brought into action. Thereby a SAR system operated as a moving illuminator emitting chirped millimeter wave signals. After introducing the bistatic geometry and the used radar parameters the capability of the approach is shown in detail by the evaluation of one processed SAR image. Herein occurring reflections can be associated clearly to the illuminated scenery due to the achieved resolution in azimuth. Finally the effect of shadowing and the related geometrical behavior are outlined. [C849]

"Adaptive LFM waveform diversity"

Previous work has addressed adaptive radar waveforms that may be designed to be spectrally orthogonal to a received, in-band, time-varying, interference environment. This paper introduces a different adaptive waveform technique whereby a standard LFM waveform is modified to minimize its adjacent-band interference to other spectral users. In addition, results are shown for in-band and/or adjacent-band spectral suppression for improving radar performance and minimizing interference to other spectral users while maintaining good ambiguity function performance. Ambiguity functions are plotted for each case showing good approximation to the ideal LFM ambiguity function. [C850]

"Simulation of network-enabled radar systems to assess the value of jamming in a general radar topology"

This paper explores the concept of a system of diverse and independent radar systems and the corresponding network theory in a network-centric warfare environment. Matlab simulations are developed to demonstrate the concepts and quantify the network metrics discussed for important netted radar configurations. The effect of electronic attack is also addressed. Simulation results to demonstrate the signal-to-noise ratio performance with and without network synchronization are shown, including the degradation due to electronic attack. [C851]

"Intercarrier Interference in OFDM: A deterministic model for transmissions in mobile environments

with imperfect synchronization"

Intercarrier Interference (ICI) is an impairment well known to degrade performance of Orthogonal Frequency Division Multiplexing (OFDM) transmissions. It arises from carrier frequency offsets (CFO), from the Doppler spread due to channel time-variation, and, to a lesser extent, from sampling frequency offsets (SFO). The literature reports several models of ICI due to each kind of impairment. Some studies describe ICI due to two of the three impairments, but so far no general model exists to describe the joint effect of all three impairments together. Furthermore, most available models involve some level of approximation, and the diversity of approaches makes it cumbersome to compare power levels of the different kinds of ICI. In this work, we present the derivation of a general and mathematically exact model for the ICI stemming from the joint effect of the three impairments mentioned. [C852]

"Implementation of 3D sound effect modeling technology based on vehicle driving simulator"

Sound simulation system of virtual driving environment of auditory perception module, can make up for the lack of a single visual information to enhance the driver of the interactive virtual driving environment and the judgement of the spot realistic driving simulator, in order to better complete the training and driving training mission. This article discusses the virtual 3D positioning in the voice of principle, sound attenuation distance model, the Doppler effect and sound formula, and other key technologies on the two voices in the virtual space development kits OpenAL, DirectSound; under simulated driving For the practical application, given some applications and examples of relevant research which should be focus on in the field of staff have a certain value. [C853]

"Tracking of the multi-dimensional parameters of a target signal using particle filtering"

In this contribution, a low-complexity particle filter (PF) is proposed to track the parameters of the signal reflected by a target illuminated with a digital-video-broadcast terrestrial (DVB-T) signal. The tracked parameters are the delay (time of arrival), the azimuth and elevation of arrival, the Doppler frequency, the complex amplitude of the target signal, as well as the rates of change of all but the last parameter. The proposed PF tracks these parameters based on samples of the target signal by assuming that the temporal behaviour of these parameters is governed by a multi-dimensional linear state-space model. The algorithm has an additional resampling step specifically designed to cope with the highly concentrated multi-dimensional posterior probability density function of the parameters. This step allows for tracking the parameters of the target signal with only a few particles, e.g. 50, leading to low computational complexity. Simulation results show that the PF outperforms the maximum-likelihood estimator applied to individual samples of the target signal in terms of higher accuracy and robustness. Under certain conditions usually met in reality the proposed PF can be used to track the parameters of the signals contributed by individual targets in multi-target scenarios. [C854]

"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. [C855]

"Doppler effect of Laguerre-Gaussian beams propagating in left-handed materials"

We investigate the Doppler effect associated with light beams carrying orbital angular momentum in left-handed materials (LHMs). The Doppler shift divides into four tapes of contribution: an axial contribution along the propagation direction, a contribution due to the Gouy phase, a contribution of the beam curvature, and finally an azimuthal contribution due to the screwing wavefront. We demonstrate that the axial Doppler effect in LHMs is reversed as expected. The additional contribution caused by Gouy phase shift and beam curvature should also

be reversed. However the azimuthal Doppler shift, proportional to the orbital angular momentum of photons, is unreversed. The physics underlying this intriguing effect is the joint contributions of negative phase velocity and inverse screw of wave-front. We predict that the orbital angular moment of the photon in LHMs should remain its direction unreversed. [C856]

"Self-mixing DFB Velocimeter with 3-dB Fiber Coupler"

Two beam irradiation scheme enables Doppler velocity measurement using a laser diode without the information of the irradiation angle. By combining the self-mixing effect of a laser diode and the two beam irradiation, the measurement system can be very simple and compact. In this paper, this scheme was demonstrated by using a pig-tail 1.55 pm DEB laser diode and a 3-dB fiber coupler. It was confirmed that the velocity measurement with high precision was possible without the irradiation angle information. [C857]

"Low power microwave systems for heartbeat rate detection at 2.4, 5.8, 10 and 16 GHz"

This paper demonstrates the possibility of detecting heartbeats using a vector network analyzer and two antennas. Within the same system, a comparative study is performed by using different frequencies with different power levels for each frequency. In an anechoic chamber, measurements were taken at 2.4, 5.8, 10 and 16 GHz. This work proves the ability to accurately detect heart activity and extract heartbeat rates, using low power such as -30 dBm from the radiating structure. [C858]

"An improved channel order estimation method for OFDM systems based on MDL criterion"

Channel estimation plays an important role in wireless OFDM systems. This paper studies the channel order estimation problem, which aims to estimate the number of paths of wireless channels. We first introduce the traditional channel order estimation method based on minimum description length (MDL) criterion. We find that the traditional method do not perform well when the number of channel samples is small. In order to solve this problem, we propose an improved channel order estimation method, which is also based on MDL criterion. Simulation results show that the improved method has a better performance than the traditional method in terms of estimation precision. [C859]

"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. [C860]

"Experiments on frequency error compensation using Synchronization Channel in OFDM radio access"

This paper experimentally investigates the effect of frequency error compensation via demodulation automatic frequency control (AFC) using the synchronization channel (SCH) in downlink OFDM radio access. The implemented OFDM receiver compensates for the frequency error caused by the difference in frequency between a base station (BS) and a user equipment (UE) using a time-division multiplexed SCH signal and that caused by the Doppler shift generated by the mobility of a user using reference signals with staggered multiplexing. Experimental results elucidate that even when the standard oscillator frequency of UE cannot track the more accurate one of a BS, demodulation AFC can suppress the residual frequency error to a sufficiently low level using the SCH so that the degradation in the block error rate of the physical broadcast channel control signals is slight with respect to the case without frequency error for a speed greater than 350 km/h. [C861]

"Asymptotic capacity of underspread and overspread doubly selective MIMO channels"

In this paper, we consider stationary time- and frequency-selective MIMO channels. No channel knowledge

neither at the transmitter nor at the receiver is assumed to be available. We investigate the capacity behavior of these doubly selective channels as a function of one of the system parameters, the number of transmit antennas and channel parameters as delay spread, Doppler bandwidth and channel spread factor (the product of the previous two parameters). For critically spread channels (channel spread factor of 1), it is widely believed that the dominant term of high-SNR expansion of the capacity is log(log(SNR)) or in other words, the pre-log (the coefficient of log(SNR)) is zero. We provide a very simple scheme showing that for critically spread and mildly overspread channels a non-zero pre-log exists under certain conditions. We specify these conditions in terms of the Doppler bandwidth and the delay spread. We reason that for nearly critically spread channels, MIMO systems exhibit same degrees of freedom as that of a SISO system. At higher channel spread factor (overspread case), the log(SNR) term vanishes and log(log(SNR)) term becomes the dominant capacity term. We specify the range of existence for log(SNR) regime. [C862]

"Simulation of human microDopplers using computer animation data"

The capability to detect, track and monitor human activities in non-line-of-sight environments is an important component of security and surveillance operations. The movement of the human body and limbs result in unique microDoppler features which can be exploited for identification and classification of different types of human motions. In this paper, a method to simulate the microDoppler signatures of complex human motions from virtual reality animation data is presented. The simulation method is tested on three types of human motions-walking, running and crawling. The simulated Doppler spectrograms are compared with measurement results. Additional simulation data are presented to show patterns over a long time duration and the effect of frequency and viewing angle. [C863]

"Imaging the rotor blades of hovering helicopters with SAR"

An elementary analysis of X-band SAR images of the flashes from the rotating blades of a hovering helicopter is presented. The analysis is supplemented by simulations based on a physical optics approximation. It is shown that the SAR image consists of a set of ghost images. The ghosts have the form of a dasiacombpsila of periodically repeated point spread functions. Each one corresponds to the point spread function of the unmodulated SAR for the leading and trailing blade edges weighted by an envelope consisting of a much broader dasiasincpsila function. Due to interference effects the blade scattering is effectively confined to a small length of the blade. Some effects of varying the rotation rate are presented. [C864]

"Micro-Doppler analysis of pedestrians in ISAR imaging"

In radar imaging, it's well known that relative motion or deformation of parts of illuminated objects induce additional features in the Doppler frequency spectra. These features are called micro-Doppler effect and appear as sidebands around the central Doppler frequency. They can provide valuable information about the structure of the moving parts and may be used for identification purposes. Previous papers have mostly focused on ID micro-Doppler analysis by V.V.Chen et al (2002). In this paper, we propose to emphasize the analysis of such "non stationary targets" using a 2D imaging space, using both the micro-Doppler and a high range resolution analysis. As in 2D-ISAR imaging, range separation enables us to better discriminate the various effects caused by the time varying reflectors. We will focus our study on the human motion. Thanks to the micro-Doppler signature we are able to extract information on the gait of pedestrians. We will show examples on simulated and experimental data. [C865]

"Photodiode-free Doppler velocimeter based on self-mixing effect in commercial VCSELs"

In this paper, we explore a new signal acquisition method for laser Doppler velocimeter based on the self-mixing technique. The self-mixing technique is applied on commercial multimode transverse Vertical-Cavity Surface-Emitting Lasers (VCSELs) and the signal is acquired by amplification of the junction voltage of the laser diode when it was usually picked-up with an external photodiode. The sensor developed exhibits up to 25 dB signal-to-noise ratio for a wide velocity range. We present a study of the sensitivity of such photodiode-free sensors versus the laser static conditions and we compare the results with usual photodetected signals. Finally we expose the advantages of this technique and propose new applications for self-mixing sensors. [C866]

"Modeling and analysis of speckle effects for velocity measurements with Self-Mixing Laser Diode Sensors"

This paper deals with the optimization of laser diode self mixing sensors for velocity measurements when self-mixing signals are corrupted by the speckle phenomenon, a process of a random nature due to the surface roughness of the moving target. A new behavioral model is presented and used to design and compare real time and optimal signal processing algorithms for Doppler frequency estimations. Finally, experimental results,

obtained in the context of automotive applications, validate the proposed model in measuring car velocities. [C867]

"EMI repair in pulse doppler radar"

The electromagnetic spectrum traditionally used by radar systems is under pressure from the growing global need for wireless communications services. Additional factors, such as the technology shift towards high duty-cycle solid-state transmitters and phased arrays using uniformly illuminated transmit apertures, are making the radar-to-radar electromagnetic interference problem more important than ever before. Such high-level electromagnetic interference (EMI) to radar can result in degraded performance, and for modern high-performance pulse doppler radars the problem is aggravated by the need to use coherent dwells of many pulses for coherent suppression of strong clutter returns. Just a few high-level EMI returns can severely desensitize the radar across many range cells in the pulse repetition interval (PRI) and even result in complete loss of information due to receiver saturation effects. This paper will describe a simple doppler repair technique for effectively reconstructing lost data within a pulse doppler radar coherent dwell and thus preserve clutter suppression and sensitivity in a severe EMI environment. [C868]

"Performance Analysis of WIMAX (802.16e) Systems"

The performance of WIMAX (IEEE 802.16e) systems can be improved by using adaptive antennas in the base stations. These systems operate in Rayleigh/Rician fading channels in the 2-6 GHz band for mobile users with velocities up to 125 km/hr. In this paper, adaptive antenna systems are employed in order to find the direction of arrival (DOA) of the signals and to maximize SINR by using beamforming, Capon, MUSIC and ESPRIT algorithms. The paper also presents the effects of modulation, coding, OFDM symbol duration and Doppler shift on the performance of WIMAX systems. [C869]

"New Analytical Method to Investigate the Effect of Normalized Doppler rate on the Capacity of MIMO channels Using Karhunen-Loeve Expansion"

In this paper the effect of normalized Doppler rate fN on the capacity of MIMO channels with any arbitrary fading spectrum in fast fading environment is investigated. A channel with land mobile fading spectrum with the autocorrelation function introduced by Jake is considered for simulations. Normalized Doppler rate fN is actually the product of the actual Doppler rate fD and the duration of the transmitted symbol T. The discrete version of Karhunen-Loeve expansion is utilized to produce a complex Gaussian process in which each of its instant values is correlated to past values based on an arbitrary autocorrelation function. This expansion is also used to expand the channel matrix with each entry being a complex Gaussian process. This is a computationally efficient technique for statistical simulations to evaluate the ergodic capacity and can be used to avoid lengthy numerical computations. [C870]

"Efficient Adaptive Carrier Tracking for Mars to Earth Communications During Entry, Descent and Landing"

In the Mars rover missions the signals transmitted back to Earth travel under low SNR conditions in highly non-stationary channels [1, 2]. During the entry, descent and landing phase (EDL), the spacecraft high dynamics yields severe Doppler effects. We propose a robust and low complexity scheme to estimate and track carrier frequency from the received signals at the Earth end. The method employs a hierarchical arrangement of convex linear prediction cells that is dynamically adapted to respond to the channel conditions. The adaptive combination is able to outperform the best individual estimator in the set, leading to a universal scheme for frequency estimation and tracking. In order to compensate the lag error effect, we explore an efficient forward and backward aggregation scheme that improves considerably the frequency RMS error as compared to the original method [3]. [C871]

"Extension of Automotive Radar Target List Simulation to consider further Physical Aspects"

In this paper, we present extensions to the existing model which consider the effects of multipath propagation and multiple reflections in order to bring the simulated target lists a step closer to reality. [C872]

"Enhanced Frequency Shift in Optical Slow-Wave Structures"

Doppler effects in electrooptic media can be exploited to induce a continuous, accurate and fast shift of the carrier frequency of optical signals, without the need for nonlinear materials, additional optical sources or high optical power levels. In this contribution, it is shown that the efficiency of the frequency-shift process can be significantly enhanced by slow-wave propagation in coupled resonator optical structures. By means of time-

domain numerical simulations, lumped and traveling wave architectures for slow-wave frequency converters are discussed and compared to the state-of-the-art devices, with the aim of clarifying the role played by optical resonators. Relationships between the maximum frequency shift and the bandwidth of the dynamic slow-wave structure are derived. Stop light effects are also explored, showing that the speed of the frequency-shift process can be arbitrarily slowed down, if the optical pulse is trapped, frequency shifted while inside the structure and finally released. [C873]

"A Novel Arrany Signal Processing Technique for Multipath Channel Parameter Estimation"

In this paper, a new array signal processing technique, which make use of the cross ambiguity function calculation, is proposed. Developed technique estimates direction of arrival (DOA), time delay, Doppler shift and amplitude corresponding to each impinging signal onto a sensor array in an iterative manner. Performances of the proposed technique cross ambiguity function -direction finding (CAF-DF) and multiple signal classification (MUSIC) are compared using synthetic signals in terms of root mean squared error (rMSE) for different signal-to-noise ratio (SNR) values. Success of the proposed technique is studied on the recorded multipath high-latitude ionosphere data. Results show that proposed CAF-DF technique increases the success rate considerably in separating signal sources even for low SNR values. [C874]

"Quadrature Doppler Ultrasound Signal Denoising Based on Matching Pursuits with Different Time-Frequency Dictionaries"

The spectral analysis of the Doppler ultrasound signal has been widely used in medical diagnosis. The additional frequency components arising from noise will produce an adverse effect on the subjective study of the spectrogram and its quantitative analysis. To remove noise effectively, matching pursuits with three different time-frequency dictionaries including Gabor atoms (GMP), cosine packets (CMP), and wavelet packets (WMP) are proposed to remove noise from the quadrature Doppler ultrasound signal in this paper. The simulation results have shown that the GMP method can be best adapted to approximate the Doppler ultrasound signal with fewer atoms compared with the CMP and WMP methods, and this approach is also superior to the translation-invariant wavelet transform method. In contrast to the translation-invariant adapted local cosine transform, although the GMP method has achieved approximate performance improvements with higher computation intensity, it offers the potential advantages in pulsed Doppler ultrasound application because it have no requirement for the signal over-sample, which is needed in the traditional transform-based denoising methods in order to obtain a more precise estimation of the noise level. [C875]

"Polarization Diversity for Detecting Targets in Heavy Inhomogeneous Clutter"

Polarization diversity has proved to be a useful tool for radar detection, especially when discrimination by Doppler effect is not possible. In this paper, we address the problem of improving the performance of polarimetric detectors for targets in heavy inhomogeneous clutter. First, we develop a polarimetric detection test that is robust to inhomogeneous clutter. We run this polarimetric test against synthetic and real data to assess its performance in comparison with existing polarimetric detectors. Then, we propose a polarimetric waveform-design algorithm to further improve the target-detection performance. A numerical analysis is presented to demonstrate the potential performance improvement that can be achieved with this algorithm. [C876]

"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. [C877]

"Filtering Depth Measurements in Underwater Vehicles for Improved Seabed Imaging"

Underwater vehicles are commonly used for detailed seabed mapping. To derive a bathymetric map, the depth of the underwater vehicle must be known. The offshore survey industry has often strong requirements on both absolute and relative accuracy. Depth is usually deduced from a measurement of absolute pressure. Regardless of the quality of the pressure sensor, the pressure measurement is influenced by environmental factors, such as waves, tide, atmospheric pressure and sea water density profile. In the paper we analyze these factors with

respect to their behavior and effect on the measured depth. An underwater vehicle equipped with an aided inertial navigation system (AINS) has through its accelerometers and Doppler velocity log redundant information on the movement of the underwater vehicle. Using this information, an AINS is well suited to filter out dynamic pressure sensor noise. Linear wave theory is used to model the effects of the waves on the pressure sensor, and it is suggested how the parameters of the pressure sensor noise model can be deduced from the mean wave amplitude and period. AINS performance is often substantially improved by post-processing. The paper will therefore examine the depths outputted from the pressure sensor, from the AINS real-time filter, and from post processing the AINS measurements. [C878]

"HF Radar Observation of Wave Directional Spectra in a Strong Current Regime"

