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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 24-1

“Ground Penetrating Radar”
(«Подповерхностная радиолокация»)

Журнальные публикации

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"Three-Dimensional GPR Ray Tracing Based on Wavefront Expansion With Irregular Cells"

A new ray-tracing method in 3-D heterogeneous isotropic media is proposed based on the bilinear travel-time interpolation and wavefront group marching method (GMM). In this method, an irregular cell discretization scheme is used to accurately describe arbitrarily undulant interfaces in a model. The ray tracing is carried out by forward-backward processing. In the forward step, the travel time in an irregular cell is expressed in terms of the bilinear interpolation of the known travel times on the cell's surfaces. Then, the wavefront is evolved from the source to the whole computational domain by using the newly developed travel-time solver and the fast wavefront expansion GMM. In the backward step, each ray path is traced from the receiver by finding the intersection points of potential ray propagation vectors with the surfaces of the relevant cells. The same travel-time solver is used to compute the candidate intersection points on all surfaces of each relevant cell, and the point with the minimum travel time is selected as a ray point from which the similar step is continued until the sources are found. Several numerical experiments are presented to demonstrate that the new algorithm is accurate, efficient, and robust. [J1]

"Modeling the Configuration of HF Electrical Antennas for Deep Bistatic Subsurface Sounding"

In the frame of the European Space Agency's 2016 ExoMars mission, the Electromagnetic Investigation of the SubSurface (EISS) ground-penetrating radar has been designed and developed to perform deep soundings of the Martian subsurface from the surface. The EISS is designed to take advantage of the potential for bistatic radar investigations of the Martian subsurface between the fixed station (Lander) and the mobile platform (rover) and to characterize the 3-D structure and stratigraphy of the subsurface at depths ranging from 100 m to a few kilometers out to a 1-km radius around the lander. The EISS makes use of an electric dipole antenna made of two identical 35-m resistively loaded monopoles to transmit (and also receive in a monostatic mode) the high-frequency signal. However, the EISS's most innovative capability is its potential for bistatic operation, made possible by the accommodation of a small magnetic sensor on the rover (as initially planned for the ExoMars mission) which can measure the magnetic field (all three components) of the received waves whatever the direction and orientation of the rover. The aim of this paper is to show that the two monopoles of the antenna must be deployed on the surface in nearly opposite directions but not aligned to ensure good volume coverage around the transmitter. This paper is based on Finite Difference in Time Domain (FDTD) electromagnetic simulations. The simulated data have been used to study the impact of the angle between these two monopoles on the instrument performance. [J2]

"Energy-Efficient Precoding for Multiple-Antenna Terminals"

The problem of energy-efficient precoding is investigated when the terminals in the system are equipped with multiple antennas. Considering static and fast-fading multiple-input multiple-output (MIMO) channels, the energy-efficiency is defined as the transmission rate to power ratio and shown to be maximized at low transmit power. The most interesting case is the one of slow fading MIMO channels. For this type of channels, the optimal precoding scheme is generally not trivial. Furthermore, using all the available transmit power is not always optimal in the sense of energy-efficiency [which, in this case, corresponds to the communication-theoretic definition of the goodput-to-power (GPR) ratio]. Finding the optimal precoding matrices is shown to be a new open problem and is solved in several special cases: 1. when there is only one receive antenna; 2. in the low or high signal-to-noise ratio regime; 3. when uniform power allocation and the regime of large numbers of antennas are assumed. A complete numerical analysis is provided to illustrate the derived results and stated conjectures. In particular, the impact of the number of antennas on the energy-efficiency is assessed and shown to be significant. [J3]

"Combination of Advanced Inversion Techniques for an Accurate Target Localization via GPR for Demining Applications"

We used advanced ground-penetrating radar (GPR) inversion techniques for detecting landmines in laboratory conditions. The radar data were acquired with a calibrated vector network analyzer combined with an off-ground monostatic horn antenna, thereby setting up a stepped-frequency continuous-wave radar. Major antenna effects and interactions with the soil and targets were filtered out using frequency-dependent complex antenna transfer functions. The proposed strategy first exploits inversion approaches that are able to give an accurate characterization of the antenna-soil interaction and a reliable estimate of the soil permittivity. The outcomes of this first phase are at the basis of the application of a microwave tomographic approach based on the Born approximation to achieve the imaging of the subsurface. The algorithms were applied for imaging three landmines of different sizes and buried at different depths in sand. Although the radar system was off the ground, the results showed that it was possible to reconstruct all mines, including a shallow plastic mine as small as 5.6 cm in diameter. This last mine was invisible in the raw radar data, and the use of common GPR imaging techniques did not lead to satisfactory results. The proposed integrated method shows great promise for shallow subsurface imaging in a demining context, particularly because it automatically provides accurate information on the shallow soil dielectric permittivity. [J4]

"Ground Moving Targets Imaging Algorithm for Synthetic Aperture Radar"

It is well known that the motion of a target induces range migration, especially for high-resolution synthetic aperture radar (SAR) systems. Ground moving target imaging necessitates the correction of the unknown range migration. To finely refocus a moving target, one must accurately obtain the motion parameters for compensating the target trajectory. However, in practice, these parameters usually cannot be precisely estimated. This paper proposes a new imaging approach for ground moving targets without a priori knowledge of their motion parameters. In the devised method, the azimuth compression function is constructed in range frequency domain, which can eliminate the coupling effect between range and azimuth. Theoretical analysis confirms that the methodology can precisely focus targets without interpolation procedure. The effectiveness of the proposed imaging technique is demonstrated by both simulated and real airborne SAR data. [J5]

"Efficient Electromagnetic Imaging of an Artificial Infiltration Process in the Vadose Zone Using Cross-Borehole Radar"

Cross-borehole ground-penetrating radar (GPR) has been widely used to characterize the shallow subsurface and to monitor hydrogeologic processes. To investigate an infiltration process in the vadose zone, an artificial groundwater infiltration test was conducted in Nagaoka, Japan. Time-lapse cross-borehole GPR data were collected using zero-offset profiling (ZOP) mode. The infiltration process was observed as a variation of GPR traveltimes, which can be transformed into a dielectric constant, and further converted to volumetric water content. A standard ZOP analysis, for which all first arrivals are assumed to be direct waves, results in an underestimation of the dielectric constant because of the existence of critically refracted waves. This letter presents an efficient algorithm using the maximum first-cycle amplitude to approximately determine the traveltime of direct arrival, deriving a dielectric constant model more accurately than the standard ZOP analysis from ZOP data. Tests on synthetic and real field data show that the proposed approach is effective in building accurate water content profile without iterative calculations as in the standard ZOP analysis. [J6]

"Mode Effect on Direct Wave in Single-Hole Borehole Radar"

In this paper, we investigate the influence of radar sonde eccentricity on a direct wave between a transmitting and a receiving antenna in a single-hole borehole radar measurement. We analyze the direct wave using an analytical method with the approximated solution of branch cut integrals and that of residues of poles. According to our calculation, at high frequencies above 200 MHz, guided waves, which are caused by the poles, play a vital role in the direct wave. We found that the most important pole is the HE11mode one, which is excited only when the antenna is eccentered in the borehole. We show that this causes artificial noise in the moving average subtraction, which is a common signal processing method used to remove the direct wave. In a laboratory experiment with a ground plane, we confirmed the excitation of the guided waves when the antenna was eccentered. In field experiments in granite, we conducted a special experiment, in which the location and rotation of the radar sonde were controlled mechanically. We found the excitation of the HE11mode at high frequencies when the sonde was noncentered by 1.7 cm in a borehole. These effects are also predicted in a theoretical analysis. [J7]

"A Compact Wideband Antenna Integrated With a Pulse-Forming Line for Transient Pulse Radiation"

A compact wideband antenna integrated with a pulse-forming line for transient pulse radiation is proposed in this paper. It can be used in the fields such as ultrawideband (UWB) radar, ground-penetrating radar, UWB

communications, etc. This antenna is integrated with a solid-state switch and a planar Blumlein pulse-forming line. The dimension of the antenna is 300 mm Ч 300 mm Ч 3 mm. In the experiment, the switch was triggered by a laser with a wavelength of 1064 nm. The peak power of a single antenna was 14.45 MW when the applied voltage was 17 kV. A Gaussian doublet pulse with a duration of 1.5 ns and a peak-peak amplitude of 305.7 V/m at a distance of 2 m from the antenna along the main beam direction was recorded in the experiment. The measured waveform was in good agreement with the predicted one. [J8]

"Surface acoustic wave devices as passive buried sensors"

Surface acoustic wave (SAW) devices are currently used as passive remote-controlled sensors for measuring various physical quantities through a wireless link. Among the two main classes of designs-resonator and delay line-the former has the advantage of providing narrow-band spectrum informations and hence appears compatible with an interrogation strategy complying with Industry-Scientific-Medical regulations in radio-frequency (rf) bands centered around 434, 866, or 915 MHz. Delay-line based sensors require larger bandwidths as they consists of a few interdigitated electrodes excited by short rf pulses with large instantaneous energy and short response delays but is compatible with existing equipment such as ground penetrating radar (GPR). We here demonstrate the measurement of temperature using the two configurations, particularly for long term monitoring using sensors buried in soil. Although we have demonstrated long term stability and robustness of packaged resonators and signal to noise ratio compatible with the expected application, the interrogation range (maximum 80 cm) is insufficient for most geology or geophysical purposes. We then focus on the use of delay lines, as the corresponding interrogation method is similar to the one used by GPR which allows for rf penetration distances ranging from a few meters to tens of meters and which operates in the lower rf range, depending on soil water content, permittivity, and conductivity. Assuming propagation losses in a pure dielectric medium with negligible conductivity (snow or ice), an interrogation distance of about 40 m is predicted, which overcomes the observed limits met when using interrogation methods specifically developed for wireless SAW sensors, and could partly comply with the above-mentioned applications. Although quite optimistic, this estimate is consistent with the signal to noise ratio observed during an experimental demonstration of the interrogation of a delay line buried at a-- depth of 5 m in snow. [J9]

"Sparse Reconstruction From GPR Data With Applications to Rebar Detection"

The problem of detecting and localizing 2-D thin scatterers (i.e., elongated scatterers whose cross sections are small in terms of the probing wavelength) from scattered field measurements is considered. To this end, a linear model that neglects mutual scattering and is based on a distributional representation of the unknown is established. An improved imaging technique based on a minimization algorithm, which takes advantage of the inherent sparseness of the considered ground-penetrating radar scenario, is presented and compared to a classical migration algorithm. The comparison is achieved for both synthetically generated and experimental data collected in realistic conditions under a multimonostatic/multifrequency configuration. [J10]