Dual Wellen HF Radar (WERA) systems have been observing near-surface currents and wave parameters over the Southeast Florida shelf since June 2004 as a part of the Southeast Atlantic Coastal Ocean Observing System (SEACOOS). The region of coverage includes the Florida Straits and the Florida Current (FC) which typically has maximum surface velocities approaching 2 ms"1. The echo-Doppler spectra are also routinely recorded and archived at both stations which allows post-processing to extract surface wave directional spectra using an iterative approach as implemented in Seaview Sensing reg software. Both WERA sites operated continuously during the passage of Hurricane Jeanne over the Florida Straits on 25 Sept 2004. Although it passed ~200 km to the north of the measurement domain, the local mean winds exceeded 20 ms-1and rotated over 270deg. The near-surface currents during the passage of Hurricane Jeanne reflected the influence of the wind as well as the Florida Current. The effect of the wind on the near surface flow was seen in easterly and southerly flow over the shallow shelves near Florida and the Bahamas respectively as well as relatively slow flow in the center of the Florida current. Maximum current velocities were only 130 cms-150-60 cms-1less than typical values. The interaction of these wave fields from differing directions with the high lateral shear of the western edge of the Florida Current was observed every 10 minutes.. The wind-wave component of the spectrum was observed to respond rapidly to the rotating wind-field, but effects of the horizontal shear were observed in the off-wind angle of the wind-wave peak. Tower frequencies were often observed at large angles to the local wind. [C879]

"Real Time Monitoring of Water Quality Parameters in Corpus Christi Bay to Understand Hypoxia"

Corpus Christi Bay (Texas, USA) is home to the nation's seventh largest port with numerous petrochemical facilities. This shallow wind-driven bay (average depth 3 m) is very dynamic, and is typically a well-mixed system. However, the water column becomes stratified during the summer months in the south-east portion of the bay, and so dissolved oxygen (DO) in the upper-layer water column is not able to mix with the lower-layer water column. Therefore, an hypoxic condition can develop at the lower portion of the water column in the bay, and as this bay is very stochastic in nature, this condition lasts on the order of hours. It is difficult to 'capture' this kind of episodic events through discrete sampling at limited locations in the bay. Our research group has developed an integrated data acquisition system which can measure horizontal and vertical variation of various water quality parameters 'synchronically' over a highly-resolved spatial regime. Also, software has been developed in our laboratory which can display the horizontal and vertical variation of these parameters in real time and thereby, guides in determining the spatial extent of the water quality parameters of interest. As part of our routine monitoring of Corpus Christi (CC) Bay, we conducted an east-west transect of the bay's ship channel on November 29, 2006 and March 22, 2007. The data collected by our system suggests that the inverse estuary situation exists in the ship channel, i.e., the water becomes more saline and dense as we moved away from the mouth of the Gulf of Mexico towards the bay interior. The prevailing south-east wind on those days 'pushed' the high saline water from the mouth of the Laguna Madre and Oso Bay toward the ship channel. The preliminary results of the hydrodynamic model developed by our research collaborators showed the similar circulation pattern. Integrating the model with the observed data will help us in characterizing the stratification pattern of the bay an- d therefore, greater understanding of the hypoxic phenomena. Also, particle concentrations measured by a particle sizer (one of the instruments in our suite of instruments) are well correlated with the acoustic backscatter intensity measured by our acoustic Doppler current profiler. This kind of relationship is very important because it provides a greater capability to characterize the particle dynamics of the bay. Particles can transport 'particulate BOD' (biochemical oxygen demand), thus affecting hypoxia. Quantification of the particle influx/outflux to the Gulf of Mexico through the ship channel may help us to understand the contribution of the ship channel effects on hypoxia in the bay. [C880]

"Analysis and Mitigation of Doppler Rate Effect in a Multipath Channel"

Establishing robust communications in the presence of Doppler rate is a requirement for several waveforms such as SATCOM and HF. In this paper, we motivate the need to model Doppler rate by analyzing the kinematics of motion in the 2-D plane. We formulate the time-varying, multipath channel output as a composite chirp signal

with a convolutive mix. We propose a data-aided method to transform the channel output into a composite signal whose chirp parameters can be estimated by existing techniques. We present a method to decouple chirps from the channel output and estimate channel coefficients. The performance of the channel estimator is characterized in terms of mean-squared-error. The sensitivity of the algorithm to errors in chirp estimates is studied as a function of symbol rate. [C881]

"Robust Statistics Based Expectation-Maximization Algorithm for Channel Tracking in OFDM Systems"

Decision directed channel tracking (DDCT) at high fade rates in OFDM based systems is addressed in this paper. Existing DDCT algorithms like the expectation-maximization (EM) algorithm (Al-Naffouri et al., 2002) suffer from error propagation and exhibit poor performance when applied to large frames at high fade rates. We propose a robust EM algorithm which mitigates the effect of error propagation and is able to track the channel in the decision directed mode even over frame durations experiencing 2-3 fade cycles. This EM algorithm uses the Huber's cost function in the maximization step instead of the non-robust least squares or Kalman cost function. Further, the noise variance is estimated using the robust median absolute deviation estimator instead of the standard maximum likelihood estimator. The proposed robust EM based DDCT scheme has a better error rate and MSE performance when compared to Kalman filter based pilot assisted channel tracking scheme with a 6.25% pilot overhead, even at a normalized Doppler of 0.04. [C882]

"Synchronization Signal Design for OFDM Based On Time-Frequency Hopping Patterns"

In an OFDM system, channel estimation can be considered as sampling the time-frequency response of the channel through a number of known pilot symbols placed across the time-frequency plane. Sampling theory dictates that the pilot insertion frequency must be above the Nyquist rates in both time and frequency to avoid aliasing of the delay-Doppler response. Based on the regularly spaced pilot pattern, we can derive alternative patterns that preserve the non-aliasing property by hopping the scan lines in either time domain or frequency domain, but not both. From this extended set of patterns, we find ones with properties that, in addition to channel estimation, can achieve responsively other synchronization tasks such as initial time-frequency offset estimation and device identification. The ambiguity function analysis frequently used in radar signal design leads to a periodic time-hopping pattern based on the costas array that has minimal coincidences with its circular time-frequency shifts, which can be used for the identification of multiple devices. The hopping in time also greatly increases the pilot's time support, thus enabling the quick initial acquisition of timing and frequency offset with very short observation. [C883]

"Accurate Doppler Frequency Shift Estimation for any Satellite Orbit"

One of the most important parameters in satellite communication links, particularly in low earth orbits (LEO) and elliptical orbits is Doppler frequency shift (DFS) and Doppler frequency rate (DFR) at communication channels. This paper analyzes Doppler frequency effects in various satellite orbits. For this purpose, a new orbit generator is presented for accurate simulation of satellite orbits. The non-spherical mass distribution turbulence of the earth and its effects on Doppler shift calculations is considered and simulation results of Doppler frequency shift for an elliptical LEO satellite in L-band is presented. [C884]

"Performance of Random Spreading MC-CDMA in the Presence of Multiple Interferences and Doppler Shift"

The performance of multicarrier code division multiple access (MC-CDMA) systems that employ random spreading sequence in downlink slowly fading channels is analyzed. An expression of the probability density function (pdf) of multiple access interference (MAI) is derived for CDMA systems and the results are extended to MC-CDMA systems to determine the pdf of MAI, inter-carrier-interference (ICI) and noise in terms of the number of users, the spreading factor, the number of sub-carriers and frequency offset. The results show that the effects of frequency offset becomes crucial as system loading increases. In this paper the synchronous downlink of cellular MC-CDMA is considered where, a Gaussian approximation of the MAI and ICI is derived to reduce the computational complexity in calculating the system performance. [C885]

"Optical frequency transfer over 38 km of installed fiber at less than 3 ГґВ— 10-19 residual fractional instability"

We transmit a narrow-linewidth cw laser at 1535 nm across 38 km of installed fiber. Through standard Doppler-cancellation techniques, we achieve a residual fractional frequency instability of 4 times 10-17at 1 second averaging time. [C886]

"Hilbert-Huang Transform (HHT) Analysis of Human Activities Using Through-Wall Noise Radar"

Various parts of the human body have different movements when a person is performing different physical activities. There is a need to remotely detect human heartbeat and breathing for applications involving anti-terrorism and search-and-rescue. Ultrawideband noise radar systems are attractive because they are covert and immune from interference. The conventional time-frequency analyses of human activity are not generally applicable to nonlinear and nonstationary signals. If one can decompose the noisy baseband reflected signal and extract only the human-induced Doppler from it, the identification of various human activities becomes easier. We propose a nonstationary model to describe human motion and apply the Hilbert-Huang transform (HHT), which is adaptive to nonlinear and nonstationary signals, in order to analyze frequency characteristics of the baseband signal. When used with noise-like radar data, it is useful covertly identify specific human movement. [C887]

"Performances Simulation of Flat Fading Channels in Mobile Ad Hoc Networks"

The bit error rate is an important metric to consider when analysing performance of wireless system. The mobile-to-mobile channels are quite different from fixed-to-mobile channels especially the power spectral density of the Doppler spread. This paper proposes the performances simulation of M2M channel in ad hoc networks context. The simulations are carried out using a realistic channel model and a DQPSK modulation with differential detection. The results show the effect of double mobility degree on bit error rate. [C888]

"Doppler-Polarimetric Approach to Microwave Remote Sensing of Precipitation"

This study has shown that considered Doppler and polarization parameters of radar signal contain information on rain microstructure and turbulence intensity in weather object. The differential Doppler velocity of raindrops carries the important information on microstructure of rain and can be used in order to measure the rain intensity. However turbulence decreases this effect and should be taken into consideration as well. Application of independent turbulence-related variables can improve the reliability and accuracy of radar measurements in rain. Measurements of weather objects by Doppler-polarimetric radar can be very useful to solve wave propagation problems for the tasks of microwave remote sensing, communications and the radar's ability to detect targets embedded in high clutter background. [C889]

"Mobile Position Tracking by TDOA-Doppler Hybrid Estimation in Mobile Cellular System"

An effective method is presented for position tracking of a moving mobile terminal (MT). The method is based on time/distance difference of arrival (TDOA) estimation and Doppler measurements. TDOA locationing based on Chan's method provides an analytical solution which is closer to the Cramer-Rao Lower Bound (CRLB).However its accuracy is affected by multi-access interferences and non-line-of-sight (NLOS), thus making Doppler-aided positioning a good complementary technique due to its independency of the above effects. After acquiring the initial position of MT using TDOA information, the moving track is estimated by a hybrid method which combines TDOA with Doppler. Simulation results show this hybrid method can achieve better performance than TDOA or Doppler technique. [C890]

"Basis Expansion Model and Doppler Diversity Techniques for Frequency Domain Channel Estimation and Equalization in DS-CDMA Systems"

In this paper, we propose a frequency domain adaptive estimation of Doppler shifts for multiple Doppler subpaths in direct sequence code division multiple access (DS-CDMA) systems. By modeling the doubly selective channel using a basis expansion model (BEM), the proposed expectation-maximization (EM) algorithm-based estimation method can obtain accurate information of Doppler shifts. Based on the estimated information of Doppler shifts, a FDE-based receiver architecture is developed to exploit Doppler diversity in frequency domain. Simulation results demonstrate that this receiver structure features a low computational complexity while achieving good performance compared with traditional receiver structures in DS-CDMA systems. [C891]

"Handoff Probability in Wireless Networks Over Rayleigh Fading Channel: A Cross-layer Approach"

Handoff probability is one of the significant metrics to characterize the handoff operation in wireless mobile networks. Handoff probability refers to the probability that an Mobile Station (MS) will handoff to a neighboring cell without call completion upon the instant arriving at the border of the serving cell. In the literature for developing the metrics, the physical fading channel is not taken into account. In addition, the tele-traffic parameters are usually simplified as exponential distributed variables for the sake of analytical tractability. In this paper, by proposing a new cross-layer approach, we formulate the closed-form result for the handoff probability

under the Rayleigh fading scenario. In particular, the results could demonstrate the explicit relationship between the handoff probability and the physical link characteristics, e.g. carrier frequency, maximum Doppler frequency and fade margin. In addition, the formulae is developed with the generalized tele- traffic parameters for the aim of general applicability. The numerical investigations demonstrate that the fading channel has a substantial impact on handoff probability. [C892]

"Proposed Active Optical Frequency Standards based on Magneto-optical Trap Trapped Atoms"

A new conception of optical frequency standards, active optical frequency standards (AOFS) is under developing. In this report, we propose a novel scheme for active optical frequency standards based on magneto-optical trap (MOT) trapped atoms. With the advantages of 4-level atomic system proposed here, this scheme overcomes the main limitations on the accuracy of active optical clock based on atomic beam due to Doppler effect. [C893]

"Simulation and Analysis of Chinese Digital Audio Broadcast System on Base Band"

In this paper, a simulation model is put forward using Matlab and Simulink based on "Specification of 30 MHz-3000 MHz terrestrial digital audio broadcasting system" issued by China. All transmission modes in the specification have been simulated, and the results of simulation were analyzed. We concerned more on the Doppler Shift than the SNR in simulation. Results of simulation prove that effect of the Doppler Shift is in main position in mobile reception while effect of the SNR is in main position in fixed or low-speed movement reception. [C894]

"Non-rigid registration of three-dimensional (3D) grayscale and Doppler ultrasound breast images"

The purpose of this study is to evaluate the accuracy of image volume based registration (IVBaR) of 3D ultrasound (US) image volumes of the whole breast acquired at different times. Successful IVBaR could aid in detection of tumor changes in response to neoadjuvant chemotherapy and potentially be useful for routine breast cancer screening and diagnosis. IVBaR was successful in 9 of 10 reproducibility studies, 11 of 15 image pairs collected before and after approximately 45 days of chemotherapy. Doppler study yielded volume of blood flow to the region surrounding the lesion and its change when reducing breast compression. The color flow vessels provided independent measures for validation of registration of the grayscale portion of those images. [C895]

"Evaluation of stationarity of laser Doppler signal in the pulse-based synchronized-averaging analysis"

Pulse parameters calculated from the LDF waveform based on time-domain synchronized averaging analysis were shown to be able to discriminate the difference in microvascular resistance, however its applicability depends seriously on the assumption of signal stationarity. In this study, our aim is to investigate the effect of pulse number, which may destroy the signal stationarity, on the pulse LDF parameters. The study presented here has established the criteria for pulse number to achieve the signal stationarity so that the microcirculatory discriminability of the pulse-based time-averaging analysis on LDF signal can be improved. The proposed quantitative method to verify the assumption of signal stationarity when utilizing time-averaging can also be applied to analysis of other bio-signals. [C896]

"5.8 GHz Fixed WiMAX Performance in a Sea Port Environment"

This paper presents a fixed worldwide interoperability for microwave access (WiMAX) performance at 5.8 GHz in a sea port environment in the presence of multipath, Doppler shift, and boat's rocking. Multipath and Doppler shift measurements were carried out to understand bit error rate (BER) results from a fixed WiMAX equipment. Percentage probability of root-mean-square (RMS) delay spread from multipath measurement reached 100% within the fixed WiMAX symbol period. Doppler shift was the main factor degrading fixed WiMAX performance. However, it was found that this effect can be significantly mitigated by using a directive antenna. Received signal distribution from antenna mounted on a diving boat was compared with that from antenna mounted on shore to understand the effect of boat's rocking to signal reception. [C897]

"Laser Doppler Velocimetry based on self-mixing effect in vertical-cavity surface-emitting lasers"

In this paper, a laser Doppler velocimeter is developed base on self-mixing effect in a vertical-cavity surface-emitting laser (VCSEL). The monitor photodiode mounted on the back facet of the VCSEL acts as a transducer and it generates the self-mixing current signal. Measuring the power spectrum of Doppler frequency of this signal, the target velocity component projected along the optical axis of the laser beam is calculated. The experiment results show that the accuracy of velocity measurement is high with relative error of Doppler frequency lower than 2%, while for the velocity higher than 70 mm/s. The selection of one polarization state in

the detection light beam by inserting a polarizer can enhance of several dB the responsivity of VCSEL to external optical injection. [C898]

"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. [C899]

"Spreading sequence comparison for MC-CDMA systems in a doubly selective channel"

Future wireless communication systems are intended to offer multimedia services to a large number of subscribers at the same time. The MC-CDMA technique has recently gained considerable attention for many future communication systems due to its ability to support high rates while ameliorating ISI and channel propagation effects. This paper investigates the performance analysis and simulation of a MC-CDMA systems with several spreading codes operating over a doubly selective channel. The time selectivity is modelled by the Doppler spread. The Doppler spread is the difference in Doppler frequencies between different channel paths. The performances are presented in term of bit error rate (BER) as a function of the Doppler frequency for several values of signal to noise ratio (SNR) and for different number of users. Numerical results show that the Carrier Interferometry (CI) codes give the best performance for multi interfering users. [C900]

"A Dual Transducer Ultrasound System for Quantitative Doppler Measurements"

The possibility of accurately measuring the velocity of blood flowing in human vessels represents a significant opportunity for hemodynamic research and diagnosis. The ultrasound (US) investigation represents a non invasive, diffuse and low cost method capable of evaluating the blood velocity by exploiting the Doppler effect. Unfortunately, the accuracy attainable with standard US equipment is heavily limited by the difficulty of assessing the Doppler angle during in-vivo investigations. In this paper a house-made US system for quantitative velocity measurements is presented. This system relies on an open, full digital architecture appositely designed for research purposes. In particular, the system capability of simultaneously controlling two US probes is shown suitable to implement a novel measurement method which overcomes the above Doppler angle ambiguity. The results of recent in-vitro experiments are reported, showing a velocity measurement accuracy of 0.5% and a precision of 7%. [C901]

"Liquid Flow Sensor Based on PVDF in its Beta Phase"

This article describes a system for the measurement of liquid or gaseous fluids. The main innovation is that the device is of tubular form and is composed by a single part. It is manufactured from a piezoelectric polymer such as beta-PVDF, in which one electrode in the inside and three electrodes in the outer side are placed. One of the exterior electrodes is excited by an electric voltage, whose frequency, of the order of tens or hundreds of megahertz, produces mechanical oscillations in the area of the pipe in contact with it, producing an ultrasound with the same frequency. The areas of the pipe under the other two electrodes also work as ultrasound transducers, receiving the signal produced by the first one. There are two main methods of reading flows with ultrasound sensors: a method based on the Doppler effect and another method based in the transit time. In both of these methods, they are used the differences of frequency or phase between the emitted and the received signals in order to calculate the speed of the liquid or gas that passes through the pipe. The flow is then calculated by multiplying the speed of the fluid by the area of the section of the pipe. In this project, it was used the technique of the time of transit, where the flux is calculated from the difference between the time that ultrasounds need to travel in the direction of the flow and in the direction opposite to the flow. The main difference between this flow sensor and other ones available in the market is that this sensor is the pipe by itself, becoming simpler, more compact, more robust and cheaper. [C902]

"Data Acquisition System for Doppler Radar Vital-Sign Monitor"

Automatic gain control (AGC) units increase the dynamic range of a system to compensate for the limited dynamic range of analog to digital converters. This problem is compounded in wireless systems in which large changes in signal strength are effects of a changing environment. These issues are evident in the direct-conversion Doppler radar vital- sign monitor. Utilizing microwave radar signals reflecting off a human subject, a two-channel quadrature receiver can detect periodic movement resulting from cardio-pulmonary activity. The quadrature signal is analyzed using an arctangent demodulation that extracts vital phase information. A data

acquisition (DAQ) system is proposed to deal with issues inherent in arctangent demodulation of a quadrature radar signal. [C903]

"Normalization of vasomotion in laser Doppler perfusion monitoring"

Laser Doppler flux signals show temporal fluctuations caused by physiological phenomena like heartbeat, respiration, and local variation of vascular tonus, vasomotion. This study investigates the influence of fiber arrangement, equipment and two probe locations on the variations in laser Doppler flux signals in five frequency bands in the absence of provocations. Two probes with detecting optical fibers at several distances from the illuminating source were used, as well as instruments from two manufacturers. The results show that normalization of the filtered flux signals with the mean flux leads to an enormous decrease of the influence of fiber distance. The difference between instruments is small after normalization. Some influence of probe location remains after normalization. Development of a standard method for normalization of the variations in laser Doppler signals is recommended. [C904]

"Distributed CDMA-based MAC Protocol for Underwater Sensor Networks"

Underwater sensor networks are typically distributed in nature and the nodes communicate using acoustic waves over a wireless medium. Such networks are characterized by long and variable propagation delays, intermittent connectivity, limited bandwidth and low bit rates. Due to the wireless mode of communication between the sensor nodes, a medium access control (MAC) protocol is required to coordinate access to the shared channel and enable efficient data communication. However, conventional terrestrial wireless network protocols that are based on RF technologies cannot be used underwater. In this paper, we propose PLAN-a MAC Protocol for Long-latency Access Networks that is designed for use in half-duplex underwater acoustic sensor networks. We utilize CDMA as the underlying multiple access technique, due to its resilience to multi-path and Doppler's effects prevalent in underwater environments, coupled with an RTS-CTS handshaking procedure prior to the actual data transmission. Using simulations, we study the performance and efficiency of the proposed MAC protocol in underwater acoustic networks. [C905]

"Polarization diversity for detecting targets in inhomogeneous clutter"

Polarization diversity has proved to be a useful tool for radar detection, especially when discrimination by Doppler effect is not possible. In this paper, we address the problem of improving the performance of polarimetric detectors for targets in heavy inhomogeneous clutter. First, we develop a polarimetric detection test that is robust to inhomogeneous clutter. We run this polarimetric test against synthetic and real data to assess its performance in comparison with existing polarimetric detectors. Then, we propose a polarimetric waveform-design algorithm to further improve the target-detection performance. A numerical analysis is presented to demonstrate the potential performance improvement that can be achieved with this algorithm. [C906]

"Channel Estimation and Symbol Detection Using Superimposed Pilot for Rapidly Time-Varying OFDM System"

A superimposed-training (ST) based rapidly time-varying frequency selective channel estimation scheme for orthogonal frequency division multiplexing (OFDM) system is investigated. The time-varying coefficients of the rapidly time-varying channel are modeled by exponential basis expansion. Meanwhile, the optimal training sequences are derived with respect to minimizing the mean square error (MSE). Furthermore, an iterative technique for symbol detector is proposed to cancel the effects of the embedded training on symbol recovery. Simulation results confirm the effectiveness of the proposed approach, even for the rapidly time-varying channel with a great Doppler frequency. [C907]

"Cluster-Based Double Bounce MIMO Channel Model and Capacity Analysis"

The spatial and temporal correlation is investigated at both transmitter and receiver. A cluster-based double bounce MIMO channel model is presented. The model can be used for nonselective Rice fading MIMO channels, and the expressions for correlation coefficient and channel capacity are derived. The correlation coefficient is the function of antennas spacing, angular spread, power angular spectrum, mean angle-of-arrival, Doppler spread and delay spread. In space domain, the capacity increases with antenna spacing and angular spread. For multiple clusters incidence wave, the correlation coefficient and capacity will oscillate with increasing antenna spacing. The capacity will decrease with increasing Rician factor. In time domain, the capacity gets higher with increasing Doppler and delay spread. When the frame length is larger than coherent time, the capacity will get to the independent capacity asymptotically. Two typical scenarios are simulated for indoor and outdoor environments. [C908]

"Ultracold 88Sr atoms for an optical lattice clock"

This paper reports results of cooling and trapping of 88Sr for future use in an optical lattice clock. Strontium atoms are cooled to ultra-cold temperatures using a two-stage cooling process. In the first stage, atoms are captured from a Zeeman-slowed atomic beam and cooled to 2 mK in a magneto optical trap operated on the 1So-1P1transition at 461 nm. The second cooling stage utilizes the spin forbidden 1So-3P1transition at 689 nm. To reach ultra-cold temperatures, 50 ms of broadband cooling is followed by 28 ms long single frequency cooling. The transfer efficiency from the first to the second cooling stage was measured to be 23%, leaving 7 x 106 atoms at a temperature of 1 muK. The atomic cloud is overlapped with a horizontally oriented 1-D far-off resonance optical dipole trap (FORT) at 813 nm with an effective potential depth of 25 muK. Due to equal light shifts of the 1Soand the 3P1state simultaneous Doppler cooling during the atom loading into the FORT is possible which leads to a transfer efficiency into the dipole trap of up to 60%. [C909]

"A Magnesium Optical Clock"

Summary form only given. We investigated a novel method which is based on a coherent two photon-process which provides higher velocity selectivity. The method extends standard Doppler cooling based on the transition 31S0rarr 31P1by coupling the excited state with an additional laser to the 1D2level. This gives the possibility to modify the population in the intermediate state 31P1and thus the mechanical light force, which in our experiments is actually dominated by the photons of the strong cooling transition. [C910]

"Real-Time Signal Processing Method for Obtaining Charge Distribution on Aerosols Produced by Medical Inhalers"

The paper discusses a novel noninvasive method of measurement of a charge level on a population of particles using phase doppler anemometry (PDA). The PDA system is used to track the motion of charged particles in the presence of an electric field. By solving the equation of particle motion in a viscous medium combined with the simultaneous measurement of its size and velocity, the magnitude as well as the polarity of the particle charge can be obtained. A signal processing scheme based on Phase Locked Loop has been proposed to obtain the particle charge in real time. A MATLAB/SIMULINK model has been implemented and tested in the range particle velocities of 10~320 mm/s and corresponding particle charge levels from several electrons to the Gaussian Limit. [C911]

"Motive Parameters Estimation Using Narrow-band Passive Acoustical Measurements"

This paper develops a method for estimating the flying trajectory of a turboprop or rotary-wing aircraft based on narrow-band passive acoustical technique, which measures the instantaneous frequency of the acoustical signal emitted by the target and received by three stationary sensors placed on the ground. The received instantaneous frequency varies due to the acoustical Doppler effect. Under the condition that the target flies at a constant velocity and the trajectory is a straight line, a intuitional model to describe the trajectory is proposed, which completely specifies the flight path by seven parameters. The nonlinear least-square problem of estimating the parameters is simplified by decomposing it into four steps. Computer simulations are provided to show the performance of the proposed method compared with the Cramer-Rao lower bound (CRLB) in the presence of white Gaussian measurement noise. [C912]

"LCMV Beamforming Algorithm Based on the ractiona Fourier Transform"

We propose a new method of LCMV beamforming based on the fractional Fourier transform (FrFT). This method encompasses the conventional linearly constrained minimum variance (LCMV) beamforming in the frequency domain or spatial domain as special cases. It is especially useful for applications involving chirp signals such as signal enhancement problems with accelerating sinusoidal sources where the Doppler effect generates chirp signals and a frequency shift and active radar problems where chirp signals are transmitted. Numerical examples demonstrate the potential advantage of the proposed method over the ordinary frequency or spatial domain beamforming for a moving a target. [C913]

"Optimization of Orthogonal Discrete Frequency-Coding Waveform Based on Modified Genetic Algorithm for MIMO Radar"

A modified genetic algorithm (GA) is proposed to numerically design orthogonal discrete frequency-coding waveforms (DFCWs) which have good aperiodic autocorrelation and cross-correlation properties for orthogonal multiple input multiple output (MIMO) radar. Some of the designed results are presented, and their correlation properties are better than other known in the literature. The effect of Doppler frequency shift on the performance

of these signals and ambiguity function are investigated. The simulation results and comparisons show that the proposed algorithm is more effective for the design of DFCWs with superior aperiodic correlation. [C914]

"Capacity of Training-Based V-BLAST System with LMMSE Receiver in Continuously Fading Channels"

A closed-form solution for the information- theoretical capacity of vertical bell-laboratories-layered-space-time (V-BLAST) system over continuously flat-fading MIMO channels with training-based channel estimation and linear minimum-mean-square-error (LMMSE) receiver is derived. Since large system analysis via the distribution law of random matrix is used in the analysis, our analysis and results are asymptotic in nature. Simulation results show that the analytical capacity expression is still valid for limited-scale V-BLAST system. Furthermore the optimal training length that maximize the capacity is found numerically as functions of the Doppler frequency and signal-to-noise ratio (SNR). [C915]

"A New Direct Decimation Algorithm for Digital Down-Conversion of GPS Satellite Signal"

In order to simplify satellite navigation receiver architecture, a down conversion method based on digital signal decimation is proposed. By using separating and accumulating method, direct down-conversion of a digitized carrier signal with relative high frequency is realized. This method has virtues of simpler structure, high speed and less calculation. Also it can well preserve navigation message and Doppler information, whereas it may degrade the S/N of signal and sensitivity of receiver. Analysis and simulation results show that it has no effect on positioning precision of receiver. [C916]

"Plasma Relativistic Microwave Amplifier and Oscillator"

Summary form only given. Plasma relativistic microwave amplifier is tuned from 2 to 3 GHz. Spectra and the phase difference of the input and output signals were measured. The output microwave power is 30 to 70 MW, the amplification is 30 dB, the pulse duration is 70 ns. In the plasma relativistic oscillator the feedback suppression was observed due to the normal Doppler effect. First results of experiment with the plasma microwave oscillator in repetitively-rate regime are presented. [C917]

"Space debris radar imaging"

For space debris radar imaging with the dimension smaller than radar range resolution, only SRDI (Single Range Doppler Interferometry) was discussed before. A single range matching filtering approach for space debris radar imaging is proposed in this paper. The proposed approach is to obtain 2-D image of space debris by using a range cell to transversely echo data and matching filter the signals with different turning radius. Investigations and simulations show that: of the proposed approach, its computational burden is less than that of SRDI, and its imaging effect is better. [C918]

"Maximum Doppler Frequency in Reverberation Chamber with Continuously Moving Stirrer"

Reverberation chambers equipped with a continuously moving mechanical mode stirrer cause Doppler spread in the measured signal. In order not to affect the signal, the instrument used for recording the measurement samples should have an IF bandwidth that exceeds the maximum Doppler frequency of the reverberation chamber. The actual stirrer speed cannot be used to calculate the maximum Doppler frequency the usual way, because the resonances in the chamber enhance the effect of stirrer motion. A relation for the maximum Doppler frequency in reverberation chambers is derived, and measurements are performed to verify it. [C919]

"Analysis and Performance Evaluation of a K-Symbol Pilot Assisted Channel Estimator using Linear Interpolation for OFDM Systems"

In this work, the performance of a novel linear interpolator scheme that uses K successive orthogonal frequency division multiplexing (OFDM) symbols is examined. The estimator collects K successive OFDM symbols to create a virtual super symbol (VSS) with K-P pilots using P pilots from each OFDM symbol. The (K-1) middot P pilots are shifted in frequency in such way that in the VSS their distance is divided by K compared to standard symbols. Successive least squares (SLS) channel estimation through linear interpolation is performed by using more than one symbol in the LS estimator introducing the weight channel change (WCC) factor that represents the change of the wireless channel between the successive symbols used. A novel analysis deriving exact expressions for the mean square error (MSE) as a function of pilot spacing, channel statistics and WCC for an OFDM system where data subcarriers also exist before the first and after the last pilot is given. The MSE and the bit error rate (BER) of the estimator are characterized by the number and distance of the pilots, the Doppler spread and the WCC factor. Simulations show the effect of each factor on MSE and BER performance. [C920]

"Performance Bounds and Algorithms for Tracking with a Radar Array"

Target tracking using a radar array system is considered. A signal model which includes the effects of path loss, signal delay, Doppler shift and angle-of-arrival is adopted. The conventional approach to radar tracking assumes that the raw measurements are processed to produce a collection of candidate target detections. We propose a new approach in which the raw received measurements are used for tracking. Performance bounds and a simulation analysis of filters developed for each model demonstrate the performance gains which can be achieved by tracking with raw sensor measurements [C921]

"Investigating the effect of a target's time-varying Doppler generating axis of rotation on ISAR image distortion"

ISAR imaging has potential in assisting with the classification of non-cooperative targets. Blurred ISAR imagery may however lead to misleading classification results. Much research has been done to understand some of the causes of distortion in ISAR imaging mostly under the limited assumption that a target's axis of rotation is constant over the CPI. This paper investigates how the target's time-varying Doppler generating axis of rotation, caused by the complex 3D motion of a target at sea, contributes to ISAR image blurring. Quaternion algebra is used to aid the characterisation of a time-varying Doppler generating axis of rotation on the migration through cross-range cells. Real motion data of a sailing yacht is used to examine the effects of 3D rotational motion on ISAR imagery of point scatterer like simulated targets and the associated blurring. Simulation results show that small yaw rate perturbation during side-view ISAR imaging intervals gives rise to significant changes in the direction of the Doppler generating axis which results in scatters migration through cross-range cells. [C922]

"Fine micro-Doppler analysis in ISAR imaging"

In ISAR imaging, it's well known that rotating parts of a target such as wheels or rotors induce additional features in the Doppler frequency spectrum. These features are called micro-Doppler effect and appear as sidebands around the central Doppler frequency. They can provide valuable information about the structure and motion of the rotating parts and may be used for target identification. In this paper, we propose a fine analysis of the Doppler returned by reflectors of a rotating wheel. Thanks to the to micro-doppler signature we are able to extract information on its geometrical features (position, orientation). The method has been performed on simulated and experimental data and provides satisfactory results. [C923]

"Continuous-wave Ultrasonic Tomography In the Presence of Relative Motion of Some Particles within the Rotating Body"

Continuous-wave ultrasonic tomography is an imaging technique used to obtain information about the structure of deep-lying layers of a certain rotating body. In recent research, the analysis of this tomographic technique is introduced. In this paper, it was assumed that the rotating object is a rigid body, i.e. all particles of this object have the same amount of angular motion and accordingly, all these particles deliver Doppler signals whose frequency depend only on their distance from the axis of rotation. However, If the rotating body includes particles that can move relative to the rest of the body, then the net Doppler frequency shift resulting from the rotation of such particles will not be imaged in their true position, i.e. they will be either too far or too near to the axis of rotation. This effect can be considered as an error in the imaging process. In this paper, this problem will be discussed and suggestions will be introduced in order to avoid this error. [C924]

"A New Accurate Symbol Synchronization Scheme for underwater acoustic communication systems"

In underwater acoustic communication systems, symbol synchronization accuracy is affected gravely by Doppler effect. So it is very important to structure a new accurate symbol synchronization scheme. Accurate symbol synchronization and Doppler effect value can be gained by designing a new frame structure using LFM (linear frequency modulation signals). [C925]

"Design of Multilevel Radar Target Simulator"

Radar target simulators form an essential requirement in the defense industry for electronic countermeasure and performance evaluation of radars. In this paper we present an field programmable gate array (FPGA) based design of a generic multilevel radar target simulator capable of simulating target echo at video, intermediate frequency (IF) and radio frequency (RF) levels in Synthesis or Digital Radio Frequency Memory (DRFM) modes of operation. Both modes of operation are capable of simulating target echoes with range, doppler and Radar Crosection (RCS) effects in real time. The methodology used in the design of Synthesis mode of operation

involves the regeneration of the stored modulated waveform codes of transmitted radar pulses by adding necessary delay, doppler and RCS effects in real time. The design follows a systematic approach starting with Trajectory generation followed by Radar waveform code samples generation(offline), Delay and radial velocity computation (offline),attenuation value computation (offline) to simulate RCS, Noise generation (offline), Synchronization with respect to Radar transmit pulses, Identification of the radar transmit pulse characteristics, Retrieval of corresponding waveform samples with desired range, doppler, noise effects and finally the conversion to the DAC input format. Thus generated IF level signal is further up converted to RF. But in the DRFM mode of operation, down converted RF signal is sampled and delay, doppler and noise effect are added. The selection of the mode of operation is done through a Graphical User Interface (GUI). The paper elaborates the methodology used and highlights the efficiency of the design with supporting results. [C926]

"Scheduling Delay-Constrained Data in Wireless Data Networks"

In modern cellular networks, the channel quality is dynamic among users and also over time. The time-granularity for such dynamics is significantly diverse-either slow or fast compared to packet transmission time. Because of these issues most existing scheduling policies can not work consistently well. In this work, we propose a scheduling policy with performance relatively insensitive to the time-granularity of the dynamics of channel quality. Our policy is self-adaptive to the scale of channel variations by using an ensemble of proposed algorithms. The proposed scheduling policy is proved to have a worst-case performance bound in the existence of both slow and fast time-varying channels. Simulation results confirm that the policy better tolerates channel variations than other popular schemes such as EDF and the Greedy algorithm. [C927]

"Doppler Effect on Location-Based Tracking in Mobile Sensor Networks"

Mobile sensor networks (MSNs) consist of large number of small and computationally impoverished devices deployed over an area to track mobile objects. Mobility is becoming an important feature of MSNs. Recently, sensors have began to be deployed on mobile platforms such as robots. In this paper, we propose an evaluation of the mobility impact on MSN tracking efficiency. More precisely, we consider the Doppler effect on the results of several target location approaches. Two radar-based angle estimation techniques have been considered: Frequency-Modulated Continuous Wave (FMCW) Radar, and monopulse angle estimation. We also analyze the control of the uncertainty due to Doppler shift through a manipulation of the area coverage (i.e., number of sensors per area coverage). [C928]

"Accurate BER Performance Comparison of Frequency Domain and Time Domain π/4-DQPSK OFDM Systems"

An exact closed-form bit error rate (BER) expression is derived for an orthogonal frequency-division multiplexing system with π/4-shifted differentially encoded quadrature phase shift keying (π/4-DQPSK) in the presence of carrier frequency offset over frequency-selective fast Rayleigh fading channels. Different system configurations, including time domain differential modulation, frequency domain differential modulation, single channel reception, and multi-channel reception with maximal ratio combining, are considered in the exact BER analysis. For a small number of subcarriers, the BER expression can be calculated directly. A Monte Carlo method is designed to evaluate the BER for a large number of subcarriers. The analytical expression can be used to investigate the effect of several channel parameters, including mean delay spread and maximum Doppler spread, on the system BER performance. Particularly, the effect of carrier frequency offset on the system performance, and the differences and opportunities to use frequency domain differential modulation or time domain differential modulation, can be studied in a quantitative way for a more realistic wireless channel environment model. [C929]

"Fault-Tolerant 2D Fourier Transform with Checksum Encoding"

Space-based applications increasingly require more computational power to process large volumes of data and alleviate the downlink bottleneck. In addressing these demands, commercial-off-the-shelf (COTS) systems can serve a vital role in achieving performance requirements. However, these technologies are susceptible to radiation effects in the harsh environment of space. In order to effectively exploit high-performance COTS systems in future spacecraft, proper care must be taken with hardware and software architectures and algorithms that avoid or overcome the data errors that can lead to erroneous results. One of the more common kernels in space-based applications is the 2D fast Fourier transform (FFT). Many papers have investigated fault-tolerant FFT, but no algorithm has been devised that would allow for error correction without re-computation from original data. In this paper, we present a new method of applying algorithm-based fault tolerance (ABFT) concepts to the 2D-FFT that will not only allow for error detection but also error correction within memory-constrained systems as well as ensure coherence of the data after the computation. To further improve reliability of this ABFT approach, we propose use of a checksum encoding scheme that addresses issues related to

numerical precision and overflow. The performance of the fault-tolerant 2D-FFT will be presented and featured as part of a dependable range Doppler processor, which is a subcomponent of synthetic-aperture radar algorithms. This work is supported by the Dependable Multiprocessor project at Honeywell and the University of Florida, one of the experiments in the Space Technology 8 (ST-8) mission of NASA's New Millennium Program. [C930]