"Occupational and Residential Exposures to ELF Magnetic Fields Over a 24-h Period Among a Sample of Urban Populations in Korea"

The objective of this survey is to characterize the extremely low frequency (ELF) personal magnetic field (MF) exposure of the general population in Korea. This is the first-ever personal MF exposure survey done in Korea. The participants of the survey on MF exposure were randomly selected by occupation. The survey was conducted as follows: study participants wore an MF meter for about 25-28 h, and the exposure data were stored in the meter every 4 s. The personal MF exposure meter that was used for this survey was EMDEX-LITE, made by Enertech Consultants, Inc., USA. The participants were asked to record their activities so that MF exposure can be evaluated for a 24-h period. The personal MF exposure survey has been conducted for about four years, and the total number of participants was 466. To get the 24-h exposure data is one of the main purposes of this survey. The survey also provided an opportunity to analyze exposures corresponding to different types of activities. The exposure was analyzed in separate periods corresponding to the following activities: the entire 24-h period, in bed, at work, and by occupation. Therefore, the database was utilized to analyze the present status of personal MF exposure. [J11]

"A tabu search approach for assigning node Bs to switches in UMTS networks"

This paper proposes a mathematical model for assigning Node Bs to switches in UMTS networks, as well as an implementation of the tabu search metaheuristic for solving such a problem. In this model, the overall problem is divided into two assignment sub-problems: the assignment of a set of Node Bs to a set of radio network controllers (RNCs), and the assignment of those RNC concurrently to a set of voice switches (MSCs: Mobile Switching Centers) and a set of data switches (SGSNs: Serving GPRS Support Nodes). In order to solve the

overall assignment problem, the proposed implementation defines a number of moves which enable to efficiently explore the set of possible solutions. Computational results enable to identify the parameters that are able to reduce the costs of the obtained solutions, as such costs are relatively close to the estimated lower bounds and found in reasonable computational time. [J12]

"RF Tomography for Below-Ground Imaging of Extended Areas and Close-in Sensing"

Three extensions to radio-frequency (RF) tomography for imaging of voids under wide areas of regard are presented. These extensions are motivated by three challenges. One challenge is the lateral wave, which propagates in proximity of the air-earth interface and represents the predominant radiation mechanism for wide-area surveillance, sensing of denied terrain, or close-in sensing. A second challenge is the direct-path coupling between transmitters (Txs) and receivers (Rxs), that affects the measurements. A third challenge is the generation of clutter by the unknown distribution of anomalies embedded in the ground. These challenges are addressed and solved using the following strategies: 1) A forward model for RF tomography that accounts for lateral waves expressed in closed form (for fast computation); 2) a strategy that reduces the direct-path coupling between any Tx-Rx pair; and 3) an improved inversion scheme that is robust with respect to noise, clutter, and high attenuation. A finite-difference time domain simulation of a scenario representing close-in sensing of a denied area is performed, and reconstructed images obtained using the improved and the classical models of RF tomography are compared. [J13]

"Analysis of GPR UWB Half-Ellipse Antennas With Different Heights of Backed Cavity Above Ground"

Ultrawideband (UWB) antenna is a critical part of the ground penetrating radar (GPR) system, and the bow-tie antenna is the most popular one in all kinds of UWB antennas. In this letter, an antenna with two half-elliptical-shape arms, which is an improvement of the bow-tie antenna, is presented with the input impedance of around 100 ??. The voltage standing wave ratio (VSWR) and radiated waveform are analyzed as the antennas with different backed cavity heights and different elevations above ground surface. The influence of the vehicle on which the half-ellipse antenna (HEA) is mounted is also given in the above three aspects. [J14]

"Discrete Almost-Symmetric Wave Packets and Multiscale Geometrical Representation of (Seismic) Waves"

We discuss a multiscale geometrical representation of (seismic) waves through a decomposition into wave packets. Wave packets can be thought of as certain localized "fat" plane waves. Here, we construct discrete almost-symmetric 3-D wave packets by using the unequally spaced fast Fourier transform. The resulting discrete transform is unitary, implying that the reconstruction operator is simply the adjoint of the decomposition operator. Another relevant aspect of the discretization scheme is the appearance of parameters that control the tiling of the phase space that corresponds with the dyadic parabolic decomposition, preserving the relative parabolic scaling while adapting to the physical problem at hand. We consider applications in exploration and global seismology, in particular for higher dimensional data regularization, seismic map migration, denoising, directional regularity analysis, and feature extraction. [J15]

"Compressive Stepped-Frequency Continuous-Wave Ground-Penetrating Radar"

Data acquisition speed is an inherent problem of stepped-frequency continuous-wave (SFCW) radars, which may discourage further usage and development of this technology. We propose an emerging paradigm called compressed sensing (CS) to overcome this problem. In CS, a signal can be reconstructed exactly based on only a few samples below the Nyquist rate. Accordingly, the data acquisition speed can be increased significantly. A novel design of an SFCW ground-penetrating radar (GPR) with high acquisition speed is proposed and evaluated. Simulation by a monocycle waveform and actual measurement by a vector network analyzer at a GPR test range indicate the applicability of the proposed system. [J16]

"A Novel UWB Sampling Receiver and Its Applications for Impulse GPR Systems"

A novel ultrawideband (UWB) synchronous receiver for a UWB radar system is presented. The developed receiver is the first to employ a sampling phase detector, which integrates a step recovery diode and a pair of Schottky diodes, to sample the UWB signal of a radar, enabling the miniaturization of the design. It achieves a 6-GHz sampling bandwidth, a dynamic range of more than 50 dB, and low harmonic distortion of the output baseband signal. The receiver's down-converted IF signals closely match with their original shape, demonstrating its good performance to reconstruct the microwave signals from a receiving antenna. These IF signals can be converted to digital signals by a low-cost A/D. For verification, the performance of the UWB

receiver is tested through the experiments of buried steels at different thicknesses in the sand when it is applied to the ground-penetrating radar (GPR). The results show that the GPR system has good horizontal resolution and large detection depth. Therefore, this GPR system is very attractive and effective for applications of short-range and high-resolution detection. [J17]

"Planar-Monopole-Fed, Surface-Mounted Quasi-TEM Horn Antenna for UWB Systems"

A compact, quasi-TEM horn antenna is presented. This planar-monopole-fed, surface-mounted, UWB antenna has nearly constant gain of 4.8 ± 0.65 dBi from 2.75-12 GHz. It is λ/4 (45 mm) long at the lowest operating frequency. It also has nearly linear phase response in this ultrawideband. The radiation pattern in the azimuth plane is broad and the pattern in the elevation plane is relatively narrow. [J18]

"A Modified Bow-Tie Antenna for Improved Pulse Radiation"

The analysis, design, and realization of a modified bow-tie antenna optimized for impulse ground penetrating radar (GPR) applications is described. The proposed antenna shows improved properties important for GPR, which include its compact size (in comparison with a conventional bow-tie antenna) and ability to radiate UWB pulses with increased amplitude and very small late-time ringing. A substantial increase in the amplitude of the transmitted pulse is achieved by utilizing radiation from discontinuities introduced by the resistive loading employed in the antenna to suppress late-time ringing. By choosing an optimal distance between the antenna's feed point and the location of the resistive loading, radiations that occur from the antenna's feed point and the mentioned discontinuities at the resistive loading will combine constructively in the boreside direction of the antenna. As a result, one will observe a substantial increase of the amplitude of the transmitted pulse in the boreside direction. Furthermore, an analytical expression describing approximate time-harmonic current distribution is derived to indicate an optimal resistive loading profile for the proposed antenna. Additionally, the traveling-wave current distribution of the antenna is theoretically analyzed to examine the applicability of the obtained time-harmonic expression for pulse excitation. It has been found that when the antenna is resistively loaded both the time-harmonic and traveling-wave currents decay to approach nearly the same value at the end section of the antenna. As the amount of current at the antenna ends corresponds to the level of reflection which occurs there, the derived expression is found to be useful to indicate an optimal loading profile for the proposed antenna. A theoretical model of the proposed antenna has been developed to perform numerical analysis using a modified NEC-2 code. In addition, an experimental verification has been carried out and both the simulation and e--xperiment confirmed the improved properties of the proposed antenna. [J19]

"Modified Kirchhoff Migration for UWB MIMO Array-Based Radar Imaging"

In this paper, the formulation of Kirchhoff migration is modified for multiple-input-multiple-output (MIMO) array-based radar imaging in both free-space and subsurface scenarios. By applying the Kirchhoff integral to the multistatic data acquisition, the integral expression for the MIMO imaging is explicitly derived. Inclusion of the Snell's law and the Fresnel's equations into the integral formulation further expends the migration technique to subsurface imaging. A modification of the technique for strongly offset targets is proposed as well. The developed migration techniques are able to perform imaging with arbitrary MIMO configurations, which allow further exploration of the benefits of various array topologies. The proposed algorithms are compared with conventional diffraction stack migration on free-space synthetic data and experimentally validated by ground-penetrating radar experiments in subsurface scenarios. The results show that the modified Kirchhoff migration is superior over the conventional diffraction stack migration in the aspects of resolution, side-lobe level, clutter rejection ratio, and the ability to reconstruct shapes of distributed targets. [J20]

"Gaussian Process Approach to Buried Object Size Estimation in GPR Images"

Recently, a promising pattern-recognition system has been presented to deal with the extraction of buried-object characteristics in ground-penetrating-radar images. In particular, it allows the detecting of buried objects by means of a search method based on genetic algorithms and the recognizing of the material type of the identified objects through a classification approach based on support vector machines. In this letter, we propose to extend the processing capabilities of this system by addressing the issue of the detected buried-object size estimation. This problem is viewed as a regression issue where it is aimed at reproducing the relationship between a set of opportunely extracted features and the object size. For such purpose, it is formulated within a Gaussian process (GP) regression approach. A detailed experimental study is reported, showing encouraging object-size-estimation accuracies even when buried objects are close to each other. [J21]

"Reconstruction of GPR Signals by Spectral Analysis of the SVD Components of the Data Matrix"

This letter considers the problem of reconstructing total-time responses from noisy data collected by ground-

penetrating radar (GPR). The well-known singularity expansion method (SEM)-a theory-for late-time response representation is generalized to establish a matrix model (data matrix)representing total-time responses of radar scattering waveforms. Using singular value decomposition of the data matrix-an intermediate processing technique, we present an approach to model-order determination and successfully reconstruct the total-time responses. The model order is quantitativelyselected by spectral analysis of left singular vectors of the data matrix and of the emitted waveform. The most important discoveries in this letter are as follows: (1) the GPR upper frequency can be used as a criterion for the selection of left singular vectors of the data matrix, and (2) the left singular vectors of the data matrix, which should not be neglected, tend to be predominantly low-pass functions and also provide valuable information for model-order determination. [J22]