"Velocity Estimation of Mobile Terminals by Exploiting GSM Downlink Signalling"

In this paper, we experimentally evaluate algorithms for velocity estimation of a GSM 900 mobile terminal which are based on the analysis of the statistical properties of the fast fading process. It is shown how theses statistics can be obtained from the training sequences present in downlink transmission bursts without establishing an active connection. Realistic simulations of a GSM channel according to the COST 207 channel models have been conducted. These models incorporate effects like multipath propagation, fading, cochannel interference and additive noise. It is shown that velocity estimation by searching for the maximum slope of the power density spectrum of the fast fading performs best. [C931]

"Simultaneous Measurement of Young's Modulus and Damping Dependence on Magnetic Fields by Laser Interferometry"

The main objective of this work is to characterize the dependence on applied magnetic field of both Young's modulus and damping due to aspects relative to magnetostriction and domain theory. The studied samples are ferromagnetic slender rods longitudinally placed inside a straight solenoid with a pair of Helmholtz coils designed to achieve a homogeneous field along all the longitude of the sample. The longitudinal vibration in the sample is induced by a brief impact perpendicular to the base of the cylinder with a pendulum with a quartz sphere, and its vibration velocity is measured by a compact laser vibrometer based on Doppler Effect. The signal acquired is processed by a software developed in Matlab environment obtaining the vibration frequency (related to the Young's modulus) and the logarithmic decrement. That experimental method has been applied to nickel rods, obtaining maximum variations about 2.5% in Young's modulus and 156% in logarithmic decrement, and offering important advantages over other methods like lack of interaction with the sample, high accuracy, rapidity, no destruction of the sample after the test and possibility of checking small size specimens such as wires. [C932]

"Mobile reception of Television signals"

In the 50's and 60's when television reception became common, we found the first TV receivers in vehicles. Since the year 2000, terrestrial analog television is more often being replaced by digital standards. Digital television receivers used for automotive applications are equipped with far more electronic circuits to improve reception and picture quality not found in stationary receivers such as those in our homes. There are basically two effects which have a strong impact on the television reception performance and they are fading and the Doppler frequency shift. Antenna diversity is used for digital terrestrial mobile TV receivers to improve overall television reception in vehicles. Beside the present digital TV standards, new standards such as DVB-H and DMB-T are being specially designed for mobile TV applications to help establish TV reception in more and more vehicles. [C933]

"LDA- Visibility technique for circularly polarized backscattered waves"

The visibility for circularly polarized backscattered laser beam is derived and computed. A model is developed to establish a relationship between the visibility and the particle size. The analysis is restricted to spherical absorbing or non-absorbing particles. The effect that the optical parameters, such as beam angular separation (Psi), collecting aperture size(R), and off-axis collecting angle (Phi0) have on the visibility profiles is examined. It is found that the range of particle sizes over which the visibility technique is applicable increases with decreasing Psi. It is observed that the range of particles for which the technique is applicable is not affected significantly by a change in R (R>4). In addition, in many cases, moving the collecting aperture slightly off-axis improves the quality of the visibility profile for particle sizing. Experimental data are obtained for comparison with the theoretical results for latex particles of known sizes (0.46mum, 0.74 mum, and 0.9 mum, 1.04 mum, 2.02 mum, and 2.91mum). Various visibility values associated with various signals are obtained for each particle. Preliminary results establish that these experimental data follow the same trend as the theoretical results. [C934]

"Optimal Carrier Frequency of Non-contact Vital Sign Detectors"

Simulations were performed based on a model developed in ADS to demonstrate the effects of non-linear cosine transfer function in non-contact vital sign detection. Harmonics and intermodulation effects have been analyzed theoretically and demonstrated by simulation. It is shown that in contrast to the observation from simple linear approximation that detection sensitivity always increases with carrier frequency, there is an optimum carrier

frequency for non-contact Doppler radar vital sign detection. For typical values of human chest wall movement, the simulation shows that the upper bound of the carrier frequency should be limited to the lower region of the Ka-band to improve detection accuracy [C935]

"Enhanced Link Adaptation Methods for Wireless Multi-Carrier Systems"

This work describes a family of low feedback, high performance link adaptation algorithms for multi-carrier systems. The methods include the use of the exponential effective SNR mapping (EESM) method as part of the modulation/coding selection process. The drawbacks of current link adaptation algorithms are reviewed, and means of combating the effect of Doppler and fading gain variation are proposed. In addition, a method enabling conventional SNR feedback reports to be converted to the effective SNR domain is described. This allows the effect of variable power allocation on coded BER to be more accurately estimated. Simulation results show that the proposed methods are effective. [C936]

"Synchronization and Channel Estimation for OFDM Systems with Transparent Multi-Hop Relays"

In this paper, the effect of a propagation delay resulting from the use of an OFDM system with a transparent mobile multi-hop relay (MMR) is initially analyzed. Additionally, a channel estimation technique for the OFDM system with throughput enhancement (TE) MMR or cooperative MMR is proposed. Secondly, the effect of a Doppler shift caused by a mobile MS is analyzed and a compensation technique for the carrier frequency offset (CFO) in the OFDM system with TE MMR is proposed. [C937]

"Blind Separation of Human Heartbeats and Breathing by the use of a Doppler Radar Remote Sensing"

The combined use of a Doppler radar with digital signal processing technique gives an effective non-invasive remote sensing of heart beat signals. Initial results have showed that the proposed technique is very promising in successfully isolating desired heart beat signals from other mobile objects and other distortion effects characterizing the wireless channel. We concentrate in this paper on the harder problem of separating at low SNR the signals from two subjects in the same room. We show that preliminary results obtained by the real analytical constant modulus algorithm (RACMA) and the independent component analysis (ICA) on experimental data are very promising into this goal. [C938]

"Estimation and Cancellation of Doppler Shift for an OFDM Smart Antenna System"

Due to users' mobility, the Doppler shift can cause the estimation error of the DOAs in antenna array systems. Therefore, the performance of the DOA based beamforming smart antenna system is degraded. In this paper, we utilize the spatial signature to estimate the Doppler shift. After estimating the Doppler shift, the effect caused by the Doppler shift is compensated and the DOAs of received signals are estimated by the spectral-smoothing algorithm and TLS-ESPRIT. In the simulation results, without the proposed estimation and compensation method of the Doppler shift, there exists estimation error of DOAs of the received signals. However, after using the proposed Doppler shift estimation method, DOAs of the received signals can be estimated. When the estimated DOAs are applied to the DOA based beamforming algorithm, the performance of the IEEE 802.16e system with smart antenna system can be better than that without Doppler estimation and compensation. [C939]

"Estimation of Time Delay, Frequency O set and Channel for Asynchronous Multiuser MIMO with Multipath"

In multiuser MIMO uplink, different pairs of transmitter and receiver may have different time delays and carrier frequency offsets (CFOs). This causes the time delay and CFO estimations much more difficult than those for a single input single output (SISO) system. It is a challenging problem to resolve the time delays and CFOs in the MIMO uplink. In this paper, an asynchronous multiuser MIMO system with multipath channels and CFOs is remodeled into another system. A blind method based on second order statistics is then used for estimating the shaped channels with ambiguity. Based on the shaped channels, specially designed pilots are proposed to find the CFOs. The same pilots are also used for resolving the time delays and the ambiguity in the estimated channels. Only upper bounds for the channel orders and time delays are needed for implementing the algorithms, which makes them applicable to practical multiuser MIMO systems. [C940]

"Variable Sub-Carrier Bandwidths in OFDM Systems"

Orthogonal frequency division multiplexing (OFDM) is widely used in wireless systems because of its high spectral efficiency, though it is known that it is highly vulnerable to frequency synchronization errors, which severely impede its performance. Such errors arise due to carrier frequency offset and Doppler frequency

spread. They destroy the orthogonality among sub carriers and introduce inter carrier interference (ICI). The interference power is proportional to the received signal strength and amount of frequency offset. Several proposal to reduce the impact of ICI in OFDM use very complex signal processing and some have associated bandwidth efficiency loss. Since ICI is inversely proportional to the sub carrier bandwidth, it is interesting to investigate the gains in a system with adaptable sub carrier bandwidth. A system which can support variable sub carrier bandwidths simultaneously meeting the needs of different ICI conditions is compared against a normal OFDM system which uses fixed carrier bandwidth (FSB). Results show that the VSB schemes can be preferred over FSB OFDM system when users with different receive signal strength and Doppler condition have to be served simultaneously. [C941]

"Tracking High-Speed Targets Using a Pulse Doppler Stepped-Frequency Waveform"

This paper develops a computationally efficient processing technique using fast Fourier transforms (FFT), averaging, and weighted least squares fits to track high-speed targets with a pulse Doppler waveform that is stepped in frequency. The measurements will be unambiguous in Doppler for high-speed targets of interest, but highly ambiguous in range before tracking. First, a range-Doppler matrix is formed using motion compensated data. Then, the effect of the range, radial velocity, and radial acceleration of the target on the processed data is approximated by a polynomial series, and the parameters are estimated using a weighted least squares fit. Monte Carlo simulations of the algorithm when four or more cpis of data are processed are in reasonable agreement with the theoretical predictions. [C942]

"De-Noising of the Doppler Fetal Heart Rate Signal with Wavelet Threshold Filtering Based on Spatial Correlation"

The fetal heart rate (FHR) signals provide valuable information for fetal development and well-being. However, the components of the original signals obtained by the Doppler ultrasonic method are very complex and seriously interfered by many factors, which makes it very difficult to extract heart rate. This present paper analyzes the characteristics of Doppler echo signals and applies the spatial correlation to estimate original noise variance, then develops an adaptive method calculating de- noising threshold, finally makes certain amendments for it in practice. The result of processing actual Doppler fetal heart sound signals proves that the method can effectively reduce the noise and extract fetal heart sounds, and calculate more accurately fetal heart rate by auto-correlation. [C943]

"An Adaptive Wavelet Method for Clutter Rejection of Doppler Signal: A Simulation Study"

An adaptive method combining wavelet transform (WT) with the bivariate shrinkage function (BSF) with local variance estimation is presented for rejecting the strong clutter from Doppler ultrasound signal. The raw Doppler signal is decomposed by the undecimated WT in which the fast algorithm of translation invariant discrete wavelet transform (TIDWT) is adopted, and then the scale and wavelet coefficients selected in terms of clutter frequency range are shrunk by BSF. The clutter is first reconstructed by updated coefficients. This new method was validated by simulated carotid Doppler signal, and compared to static high pass filter (HPF). The improvements including spectrogram and signal-to-clutter (S/C) ratio by the new method over HPF was noticeable. For the simulated signal with S/C ratio -20 dB, the improvement in S/C ratio was 22.66 by the new method, but 22.05 by HPF. The mean spectrum further indicated that the new method effectively reject clutter and simultaneously possess nicer retention of blood components. [C944]

"Frame Delay, Loss Rate and Throughput Analysis for Video Applications over time correlated 802.11a/g channels"

This paper presents simulation results for the transmission of unicast MAC frames over 802.11a/g. Fading channel models at various Doppler spreads are developed to generate time-correlated SNR waveforms. These are used in a bit accurate MAC/PHY simulator to estimate frame loss rate, transmission delay, jitter and throughput for a steady flow of transmit frames. Time-correlated channels are required to correctly simulate the bursty nature of packet loss in a wireless channel. The Doppler spread is shown to have a strong effect on the performance of 802.11 ARQ at the MAC layer. Compared to the slow fading case, in a fast fading channel fewer MAC layer retransmissions are required and the end-to-end delay is significantly reduced. Under poor channel conditions the simulated delay and frame loss rate are seriously underestimated if time-uncorrelated fading is assumed. [C945]

"On Using Channel Prediction in Adaptive Beamforming Systems"

Adaptive transmission schemes based on channel state information at the transmitter have the potential to

significantly improve the performance of a wireless system by matching the transmitted signal to the time varying wireless channel conditions. However, channel estimation errors and feedback delay can limit the performance gain. In this paper, the performance gain that can be obtained using channel prediction in an adaptive beamforming system with channel estimation error and feedback delay is evaluated. Channel prediction is shown to improve outage performance significantly by reducing the effect of feedback delay. Results also show that, for a given target outage performance, channel prediction allows the system to operate at much larger channel Doppler spread. [C946]

"LDV Sensing and Processing for Remote Hearing in a Multimodal Surveillance System"

Recent improvements in laser vibrometry and day/night infrared (IR) and electro-optical (EO) imaging technology have created the opportunity to create a long-range multimodal surveillance system. This multimodal capability would greatly improve security force performance through clandestine listening of targets that are probing or penetrating a perimeter defense. This system could also provide the feeds for advanced face and voice recognition systems. [C947]

"Noise Reduction for Doppler Ultrasound Signal Based on Matching Pursuits with Different Time-Frequency Dictionaries"

The spectral analysis of the Doppler ultrasound signal has been widely used in medical diagnosis. To remove noise effectively, matching pursuits with three different time-frequency dictionaries including Gabor atoms (GMP), cosine packets (CMP), and wavelet packets (WMP) are proposed to remove noise from the Doppler ultrasound signal in this paper. The simulation results have shown that the GMP method can be best adapted to approximate the Doppler ultrasound signal with fewer atoms compared with the CMP and WMP methods. In contrast to the translation-invariant adapted local cosine transform, although the GMP method has only achieved approximate performance improvements with higher computation intensity, it offers the potential advantages in pulsed Doppler ultrasound application because it has no requirement for the signal over-sample, which is needed in the traditional transform-based denoising methods to obtain a more precise noise level estimate. [C948]

"Effect of Contact Interface in Transducer System in Ultrasonic Bonding"

The effect of contact interface on ultrasonic energy propagation is the common problem of all kinds of ultrasonic transducer. In ultrasonic bonding, contact interfaces between different parts are nonlinear factors, so they affect directly the ultrasonic energy propagation and bonding quality. By using finite element method and laser Doppler vibrometer, the effect of contact interface on the ultrasonic energy and vibration are investigated. It is found that, incorrect contact interfaces cause multiple vibration models and mix certain resonance frequencies, induce non-stable output of the ultrasonic energy, and lead to hysteresis response. All these would cause some bonding shortcomings such as lower bonding strengths and chip tilting. [C949]

"Characteristic Comparing between Thermosonic Flip Chip Bonding and Reflow Flip Chip"

Ultrasonic features in bonding area are of interests for researchers in the field of microelectronics packaging. In this study, the interface characteristics of bonding were detected by using XD7100 X-ray, the velocity of ultrasonic vibration at bonding tool was determined with a PSV-400-M2 high frequency (1.5 MHz) laser Doppler vibrometer, micro- characteristics of the specimens of thermosonic flip chip bonding were inspected by using a high resolution transmission electron microscope. Results show that bubbles at the interfaces of reflow soldering flip chip were observed, however they were not discovered during thermosonic flip chip, the interface characteristics of thermosonic flip chip is better than that of reflow soldering flip chip. The acceleration of the ultrasonic vibration was about 500000 m/s2 for a 62.73 kHz bonding frequency. This strong mechanical effect activates dislocations in the metal crystalline lattice and enhances atomic diffusion across the bonding interfaces, and these differ from melting mechanism of reflow soldering. [C950]

"Link and Doppler Analysis for Space-Based AIS Reception"

In this paper, we present an investigation of space-based automatic identification system (AIS) signal reception by a nano/micro-sized satellite in low Earth orbit (LEO), using existing VHF communication channels. Today's ship-to-shore and ship-to-ship communication is limited by the horizon, and the signal reception is highly dependent on the altitude of the transmitter antenna located onboard the ship. Link performance, Doppler shift due to satellite motion, atmospheric interference, and antenna design is investigated. The results in this paper show that the Doppler effect plays a major role for communication with satellites in LEO, and techniques for improved Doppler compensation is suggested. [C951]

"A Clutter Canceller for Continuous Wave GPR"

In this work an innovative clutter canceller for Continuous Wave GPR (Ground Penetrating Radar) has been designed and implemented. An IQ modulator has been used to build up the central part of the device. The IQ modulator replaces more expensive components like digital controlled phase shifters and attenuators. This device also have wider dynamics with respect to linear vectorial modulator. To prove the feasibility of the system, the effect of signal feedthrough for IQ modulators is studied. Tests and measurements of the complete device are exposed. [C952]

"Measurements for Vehicular Ad-hoc Networks in Motorway Environments"

This paper presents the measurements and analytical results made over important characteristics of wireless signals propagation for vehicular ad-hoc networks in motorway environments, including Doppler Effect, free space signal propagation, and system operating margin. In this work, we employ IEEE 802.11b wireless cards for inter-vehicular communication to analyze large and small-scale propagation models. Our results show that the Doppler Effect does not affect transmission between communication partners at high speeds in small-scale models. Finally, we realize an experiment to validate the former results in the worst case scenario, when the transmitter and receiver are travelling in opposing directions on a straightaway. Results show that at least 8 packets can be relayed when the transmitter and receiver antennas are mounted on automobile dashboards. [C953]

"Study on the Chip and Tool Tip Vibration of Thermosonic Flip Chip Bonding"

The vibration of flip chip and tool tip during thermosonic flip chip (TSFC) bonding were observed and the effect of bonding force on the chip vibration was studied. Firstly, the vibration velocity of tool tip and chip on TSFC bonding was monitored with a laser Doppler vibration measure system (LDV), and the "stall" phenomena was observed by the virtual value curve of vibration velocity, i.e., after the TSFC bonding started a fever milliseconds, the chip velocity decreases suddenly, while the tool tip velocity still increases. Stall indicated that the bump/pad interface has formed initial bonding strength. And then the frequency characters of the vibration velocity signals were studied. It is found that the 3rd harmonic of chip vibration velocity indicates the stall phenomena, i.e., when the 3rd harmonic appeared, the stall happens. Finally, effect of bonding force on vibration harmonics of chip were studied, and the experiment results show that the 3rd harmonic is appeared early when the bonding force is little, which indicated that the little bonding force is good for the initial bonding force formation. [C954]

"Clutter Modeling and Characteristics Analysis for Bistatic SBR"

In order to analyze clutter characteristics and develop clutter suppression method, clutter modeling is very important. In this paper, we introduce the clutter modeling method of bistatic space-based radar (SBR) and obtain the analytic resolution of the clutter isorange contour in a range gate. Besides, the Earth's rotation effect is taken into account and the modification to Doppler frequency is derived. Finally, we plot clutter angle-doppler traces based on the modeling Finally, we plot clutter angle-doppler traces and discuss the clutter characteristics for different bistatic geometries. [C955]

"Characterization of Zero-Doppler Clutter Removal Techniques for ISAR Applications"