"Radio Frequency Tomography for Tunnel Detection"

Radio frequency (RF) tomography is proposed to detect underground voids, such as tunnels or caches, over relatively wide areas of regard. The RF tomography approach requires a set of low-cost transmitters and receivers arbitrarily deployed on the surface of the ground or slightly buried. Using the principles of inverse scattering and diffraction tomography, a simplified theory for below-ground imaging is developed. In this paper, the principles and motivations in support of RF tomography are introduced. Furthermore, several inversion schemes based on arbitrarily deployed sensors are devised. Then, limitations to performance and system considerations are discussed. Finally, the effectiveness of RF tomography is demonstrated by presenting images reconstructed via the processing of synthetic data. [J23]

"Soil Surface Water Content Estimation by Full-Waveform GPR Signal Inversion in the Presence of Thin Layers"

We analyzed the effect of shallow thin layers on the estimation of soil surface water content using full-waveform inversion of off-ground ground penetrating radar (GPR) data. Strong dielectric contrasts are expected to occur under fast wetting or drying weather conditions, thereby leading to constructive and destructive interferences with respect to surface reflection. First, synthetic GPR data were generated and subsequently inverted considering different thin-layer model configurations. The resulting inversion errors when neglecting the thin layer were quantified, and then, the possibility to reconstruct these layers was investigated. Second, laboratory experiments reproducing some of the numerical experiment configurations were conducted to assess the stability of the inverse solution with respect to actual measurement and modeling errors. Results showed that neglecting shallow thin layers may lead to significant errors on the estimation of soil surface water content(????>0.03 m3/m3), depending on the contrast. Accounting for these layers in the inversion process strongly improved the results, although some optimization issues were encountered. In the laboratory, the proposed full-waveform method permitted to reconstruct thin layers with a high resolution up to 2 cm and to retrieve the soil surface water content with an rmse less than 0.02 m3/m3, owing to the full-waveform inverse modeling. These results suggest that the proposed GPR approach is promising for field-scale mapping of soil surface water content of nondispersive soils with low electrical conductivity and for instances when soil layering is encountered. [J24]

"Phase Spectrum of Signals in Ground-Penetrating Radar Applications"

The phase structure of ground-penetrating radar (GPR) signals operating on the basis of a stepped-frequency continuous wave (SFCW) is extracted to obtain additional information about the physical properties of buried objects. The phase structure is obtained from a signal-phase-frequency spectrum by applying the discrete Fourier transform to signals on the output of an SFCW georadar quadrature phase detector. We show that the phase gradient of a phase-frequency spectrum of signals reflected from underground layers and buried objects is determined by their electrical properties. We represent a signal phase structure during the georadar movement along the ground surface as an image of phase isolines (lines corresponding to the phase shift of n2??). We show that the spatial variability of isolines is determined by a medium physical property change or by the presence of inhomogeneous objects. [J25]

"Context-Dependent Multisensor Fusion and Its Application to Land Mine Detection"

We present a novel method for fusing the results of multiple land mine detection algorithms which use different sensors, features, and different classification methods. The proposed multisensor/multialgorithm fusion method, which is called context-dependent fusion (CDF), is motivated by the fact that the relative performance of different sensors and algorithms can vary significantly depending on the mine type, geographical site, soil and weather conditions, and burial depth. CDF is a local approach that adapts the fusion method to different regions of the feature space. The training part of CDF has two components: context extraction and algorithm fusion. In context extraction, the features used by the different algorithms are combined and used to partition the feature space into groups of similar signatures, or contexts. The algorithm fusion component assigns a degree of worthiness to

each detector in each context based on its relative performance within the context. To test a new alarm using CDF, each detection algorithm extracts its set of features and assigns a confidence value. Then, the features are used to identify the best context, and the degrees of worthiness of this context are used to fuse the individual confidence values. Results on large and diverse ground-penetrating radar and wideband electromagnetic data collections show that the proposed method can identify meaningful and coherent clusters and that different expert algorithms can be identified for the different contexts. Typically, the contexts correspond to groups of alarm signatures that share a subset of common features. Our extensive experiments have also indicated that CDF outperforms all individual detectors and the global fusion that uses the same method to assign aggregation weights. [J26]

"A Novel, Fast, Approximate Target Detection Technique for Metallic Target Below a Frequency Dependant Lossy Halfspace"

The extinction pulse (E-Pulse) technique has been widely applied to problems involving radar target identification. In this paper a fast approximate target detection and recognition scheme based on the E-Pulse technique is proposed and applied to a subsurface target detection and recognition scenario. Previous studies have demonstrated that the target resonances for subsurface targets are closely related to the target resonances for a target within a homogenous environment. In the proposed method, the target resonance for the target in the homogenous medium will be used to construct the E-Pulse for target detection and recognition purposes. The details of the proposed method will be described in this paper. The obvious example of a target below a dielectric halfspace is the use of ground penetrating radar (GPR) for detecting and recognizing unexploded ordnance (UXO). However, instead of a GPR related scenario, a numerical example of a biomedically related problem, of a hip prosthesis model sited within a halfspace of homogenous human tissue model with realistic dielectric properties will be used to demonstrate the feasibilities of the proposed technique for target detection and recognition. The reasons for the choice of this particular example will also be explained in the paper. [J27]

"Stealth technology for wind turbines"

Currently, a large proportion of proposed UK wind farms have either concerns raised at the pre-planning stage or formal objections made by radar operators on the basis of the potential for wind turbines to cause interference to radar systems. The current generation of on and off-shore three-bladed horizontal axis wind turbines have radar signatures consistent with their often very large physical size and hence considerable potential to reduce the ability of ground-based radars to detect targets in the vicinity of the farm. The impact of wind farms, particularly on ground-based aviation radars such as those operated for air defence and military and civil air traffic control purposes is likely to become particularly acute as European Union member governments strive to meet the requirements for energy generation under the Renewables Obligation. In addition, the increasing number of offshore wind farm projects proposed has the potential to cause interference to marine radars such as coastal vessel traffic services and those on-board vessels for navigational purposes. This study considers the options available for the reduction of turbine radar signature and presents solutions for each of the main external turbine components. The radar signature reduction approaches are based on existing technologies developed for aerospace stealth applications. However, the realisation of these for the purposes of reducing wind turbine radar signatures is a novel development, particularly in the solutions proposed. The reduction of wind turbine-induced radar interference is a growing area of research. [J28]

"An Analytical Approach for Performance Evaluation of Bit-Patterned Media Channels"

In this work, a new analytical approach is used to evaluate the error performance of bit-patterned media (BPM) magnetic recording channels that employ one-dimensional (1D) and two-dimensional (2D) generalized partial response (GPR) equalizers to combat the significant inter-track interference (ITI) expected in BPM magnetic recording systems. The probability density function of ITI is obtained analytically and is used to estimate the bit error rate (BER) from the Viterbi detector. The proposed method takes into account most of the important factors affecting the BER such as ITI, un-equalized intersymbol interference (ISI), colored noise and the distance and the multiplicity of error events. In this work, it is shown that for 1D channels, modeling ITI and un-equalized ISI by Gaussian PDFs leads to inaccurate BERs and that the non-Gaussian distribution of the ITI and un-equalized ISI must be taken into account for more accurate BER estimates. This method provides fast and accurate estimates of BERs for moderate to high signal-to-noise ratios (SNRs). By using this analytical method, time-consuming numerical simulations for error performance evaluation can be avoided. [J29]

"Estimation of the Backscatter Vertical Profile of a Pine Forest Using Single Baseline P-Band (Pol-)InSAR Data"

The vertical backscatter profile of a pine forest constituted by stands of different height is inverted from a single

baseline P-band Pol-InSAR data in order to identify scatterers in the canopy. The proposed approach uses the Gaussian vertical backscatter profile model, which associates an interferometric coherence expression to a vertical scatterers' distribution characterized by relative standard deviation and elevation. The methodology, which uses in situmeasurements of forest height and unbiased ground level estimation, is applied to HV and VV channels, providing accuracy given sufficiently low ground-to-canopy power ratios. Inverted backscatter profiles show maximum power converging toward the basis of the tree crown on highest forests, where the largest branches are located, indicating the high sensitivity of P-band measurements to the forest structure and to the vertical biomass distribution. Over lower stands with larger tree densities, the power peak is located in the upper part of the canopy, which can be explained by a stronger attenuation in the canopy. [J30]

"Inter-Track Interference Mitigation for Bit-Patterned Magnetic Recording"

In bit-patterned magnetic recording (BPMR), inter-track interference (ITI) becomes a major impairment due to the small track pitch. One way to mitigate the ITI is to equalize the read channel to a two dimensional (2D) partial-response (PR) target. However, we find that the channel detection on the center track cannot take advantage of the 2D target without good estimation of the data on the sidetracks. Therefore, we propose a multi-track detection technique, where the detection on the center track is aided by the information obtained from the detection of the sidetracks. This technique works with any equalizer capable of equalizing the channel to a 2D target. We apply this method to joint-track equalized and 2D equalized BPMR channels. Our simulation results show that the proposed technique provides a significant performance improvement. [J31]

"A New Stochastic LLP Model for Studying Extremely Low Frequency Bioelectromagnetic Interaction"

In this paper, we present a stochastic 3-D Langevin-Lorentz-Poisson (LLP) coupled model in order to investigate the ion transport across ionic channels situated on the cell membrane in the presence of external ELF magnetic fields. An iterative scheme is adopted, which alternates the solution of a Poisson problem with the time domain integration of a modified kind of Langevin-Lorentz equations. A Fokker-Planck analysis of the latter equations is performed to compute the statistical parameters of ion motion. An example of application to the analysis of a Ca++ membrane ionic channel is also given. [J32]

"Unified Time- and Frequency-Domain Approach for Accurate Modeling of Electromagnetic Radiation Processes in Ultrawideband Antennas"

A singularity-expansion-method-based methodology is proposed for the accurate time- and frequency-domain analysis and modeling of wave radiation processes in ultrawideband antennas. By means of this approach, the transient electromagnetic field distribution in the Fraunhofer region is presented in analytical closed form as the superposition of outgoing propagating non-uniform spherical waves. The time dependence of the wave amplitudes is determined by the resonant phenomena occurring in the structure. Analytical expressions for the antenna gain and effective height are derived. The major novelties of the presented formulation lie in a dedicated two-step vector fitting procedure for a minimal pole/residue spherical harmonic expansion of the time-domain equivalent electric and magnetic currents excited on a suitable spherical Huygens surface enclosing the antenna under analysis, as well as in the introduction of a new class of incomplete spherical Bessel functions useful to describe transient wave phenomena in truncated structures. The proposed approach is validated by application to an ultrawideband resistively loaded bow-tie antenna for ground-penetrating radar applications. [J33]

"Secure cognitive mobile hotspot"

The paper presents a novel consumer device that acts as a cognitive mobile hotspot to provide ubiquitous secure wireless WAN and LAN connectivity while on the move. The mobile hotspot acts as a gateway and integrates VHF/UHF radios with multiple wireless WAN and LAN technologies. The device supports GPRS, EDGE, WCDMA, CDMA2000 and WiMAX as WAN interfaces for long range communication and 802.11, Bluetooth and VHF/UHF interfaces for short range communication. The cognitive controller in the device seamlessly switches the WAN interfaces to provide optimum connectivity and Quality of Service parameters to the LAN devices and VHF/UHF radio links. In applications where nodes are fully mobile, the cognitive mobile hotspot acts a centroid by adjusting its position dynamically and provides a complete mobile backbone for optimum connectivity to mobile devices in a heterogeneous environment. The unique device opens a new paradigm of mobile backbone and seamless switching between multiple wireless broadband technologies and integration of wireless LAN and VHF/UHF interfaces. The device finds applications in vehicle area networks, mobile branch offices, mobile healthcare, media & broadcasting, sporting competitions, trade fairs, exhibitions and mission critical applications like flood relief operations and disaster recovery. [J34]

"Wavefront Reconstruction Method for Subsurface Radar Imagery Acquired Along Circular and Planar Scan Trajectories"

Subsurface radar (SR) techniques are used in situations where the scan area consists of a material that has different dielectric properties to the one where the radar elements are located. For many SR applications, the targets are at a shorter distance than in airborne/seaborne radar scenarios. Additionally, the data acquisition process may be performed along nonconventional scan trajectories in order to suit the geometry of the scan area. This paper presents a novel reconstruction technique for SR data collected along circular and semi-elliptical scan trajectories. The spectrum of the collected data is processed in order to locate the spatial origin of the reflections and remove the artifacts introduced by the scan trajectory. Sampling constraints and the behavior of the point-spread function (PSF) in both scan geometries are discussed and illustrated. The proposed algorithm was tested using simulated examples and experimental data collected from phantoms that mimic the dielectric properties of two novel SR applications: breast cancer detection and wood inspection. The proposed method yielded promising results in terms of both spatial accuracy and focal quality. [J35]

"Experimental demonstration of high-resolution ultra-wideband impulse radar based on electrical-optical hybrid pulse generation"

A high-resolution ultra-wideband (UWB) impulse radar has been developed in order to realise high-resolution object imaging in a ground-penetrating radar (GPR) for landmine detection. The UWB impulse radar is based on an electrical-optical hybrid pulse generation scheme such that a clean, short pulse train with small, short ringing can be generated. The generated UWB impulse train has a pulse duration of approximately 200-ps and a repetition rate of less than 1-GHz. Its estimated equivalent isotropically radiated power was well matched with a spectral mask for GPRs, as defined by the Federal Communications Commission of the USA. From an experimental demonstration, it was observed that the developed high-resolution UWB impulse radar was able to resolve a relative positional change of an object with a resolution of less than 10-mm, resulting in accurate imaging of a complex three-dimensional object. [J36]

"Correction to "A New Vector Waveform Inversion Algorithm for Simultaneous Updating of Conductivity and Permittivity Parameters From Combination Crosshole/Borehole-to-Surface GPR Data""

In the above titled paper (ibid., vol. 48, no. 9, pp. 3391-3407, Sep. 10), there is an error in equation (A-5). The correct form is presented here. [J37]

"Analytical Expressions for DG Allocation in Primary Distribution Networks"

This paper proposes analytical expressions for finding optimal size and power factor of four types of distributed generation (DG) units. DG units are sized to achieve the highest loss reduction in distribution networks. The proposed analytical expressions are based on an improvement to the method that was limited to DG type, which is capable of delivering real power only. Three other types, e.g., DG capable of delivering both real and reactive power, DG capable of delivering real power and absorbing reactive power, and DG capable of delivering reactive power only, can also be identified with their optimal size and location using the proposed method. The method has been tested in three test distribution systems with varying size and complexity and validated using exhaustive method. Results show that the proposed method requires less computation, but can lead optimal solution as verified by the exhaustive load flow method. [J38]

"LatinCon02-A Danger Theory Inspired Survivability Framework for the Next Generation Mobile Network"

The demand for anytime, anywhere, anyhow communications in next generation mobile networks (NGMN) necessitates a paradigm shift from independent network services into a more harmonized system. To accomplish this vision, the NGMN is envisaged to interconnect the existing and emerging access networks via a common IP based platform. Unfortunately, such architecture exposes the interworked infrastructure to malicious security threats arising from within individual networks and heightens the possibility of their migration across network boundaries. Owing to their autonomous characteristics, the proprietary security solutions designed for legacy networks cannot be extended to address such sophisticated security threats affecting NGMN functionality. This paper explores the possibility of using a biologically inspired approach for detecting two dominant security threats; namely, denial-of-service (DoS) and distributed DoS (DDoS) in the NGMN. Motivated by the phenomenal capabilities of the human immune system (HIS) in defending the human body against dangerous foreign agents, we propose an HIS inspired survivability framework to address these security threats in the NGMN. The proposed framework incorporates two key components; that is the attack detection framework and

the security control framework. While the former is used to identify malicious attacks on the network, the latter offers a competent technique for isolating and recovering from such attacks. Performance evaluation indicates that the proposed survivability framework is efficient in detecting attacks and quarantining the under attacked network segments, thereby increasing the survivability of the NGMN. [J39]

"Lightning Overvoltages in Low-Voltage Circuit for Various Lightning Striking Points"

Lightning overvoltages in low-voltage circuits in houses originating from a distribution line or an antenna have been actively studied. However, the mechanism by which damage is caused to home appliances due to a lightning strike to the ground near the house is still unclear. This paper discusses lightning overvoltages and currents in low-voltage circuits for various scenarios, such as a lightning strike to the ground, a direct strike to a distribution line, and a direct strike to an antenna. Simulations are carried out using the Electromagnetic Transients Program. From the simulation results, direct lightning strikes cause the most serious damage to home appliances, but nearby lightning strikes should also be considered when designing lightning protection schemes. [J40]

"On the Potential of Kinematic GPR Surveying Using a Self-Tracking Total Station: Evaluating System Crosstalk and Latency"

In this paper, we present an efficient kinematic ground-penetrating radar (GPR) surveying setup using a self-tracking total station (TTS). This setup combines the ability of modern GPR systems to interface with Global Positioning System (GPS) and the capability of the employed TTS system to immediately make the positioning information available in a standardized GPS data format. Wireless communication between the GPR and the TTS system is established by using gain variable radio modems. Such a kinematic surveying setup faces two major potential limitations. First, possible crosstalk effects between the GPR and the positioning system have to be evaluated. Based on multiple walkaway experiments, we show that, for reasonable field setups, instrumental crosstalk has no significant impact on GPR data quality. Second, we investigate systematic latency (i.e., the time delay between the actual position measurement by TTS and its fusion with the GPR data) and its impact on the positional precision of kinematically acquired 2-D and 3-D GPR data. To quantify latency for our kinematic survey setup, we acquired forward-reverse profile pairs across a well-known subsurface target. Comparing the forward and reverse GPR images using three fidelity measures allows determining the optimum latency value and correcting for it. Accounting for both of these potential limitations allows us to kinematically acquire high-quality and high-precision GPR data using off-the-shelf instrumentation without further hardware modifications. Until now, these issues have not been investigated in detail, and thus, we believe that our findings have significant implications also for other geophysical surveying approaches. [J41]

"Concrete Moisture Content Measurement Using Interdigitated Near-Field Sensors"

The efficacy of a meander and a circular interdigitated sensor in detecting and measuring the moisture present in wet concrete samples is demonstrated. Analytical, simulation, and measurement results of interelectrode capacitance for samples with different moisture contents show good agreement. As moisture content increases from 0% to 6%, the interelectrode capacitance that predicts the moisture content increases by 126.4% for the meander sensor and 187% for the circular sensor. Regression analysis of the measured data demonstrates that for moisture content less than 6% the relationship between the measured capacitance and the percent moisture content is predominantly linear. [J42]

"Physical Meaning of Perturbative Solutions for Scattering From and Through Multilayered Structures With Rough Interfaces"

Theoretical formulas without a clear comprehension of their intrinsic meaning are of difficult use in the context of practical applications. In this paper, we investigate on the physical meaning of existing first-order solutions for the field scattered by layered structures with rough interfaces, which were derived by Imperatore in the framework of perturbation theory. To capture the intrinsic significance of the closed-form scattering solutions, suitable expansions are rigorously performed by leveraging on local scattering descriptors. The obtained series expansions, which can be seen as ray series, can be then accurately analyzed showing that each term has a direct physical explanation. The analysis is carried out for both from- and through-layered-structure scattering configurations. As a result, analytical perturbative solutions turn out to be completely interpretable by simple physical concepts, so that the global scattering response can be interpreted as the superposition of single-scattering interaction mechanisms taking place locally, which are filteredby the layered structure. The meaning of the first-order approximation is also discussed in the layered structure context. Finally, we give a complete explanation for the scattering enhancement phenomenon contemplated in the first-order limit. [J43]

"Airborne Collision Avoidance System for low attitude flights using Radio Data System"

Radio Data System (RDS) is a mature technique which has been developed over the past 20 years. Due to the common use of FM radio, the traits of low estate requirement and the convenience in broadcasting, RDS is suitable for use in wireless transmission of large-range and low-load data. This proposes the application of RDS in the Traffic Collision Avoidance System (TCAS) for low altitude flights. The real-time surveillance information from the airport control center of low attitude flights can be wirelessly transmitted in real-time to the RDS receiver in the aircrafts. Because of the low-price of RDS broadcast station and the widespread use of RDS receiver contributed by the application of RDS-TMC for car navigation system in recent years, using RDS as the redundancy communication system in low altitude flights is plausible in almost every aspect, Nevertheless, one thing left to be desired is the slow transferring speed (1187.5 bps) of RDS, which is amended in this research by particularly designed data formats to reduce the information load in each transmission. As a result, the application proposed herein is feasible. [J44]