Inverse Synthetic Aperture Radar (ISAR) processing is used to generate high-resolution images. This work considers an outdoor test range whereby the ISAR processing induces zero-Hz Doppler clutter (ZDC) effects which adversely impact image quality by either (1) masking actual target responses, or (2) inducing responses not directly attributable to target features. Techniques for removing adverse ZDC effects have been developed and are generally user dependant and/or target specific. This work aims to identify key ZDC reduction mechanisms and characterization metrics to be exploited for more generic applications. Two characterization techniques are considered: pixel-average percentage difference and image cross-correlation of pre-ZDC and post-ZDC processed data. The impact of data windowing is also investigated using various window widths and types. [C956]

"Successive Target Cancelation in Pulse Compression Radars"

Many radars suffer from masking of weaker targets by stronger ones due to range sidelobes of pulse compression codes. We propose a method to prevent this by successively detecting targets and canceling their effects. Performance of the proposed method will be investigated in various scenarios with regard to existence of noise, targets, and the Doppler effect. [C957]

"A New Doppler-Tolerant Polyphase Pulse Compression Codes Based on Hyperbolic Frequency Modulation"

The conventional polyphase pulse compression codes including Frank code, P1, P2, P3 and P4 code suffer severe signal loss in performance under Doppler environment. This paper proposed a new polyphase pulse compression codes which are conceptually derived from the step approximation of the phase curve of the hyperbolic frequency modulated chirp signal. Comparing with the above conventional codes and the sidelobe-optimized polyphase P(n,k) code, the peak value of this new polyphase codes degrades much slower and the range solution as well as maximum sidelobe level are almost constant when Doppler frequency increases. The main disadvantage of this polyphase code is the relatively high sidelobe level without Doppler effect, which can be addressed by applying the proper window function. The desired Doppler-tolerant property of this new polyphase codes is very attractive for radars employing digital signal processing. [C958]

"Cancellation of Doppler Distortion in Pulse Compression for Targets Moving in an Arbitrary Direction"

It can be shown that the hyperbolic frequency modulated waveform is Doppler-invariant only when the Doppler factor is a constant number, i.e., the target has a constant velocity and along the direction from the radar to the target. If the target moves in an arbitrary direction, the degradation of the pulse compression caused by the mismatch between the reflected signal and the matched filter may still exist. In this paper we demonstrate that the Doppler effect caused by the moving target in an arbitrary direction can be approximated by a target with an initial velocity and a constant acceleration along the direction from the radar to the target, which results in a frequency shift in the reflected waveform. Therefore a bank of matched filters with pre-selected values of frequency shifts can be utilized to compensate for the Doppler effect. Numerical examples with target moving in an arbitrary direction are presented to illustrate this effect, which have been successfully compensated by shifting the frequency response of the matched filter. [C959]

"Adapting the Clean Deconvolver and Clean Detector to Doppler Uncertainty"

This paper extends the author's work on the CLEAN algorithm. In the previous paper the author develops the CLEAN Deconvolver and CLEAN Detector that each has their optimality claims. In this paper the CLEAN Deconvolver and the CLEAN Detector are extended to the situation of unknown Doppler. Results presented show that good performance can still be achieved when the Doppler is unknown. [C960]

"Non-Contact Measurement of Periodic Movements by a 22-40GHz Radar Sensor Using Nonlinear Phase Modulation"

A non-contact detection technique of measuring both the frequency and the amplitude of periodic movement using the property of nonlinear phase modulation is proposed and demonstrated by a 22-40 GHz radar sensor. It is shown that this method has the following advantages: (1) no calibration of signal amplitude required for accurate measurement of movement amplitude; (2) ability of self-verification; (3) very simple architecture. The method can be used to detect movements with amplitudes larger than 0.335 of the carrier wavelength for a fixed carrier frequency system and 0.214 of the minimum carrier wavelength for a frequency tunable system. By analyzing and simulating the wide angle incidence effect, it is shown that a proper choice of radio frequency, measurement distance, and antenna pattern can ensure accurate measurement of movement amplitudes. [C961]

"Using Frequency Hypsography to Deduce Doppler Frequency Shift and Phase Path"

This paper presents a new method- using frequency hypsography to calculate Doppler shift and phase path. Formula deduced from this method can avoid some unbelievable factors that are produced from hypotheses on not only parameter of ionosphere but also model of electronic density distribution. And this formula can also explain "C" trace occurring on HF-Doppler records. [C962]

"MER performance analysis of M-QAM-OFDM with Wiener phase noise"

The orthogonal frequency-division multiplexing (OFDM) technology has been proposed as the standard for broadcasting both audio and video digital signals and for wideband wireless communication systems (e.g.,WLAN). However, the performance of the OFDM scheme is severely affected by the phase noise of the oscillators at the receiver. The modulation error rate (MER) is widely applied as a measure of OFDM signals' performance which integrates impairments such as nonlinearity, IQ imbalance, phase noise as well as Doppler frequency shift. In this paper, we investigate the effects induced on the OFDM signals by Wiener phase noise, and propose analytical equations for MER calculation. Theoretical results show perfect agreement with those obtained by simulation and they can be used to predict the MER degradation of OFDM system and choose

suitable oscillators with no need to run extensive simulations. [C963]

"Ionospheric Propagation Effects on Ground and Space Based Radars"

This paper discusses the application of EM propagation theory to account for observations of scintillation from equatorial satellite beacon and radar measurements of transionospheric propagation. Satellite beacon measurements from the wideband satellite experiment are used to calculate the degradation caused by scintillation in the radar coherent integration process. Coherent integration will be required in any space based radar to achieve separation in Doppler of moving targets from the large return of the earth. Measurements of ionospheric scintillation in the equatorial region taken with the VHF/UHF ALTAIR radar in the Marshall Islands are described. These measurements support the use of the strong scatter limit of the parabolic wave equation that accounts for certain features of the observations. A technique is illustrated to calculate realizations or sample functions of wide bandwidth radar signals that have passed through the ionosphere. This technique gives realizations that are consistent with the ALTAIR observations. Results are given for radar performance of target detection for several different radar signal combining techniques. [C964]

"Track Registration for Multistatic Radars with Multipath"

Bistatic radars deployed in built-up areas, suffer from the effects of multipath due to the presence of reflecting walls. When the geometry of the reflecting surfaces are accurately known, it is possible to identify and utilize radar measurements from the various multipath signals but only if the radar receivers are well registered. Given a 2-D scenario with a single moving target, a smooth reflecting wall, a radar transmitter and two noncollocated radar receivers, we investigate the observability of target state and sensor biases for the following multipaths: (i) direct path: transmitter-target-receiver, (ii) transmitter-wall-target-receiver, (Hi) transmitter-target-wall-receiver, (iv) transmitter-wall-target-wall-receiver. Each radar receiver has a known location and measures range (propagation path length), azimuth, and doppler but has unknown range and azimuth biases in its measurements. Results show that measurements from different multipath signals can be identified. Furthermore, a selection of these measurements can be combined to carry out track registration. [C965]

"Spectral Signature Classification Using A Support Vector Classifier For Real-Time Instrumentation"

The research WSR-88D (weather surveillance radar) locally operated by the National Severe Storm Laboratory (NSSL) in Norman has the unique capability of collecting massive volumes of Level I time series data over many hours which provides a rich environment for evaluating our new post-processing algorithms. In this work, a Support Vector Machine (SVM) classifier is employed to identify tornado vortices based on their characteristic Doppler spectra and eigen analysis technique. A SVM-based classifier evades the pitfalls of the traditional statistical learning algorithms, such as neural networks, by setting up a convex optimization problem with a single global minimum. In addition, through the use of kernels and nonlinear mapping to higher dimensional spaces, the SVM classifier is able to effectively handle nonlinear classification problems. Finally, the SVM classifier has the added advantage of reducing overfitting by constructing a maximum margin separating hyperplane in a higher dimensional feature space which ensures a small generalization error bound . [C966]

"Error analysis of pixel positioning accuracy of SAR images based on R-D location model"

The range-doppler (R-D) model, which requires no reference points and is independent of satellite attitude knowledge and control, is used to determine the location of SAR image. However, the error of R-D model has not been analyzed. This paper investigates the effects of the pixel positioning accuracy of SAR images on uncertain measurement errors such as range measurement, Doppler center frequency measurement, orbit and the earth mode. The results indicate the earth model and zero-doppler condition have especially severe effect on the pixel positioning accuracy. But the exact earth model and Doppler center frequency true-value have been used, orbit errors become the critical errors. The atmospheric delay error is less than the other errors, however, this delay error is remarkable in low latitude areas. Moreover, the pixel positioning errors of SAR images are nonlinear, and the errors decrease gradually with decreasing latitude as well as increasing longitude. [C967]

"Precise computation of doppler parameters for spaceborne SAR in elliptic orbits"

There are errors in the existing formulae for calculating the Doppler parameters for spaceborne SAR. Too large errors would adversely affect the convergence speed of the estimation algorithms for Doppler parameters. This paper derives several precise analytical formulae based on the results presented in the published literature. During the deduction process, the effect of flight-path angle is considered as a key issue. To the author's knowledge, the effect was neglected in all of the relevant published literature. The consequence is that the existing formulae can only be approximately used in a nearly circular orbit. If the existing formulae are applied to

a satellite with large eccentricity, the error may be too large. In contrast, the formulae derived in this paper can be used in any cases, for there are no errors in our formulae. The accuracy of the derived formulae and the effect of the flight-path angle are verified by a simulation experiment using the parameters of Radarsat. [C968]

"Velocity determination of single sound source based on Doppler effect"

An algorithm is proposed for determination velocity of single moving sound source with uniform velocity and frequency. A synthesized sound signal is formed to simulating the moving sound source recorded by a fixed recorder, on which Hilbert transform is applied to obtain the instantaneous frequency of the sound signal. Utilize the Doppler effect as a model, which describes the relationship between the velocity and instantaneous frequency, to fit sampled instantaneous frequency by nonlinear least square, the velocity of a mobile can be obtained. Experimental results show that the accuracy of the obtained mobile's velocity is affected greatly by the background noise. Wavelet and EMD are used to reduce the noise in the noisy sound signal and instantaneous frequency, respectively. [C969]

"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. [C970]

"Improved sub-aperture compensation for range-dependent motion errors in wide-swath UWB SAR"

An improved sub-aperture compensation algorithm for range-dependent motion errors in Synthetic Aperture Radar (SAR) with wide beam and wide swath is presented. The negative effect of strong Range Cell Migration (RCM) is removed and the range-dependent motion errors are corrected according to the relation between the Doppler frequency of a target and its location relative to the radar both in azimuth and range direction. [C971]

"Research on high-resolution ship targets radar imaging at sea"

This paper addresses the problem and the method to make high-resolution radar imaging of ship targets at sea. Based on the general ship 3-D swaying geometry, the paper analyses the effect of ship sailing velocity and 3-D rotation movements to SAR imaging mode, and then provides an imaging interval selection method with the R-D (range-Doppler) ISAR imaging algorithm. We stress the fact that the robustness and the facility of this method to deal with abound echo data in real-time engineering process. The ISAR imaging results of actual measured ship echo data proves the validly of this method. [C972]

"Fine micro-Doppler analysis in ISAR imaging"

In ISAR imaging, it's well known that rotating parts of a target such as wheels or rotors induce additional features in the Doppler frequency spectrum. These features are called micro-Doppler effect and appear as sidebands around the central Doppler frequency. They can provide valuable information about the structure and motion of the rotating parts and may be used for target identification. In this paper, we propose a fine analysis of the Doppler returned by reflectors of a rotating wheel. Thanks to the to micro-Doppler signature we are able to extract information on its geometrical features (position, orientation). The method has been performed on simulated and experimental data and provides satisfactory results. [C973]

"Effects of attitude error on spaceborne ScanSAR mosaic"

Attitude stability is a very important parameter for the platform design of scanning synthetic aperture radar (ScanSAR) satellite. In this paper, the effect of satellite attitude error on the Doppler parameters is derived in detail. And the effects of Doppler centroid frequency error on spaceborne ScanSAR mosaic in azimuth are analyzed, to provide a theoretical guideline for the design of spaceborne ScanSAR system, as verified by simulations. [C974]

"Parameter based SAR simulator for image quality evaluation"

A SAR simulator for image quality evaluation is presented. This simulator can be used for the estimation of SAR image quality performance from the simulated raw data and the verification of the SAR payload design parameter associated with the image quality parameters. Evaluation of SAR image quality is achieved by analyzing the error effect of system parameter using the developed simulator. [C975]

"Relationship between antenna pointing stability and spaceborne ScanSAR scalloping calibration"

Based on uniform weighting antenna model, the Doppler center frequency error from instability of antenna pointing is derived in detail for spaceborne scanning synthetic aperture radar (ScanSAR) system. And the effects of Doppler center frequency error on image radiometric correction are analyzed. The basic precision of the antenna pointing stability is present for the offsets of ScanSAR image radiometric correction, which is verified by simulations. [C976]

"ISAR imaging of targets with moving parts using micro-doppler detection on the range profile image"

In ISAR imaging, most works have assumed the target to be a rigid body, a body without any rotating, vibrating or moving parts. The rotation of structures in a target, such as the rotor of a helicopter or the turret of a tank target, may induce frequency modulation on the returned signals and generate sidebands about the center frequency of the target's body Doppler frequency, known as the micro-Doppler phenomenon. In this paper we present a new method based on range grouping of the target's range profile for the separation of the rotating or moving parts from the target's body. The method is carried out on the Range Profile Image, different from other methods that do the separation at the signal level. [C977]

"Phase distortion modelling due to motion in wave scattering mechanism applied to SAR images analysis"

In SAR image processing, taking phase distortion in radar signals into account is equivalent to considering motion as information embedded in it. In the aim of doing this, a model based on Gaussian linear frequency modulation is introduced, adapted to quantification and estimation of phase distortion. This model is based on three parameters, the Doppler frequency modulation rate K, the analysis time Taand the Doppler frequency fd, and allows practically a local representation of any quasi-punctal target echo. [C978]

"Improved RDM for SAR autofocus processing"

Reflectivity displacement method (RDM) is a classical algorithm of synthetic aperture radar (SAR) autofocus processing, whose performance degenerates with low contrast of the scene. This paper proposes an improved RDM for SAR auto focusing. Based on the relationship between the Doppler rate and the range, the proposed method can adoptively overcome the effect of the low contrast on the Doppler rate estimation and obtain fine autofocusing results. The experiments with real SAR data are used to show the effectivity of the proposed method. [C979]

"Optimum Pulse Shaping for OFDM/BFDM Systems Operating in Time Varying Multi-Path Channels"

In this paper, we consider a pulse shaping OFDM/BFDM system operating over a doubly dispersive channel. We propose to search the optimal pulse maximizing the signal to interference ratio (SIR). We show that the impact of interference, composed by both inter-symbol interference (ISI) and inter-carrier interference (ICI), occurring in such a system, depends crucially on time frequency localization of transmit and receive pulses. We propose to maximize the SIR, written as a ratio of two quaternary forms, by altering between transmit and receive pulse spaces both generated by Hermite Waveforms. Numerical results show that optimized BFDM systems can outperform conventional OFDM systems with respect to SIR. In fact, biorthogonality offers more freedom to design pulses improving robustness of the multi-carrier system against channel dispersion. [C980]

"Laser Doppler speckle contrast imaging of cerebral blood flow during functional activation in rat somatosensory cortex"

A laser Doppler speckle contrast imaging (LDSCI) system has been developed for detecting the local cerebral blood flow (LCBF) changes in a living brain with a high temporal (subsecond) and spatial (micrometer) resolution. Near-infrared laser was used to allow the light to penetrate into the cortex beneath the brain surface and the changes in microscopic blood flow were detected due to the laser Doppler effects of moving particles (i.e., Red

blood cells) on the speckle change of the imaging. To examine the sensitivity of our LDSCI system, in vivo animal study was performed to investigate activation-flow coupling in somatosensory cortex in response to electrical stimulation of hindpaw in the living rat. The functional hyperemia obtained in this study was in agreement with results from traditional point measurement using Laser Doppler flowmetry. However, the tempo-spatial feature of the LDSCI system would facilitate a better understanding of the mechanism of blood flow-neuronal activity coupling. [C981]

"Cocaine-induced cerebral hemodynamic and neuronal function changes in vivo measured by Laser Doppler Flowmetry"

In this study laser Doppler flowmetry (LDF) was used to characterize the effects of cocaine on the local cerebral blood flow (LCBF) in rat brains in vivo. Also, the comparison of LCBF transients (DeltaLCBF(t)) elicited in the same animal in response to forepaw electrical stimulation was investigated before and after acute cocaine challenge to characterize the effects of the cocaine on the neural function. Our experimental results demonstrated that an acute cocaine administration (1mg/kg, i.v.) induced a increase of ~ 20-30% in LCBF immediately following the cocaine administration. The mean arterial blood pressure (MABP) also increased to 133 mm Hg from a baseline of approximately 91 mm Hg. Both LCBF and MABP increases were temporal, and recovered to baseline 10-12 min and 4-6 min post-injection of cocaine, respectively. However, DeltaLCBF(t) signal elicited by forepaw stimulation was quenched until 40 min after cocaine injection. Our results elucidated the time course of cocaine's acute cerebrovascular and neurological effects, which might provide a better understanding of the etiology of cocaine-related stroke and transient ischemic attacks explored previously in the human studies. [C982]

"Urban target classifications using time-frequency micro-Doppler signatures"

Moving target indicators (MTI) find important applications in urban sensing. While motion detection can be achieved using simple CW radars, characterization of moving targets can be provided by estimating the key parameters of the target micro-Doppler signature. For indoor sensing, this signature has underlying instantaneous frequency features, which may depend on the radar viewing angle. This paper considers typical animate and inanimate moving objects and presents time-frequency motion classifiers using quadratic time-frequency distributions. The distinctions between the different target micro-Doppler parameter values and bounds are delineated. [C983]

"Influence of phase on Cramer-Rao lower bounds for joint time delay and Doppler stretch estimation"

The Cramer-Rao lower bounds for joint time delay and Doppler stretch estimation have been obtained for wideband signals with known phase already. However, the carrier phase is usually unknown in non-coherent receivers in the applications such as radar and sonar. And accuracy of the joint estimation of time delay and Doppler stretch will be affected by this unknown phase. In this paper, starting with a general wideband signal model with unknown phase, the Cramer-Rao lower bounds for joint time delay and Doppler stretch estimation are derived by using Fisher information matrix. The bounds obtained under unknown and known phases are compared and the relations between them are offered. Further explanations about the relations are also given from the view of information theory. Simulations are provided to support the theoretical results. [C984]

"SNR and BER derivation and analysis of downlink OFDM systems with noisy fading Doppler channels"

In this paper, we investigate the SNR and BER performance of an OFDM system under imperfect synchronization which is caused due to noise, Doppler shift and frequency selective fades in the channel. An analytical expression for BER is derived assuming BPSK modulation and numerical results are presented to show the effect and extent of the above channel impairments in OFDM downlinks. [C985]

"Two-dimensional radar imaging based on instant range profile"

To solve the problem of range dispersion of the dechirped echo caused by high-velocity radial motion, an improved method based on instant range-Doppler (IRD) is proposed. Firstly, a target echo model illuminated by wideband linear frequency modulated radar signal is built. Then the effect of high velocity on the target echoes is analyzed. On the feature of the orbit target with high radial velocity, a method based on instant range profile using the short-time Fourier transform (STFT) is presented. It is proved effective by computer simulation results. [C986]

"A novel approach to three-channel SAR-GMTI channel equalization and moving target detection and location based on real data"