"Credit pre-reservation mechanism for UMTS prepaid service"

Online Charging System (OCS) supports multiple prepaid and postpaid sessions simultaneously. Through credit reservation, the OCS assigns some credit units to a session. These credit units are decremented based on the traffic volume or the duration time. If the assigned credit units are consumed before the session is completed, an reserve units (RU) operation is executed to obtain more credit units from the OCS. If the credit at the OCS is depleted, the prepaid session is forced to terminate. During the RU operation, packet delivery is suspended until extra credit units are granted from the OCS. To avoid session suspension during credit reservation, we propose the credit pre-reservation mechanism (CPM) that reserves credit earlier before the credit at the GGSN is actually depleted. Analysis and simulation experiments are conducted to investigate the performance of the mechanism. Our study indicates that the CPM can significantly improve the performance of the OCS prepaid mechanism. [J45]

"Synthetic aperture ultrasound imaging of XLPE insulation of underground power cables"

Radar meets ultrasound; this article covers a new approach to testing underground power cable insulation in a nondestructive fashion. The possibilities and future potential of the combined use of two different imaging technologies are discussed. [J46]

"Time-Reversal Ground-Penetrating Radar: Range Estimation With Cramйr-Rao Lower Bounds"

In this paper, first, a new range-estimation technique using time reversal (TR) for ground-penetrating-radar (GPR) applications is presented. The estimator is referred to as the TR/GPR range estimator. The motivation for this paper comes from the need of accurately estimating the location of underground objects such as landmines or unexploded ordinance for safe clearance. Second, the Cramer-Rao lower bound (CRLB) for the performance of the TR/GPR range estimator is derived and compared with the CRLB for the conventional matched filter (MF). The CRLB analysis shows that the TR/GPR range estimator has the potential to achieve higher accuracy in estimating the location of the target than that of the conventional MF estimator. Third, the proposed TR/GPR estimator is tested using finite-difference time-domain simulations, where the surface-based reflection GPR is modeled using an electromagnetic transverse-magnetic (TM) mode formulation. In our simulations, the TR/GPR estimator outperforms the conventional MF approach by up to 5-dB reduction in mean square error at signal-to-noise ratios ranging from -20 to 20 dB for dry-soil environments. [J47]

"Adaptive tomographic sensors for below ground imaging"

Herein, ground penetrating radar and tomography are combined to detect and identify hidden targets, such as underground facilities and bard and deeply buried targets. Past experiences in below-ground imaging is described, current measurement results are presented, and future plans are discussed. [J48]

"A New Vector Waveform Inversion Algorithm for Simultaneous Updating of Conductivity and Permittivity Parameters From Combination Crosshole/Borehole-to-Surface GPR Data"

We have developed a new full-waveform groundpenetrating radar (GPR) multicomponent inversion scheme for imaging the shallow subsurface using arbitrary recording configurations. It yields significantly higher resolution images than conventional tomographic techniques based on first-arrival times and pulse amplitudes. The inversion is formulated as a nonlinear least squares problem in which the misfit between observed and modeled data is minimized. The full-waveform modeling is implemented by means of a finite-difference time-domain solution of Maxwell's equations. We derive here an iterative gradient method in which the steepest descent direction, used to update iteratively the permittivity and conductivity distributions in an optimal way, is found by

cross-correlating the forward vector wavefield and the backward-propagated vectorial residual wavefield. The formulation of the solution is given in a very general, albeit compact and elegant, fashion. Each iteration step of our inversion scheme requires several calculations of propagating wavefields. Novel features of the scheme compared to previous full-waveform GPR inversions are as follows: 1) The permittivity and conductivity distributions are updated simultaneously (rather than consecutively) at each iterative step using improved gradient and step length formulations; 2) the scheme is able to exploit the full vector wavefield; and 3) various data sets/survey types (e.g., crosshole and borehole-to-surface) can be individually or jointly inverted. Several synthetic examples involving both homogeneous and layered stochastic background models with embedded anomalous inclusions demonstrate the superiority of the new scheme over previous approaches. [J49]

"A Compressive Sensing Data Acquisition and Imaging Method for Stepped Frequency GPRs"

A novel data acquisition and imaging method is presented for stepped-frequency continuous-wave ground penetrating radars (SFCW GPRs). It is shown that if the target space is sparse, i.e., a small number of point like targets, it is enough to make measurements at only a small number of random frequencies to construct an image of the target space by solving a convex optimization problem which enforces sparsity through lscr1minimization. This measurement strategy greatly reduces the data acquisition time at the expense of higher computational costs. Imaging results for both simulated and experimental GPR data exhibit less clutter than the standard migration methods and are robust to noise and random spatial sampling. The images also have increased resolution where closely spaced targets that cannot be resolved by the standard migration methods can be resolved by the proposed method. [J50]

"Noise Reduction in a Non-Homogenous Ground Penetrating Radar Problem by Multiobjective Neural Networks"

This paper applies artificial neural networks (ANNs) trained with a multiobjective algorithm to preprocess the ground penetrating radar data obtained from a finite-difference time-domain (FDTD) model. This preprocessing aims at improving the target's reflected wave signal-to-noise ratio (SNR). Once trained, the NN behaves as an adaptive filter which minimizes the cross-validation error. Results considering both white and colored Gaussian noise, with many different SNR, are presented and they show the effectiveness of the proposed approach. [J51]

"Voice call handover mechanisms in next-generation 3GPP systems"

The evolved 3GPP system is a hybrid mobile network architecture supporting several radio access technologies and several mobility mechanisms. In this article we briefly review the architecture and key components of this system, with particular emphasis on how it can support voice call mobility in several deployment scenarios. First, we present the so-called single-radio voice call continuity mechanisms that enable mid-call handover of VoIP calls from E-UTRAN access to the legacy UTRAN/GERAN or lxRTT access. Then we focus on deployment scenarios that do not support voice services on E-UTRAN and present the so-called fallback mechanisms that enable handover from E-UTRAN to UTRAN/GERAN or lxRTT at the beginning of a voice call. Finally, we address the application- layer voice call handover mechanisms enabled by the IP multimedia subsystem. Our conclusion is that the next generation of 3GPP systems are highly sophisticated mobile communication systems that support extended voice call mobility mechanisms, capable of addressing all commercial deployment needs. [J52]

"Network-based mobility management in the evolved 3GPP core network"

A key aspect of the 3GPP system architecture evolution is the specification of an evolved packet core that supports multiple access networks. The EPC enables operators to deploy and operate one common packet core network for 3GPP radio accesses (E-UTRAN, UTRAN, and GERAN), as well as other wireless and wireline access networks (e.g., eHRPD, WLAN, WIMAX, and DSL/Cable), providing the operator with a common set of services and capabilities across the networks. A key requirement of the EPC is to provide seamless mobility at the IP layer as the user moves within and between accesses. This article provides an overview of the EPC specifications that use a network-based mobility mechanism based on Proxy Mobile IPv6 to enable mobility between access networks. An important facet of providing seamless mobility for a user's sessions across technologies is to ensure that quality of service is maintained as the user moves between accesses. An overview of the "off-path" QoS model to supplement PMIPv6 is also provided. [J53]

"Wireless Convergence (review of Fixed-Mobile Wireless Networks Convergence by J. Ghetie; 2008) [JBook/Software review]"

This book moves from the fundamentals of modern networks to projected developments and convergence of the

various services. The book does a good job of bringing together the variety of networks and their advantages, disadvantages, standards, and potential for convergence. However, because it spends so much space on specific technologies, it will be out of date almost immediately. [J54]

"Experiments and Algorithms to Detect Snow Avalanche Victims Using Airborne Ground-Penetrating Radar"

Snow avalanche victims have only a good chance to survive when they are located within a short time. This requires an active beacon for them to wear or a very rapid deployment of a search-and-rescue team with dogs. Customary ground-penetrating radar (GPR) instruments used on the snow surface are not able to reduce fatality numbers because they are slow to search a field. A potential alternative could be an airborne search using radar. An airborne radar search is technologically challenging because a very large data stream has to be processed and visualized in real time, and the interaction of the electromagnetic waves with snow, subsurface, and objects must be understood. We studied a two-step algorithm to locate avalanche victims in real time. The algorithm was validated using realistic test arrangements and conditions using an aerial tramway. The distance dependence of the reflection energy with increased flight heights, the coherence between the use of more antennas and the detectable range, and the reflection images of different avalanche victims were measured. The algorithm detected an object for each investigated case, where the reflection energy of the scans was higher than for the scans of pure snow. Airborne GPR has a large potential to become a rapid search method in dry snow avalanches. However, a fully operational version still requires substantial improvements in hardware and software. [J55]

"Automatic Analysis of GPR Images: A Pattern-Recognition Approach"

In this paper, we propose a novel pattern-recognition system to identify and classify buried objects from ground-penetrating radar (GPR) imagery. The entire process is subdivided into four steps. After a preprocessing step, the GPR image is thresholded to put under light the regions containing potential objects. The third step of the system consists of automatically detecting the objects in the obtained binary image by means of a search of linear/hyperbolic patterns formulated within a genetic optimization framework. In the genetic optimizer, each chromosome models the apex position and the curvature associated with the candidate pattern, while the fitness function expresses the Hamming distance between that pattern and the binary image content. Finally, in the fourth step, the problem of the recognition of the material type of the identified objects is approached as a classification issue, which is solved by means of an opportune feature-extraction strategy and a support vector machine classifier. To illustrate the performances of the proposed system, we conducted a thorough experimental study based on GPR images generated by a GPR simulator based on the finite-difference time-domain method so as to construct different acquisition scenarios by varying the number of buried objects, their position, their size, their shape, and their material type. In general, the obtained experimental results show that the proposed system exhibits promising performances both in terms of object detection and material recognition. [J56]

"UbiPhone: Human-Centered Ubiquitous Phone System"

Emerging rich wireless networking modalities facilitate the development of new intelligent, innovative services on smart phones. The authors propose a ubiquitous phone (UbiPhone) system that demonstrates innovative context-aware human-centric phone services, which could become available on smart phones. UbiPhone's features include UbiCall, AnyCall, and an emergency contact service. [J57]

"Effects of Birefringence Within Ice Sheets on Obliquely Propagating Radio Waves"

In this paper, effects of birefringence on radio waves obliquely propagating though polar ice sheets are examined to facilitate interpretations of bistatic and side-looking radar data. A formalism applicable for arbitrary radar configurations is developed to predict the returned power from within and beneath the ice sheets that have arbitrary alignments of ice crystals (ice fabrics). We applied this formalism to a range of ice fabrics found in ice cores and assessed the effects of birefringence in terms of ray-path configurations, ice fabrics, and radar frequency. Predicted frequency dependence of the bed return power replicates prominent features observed at Greenland NGRIP ice-core site. Results show that birefringence in ice of 1 km or more thickness with strong (weak) fabric can reduce the power returned from the bed 2 dB or more at frequencies higher than 200 MHz (20 MHz) as compared to isotropic ice. This suggests that quantitative interpretation of the power returned from the bed requires careful assessment of birefringence almost everywhere over the ice sheets. Application of this formalism also suggests a radar-frequency range usable for attenuation measurements, possible effects of fabric on synthetic aperture radar processing, and a feasibility of remote sensing of ice fabric. [J58]

"Radio eye in the sky"

its baggage door, the Cessna 172 looks unremarkable, at least for one of its ageГ,Вїthis single-engine plane was built during the Apollo program. But behind that lump is mounted a radar set far more sophisticated than anything NASAГ,Вїs astronauts ever took to the moon. [J59]

"Detection and Discrimination of Land Mines in Ground-Penetrating Radar Based on Edge Histogram Descriptors and a Possibilistic -Nearest Neighbor Classifier"

This paper describes an algorithm for land mine detection using sensor data generated by a ground-penetrating radar (GPR) system that uses edge histogram descriptors for feature extraction and a possibilistic K-nearest neighbors (K-NNs) rule for confidence assignment. The algorithm demonstrated the best performance among several high-performance algorithms in extensive testing on a large real-world datasets associated with the difficult problem of land mine detection. The superior performance of the algorithm is attributed to the use of the possibilistic K-NN algorithm, thereby providing important evidence supporting the use of possibilistic methods in real-world applications. The GPR produces a 3-D array of intensity values, representing a volume below the surface of the ground. First, a computationally inexpensive prescreening algorithm for anomaly detection is used to focus attention and identify candidate signatures that resemble mines. The identified regions of interest are processed further by a feature extraction algorithm to capture their salient features. We use translation-invariant features that are based on the local edge distribution of the 3-D GPR signatures. Specifically, each 3-D signature is divided into subsignatures, and the local edge distribution for each subsignature is represented by a histogram. Next, the training signatures are clustered to identify prototypes. The main idea is to identify few prototypes that can capture the variations of the signatures within each class. These variations could be due to different mine types, different soil conditions, different weather conditions, etc. Fuzzy memberships are assigned to these representatives to capture their degree of sharing among the mines and false alarm classes. Finally, a possibilistic K-NN-based rule is used to assign a confidence value to distinguish true detections from false alarms. The proposed algorithm is implemented and integrated within a complete-- land mine prototype system. It is trained, field-tested, evaluated, and compared using a large-scale cross-validation experiment that uses a diverse dataset acquired from four outdoor test sites at different geographic locations. This collection covers over 41 807 m2of ground and includes 1593 mine encounters. [J60]

"CMP Antenna Array GPR and Signal-to-Clutter Ratio Improvement"

Ground-penetrating radar (GPR) is recognized as a promising sensor for detecting buried landmines. In this case, the GPR antenna(s) must be elevated above the ground. However, this requirement results in heavy surface clutter. It is therefore necessary to overcome the effect. A commonly used procedure of time gating and background averaging cannot suit to small shallow nonmetallic landmine beneath a rough ground surface. In this letter, we proposed techniques to enhance the target signal through common midpoint (CMP) antenna array and data processing techniques, including velocity spectrum and CMP multifold stacking. The method has been tested using experiment data over a rough ground under which small plastic antipersonnel landmines is shallowly buried. The result shows the signal-to-clutter ratio was dramatically improved. [J61]

"Interferometry by Deconvolution of Multicomponent Multioffset GPR Data"

Interferometric techniques are now well known to retrieve data between two receivers by the cross correlation of the data recorded by these receivers. Cross-correlation methods for interferometry rely mostly on the assumption that the medium is loss free and that the sources are all around the receivers. A recently developed method introduced interferometry by deconvolution that is insensitive to loss mechanisms by principle and requires sources only on one side of the receivers. In this paper, we develop such method for ground-penetrating radar, illustrate the concept, and discuss implications for practical applications with numerical examples. [J62]

"Pulse-Based Radar Imaging Using a Genetic Optimization Approach for Echo Separation"

This paper describes a novel 3-D ultra-wideband (UWB) imaging technique with the aim of detecting, classifying, and imaging water pipes located inside walls. The target under test was chosen in such a way that the echoes of the front side of the wall and of the water pipes overlap making it impossible to distinguish between them in the raw data. Applying a genetic optimization algorithm for modeling the radar response by a superposition of single echoes it was possible to determine the exact round-trip times of several scatterers. Moreover, the algorithm takes into account the pulse distortion caused by varying angles of incidence at the broad beam antenna. [J63]

"A 65 nm Single-Chip Application and Dual-Mode Baseband Processor With Partial Clock Activation and IP-MMU"

Supporting both WCDMA with HSDPA and GSM/GPRS/EDGE, the 9.3 times 9.3 mm2SoC fabricated in triple-Vth 65 nm CMOS, has three CPU cores and 20 separate power domains. Unused power domains can be powered down to reduce the leakage power. Partial clock activation scheme especially focused on music playback scene dynamically stops a PLL and clock trees when not necessary and reduces power consumption from 33.6 mW to 19.6 mW. IP-MMU translates virtual address to physical address for 18 hardware-IPs and virtual address space can be allocated when necessary and can be freed after its operation, reducing external memory by 43 MB. Video performance of D1 (720 times 520) size with 30 frames per second for MPEG/AVC decoding and encoding can be achieved under mixed virtual and physical address usage. [J64]

"Profiling the Rough Surface by Migration"

It is often advantageous to estimate the ground surface topography from radar returns. However, the popular method, searching for the brightest pixel in the ground-penetrating radar profile, cannot achieve accurate surface topography in the sharp variable surface case because of the effects of diffraction waves. In this letter, we propose a method to solve the problem and improve the accuracy of surface topography. A migration technique is introduced to refocus the diffraction waves before searching for the brightest pixel. Experimental data have been used to display the effects of diffraction waves and test the method. The result shows that the method can dramatically estimate accurate surface topography even in the sharp variable surface area. [J65]

"Nondestructive Sensor Using Microwaves From Laser Plasma by Subnanosecond Laser Pulses"

Conventional ground-penetrating radar (GPR) requires large-aperture antennas or long-span measurements to survey a remote location precisely. We propose a laser-driven GPR (LGPR) as a new detection method. LGPR uses microwaves from laser-produced plasmas as remote transmitters and can survey a remote location using a compact instrument. We performed numerical simulations to investigate the radiation mechanism of microwaves from laser plasmas and confirmed the pulsewidth of the laser suitable for LGPR. Experiments with subnanosecond pulse lasers clarified the feasibility and detection performance of LGPR. [J66]

"Subsurface Target Recognition Based on Transient Electromagnetic Scattering"

The E-pulse technique which typically uses transient scattering data from radar targets in free space is one of the most well known resonance based radar target recognition schemes on which target recognition is based. In this communication, the possibility of subsurface target recognition based on the E-pulse technique is investigated using numerical examples of a metallic hip prosthesis embedded in models of realistic human tissue. [J67]

"Wavelet-Based Compression With ROI Coding Support for Mobile Access to DICOM Images Over Heterogeneous Radio Networks"

Most of the commercial medical image viewers do not provide scalability in image compression and/or region of interest (ROI) encoding/decoding. Furthermore, these viewers do not take into consideration the special requirements and needs of a heterogeneous radio setting that is constituted by different access technologies [e.g., general packet radio services (GPRS)/ universal mobile telecommunications system (UMTS), wireless local area network (WLAN), and digital video broadcasting (DVB-H)]. This paper discusses a medical application that contains a viewer for digital imaging and communications in medicine (DICOM) images as a core module. The proposed application enables scalable wavelet-based compression, retrieval, and decompression of DICOM medical images and also supports ROI coding/decoding. Furthermore, the presented application is appropriate for use by mobile devices activating in heterogeneous radio settings. In this context, performance issues regarding the usage of the proposed application in the case of a prototype heterogeneous system setup are also discussed. [J68]

"Demonstration of a Network of Simultaneously Operating Digital Noise Radars [JMeasurements Corner]"

Search and rescue following a natural disaster is a difficult problem, exacerbated by the cluttered environment obscuring human victims. It is well known that UHF radar-frequency radiation can penetrate the types of materials typically found in these situations with relatively little loss. This paper discusses the development of a network of digital noise radars, designed to operate in that frequency range to locate and track human movement through walls and rubble. Each individual noise radar works by cross correlating the received signal with a replica of the transmit signal. A high correlation indicates the range to the target. This noise radar design makes use of the software radar concept by converting the analog transmitted and received signals to digital signals. With the signals in digital form, the cross-correlation process can be accomplished in software. A network of

three digital noise radars was developed. The three radars operated simultaneously in the same frequency range, without interference, to triangulate the (x, y) position of a target within a room. The results showed that the network of radars was capable of locating and tracking a human through an obscuring wall. [J69]

"Propagation of Large Bandwidth Microwave Signals in Water"

Large bandwidth microwave signals propagating in dispersive media can result in pulses decaying according to a non-exponential law. In particular, large bandwidth signals in the microwave band, propagating in media that can be described by the Debye model (for example fresh water), decays as the square root of the inverse of the propagation distance, instead of exponentially. Although it is a direct consequence of well-known theory of propagation in dispersive media, this result is a bit surprising and its experimental evidence has required a careful set-up. [J70]

"Effect of antenna dimensions on the antenna footprint in ground penetrating radar applications"

Ground penetrating radar (GPR) surveys show that antenna characteristic is strongly influenced by soil conditions. The footprint of the antenna is an important parameter for a good detection result. Various conditions of soil in which a target is buried may change the footprint of the antenna. An antenna with capability to control its footprint is needed in GPR applications. In this study, the authors investigate several ultra-wideband (UWB) antennas with different dimensions to study the effect of antenna dimension on their footprint. Simulation and experiments show that large (small) antenna dimensions result in a large (small) antenna footprint when the observation is located in the near-field region. When the observation is located in the far-field, the footprint of the antenna becomes large (small) if the dimensions of the antenna are small (large). Thus, the size of the antenna footprint can be adjusted by varying the antenna dimension. It is applied in this work to develop a new method for controlling the antenna footprint to deal with varying soil condition. Measurements have been carried out to validate this concept. [J71]