Aiming at airborne three-channel SAR-GMTI system and its real data, a novel channel equalization method is presented, furthermore, in virtue of the method's good performance on compensating the clutter differences between different channels, a technique for moving target detection (MTD) and location is further proposed. This method first realizes signal equalization between inner channels utilizing the leaking signals, then implements range and azimuth time calibration and compensates the channel differences via iteration after range compression, after that, it realizes MTD by clutter cancellation and imaging, finally obtains target parameters by estimating moving target doppler shift. The technique proved its good performance in real data processing with the advantages of high channel equalization precision, little computations, good clutter cancellation and MTD performances and easiness to implement. [C987]

"ISAR based on micro-doppler analysis and Chirplet parameter separation"

When target or its parts exist micro-motion, ISAR is severely contaminated by the micro-Doppler effect caused by the micro-motion. To solve the problem, the micro-motion models of translation, rotation and vibration are analyzed, and then the time-frequency distribution of these micro-motions are discussed. After echoes are decomposed with Chirplet transformation, an algorithm, which separates signals using micro Doppler and micro Doppler rate in Chirplet parameter domain, is investigated. The algorithm is verified by simulation data of point-scatterer and real data of an airliner, nice ISAR images are obtained. [C988]

"Shifted Non-Negative Matrix Factorization"

Non-negative matrix factorization (NMF) has become a widely used blind source separation technique due to its part based representation and ease of interpretability. We currently extend the NMF model to allow for delays between sources and sensors. This is a natural extension for spectrometry data where a shift in onset of frequency profile can be induced by the Doppler effect. However, the model is also relevant for biomedical data analysis where the sources are given by compound intensities over time and the onset of the profiles have different delays to the sensors. A simple algorithm based on multiplicative updates is derived and it is demonstrated how the algorithm correctly identifies the components of a synthetic data set. Matlab implementation of the algorithm and a demonstration data set is available. [C989]

"Imaging study of high squint SAR based on FMCW"

This paper establishes the model of high squint FMCW SAR received signal, analyzes its characteristics, and posts the Doppler frequency shift effect induced by the continuous motion in range direction while radar transmitting and receiving signal. Meanwhile, this paper proposes a modified RD algorithm (RDA) aimed at high squint FMCW SAR dechirp-on-receive data, which compensates for range walk in the time domain, Doppler frequency shift and range curve in the frequency domain. Point target simulation verifies the analysis and validity of the proposed algorithm. In addition, for the Doppler frequency shift induced by the continuous motion while radar transmitting and receiving signal, this paper also analyses its effect on image. [C990]

"Airborne ISAR imaging of ship side view"

In airborne ISAR imaging of ship targets, the complexity of the ship's rotation relative to the radar line of sight (RLOS) increases the difficulty in achieving high quality ship images. When imaging from long distance, the rotation induced by the tangential motion between the radar and the ship can always be neglected. The images obtained by exploiting the ship's own sway are generally the ship side view. However, when the rotation induced by the relative tangential motion cannot be neglected, the obtained images are the mixture of the ship top view and side view, which are not suitable for the ship recognition. In this paper, a method of obtaining the ship side view images under this circumstance is presented. Its main idea is to estimate the Doppler frequency derivative, which can be approximated by the chirp rate in a short imaging interval. A concentration measure is introduced to increase the estimation precision of the chirp rate in the dechirp process. The effectiveness of the proposed method is verified by the experiments on the simulation data. [C991]

"Comparison of Analytic Signal Usage on Doppler Blood Flow Signals Estimation"

Spectral resolution may be enhanced by calculation of the analytic version of the signals processed. In this paper an open issue in the spectral estimation of Doppler ultrasound blood flow signals is addressed: when should the analytic signal representation be obtained and how to achieve such a representation. A comparison of the impact of two alternatives for achieving such a representation is reported. This is done by comparing the statistical performance of the short time Fourier transform on the estimation of mean frequency and bandwidth of

simulated Doppler ultrasound blood flow signals. The comparison evaluates two approaches to obtain the analytic signal representation, one in the frequency domain -the common Fourier transform based approach-and one in the time domain-using a FIR filter with small latency that approximates the Hilbert transform. The results obtained show that the "analytic" signal should be used before the estimation process and that, in most cases, the use of the FIR filter diminishes the estimation error. [C992]

"Zero correlation zone (ZCZ) code assisted frame start detector with combining strategy for 2x2 MIMO-OFDM systems"

This paper investigates the performance of frame- start detector (FSD) for MIMO-OFDM system with zero correlation zone (ZCZ) code preamble, assuming transmission over a relatively fast fading mobile wireless channel. The channel coefficients are allowed to vary within the duration of an OFDM symbol. It has been reported that the said method fails to achieve satisfactory performance in terms of the achievable probability of correct detection. The main reason for this poor performance is the large cross-correlation values which occur outside the ZCZ. A strategy based on exploiting the output of the two ZCZ code matched filters is proposed to mitigate this problem. We will prove through computer simulations that this strategy achieves desirable effect in raising the probability of correct detection from approximately 80% to 95% for SNR=0dB with a normalized Doppler frequency of 10-3. [C993]

"Effects of transducer geometry and beam spreading on acoustic Doppler velocity measurements near boundaries"

The effects of acoustic beam directivity on the accuracy of acoustic Doppler current profiling are discussed. Traditionally, a transducer's main lobe is considered when analyzing Doppler profiler performance. However, excessively large secondary lobes dominate the overall transducer directivity near boundaries and limit profiler performance. Side-lobe suppression design is shown to improve the overall system directivity by almost 50%. Results of transducer directivity numerical modeling are in good agreement with laboratory calibrations. Practical implications of improved directivity for velocity profiling near boundaries are discussed. [C994]

"Vibration measurements to study the effect of cryogen flow in a superconducting quadrupole"

The conceptual design of compact superconducting magnets for the International Linear Collider final focus is presently under development. A primary concern in using superconducting quadrupoles is the potential for inducing additional vibrations from cryogenic operation. We have employed a Laser Doppler Vibrometer system to measure the vibrations in a spare RHIC quadrupole magnet under cryogenic conditions. Some preliminary results of these studies were limited in resolution due to a rather large motion of the laser head as well as the magnet. As a first step towards improving the measurement quality, a new set up was used that reduces the motion of the laser holder. The improved setup is described, and vibration spectra measured at cryogenic temperatures, both with and without helium flow, are presented. [C995]

"Effect of Bandwidth on Wideband-STAP Performance"

A wideband signal occupies a finite bandwidth that is significant compared to its carrier frequency. As a result when transmitted, its returns cause bandwidth dispersion across the antenna. It is shown here that the effect of the finite bandwidth is to introduce a set of uncorrelated return signals for every physical scatter in the field. Further, each such uncorrelated return contains a set of coherent signals with different directional and Doppler components that result from a jittering effect both in angle and Doppler domain. As a result, adaptive clutter cancellation using traditional processing schemes does not work well. Although in principle it is possible to correct these decorrelating effects by 3D space-time adaptive processing (STAP), the present day methods are quite costly and difficult to implement. In addition to the new wideband signal modeling framework mentioned above, we outline a hierarchical processing scheme which has the potential for dramatically reducing both processing and sample support burdens. [C996]

"Doppler Resilience, Reed-MГґBjller Codes and Complementary waveforms"

While the use of complementary waveforms has been considered as a technique for providing essentially perfect range sidelobe performance in radar systems, its lack of resilience to Doppler is often cited as a reason not to deploy it. This work describes and examines techniques both for providing Doppler resilience as well as tailoring Doppler performance to specific aims. The Doppler performance can be varied by suitably changing the order of transmission of multiple sets of complementary waveforms. We propose a method which improves Doppler performance significantly in specific Doppler ranges by arranging the transmission of multiple copies of complementary waveforms according to a suitable choice from the first order Reed-Muller codes. We provide

both a theoretical analysis and computer simulations of the Doppler response of waveform sequences constructed in this way. [C997]

"Information Hiding for Public Address Audio Signal using FH/FSK Spread-spectrum Scheme"

We present a novel application and technology for hiding the messages into the emergency public address audio signals. In the emergent situation such as disaster, the public address siren is very effective way to notify the urgency of disaster to residents and supporting staffs. The people can estimate the direction of the disaster spot or distance from the spot by hearing and seeing the siren car's moving on the way. However, the people in house or vehicle often cannot hear the notifications. Our study helps them to receive the notifications embedded into the public address siren such a scene. Moreover, the supporting staffs, who work outside, can receive the information about the helps from the siren on the way. To realize our aims, high resistancy of data transmission under outside noisy environment and high acceptance to receive from the moving signal sources are necessary. In this paper, we propose a public address information hiding (PAIH) using FH/FSK spread-spectrum scheme and evaluate its performance with the computer simulations. [C998]

"Performance of Quantized Feedback Beamforming in MIMO-OFDM Links over Time-Varying, Frequency-Selective Channels"

MIMO beamforming, which can improve signal reception and simplify receiver design, has been extensively studied and reported in the literature. Previously, we studied the different quantized feedback schemes proposed by IEEE 802.11n in terms of their feedback overhead and performance degradation. These comparisons, however, assume idealized conditions such as flat Rayleigh fading, no feedback delay, and perfect channel estimation. In practical scenarios, channels are both time-varying and frequency-selective, and feedback delays are inevitable. All these factors degrade the performance of feedback beamforming, and the aim of this paper is to quantify their impact on MIMO-OFDM links. First, we look at a single subchannel with time variations, for two different Doppler spectra (Cauchy and Jakes), and we show how much performance degrades as a function of the product of the Doppler and the feedback delay. Then, we look at the multicarrier case, taking delay spread into account, using specific indoor channel models with different power delay profiles. [C999]

"Interdomain Routing for Mobile Nodes"

In this paper, we investigate the issues related to the use of a BGP (Border Gateway Protocol) backbone to provide connectivity between mobile nodes, with a specific focus on nodes within an airborne network domain. Research efforts have developed multiple MANET (Mobile Ad hoc Network) protocols to provide routing for mobile nodes. In an airborne network environment, however, there may not be a dense enough concentration of nodes within radio range to provide the connectivity needed for effective use of a MANET protocol. In addition, aircraft within radio range of other nodes will experience intermittent and varying quality radio signals due to banking, interference, or Doppler effects. BGP is the de facto standard in use today to provide terrestrial internetworking routing among Autonomous Systems (AS) despite well known problems. BGP configuration can be complex and has convergence issues but the BGP capability to handle large numbers of routes makes it invaluable. In addition to its use in terrestrial internetworking, BGP has been identified as the routing protocol for the Transformational Satellite Communications System (TSAT) Network. Given the BGP networks in a satellite network above and a terrestrial network below an airborne network, it is important to understand the issues of connecting via BGP for airborne nodes. This paper summarizes the results of lab experiments evaluating use of a BGP network for an alternate routing path between aircraft when there is no other connectivity within their airborne routing domain. [C1000]

"Orthogonal Space-Time Block-Differential Modulation over Underwater Acoustic Channels"

Underwater acoustic communications (UAC) channels are well known to be bandlimited due to the low acoustic carrier frequency. In terrestrial communications, multi-input multi-output (MIMO) schemes have long been proved to provide improved capacity without bandwidth expansion. However, the application of these MIMO designs, especially coherent ones, is challenging since UAC channels are spreading in both the time delay domain and the frequency domain. In such extremely bandlimited and doubly-selective channel conditions, the pilots necessary for accurate channel estimation can considerably reduce the bandwidth efficiency of the system. To avoid such problems, we propose a differential MIMO scheme for doubly-selective UAC channels. Our approach is based on orthogonal space-time block coding (OSTBC), but bypasses channel estimation. As a result, not only a higher bandwidth efficiency is preserved, but also the processing complexity at the receiver is reduced. We adopt the basis expansion model (BEM) to model the doubly-selective channels. Both analytical and numerical results show that our approach can collect full 3-dimensional diversity: space, Doppler and multipath. The results are verified over both the generated channels using Jakes' model and the estimated channels from a

real underwater experiment. [C1001]

"Preamble Design and Analysis for Channels with Significant Doppler Variation"

Modern iterative Forward Error Correction (FEC) techniques have dramatically increased the coding gain applicable to satellite channels with continuous and long packet message traffic. To maximize the benefit of these gains, longer preambles and better synchronization techniques are required to leverage these gains at lower C/kT (Eb/No). However, as network layer gains in system capacity require more packet oriented traffic, preambles from multiple transmitters can constitute a larger portion of limited channel resources. This is the case with packet-oriented systems such as Demand Assigned Multiple Access (DAMA). The effect of more costly preambles is exacerbated in channels that consists of shorter asynchronous message traffic such as is widely used for channel control signaling information in many military systems. Preambles are especially important to coherently received waveforms because in addition to setting the start of message position, they are used to determine the initial parameters of carrier phase, carrier frequency, and symbol timing, which are then tracked through various estimation and control loops. This paper will show that in many ways, preamble detection can be considered a problem in non-coherent detection of Frequency Shift Keying (FSK) from a large alphabet with Ricean channel statistics. This paper presents an analysis of existing MIL-STD-188-181C[1] preamble techniques that are widely used in UHF SATCOM. Suggested compatible improvements to those techniques are presented along with more efficient Minimum Shift Keying (MSK) waveform preambles that lend themselves to acquisition while still providing sufficient estimates of frequency, carrier phase and symbol timing in demanding channels. [C1002]

"Performance Considerations on MIMO Spatial Multiplexing from the Viewpoint of Antennas and Propagation"

MIMO channel characteristics and spatial multiplexing are investigated from the viewpoint of antennas and propagation in this paper. We conducted 4x4 MIMO channel measurement campaigns in an indoor propagation environment. Using the measured data, we examined the detail of the MIMO channels. The MIMO channels and eigenvalues are largely different for MIMO array orientations in an LOS environment. This is due to the effect of mutual coupling between antenna elements. Then, the bit error rate (BER) of eigenbeam space division multiplexing (E-SDM) in a quasi-static environment is examined using the measured MIMO channel data. It is shown that the BER performance in an LOS environment is affected by the mutual coupling. Furthermore, we obtained time-varying MIMO channel data, and calculated the channel auto-correlation and Doppler spectrum. The BER performance is evaluated for different maximum Doppler frequencies and different (LOS/NLOS) environments. [C1003]

"Chemical Oxygen-Iodine Layer Device Simulation Using the 3D, unsteady Navier-Stokes Equations"

The time-dependent, chemically reacting, viscous fluid dynamics within the chemical oxygen-iodine laser (COIL) flowfield are simulated using the unsteady, laminar, multi-component Navier-Stokes equations. The solutions of these equations are generated within simulations of COIL hardware at standard operating conditions; conditions predicted in previous simulations to be unsteady. These current simulations ascertain the effect of the flow unsteadiness upon the laser gain through Doppler broadening of the spectral lineshape induced by the bulk movement of the gas. The results from the simulations demonstrate that the presence of bulk flow rotation associated with the unsteady vortex generation influences the temperature determined from the resulting lineshapes; this result has direct implications for experiments where spectroscopically measured lineshapes are utilized to determine flow temperatures. Additional simulations are used to test varying fidelity within the COIL finite-rate chemistry mechanism in the presence of the flow unsteadiness and H2O vapor condensation. The same unsteady, laminar, multi-component Navier-Stokes simulation methodology is applied to new COIL mixing nozzle concepts with the goal of utilizing the unsteadiness flow to improve device performance. Experimental planar laser induced iodine fluorescence data for these nozzle concepts are directly compared to simulation data in a newly developed methodology for COIL model validation. [C1004]

"IDRA: A new instrument for drizzle monitoring"

IRCTR is currently developing a high resolution radar aimed at the observation of rainfall and drizzle parameters for use in hydrological studies and in studies of the effect of the increase in anthropogenic aerosols in the radiation budget. Much effort has been done at obtaining a high sensitivity to be able to detect low reflectivity phenomena like drizzle. The radar is placed in the Cabauw meteorological super-site, allowing synergy with other instruments to further improve its capabilities. [C1005]

"Re-tracking of SAR altimeter ocean power-waveforms and related accuracies of the retrieved sea surface height, significant wave height and wind speed"

This paper describes the simulation of the power- waveforms acquired in by a radar altimeter operating in SAR mode over ocean surfaces, including the effects of the radar transfer function and of the geophysical ocean parameters, namely the sea surface height(SSH), the sea surface wave height (SWH) and the surface wind speed (WS). The performances of the SAR mode with respect to the retrieval of the ocean geophysical variables (SSH, SWH, WS) are then computed using the Cramer-Rao estimation bounds. It is shown that the radar to ocean range estimation provided by the SAR mode is improved by more than a factor of two compared with conventional Ku band altimeters. Improvements on SWH and wind speed are also discussed. [C1006]

"The effect of rain on retrieval of C- and Ku-band scatterometer surface winds during Hurricanes Lili (2002) and Isabel (2003)"

The Imaging Wind and Rain Airborne Profiler (IWRAP) and Simultaneous Frequency Microwave Radiometer have been flown aboard the NOAA WP-3D "Hurricane Hunter" aircraft for the past five (2002-2006) hurricane seasons. IWRAP is a conically scanning, high resolution C- and Ku-band Doppler radar that profiles from the aircraft to ocean at four incidence angles. The microwave return from the ocean is used to infer ocean surface vector winds via scatterometry. The UMass Simultaneous Frequency Microwave Radiometer (USFMR) is a C-band radiometer that measures integrated rainfall rate and ocean surface wind speed. The combination of these two instruments allows for the determination of the effect of rain on scatterometer derived surface vector winds. Our focus is on scatterometer retrievals at an incidence angle of 50deg during Hurricanes Lili (2002) and Isabel (2003). The measurements were carried out under the Coupled Boundary Layers and Air-Sea Transfer (CBLAST) program and are the highest resolution radar measurements of the lower atmospheric boundary layer in powerful hurricanes. The retrievals at C- band use the CMOD5 geophysical model function (GMF) while those at Ku-band use one which is a synthesis of the QSCAT- 1 GMF and one developed using IWRAP data. As has been reported, the effect of rain at Ku-band is a dramatic decrease, even for wind speeds greater than 20 m s-1The atmospheric attenuation dominates these results. At C-band the primary effect is a decrease in azimuthal modulation which is especially important at high wind speeds where this modulation decreases in the absence of rain. [C1007]

"Second-order motion compensation in bistatic airborne SAR based on a geometrical approach"

Common efficient SAR processing algorithms are based on nominal operational conditions. Unfortunately, due to atmospheric turbulences and maneuvering errors, these conditions are often violated in real SAR systems. Hence, a crucial problem in most airborne SAR systems is the compensation of motion errors; if not corrected, the image quality will considerably degrade. A first-order motion compensation (MoCo) technique was developed at our institute, based on a precise knowledge of the position and the velocity of the transmitter and the receiver. The problem arose while proceeding with our processing algorithm, since the reconstructed image was better focused but not completely focused. Our paper proposes a second-order MoCo technique that will considerably improve the reconstruction of the SAR image. While the first-order MoCo considered the range and azimuth times, the second-order MoCo approximation will consider the frequencies. Experiments with different sets of bistatic airborne SAR data are performed based on this solution, and some promising results are given. [C1008]

"Numerical simulation of a heterodyne Doppler LIDAR for wind measurement in a turbulent atmospheric boundary layer"

This study concerns the modeling and the design of a monostatic heterodyne pulsed LIDAR. The heart of the system is constituted of a 1.55 mum able to produce high pulse repetition frequency. The aim of this work is to assess its efficiency to perform accurate wind speed measurements in the low atmospheric boundary layer, from a 2-D scanning pattern, in the presence of refractive turbulence. A complete LIDAR numerical simulation technique has been developed. Its main originality is the integration of both optical and fluid dynamics numerical methods to take into account the signal coherence loss due to refractive turbulence and speckle effect as well as the fine structures of the wind field. The wind speed profiles along each line-of-sight are retrieved from the return signal using a low-order autoregressive model. An adequate averaging model is then used estimate horizontal components of the wind speed for altitudes up to 150 m. [C1009]

"An algorithm to improve the NEXRAD rain rate estimates"

A Doppler WSR-88D radar (NEXRAD) is currently operating in Cayey (East of PR, at 886 m). Reflectivity and rain rate (Z-R) relationships were developed using a dense network of rain gauges to validate radar estimates. These equations intent to correct the radar estimates for seasonal effects. Equations were derived for wet and

dry seasons over Puerto Rico. To minimize the errors due to beam block and clutter, equations were derived with 20 rain gauges located 15 km or less from the radar location. [C1010]

"Comb Types Channel Estimation in Multiple Access OFDM System"

This work on frequency interleaved multiple access in multi-carrier system. It investigates the performance of Comb Type Pilot Symbol Assist Modulation for mobile reception to mitigate the effect of fast fading Rayleigh channel based on its direct estimation in frequency domain. It has been found from extensive computer simulation with different delay spread and Doppler shift, that linear interpolation has worst performance where the distortion can not be compensated by increasing the signal-to-noise ratio. However, Spline and Low pass interpolator even they add higher complexity to the system, are more efficient to estimate the channel state information and gain SNR over the Linear type. [C1011]

"Adaptive Elimination of Ionospheric Contamination for HF Skywave Radars"

In this paper, an adaptive elimination algorithm is proposed based on phase estimation to solve the problem of returns' smearing caused by the ionospheric contamination in sky-wave over-the-horizon (OTH) radar. Three steps are included in the developed algorithm for acquiring the optimum ionospheric disturbance estimation. To get the contaminated first-order Bragg spectra suited to process, an adaptive band-pass filter is firstly introduced as a pre-process step. Then, a prior knowledge of the amplitude difference between the two first-order Bragg peaks is adopted to suppress the background noise effect on the ionospheric disturbance estimation. And finally, an iterative process is applied to optimize the results. A simulation example is given to demonstrate that the method is efficient in reconstructing Doppler spectra and increasing probability of detection in real-time. [C1012]

"Optimized geometry and limitations of compton cameras with LaBr3"

LaBr3(Ce) scintillators have a high atomic number, high light yield, and fast decay. Thus, detectors with LaBr3(Ce) crystal can achieve high energy resolution with a significantly improved efficiency over NaI(Tl) scintillators of the same geometry. In this work, LaBr3was investigated for use in a Compton camera with a two-plane array design, as the material for both the scattering and absorbing detector arrays. We calculated and modeled the following properties of a LaBr3Compton Camera: 1) The probability of single Compton scatter; 2) Doppler broadening effects; 3) The relationships between intrinsic efficiency and angular uncertainty; 4) Optimized efficiency for a required angular resolution by selecting various geometries, such as the thickness of detectors and distance between detectors. Our study showed that Doppler broadening effects induced an intrinsic limitation of ~0.05 radian angular uncertainty for Compton cameras with LaBr3as the scattering detector. In comparison of LaBr3with other traditional scatter detector materials such as Si, we found that below thickness of ~2 cm LaBr3has a higher efficiency for observation of single Compton scattering events, including the hits of the recoil electron and scattered photons, than that of Si. Based on these investigations, a prototype of Compton imaging system was proposed and evaluated with Monte Carlo simulation (Geant4) also. [C1013]

"Joint time-frequency analysis for radar signal and imaging"

The Fourier transform has been widely used in SAR signal and image processing. In most cases, SAR signals exhibit time-varying behavior in the Doppler spectrum. Thus, a joint time-frequency analysis (JTFA) for SAR signals is more useful. In this paper, we introduce three important issues with JTFA for radar signal and imaging: (1) time-frequency based image formation; (2) time-frequency analysis of ground moving targets; and (3) time-frequency analysis of micro- Doppler signatures. [C1014]

"Performance Prediction and Verification for the Synchronization Link of TanDEM-X"

The paper describes the synchronization link of the two satellites of the TanDEM-X mission. The synchronization link is established to track the oscillator phase noise difference which- after appropriate processing-can be used to compensate the effect of oscillator phase noise. A signal model based on the synchronization link hardware is presented which is then used to derive an analytical expression for the compensation phase including effects such as instrument drift, Doppler, antennas, and receiver noise. Specifically the influence of the synchronization link RF hardware on the quality of the derived compensation signal is crucial for the performance. Therefore the synchronization link RF hardware of the TerraSAR-X satellite is characterized to obtain realistic data. These measurements will be used for the calibration of the synchronization link, i.e. to remove systematic errors due to temperature drifts of the instrument. [C1015]

"Novel schemes of production and amplification of superradiance pulses by short intense electron beams"

A novel mechanism of superradiance (SR) in the process of stimulated backscattering of powerful pump wave by intense electron bunch has been studied. Using a relativistic 38 GHz BWO as a pump wave source, the short SR pulses of scattered radiation were observed experimentally. Due to the Doppler up-shift, spectrum of scattered pulse included the frequencies up to 150 GHz. After modifications the same experimental set-up will be used for observation of effect of amplification of subnanosecond SR pulse propagating along nanoseconds electron beam. According to PIC-code simulations under experimental conditions output pulse peak power can exceed the power of driving electron beam. [C1016]

"Radar objects detection and imaging for ground-based vehicle collision avoidance: computer simulation results and safety aspects"

The scope of this paper is to illustrate a new concept of a multi-sensor system for obstacle detection, and collision avoidance by controlling the motion of the vehicle traveling at very high speed regimes, of the order of 250 km/h. The paper illustrates the primary requirement of safety for the vehicle and the passengers and presents the effects of relative motion at such high speeds on radar data quality. A new mathematical model is described for calculating the effects of scintillation on detection range and Doppler velocity. Results indicate large spread around the expected values of range and Doppler depending on propagation and type of fluctuation of the signal. For improved obstacle detection and tracking is concluded that the effects of fluctuations of front radar measurements need to be compensated by measurements from a reference sensor on board, for example a rear sensor. [C1017]

"Compensation of ac Stark and Zeeman shifts in Doppler-free nonlinear Faraday rotation in rubidium vapor"

Nonlinear Faraday rotation (NFR) was studied for 87Rb atomic D2Fg= 2-Ft=1,2,3 transitions with crossed polarizers, with varying longitudinal magnetic field strength S = 0-10 G. The experiment was realized in counter-propagating beam Doppler-free geometry. [C1018]

"Applying the Fourier-Modified Mellin Transform (FMMT) to Doppler Distorted Waveforms"

The magnitude spectrum of a time domain signal has the property of delay-invariance. Similar to the delay-invariance property of the Fourier transform, the Mellin transform has the property of scale-invariance. By combining these two transforms together one can form the Fourier-Mellin transform that yields a signal representation which is independent of both delay and scale change. Due to the undesired low-pass property of the Mellin transform (MT), the modified Mellin transform (MMT) which is also scale-invariant is applied in our approach. Therefore the Fourier-modified Mellin transform (FMMT) of the original signal and the Doppler-distorted signal will be identical. This signal representation is useful in signal detection and target recognition. Several examples dealing with different waveforms have been simulated to illustrate the applicability of this approach. The performance of the Fourier-modified Mellin transform under different levels of noise in the signal are also illustrated in this paper. [C1019]

"Fast Fourier-domain modelling for a SAS simulator with application to time-variant targets, aspect-dependent occlusions, and Doppler effects"

This paper presents a new technique for the rapid computation of the far-field beampattern for the field scattered from a facet. We show how an affine transform and application of the warping property of the Fourier transform can be used to calculate the beampattern of an arbitrary triangular facet from the beampattern of a unit right-angle triangular facet. Thus, only a single beampattern needs to be calculated and stored; this is then interpolated as required. We describe how this technique can be applied to efficiently model time-variant facets, for example, the facets of a moving sea surface, or the visible region of a partially occluded facet. We also describe the incorporation of temporal Doppler effects. The fast Fourier-domain technique described in this paper has significantly improved the computational performance and memory footprint of our synthetic aperture sonar simulator. [C1020]

"Adaptive Window Length Estimation for Channel Estimation in CDMA Receivers"

In this paper, an adaptive window length estimation for channel estimation in direct-sequence (DS) code-division multiple-access (CDMA) receivers is presented. The estimated optimum window length is derived based on autocovariance analysis of the estimated channel coefficients. As the propagation channel changes over time, an adaptive algorithm for updating the window length is proposed through Doppler and signal-to-noise ratio (SNR) estimations. The proposed system improves the performance by adaptively selecting and continuously updating the window lengths over a wide-range of velocities (5 to 400 kmph). [C1021]

"Iterative Partial-Interference-Cancellation-based Detector for OFDM Systems over Doubly-Selective Rayleigh Fading Channels"

The time-variation of channels during one OFDM symbol destroys the orthogonality among subcarriers and results in intercarrier interference (ICI), which may detail substantial error performance. Assumed channels vary in linear fashion during one OFDM symbol, we propose an iterative partial-ICI-cancellation (PIC) based detector for OFDM systems with linear modulation over doubly-selective Rayleigh fading channels. The tentatively detected information of channel and data are fed back to regenerate the ICI and then partially subtracted from the received signals. The optimal partial ICI cancellation factor (PICF) is determined by minimizing the mean square error (MSE) of data estimation. The proposed detector iteratively renews the channel estimation and data detection after PIC, and results in performance enhancement. Based on Jake's model for the Doppler effects, the bit error ratio (BER) performance of the proposed detector is illustrated for OFDM systems with phase-shift keying (PSK) and quadrature-amplitude modulation (QAM) in Rayleigh fading channels at several speeds. [C1022]

"Sub-Doppler Spectroscopy of a vapour confined in an Extremely Thin Cell: Saturation effects and interplay between coherent resonances and incoherent losses"

Saturation effects affecting absorption and fluorescence spectra of an atomic vapour confined in an extremely thin cell (cell thickness L< 1 mum) are investigated experimentally and theoretically. It is known that in a thin cell of dilute vapour, the wall-to-wall atomic trajectories generate original sub-Doppler signatures for spectra recorded under normal incidence. [C1023]

"Fast-fading channel estimator using DCT and simplified kalman filter"

We present a novel channel estimator for fading channels using basis function approximations and Kalman filtering. The proposal results in a low complexity estimator that is robust to the shape of the channel Doppler spectrum and allows different Doppler spectra for each channel coefficient in a frequency-selective scenario. The estimator is based on the description of channel variations via truncated discrete cosine transform (DCT). We show that DCT can be approximated by a set of linear narrow-band passband filters that can be inserted into a Kalman filter formulation that track a set of decoupled parameters. This estimator attains close to perfect channel knowledge performance with only 1% training symbols in a data frame with Doppler frequencies up to 0.8 times the frame frequency. [C1024]

"Employing realistic propagation models in wireless system simulations"

This paper presents a new method of incorporating propagation models into wireless systems simulations. The multipath data for each transmitter-receiver pair in a realistic environment is calculated using the site-specific propagation modeling software developed at the University of Hawaii. Instead of fitting the multipath data into a statistical model, we directly use the data for the calculation of discrete channel impulse responses for each transmitter-receiver pair. The Doppler effects and the effects of pulse shaping filters on the calculation of discrete channel impulse responses are investigated. Finally, these channel impulse responses are employed in a CDMA system simulator to evaluate the output signal-to-noise ratio (SNR) and the corresponding bit error rate (BER). [C1025]

"Matrix Channel Estimation for OFDM Systems with Two Training Symbols and High-Order Polynomial Fitting"

A time-varying channel estimation method for orthogonal frequency division multiplexing (OFDM) systems is presented. The presented method makes use of two training symbol scheme in combination with high-order polynomial fitting, and can thus obtain precious estimation results even under very large normalized Doppler frequency. Simulation results show that the presented method with second order of polynomial can work well at a normalized Doppler frequency as large as 0.08. [C1026]

"Frame Delay and Loss Analysis for Video Transmission over time-correlated 802.11A/G channels"

This paper presents simulation results for the transmission of unicast MAC frames over 802.11a/g. Fading channel models at various Doppler frequencies are developed to generate time- correlated SNR waveforms. These are then used together with a bit accurate MAC/PHY simulator to estimate the frame loss rate, the transmission delay, and the jitter for a steady flow of transmit frames. Time correlated channels are required to correctly simulate the bursty nature of packet loss in a wireless channel. The Doppler spread is shown to have a strong effect on the performance of the ARQ mechanism in the MAC layer. Delay is computed as the sum of the

transmission delay and the accumulated queuing delay in the MAC buffer. Delay and frame loss are compared for time correlated and time uncorrelated fading channels. Compared to the slow fading case, in a fast fading channel fewer retransmissions are required and the end-to-end delay is significantly reduced. When channel conditions are poor the simulated delay and frame loss rate are seriously underestimated when time uncorrelated fading is assumed. To analyze the performance of video codecs, we show that a time correlated channel model must be combined with a dedicated 802.11a/g MAC/PHY simulation. [C1027]

"A Novel Method for Extraction of Micro-Doppler Signal"

The micro-Doppler effect may be generated by additional frequency modulations on the returned radar signal if the target contains rotating structures. The body image will be contaminated duo to the existence of the micro-Doppler. In the paper, a simple method based on integral of dwell-time is introduced, which can be utilized to separate the signal of the rotating parts from that of the target body successfully. It makes the ISAR image clearer and also provides some information of the rotating parts, such as the radii and the rotation frequencies. Computer simulations are given to prove the effectiveness of the proposed method. [C1028]

"Performance Comparison of Space-Time Coded MIMO-OFDM Systems Using Different Wideband MIMO Channel Models"

This paper investigates the performance of multiple- input multiple-output orthogonal frequency division multiplexing (MIMO-OFDM) systems using different wideband MIMO channel models. The considered MIMO channel models are based on the geometrical elliptical model and the geometrical one-ring model. The spatial correlation effects due to the limited antenna spacings and the Doppler effect caused by the movement of the receiver are studied separately. It is shown that increasing the antenna spacings leads to a higher diversity gain. The relevant range of the antenna spacings that has a strong influence on the system performance is obtained through simulations. When the antenna spacings exceed the determined range, then the diversity gain does not increase significantly. Moreover, to achieve the same system performance, the MIMO-OFDM system employing the one-ring model requires larger antenna spacings than using the elliptical channel model. Furthermore, the influence of the maximum Doppler frequency has been studied under perfect and imperfect channel state information (CSI). It is demonstrated that system performance degradations occur if the maximum Doppler frequency increases, especially in case of imperfect CSI. [C1029]

"Performance Analysis of Anti Noise FM Jamming of Pseudo-random Code Binary Phase Modulation Fuze Based on Doppler Effect"

Performance analysis of the pseudo-random code binary phase modulated (PRC-BPM) fuze is analyzed in this thesis. Firstly, its principle is introduced in brief. On this basis, the signal to jamming ratio (SJR) gain of its receiver in noise FM jamming is deduced in detail with Doppler frequency. Then, the effect of Doppler frequency, pseudo-random code width, the of period pseudo-random code serial and aiming frequency deviation on its performance of anti noise FM jamming is analyzed. The results indicate that the PRC-BPM fuze has better performance of anti noise FM jamming. [C1030]

"Fading Effects on Turbo-encoded Data"

This paper investigates, based on an interactive Matlab simulation, the turbo encoder and decoder parameters design effects on the overall system performances. Several results are highlighted with respect to different parameter influence on system performances and complexity in the absence/presence of Rayleigh/Rice fading with/without Doppler shift. The results and some interesting conclusions regarding different configurations behavior in the presence of fading will be presented. [C1031]

"QPSK/OQPSK Signal Detection with IF AGC on LEO Satellite"

The effect of IF (intermediate frequency) analog AGC on QPSK/OQPSK signal detection is evaluated for LEO satellite system where Doppler drift, large dynamic range of signal power and low Eb/No condition are difficult to deal with. The way of setting reference value of logarithmic power based AGC is discussed. Coherent accumulation and non-coherent accumulation are used for detecting, while signal's PDF and performance vs. accumulation times are derived mathematically. Experiment shows that with 60 KHz Doppler offset, Eb/No=0dB under QPSK/OQPSK, only 16 bits was consumed to detect the signal with 99.9% detection probability and 0.1% false alarm probability. [C1032]

"Analysis of Doppler Ultrasound Outflow Profiles for the Detection of changes in Cardiac Function"

Detecting changes in the contractility of the heart muscle, especially in the presence of coronary artery disease,

is an important medical task. From isolated myocytes, it was suggested that chronic ischemia decreases but prolongs contraction. Additionally, severe aortic stenosis shows higher but often prolonged outflow velocities. From this, we hypothesize that there is a correlation between the morphology of the aortic outflow velocity profile and myocardial function. To test this hypothesis, we (semi-) automatically analyzed continuous wave Doppler aortic outflow traces from 112 individuals. The traces were segmented and a set of morphology features were extracted. Areas under ROC curve were used as a measure of quality of each feature for detecting changes in cardiac function related to coronary artery disease. Signal analysis has shown that the probabilistic distributions of the various features are different for normal individuals and patients with ongoing disease. This result shows that aortic outflow profiles provide information on cardiac function and that the presented signal analysis and feature extraction method might be used to provide additional diagnostic information in the clinical management of coronary artery disease. [C1033]

"Multimode VCSELs for Self-Mixing Velocity Measurements"

In this paper, we present the feasibility of a laser Doppler velocimeter using self-mixing effect in low-cost strongly multimode VCSELs (AlGaAs). The prototype of velocity sensor demonstrates a 20dB signal-to-noise ratio over an amplification bandwidth of 10 MHz allowing velocity measurements up to 8.5m.s_1. The VCSEL-based self-mixing sensor has been characterized at various distances from the target, and with cooperative and non-cooperative surfaces. A characterization of the temperature sensitivity of the VCSEL-based velocimeter results is presented which demonstrates the great stability of the device over an important temperature range. A comparison between results obtained with strongly multimode VCSELs and Fabry-Perot laser diodes in velocimetry applications is achieved. We finally discuss the intrinsic advantages of VCSELs in self-mixing applications as in particular for on-board sensors. [C1034]

"Tsunami Detection using Multi-frequency Beam-Forming HF Radar"

We discuss a new multi-frequency beam-forming HF radar design for robust detection and tracking of tsunami waves from 200 km distances, providing continuous coverage of the tsunami approach to shore. The method works by mapping ocean currents at long range using traditional HF radar method of radial Bragg line Doppler shift measurement, then continuously looking for anomalous Doppler shift patterns and extremely high values due to the large orbital wave of the tsunami wave crest sequence. We discuss issues determining coverage quality improvement achievable using a multi frequency radar (MFR) in order to assure robust long range coverage. These issues include diurnal and seasonaly changes in noise character due to ionospheric conditions, and the effect of local wind speed and sea state providing a sufficiently good sea echo signal at long range. Multiple frequency utilization assures this higher quality at no design cost compared to existing single frequency HF radars, using the ISR digital radar design. [C1035]

"Spiral spectrum separation for information transmission by using orbital angular momentum of light beam"