"Gaussian process regressors for multiuser detection in DS-CDMA systems"

In this paper we present Gaussian processes for Regression (GPR) as a novel detector for CDMA digital communications. Particularly, we propose GPR for constructing analytical nonlinear multiuser detectors in CDMA communication systems. GPR can easily compute the parameters that describe its nonlinearities by maximum likelihood. Thereby, no cross-validation is needed, as it is typically used in nonlinear estimation procedures. The GPR solution is analytical, given its parameters, and it does not need to solve an optimization problem for building the nonlinear estimator. These properties provide fast and accurate learning, two major issues in digital communications. The GPR with a linear decision function can be understood as a regularized MMSE detector, in which the regularization parameter is optimally set. We also show the GPR receiver to be a straightforward nonlinear extension of the linear minimum mean square error (MMSE) criterion, widely used in the design of these receivers. We argue the benefits of this new approach in short codes CDMA systems where little information on the users' codes, users' amplitudes or the channel is available. The paper includes some experiments to show that GPR outperforms linear (MMSE) and nonlinear (SVM) state-ofthe- art solutions. [J72]

"Active location reporting for emergency call in UMTS IP multimedia subsystem"

The IP multimedia core network subsystem (IMS) provides multimedia services for Universal Mobile Telecommunications System (UMTS). In IMS, an emergency call is established by an Emergency-Call Session Control Function (ECSCF). The E-CSCF dispatches the call to the nearest public safety answering point (PSAP) according to the location of the caller. After emergency call setup, the caller s location is tracked by the PSAP through Location Polling. This paper investigates the performance of location tracking. Then we propose the active location reporting scheme to improve the performance of location tracking. Our study indicates that the active location reporting scheme may significantly outperform the location polling scheme. [J73]

"Radar Response of Firn Exposed to Seasonal Percolation, Validation Using Cores and FDTD Modeling"

We use ground-penetrating radars (GPRs), firn cores, and electromagnetic finite-difference time-domain (FDTD) numerical modeling to characterize the GPR response to a frozen high-arctic firn pack. As a result of extensive summertime percolation, the firn pack comprises a high fraction of ice layers, lenses, and vertical glands. We show that the GPR response on the firn pack mainly depends on the following: (1) the thickness of the ice layers; (2) the distance between layers; (3) the layer roughness; and (4) the presence or absence of elliptical ice lenses. Using 3-D FDTD modeling, we show that the GPR is not sensitive to typical ice glands, which implies that the GPR underestimates firn heterogeneity, such that firn stratigraphy in percolation and wet-snow zones could be incorrectly interpreted as being better preserved than it actually is. We find that thin ice layers (< 0.05

m) or multiple thin ice layers give a strong response. Thicker ice layers typically give a weaker backscatter per unit area, mainly due to the lack of interference of the reflections from the upper and lower interfaces, but are, due to their continuity, easily trackable. Ice layers with a thickness comparable to the GPR wavelength give 180deg phase-shifted upper and lower reflections and are, in general, separated by a band of low GPR response, due to the lack of permittivity contrast within the ice layers. Despite the ice lenses' relatively short horizontal correlation length, as inferred from cores, bands of high-amplitude clutter caused by these features can be traced over several kilometers in GPR profiles. [J74]

"A 0.13 m CMOS Quad-Band GSM/GPRS/EDGE RF Transceiver Using a Low-Noise Fractional-N Frequency Synthesizer and Direct-Conversion Architecture"

This paper presents a single-chip CMOS quad-band (850/900/1800/1900 MHz) RF transceiver for GSM/GPRS/EDGE applications which adopts a direct-conversion receiver, a direct-conversion transmitter and a fractional-N frequency synthesizer with a built-in DCXO. In the GSM mode, the transmitter delivers 4 dBm of output power with 1deg RMS phase error and the measured phase noise is -164.5 dBc/Hz at 20 MHz offset from a 914.8 MHz carrier. In the EDGE mode, the TX RMS EVM is 2.4% with a 0.5 dB gain step for the overall 36 dB dynamic range. The RX NF and IIP3 are 2.7 dB/-12 dBm for the low bands (850/900 MHz) and 3 dB/-11 dBm for the high bands (1800/1900 MHz). This transceiver is implemented in 0.13 mum CMOS technology and occupies 10.5 mm2. The device consumes 118 mA and 84 mA in TX and RX modes from 2.8 V, respectively and is housed in a 5 times 5 mm240-pin QFN package. [J75]

"The LTE link-layer design"

The LTE radio interface for 3GPP Release 8 was specified recently. This article describes the LTE link-layer protocols, which abstract the physical layer and adapt its characteristics to match the requirements of higher layer protocols. The LTE link-layer protocols are optimized for low delay and low overhead and are simpler than their counterparts in UTRAN. The state of- the-art LTE protocol design is the result of a careful crosslayer approach where the protocols interact with each other efficiently. This article provides a thorough overview of this protocol stack, including the sub-layers and corresponding interactions in between them, in a manner that is more intuitive than in the respective 3GPP specifications. [J76]

"Effectiveness of 2-D and 2.5-D FDTD Ground-Penetrating Radar Modeling for Bridge-Deck Deterioration Evaluated by 3-D FDTD"

Computational modeling effectively analyzes the wave propagation and associated interaction within heterogeneous reinforced concrete bridge decks, providing valuable information for sensor selection and placement. It provides a good basis for the implementation of the inverse problem in defect detection and the reconstruction of subsurface properties, which is beneficial for defect diagnosis. The objective of this study is to evaluate the effectiveness of lower order models in the evaluation of bridge-deck subsurfaces modeled as layered media. The two lower order models considered are a 2-D model and a 2.5-D model that uses the 2-D geometry with a compressed coordinate system to capture wave behavior outside the cross-sectional plane. Both the 2- and 2.5-D models are compared to the results obtained from a full 3-D model. A filter that maps the 3-D excitation signal appropriately for 2- and 2.5-D simulations is presented. The 2.5-D model differs from the 2-D model in that it is capable of capturing 3-D wave behavior interacting with a 2-D geometry. The 2.5-D matches results from the corresponding 3-D model when there is no variation in the third dimension. Computational models for air-launched ground-penetrating radar with 1-GHz central frequency and bandwidth for the detection of bridge-deck delamination are implemented in 2-, 2.5-, and 3-D using FDTD simulations. In all cases, the defect is identifiable in the results. Thus, it is found that in layered media (such as bridge decks) 2- and 2.5-D models are good approximations for modeling bridge-deck deterioration, each with an order of magnitude reduction in computational time. [J77]

"Mine Classification With Imbalanced Data"

In many remote-sensing classification problems, the number of targets (e.g., mines) present is very small compared with the number of clutter objects. Traditional classification approaches usually ignore this class imbalance, causing performance to suffer accordingly. In contrast, the recently developed infinitely imbalanced logistic regression (IILR) algorithm explicitly addresses class imbalance in its formulation. We describe this algorithm and give the details necessary to employ it for remote-sensing data sets that are characterized by class imbalance. The method is applied to the problem of mine classification on three real measured data sets. Specifically, classification performance using the IILR algorithm is shown to exceed that of a standard logistic regression approach on two land-mine data sets collected with a ground-penetrating radar and on one underwater-mine data set collected with a sidescan sonar. [J78]

"Mitigating Range Ambiguity in High PRF Radar using Inter-Pulse Binary Coding"

The paper proposes a way to increase the energy within a coherent processing interval (CPI) using more pulses instead of longer pulses. Long coded pulses result in masking targets at close range and poor Doppler tolerance. Increasing the number of pulses implies high pulse repetition frequency (PRF), which suffers from range ambiguity and target folding. These drawbacks of a high PRF can be mitigated by inter-pulse coding. The approach suggested here should be attractive for close and mid range applications of radar, ground penetrating radar, ultrasound imaging, and more. [J79]

"GPR Response From Buried Pipes: Measurement on Field Site and Tomographic Reconstructions"

The identification of the physical nature of an object or target causing a ground-penetrating radar (GPR) anomaly, as well as the estimation of a target's dimensions and geometry, is rather challenging. To improve target identification, basic studies are still required, and they can be addressed primarily using a laboratory- or field-based physical model. The field model (test site) is usually expensive and difficult to build, but it provides data for controlled target properties and geometry from a natural environment that are essential for testing processing techniques. In this paper, we present the results from a field experiment where GPR data were collected on plastic and metallic pipes. The main objective is the comparison of the classical migration technique with a microwave tomography approach for reconstructing the geometrical target properties. The use of the microwave tomography approach will allow us to obtain more focused and stable images of the buried objects compared to the ones obtained using classical migration techniques. [J80]

"Inverse Algorithms for the GPR Assessment of Concrete Structures"

This paper investigates the characterization of inclusions in concrete structures, including the number of inclusions, their geometries, and electromagnetic properties. To solve this problem, a two phase algorithm that combines matched-filter-based reverse-time (MFBRT) migration algorithm with the particle swarm optimization (PSO) is employed. The first phase runs the MFBRT that can, robustly, define the number of inclusions and their centers; however, it cannot define the inclusion geometry and electromagnetic properties. Given the results obtained in the first phase, the PSO is launched in the second phase, in a parametric approach, to define the radii of the inclusions and their properties. Three types of inclusions were considered, water, air, and conductor. Results considering a nonhomogenous host medium having from one to three inclusions are presented showing the effectiveness of the proposed approach. [J81]

"Latest trends in radar system testing"

Radar systems were initially limited to military applications, but today most people encounter radar applications everyday. Given the broad range of applications, a variety of radar types and technologies have emerged to meet unique needs. This paper discusses about the latest advances on system performance and testing of radar systems. When performing characterization of a radar receiver design, a variety of signals are required to accurately recreate the operational environment. This paper will review the test signal environment needed for evaluation of various modern radar systems. Performance considerations in terms of signal source fidelity and spectral purity will also be investigated. [J82]

"Radar Handbook, 3rd Edition (M.I. Skolnik, Ed; 2008) [JBook Review]"

Thirty eight radar experts contribute to this edition, which includes six completely new chapters on the following topics: ground penetrating radar; remote sensing with radar on satellites; multifunctional radar systems for fighter aircraft (MFAR); digital signal processing for radar; civil marine radar; and propagation. Each chapter contains references, ranging from 10 to 197, with a median of 71. The index runs 18 pages printed in double columns, but is not necessarily complete. Some topics, such as MIMO radar and long range radars to track satellites and ballistic missiles, will have to wait for a 4th edition. This text is the most authoritative, broadest, and deepest single volume on radar. The emphasis is on real world performance and real hardware that has been tested and works successfully in the real world, and the physics relevant to radar systems, as well as radar system engineering cost tradeoffs. [J83]