Orbital angular momentum (OAM) can be used in information transmission since OAM states can construct high dimensional Hilbert space. We propose a method to separate such OAM states quantitatively, i.e. spiral spectrum, according to the rotational Doppler effect (RDE). [C1036]

"Quantification of Eccentric Mitral Regurgitation by Regurgitant Volume"

To investigate and verify that real-time 3-dimensional (RT-3D) color Doppler is capable of quantifying the eccentric miral regurgitation (MR) by computing regurgitant volume (RV). 34 patients (mean age 37.13 plusmn 18.28 years) with confirmed eccentric MR were undergone RT-3D echocardiography. By the spatial and temporal integration of the cross-sectional velocity distribution of regurgitant valve, the systolic RV can be evaluated. Then RV were applied to assessing the severity of eccentric MR and compared with the jet volume (JV) and the vena contracta width (VCW) immediately measured. In 34 patients, 2 patients were graded as mild, 16 patients as moderate, and 16 patients as severe. Our RV measurements have good correlation with JV(r=0.9453) and VCW(r=0.8829) respectively. RT-3D color Doppler echocardiography was capable of quantifying the RV of the eccentric MR. [C1037]

"Sub-Doppler Traps in an Asymmetric Magneto-Optical Trap with Unequal Laser Detunings"

The theoretical and experimental studies on the observation of adjustable multiple sub-Doppler traps in the six-beam magneto-optical trap (MOT) with unequal laser detunings are presented. When the detuning of the longitudinal lasers along the magnetic field axis is different from that of the transverse lasers, we obtain an array of three sub-Doppler traps; one usual but suppressed trap at the origin and two additional traps symmetrically but oppositely located at equal and controllable distances from the origin. We could explain the observed sub-

Doppler traps and their behavior by the calculation of the sub-Doppler forces where multiple oscillating frequencies are involved. [C1038]

"P4B-5 The Role of Local Center Frequency Estimation in Doppler-Based Strain Imaging"

Ultrasound frequency-dependent attenuation causes a downshift in the spectrum as ultrasound waves propagate through attenuating tissue. Therefore, assuming a constant center frequency in Doppler (autocorrelation) based strain imaging will result in displacement estimation error and ultimately affect strain values, especially when using broadband signals. Here we derive a theoretical expression, based on a Gaussian-enveloped pulse, for the strain estimation error due to errors in the assumed center frequency. The expression relates the strain estimation error to the attenuation coefficient, pulse center frequency, relative bandwidth, imaging depth, and true strain. For a 6 MHz transducer (50% BW) imaging tissue with attenuation coefficient 0.5 dB/MHz/cm, we show that the center frequency downshift introduces a range of -24% to -74% relative strain bias error from 2 cm to 6 cm depths, respectively. We support our theoretical derivations with Doppler-based strain estimation results using Field II simulations, phantom, and ex-vivo bovine liver experiments. In simulation, the localized-center-frequency-estimation (LCFE) based Doppler approach reduced the bias and variance of the strain estimates, as theoretically predicted. A Philips 6.2 MHz linear transducer was used to acquire high frame rate RF data on an elasticity phantom (0.5 dB/MHz/cm) under controlled compression. In three ROIs (5 mm axial times 13 mm lateral) centered at 2, 3, and 4 cm depths, the estimated strain values are -3.7%plusmn0.9%, -3.6%plusmn0.8%, and -2.6%plusmn0.9%, respectively, with LCFE, and -3.3%plusmn1.3%, -2.4%plusmn1.6%, and -1.6%plusmn2.0% without LCFE. Respectively, the relative biases between the two methods are -11%, -33% and -39%, close to the theoretical biases of -8%, -24% and -51%. Results on an ex-vivo liver phantom with a post RFA hard lesion show a 20% reduction in strain standard deviation at the lesion center (4.5 cm depth) when using LCFE. Experimental results show that for broa- dband ultrasound signals, LCFE is important in Doppler-based elasticity imaging to reduce the bias and variance of the strain estimates, thus providing more diagnostically accurate information. [C1039]

"P4C-2 Contrast Enhanced US for Monitoring the Effect of VEGF Trap on Melanoma Tumor Vascularity"

The purpose of this study was to use contrast enhanced ultrasound (US) to monitor tumor angiogenesis in vivo in a human melanoma xenograft model and to study the effects of an anti-angiogenic therapy on tumor blood flow. Thirty nude mice (3 groups of 10) were implanted with a human melanoma cell line (DB-1). The active group received VEGF Trap (dose: 4times25 mg/kg over 2 weeks; Regeneron Pharmaceuticals, Tarrytown, NY), which binds vascular endothelial growth factor (VEGF) with high-affinity. One control group received human Fc protein and one was untreated. The contrast agent Optison (GE Healthcare, Princeton, NJ) was injected in a tail vein (dose: 0.4-0.6 ml/kg). Power Doppler (PDI) and pulse inversion harmonic imaging (PIHI regular and intermittent) was performed with an Elegra scanner (Siemens Medical Solutions, Issaquah, WA). Specimens were stained for endothelial cells (CD31), VEGF, and cyclooxygenase-2 (COX-2). Image-processing software was used to calculate fractional tumor neovascularity for US and specimens. Of the 30 mice, 11 failed for technical reasons. Linear regression showed correlations between US and percent area stained with CD31 and COX-2 ($r>0.40$; $p<0.04$). Tumor volumes were smaller (656plusmn225 mm3) in the active group than in the control groups (1160plusmn605 mm3Fc; $p=0.099$ & 1634plusmn1117 mm3untreated; $p=0.009$). Differences in fractional vascularity between groups were found for PIHI, intermittent-PIHI, CD31 and COX-2 ($p<0.02$). Even though CD31 decreased markedly from the sham control to the treated group, there was a significant increase in tumor blood flow ($p<0.001$). This may be due to a transient normalization of the vasculature following elimination of immature tumor vessels. In conclusion, contrast enhanced US appear to allow in vivo monitoring of the anti-angiogenic effects of VEGF Trap in the DB-1 human melanoma xenograft model. There are indications of vascular normalization fo- llowing treatment with VEGF Trap. However, the current data set is limited and further investigations are required. [C1040]

"P2D-4 A Phase Based Approach for Estimation and Tracking of Locally Variable Delays"

Time delay estimation is important for several ultrasound imaging methods, such as Doppler, elastography and SURF Imaging. In this paper a new phase based approach is presented which makes no assumption on the local delay variation. The method is computationally fast and performs well compared to other methods. [C1041]

"P1E-5 Understanding Ultrasound-Induced Aluminum Oxide Breakage During Wirebonding"

A few models have earlier been proposed to explain Al oxide breakage during US wirebonding as presented by L. Levine, but no widely accepted theory exists. We propose a model to describe the AlOxbreakage mechanism during tangential US excitation at constant pressure in a wirebonder. The model is based on theoretical

estimations and experimental measurements. We measure with a laser Doppler vibrometer the relative wire-base displacement and propose that stick-slip and micro-slip behavior is prevalent during ultrasonic bonding. Displacement was measured at rim of the rectangular 14 mum thick and 80 mum width Al wire and at the silicon microchip base. A rectangular shaped wire was used to have probe light good reflection. We combined displacement measurements, detailed SEM analysis of contact interfaces and FEM of the bond structure during the bonding process. We also made a synthesis of the current bonding process knowledge. As a synthesis we propose a two-step model, including early stage scrubbing and later microweld expansion. Validation of the proposed model is discussed. This work and the obtained results are steps towards a fundamental quantitative US bonding theory that is necessary to develop reliable bonding technologies towards finer-pitch and more reliable interconnections. [C1042]

"Radar Detection Through Wavelet Transform"

In this paper we intend to unite the wavelet theory with radar detection. To join both theories, we will use the connection between the wideband signal model and the wavelet transform. Once the wavelet transform is applied the echo signal received, we compare the wavelet coefficients of a scale j with a fixed threshold for a defined false alarm probability in that scale. From that comparison, the existence of target will be decided. [C1043]

"Quantized vs. Analog Feedback for the MIMO Broadcast Channel: A Comparison between Zero-Forcing Based Achievable Rates"

We consider a MIMO fading broadcast channel and compare the achievable ergodic rates when the channel state information at the transmitter is provided by "analog" noisy feedback or by quantized (digital) feedback. The superiority of digital feedback is shown, with perfect or imperfect CSIR, whenever the number of feedback channel uses per channel coefficient is larger than 1. Also, we show that by proper design of the digital feedback link, errors in the feedback have a minor effect even by using very simple uncoded modulation. Finally, we show that analog feedback achieves a fraction 1-2F of the optimal multiplexing gain even in the presence of a feedback delay, when the fading belongs to the class of "Doppler processes" with normalized maximum Doppler frequency shift 0 Г‚Вї F 1/2. [C1044]

"Non-Fixed Scatterers and Their Effects on MIMO Multicarrier Fading Communication Channels"

There are two types of scatterers in a multipath propagation environment: fixed and non-fixed scatterers. Fixed scatterers like buildings, mountains and tree stems do not move, while non-fixed (moving) scatterers like cars, people and tree leaves move from their initial positions. In addition to different movements of the mobile station (MS) that cause different kinds of Doppler fading, movements of non-fixed scatterers are also anticipated to generate other kinds of fading/correlation. This fading changes depend on the type of the propagation environment and the type of movements of local surrounding scatterers. In this paper we characterize these effects in terms of temporal correlations. In this study we assume constant speed for the MS and random displacements for scatterers based on stationary-increment Wiener vector process. As it will be verified, these random movements have direct effect on the channel process power spectral density (PSD). [C1045]

"Improved Block DFE Equalization for Mobile WiMAX OFDM Systems"

In this paper an improved decision feedback equalizer (DFE) for mobile orthogonal frequency division modulation (OFDM) systems is presented. The time-varying nature of the channel, due to the Doppler effect, produces inter carrier interference (ICI) that may be counteracted by using a DFE frequency- domain OFDM symbol equalizer. The proposed algorithm is based on a recently proposed block DFE equalizer exploiting an LDLHdecomposition. The main novelty of this work is the idea to modify the backward filter in order to have a complete MMSE linear equalization before the decisions needed for the interference cancellation. Performance may be further improved by re-filtering the signal in an iterative algorithm which makes use of the proposed backward filter at the first iteration. The proposed scheme performance is evaluated by considering a mobile WiMAX IEEE 812.16e standard transceiver. [C1046]

"P6B-11 How Fat Layers Affect the Clinical Diagnosis from Doppler Data"

Ultrasound Doppler data are routinely used in the clinical diagnosis of degree of stenosis in the renal artery. In this study the effect of fat layers on maximum velocity estimations was determined using both a Doppler string and flow phantom. Using an ATL HDI 3000 with two broadband transducers (C4-2 and L12-5), the maximum velocity was estimated for a range of velocities with and without the presence of a fat layer. The results indicate that the introduction of a fat layer has a significant effect on the overestimation of the maximum velocity when the string phantom is used. However, in the case of the flow phantom which is more physiologically

representative of in vivo conditions, underestimation of the maximum velocity was observed; this may cause patients to be diagnosed as having a smaller stenosis than is actually present. [C1047]

"P6B-13 In Vivo Blood Flow Imaging of Achilles Tendon in Mice with High Frequency Ultrasound"

Chronic degenerative Achilles tendinopathy (tendonitis) is a common clinical problem and its aetiology remains in part unexplained. For the treatment of Achilles tendinopathy, there were a lot of modalities including medication, physical agents, physiotherapy, and exercise. However, how to evaluate the effects of current therapeutic modalities and study the therapeutic mechanism in vivo remains a crucial problem. In this study, we show the potential of high-frequency ultrasound Doppler imaging for observation of Achilles tendon microcirculation of mice pre- and post-treatment and for exploration of the therapeutic mechanism with small animal models in vivo. A collagenase-induced Achilles tendinitis model of mice was also adopted here. Mice with collagenase-induced Achilles tendinitis were given a 45-kHz low-frequency ultrasound treatment, and then the morphology and microcirculation changes of Achilles tendons pre- and post-treatment were observed with B-scan, power Doppler, and color Doppler of a 25- MHz high frequency ultrasonic imaging system. Mouse Achilles tendon was about 4 to 5 mm in length and 0.5 mm in diameter. There were no focal hypoechogenic regions in normal Achilles tendons. Because of the immediate vascular dilatation resulting from the treatment of low frequency ultrasound, increase in microcirculation was observed within a shot period of time after treatment. In our future work, we will focus on imaging microcirculation changes of tendinosis pre- and post-treatment with long term time course study and expect to obtain more physiological information for future human study. [C1048]

"To enhance bit rate in orthogonal frequency division multiplexing by carrier interferometry spreading code"

In orthogonal frequency division multiplexing (OFDM) based wireless communication systems; extra guard period is inserted to eliminate ISI (inter symbol interference) and ICI (inter carrier interference) effect. The guard period decreases the symbol rate. The authors describe here a model that eliminates the effects of ICI and ISI without inserting extra guard period. The sub-carrier frequencies and carrier interferometry (CI) code distribute alternatively between consecutive OFDM symbols to eliminate the ISI effect. The CI code is used to each sub-carrier in such a way that the subcarrier frequency, orthogonal to each other, when Doppler frequency shift occurs due to relative movement of the transmitter and receiver. A pilot symbol is used in between the two symbols for linear operation of all the electronic devices. A properly designed matched filter at the transmitter and receiver can reduce the effect of ICI. Here, we consider the effect of ICI for carrier frequency synchronizing error, Doppler shift and phase error with a time invariant channel as well. [C1049]

"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. [C1050]

"Terrain obscuration managment for multiple ground target tracking"

Multiple ground targets tracking with a GMTI (ground moving target indicator) sensor is considered a challenging problem in order to establish battlefield assessment. An IMM algorithm with a variable structure is adapted to the road network and used to track multiple manoeuvring ground targets. However, the case of undetected targets due to terrain elevation or Doppler obscuration was not taken into account in our tracking process. In this paper, we present our approach to track ground targets with the possibility for the target to be undetected. The perceivability probability is computed to update the estimated state and a "sentinel" concept is used to palliate the association ambiguities when several targets enter and exit the same terrain mask. [C1051]

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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. [C1052]

"Improving Noninvasive Monitoring in Medical Care"

Early detection of non-uniformities and abnormalities in human body behavior could save lives and might diminish health care assurance expenses. The range of monitored parameters is wide, from respiratory and cardio parameters survey to early cancer detection. Due to invasive methods important drawbacks, researchers are looking for new non-invasive methods. The is presenting new approaches, combining different physical methods, compared to the existent monitoring techniques, usually used in medical care. Our approach concerns studies of using microwave Doppler effect for the contactless detection of the cardiac and respiratory activity, for the continuous respiratory and cardiac monitoring. We are also describing a microwave body emission radiometry method in abnormal tissue increased activity detection. [C1053]

"Transmission Properties of an Optically Excited Finline Used for a Doppler Frequency Converter"

Frequency conversion utilizing the Doppler effect in a slot line (finline) with an optically excited silicon substrate has been investigated. The slot-line frequency converter with a silicon substrate has been designed and fabricated. Basic transmission properties of the slot line illuminated by a 532 nm Nd:YAG laser beam have been measured using a finline structure at W-band. The experimental results have shown that the laser pulses with energy of 1 muJ can control transmission of millimeter waves in the slot line. [C1054]

"Gaussian mixture cardinalized PHD filter for ground moving target tracking"

The cardinalized probability hypothesis density (CPHD) filter is a recursive Bayesian algorithm for estimating multiple target states with varying target number in clutter. In particular, the Gaussian mixture variant (GMCPHD) for linear, Gaussian systems is a candidate for real time multi target tracking. The present work addresses the following three issues: (i) we show the equivalence between the GMCPHD filter and the standard Multi Hypothesis Tracker (MHT) in the case of single targets; (ii) using a Gaussian sum approach, we extend the GMCPHD filter by employing digital road maps for road constraint targets. The utilization of such external information leads to more precise tracks and faster and more reliable target number estimates; (iii) we model the effect of Doppler blindness by a target state dependent detection probability, leading to more stable target number estimation in the case of low Doppler targets. [C1055]

"P1A-5 Analysis of Backscattered Signals with a Neural Network Model for Microemboli Classification"

Emboli classification is of high clinical importance for selecting appropriate patient treatment. Several ultrasonic (US) methods using Doppler processing have been used for emboli detection and classification as solid or gaseous matter. We suggest in this experimental study to exploit the radio-frequency (RF) signal backscattered by the emboli since it contains additional information about the embolus than the Doppler signal. The aim of the study is the analysis of RF signals using radial-basis function neural network (RBFN) in order to classify emboli. Anthares scanner with RF access was used with a transmit frequency of 1.82 MHz and mechanical indices (MI) varying from 0.2 to 1.1. To imitate emboli US behaviour, Sonovue microbubbles were injected in a nonrecirculating flow phantom with a 0.8 mm diameter vessel with a constant flow. Non perfused tissue was assumed to behave as solid emboli. Sonovue concentration was chosen such that fundamental scattering from tissue and contrast were identical. The training, validation and test sets consisted of 50, 26 and 26 samples respectively for each MI. The training set was used to determine the network parameters while the optimal number of centres in the hidden layer of our RBFN was determined from the validation set. Amplitudes and bandwidths of fundamental, 2nd and 3rd harmonic components as well as the parameters of Gaussian approximation of the frequency spectrum were the selected input parameters of the RBFN model. When the bandwidths or the amplitudes of the fundamental and the harmonic frequencies were used as input parameters, the neural network led to unsatisfactory classification rates: only 31% of gaseous emboli were correctly characterized at low MI. This rate was increasing with the MI up to 100% of correct classification. Gaseous and solid emboli were 100% correctly characterized when the Gaussian coefficients were selected as input parameters, independently of the MI. The study has demonstrated the opportun- ity to classify emboli based on

a RF signals neural network analysis. [C1056]

"Two-photon cooling below the Doppler limit in bosonic magnesium"

Standard sub-Doppler cooling methods are not applicable in bosonic magnesium due to the non-degenerate ground state. However, the Doppler limit can be surpassed by coupling the excited state of the cooling transition to the level 1D2and cooling via a coherent two-photon transition. This process modifies the population in 1P1, similar to electromagnetically induced transparency, as well as the resulting force profile in optical molasses. These modifications can be used to obtain a steeper slope in the force profile around v=0 and hence lower temperatures as compared to doppler cooling on the strong transition only. [C1057]

"10C-3 Radial Modulation Imaging of Microbubbles at High Frequency"

In this paper, radial modulation imaging of microbubbles is investigated at high frequency. A modulation pulse frequency of 3.7 MHz with an amplitude ranging from 0 to 250 kPa, and a 1.3 MPa 20 MHz broadband imaging pulse were used. Radial modulation effects were observed on a population of flowing microbubbles and quantified using a Doppler-type processing technique. Artifact signals related to the generation of harmonics by bubbles strongly resonating at the modulation frequency were observed. The bubble response to simultaneous modulation and imaging excitations was simulated for different combinations of bubble sizes and modulation amplitudes. Simulations confirm the hypothesis that the generation of harmonics of the modulation frequency can be detected by the imaging transducer. Simulations indicate that the modulation frequency should be chosen lower than the resonant frequency of the biggest bubbles present in the population. The simulation also suggests that a 10-20% variation of bubble diameter induced by the modulation excitation is sufficient for radial modulation imaging In conclusion, the effects of radial modulation are detectable at a high frequency. Therefore, radial modulation imaging has potential for high-resolution imaging of microbubbles in the microvasculature. [C1058]

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