"Along-track interferometry for ground moving target indication"

Synthetic aperture radar (SAR) along-track interferometry (ATI) has been used extensively to measure ocean surface currents. Given its ability to measure small velocities (-10 cm/s) of relatively radar-dark water surfaces, there is great potential that this technique can be adapted for ground moving target indication (GMTI)

applications, particularly as a method for detecting very slow targets with small radar cross-sections. Herein, we describe preliminary results from an ATI GMTI experiment. The SAR data described were collected by the dual-frequency NASA/JPL airborne radar in its standard dual-baseline ATI mode. The radar system imaged a variety of control targets including a pickup truck, sport utility vehicles, passenger cars, a bicycle, and pedestrians over multiple flight passes. The control targets had horizontal velocities of less than 5 m/s. The cross-sections of the targets were not purposely enhanced, although the targets' reflectivities may have been affected by the existence of the GPS equipment used to record the targets' positions. Single-look and multiple-look interferograms processed to the full azimuth resolution were analyzed. In the data processed to date, all of the targets were observed by visual inspection in at least one of the four combinations of dual-frequency, dual-baseline interferometric data. This extremely promising result demonstrates the potential of ATI for GMTI applications. [J84]

"A low cost GSM/GPRS based wireless home security system"

Home security system is needed for occupants' convenience and safety. In this paper, we present the design and implementation of a low cost, low power consumption, and GSM/GPRS (global system for mobile communication /general packet radio service) based wireless home security system. The system is a wireless home network which contains a GSM/GPRS gateway and three kinds of wireless security sensor nodes that are door security nodes, infrared security nodes and fire alarm nodes. The nodes are easy installing. The system can response rapidly to alarm incidents and has a friendly user interface including a LCD (liquid crystal display) and a capacitive sensor keyboard. The wireless communication protocol between the gateway and the nodes is also suitable for other home appliances. Furthermore, some methods are taken to ensure the security of system information. [J85]

"Techno-economic analysis of international mobile roaming"

The impact of regulatory pressure to reduce international mobile roaming (IMR) charges, especially in Europe, and the potential competition from other technology alternatives will be the main motivations for existing mobile operators to find solutions that will reduce the cost of operations and increase maintain the revenue margins, while maintaining control over subscribers. This article provides an overview of the changing business dynamics of IMR. analyzes the existing and emerging IMR scenarios, and proposes a mechanism that addresses the technological disadvantages of existing ones. The article also evaluates the business implications of the proposed mechanism vis-a-vis ihe preferred roaming scenario of today (i.e.. home routed traffic) from a mobile operator's point of view. [J86]

"Characterization of Inclusions in a Nonhomogeneous GPR Problem by Artificial Neural Networks"

This paper aims at detecting and characterizing inclusions in concrete structures by inverting ground-penetrating radar (GPR) data. First, the signal is preprocessed using the principal component analysis (PCA) and then used to train an artificial neural network (ANN). The GPR data consists of 1200 time steps. Using PCA, the data can be compressed to 286 dimensions without losing any information. Moreover, with 99.99% of the original variance the data needs only 139 dimensions. This dimensional reduction makes the ANN training easier and faster. The ANN were trained to find the buried inclusions characteristics-and-considering a nonhomogenous host medium by inverting the preprocessed data. The results show that the expected maximum error was kept under 1%, which is a remarkable result, since the host medium is nonhomogenous. [J87]

"The Detection of Buried Pipes From Time-of-Flight Radar Data"

Ultrawideband radar is commonly used in the frequency range of 50-500 MHz to detect buried pipes at a depth of about 1-2 m depending on the soil characteristics. The typical feature used to locate the pipes is the hyperbolic pattern of the time of flight generated by a linear scan of the antenna above the surface. When the pipes are close together, the hyperbolas overlap, and a straightforward least squares fit is not possible. The Hough transform provides one possible solution. This paper extends the Hough transform by introducing a weighting factor depending on the differentials of the unknown parameters with respect to the experimental errors, namely, the probe position error and the time-of-flight error. This enables optimally placed sets of data pairs to be given greater weight than "ill-conditioned" sets, as for example when all data pairs lie near one end of the arc. The result is a decrease in the background amplitude with respect to the maximum of the peaks in the Hough accumulator space. It is shown that this improvement persists even when many arcs are present. A mathematical analysis with analytical results is given for the case of four unknowns: pipe radius R, pipe center position (Y, Z), and soil propagation velocity V. The results are presented through simulations introducing controlled uncertainties in the probe position, the time of flight, and its bin size. The simulations demonstrate the correlations that occur between the radius, depth, and velocity for given experimental uncertainties. [J88]

"SIP-based mobility management in next generation networks"

The ITU-T definition of next generation networks includes the ability to make use of multiple broadband transport technologies and to support generalized mobility. Next generation networks must integrate several IP-based access technologies in a seamless way. In this article, we first describe the requirements of a mobility management scheme for multimedia real-time communication services; then, we report a survey of the mobility management schemes proposed in the recent literature to perform vertical handovers between heterogeneous networks. Based on this analysis, we propose an application-layer solution for mobility management that is based on the SIP protocol and satisfies the most important requirements for a proper implementation of vertical handovers. We also implemented our proposed solution, testing it in the field, and proving its overall feasibility and its interoperability with different terminals and SIP servers. [J89]

"IP multimedia subsystems in 3GPP and 3GPP2: overview and scalability issues"

The Internet has experienced tremendous expansion in the past several years. Demands for IP multimedia services are emerging. The third-generation (3G) wireless networks aim to support mobile users with numerous Internet services. 3G standards organizations are developing IP multimedia subsystems (IMS) to achieve seamless integration between Internet and 3G networks. Moreover, the collaboration between IETF, 3GPP, and 3GPP2 is essential to the development of IMS for next-generation networks. This article first provides an overview of 3GPP and 3GPP2 IMS and illustrates the IMS requirements, architectures, and functional models. We then discuss potential scalability issues in IMS. This article provides guidance for constructing a robust and scalable IMS. [J90]

"Effects of Background Removal in Linear Inverse Scattering"

This paper deals with the effect of the background removal procedure on ground-penetrating radar data in the framework of a Born-based inverse-scattering solution approach for a scalar 2-D geometry. The theoretical investigation is performed by resorting to diffraction tomography reasoning, and then it is numerically confirmed thanks to the singular value decomposition of the operator that connects the unknown contrast function to the scattered field data achieved under background removal. Numerical and experimental tests are presented. [J91]

"Dosimetric Assessment of Simultaneous Exposure to ELF Electric and Magnetic Fields"

In the low-frequency range, both electric and magnetic fields interact with biological tissue by inducing intracorporal electric current densities, although ruled by different physical laws and, hence, with different intracorporal orientation and pathways. Presently, standards require a separate assessment of electric and magnetic fields even in the case of simultaneous exposure and, hence, ignore the superposition of intracorporal current densities. Numerical simulations with the Visible Man model show that this can lead to underestimating current densities in the central nervous system (CNS) by up to 29%. While the superposed electric current densities in the CNS still meet the basic restrictions, the situation changes if a fetus with its own CNS requires the same level of protection. When the compliance volume is extended to the trunk, the reference-level electric-field exposure exceeds the basic restrictions by 38%. Depending on the kind of summation of the vectorial contributions, simultaneous exposure to the 50 Hz-5 kV/m electric field and 100-T magnetic field may lead to a 2.1-fold to 2.6-fold excess of the basic restriction. While this does not prove noncompliance, it indicates that fetal CNS exposure modeling is needed for clarification. [J92]

"Authors' Reply to Comments by Takuya Sakamoto, Shouhei Kidera, and Toru Sato on “Seabed Algorithm and Comments on ‘Modeling and Migration of 2-D Georadar Data: A Stationary Phase Approach’”"

This article addresses the comments of Sakamato et al. on Greenhalgh et al.'s "Modeling and migration of 2-D georadar data: A stationary phase approach". Here, Greenhalgh et al. emphasizes the comprehensiveness of their approach over Sakamato et al.'s SEABED algorithm. [J93]

"2005 M. Barry Carlton Award [JSociety News]"

The winners of the 2005 M. Barry Carlton Award are Yanwei Wang, Xi Li, Yijun Sun, Jian Li, and Petre Stoica, for their paper, "Adaptive Imaging for Forward-Looking Ground Penetrating Radar." The paper appeared in the July 2005 issue. [J94]

"An Investigation of Using the Spectral Characteristics From Ground Penetrating Radar for Landmine/Clutter Discrimination"

Ground penetrating radar (GPR)-based discrimination of landmines from clutter is known to be challenging due to the wide variability of possible clutter (e.g., rocks, roots, and general soil heterogeneity). This paper discusses the use of GPR frequency-domain spectral features to improve the detection of weak-scattering plastic mines and to reduce the number of false alarms resulting from clutter. The motivation for this approach comes from the fact that landmine targets and clutter objects often have different shapes and/or composition, yielding different energy density spectrum (EDS) that may be exploited for their discrimination (this information is also present in time-domain data, but in the frequency domain we can remove a phase if desired and can reveal better spatial characteristics and therefore often achieve greater robustness). This paper first applies the finite-difference time-domain (FDTD) modeling technique to establish the theoretical foundation. The method to generate EDS from GPR measurements is then described. The consistency of the frequency-domain features is examined through two different GPRs that have different spatial sampling rates and frequency bandwidths. Experimental results from several test sites, based on GPR data collected over buried mines and emplaced buried clutter objects, corroborate the theoretical development and the effectiveness of the proposed spectral feature to increase the accuracy of landmine detection and discrimination. [J95]

"Possibilistic Versus Belief Function Fusion for Antipersonnel Mine Detection"

Two approaches for combining humanitarian mine detection sensors are presented-one based on belief functions and the other one based on possibility theory. The approaches are described in parallel. First, different measures are extracted from the sensor data. Mass functions and possibility distributions are then derived from the measures based on prior information. After that, the combination of masses and the combination of possibility degrees are performed in two steps, on a separate sensor level and between the sensors. Combination operators are chosen to account for different characteristics of the sensors. The selection of the decision rules is discussed for both approaches. The proposed approaches are illustrated on a set of real mines and nondangerous objects, and promising results have been obtained. [J96]

"Noise Radar Technology 2008 in Wroclaw"

{no data available} [J97]

"The Effect of Conduction on VHF Radar Images Shot in Water-Filled Boreholes"

A downhole digital memory-logging pulsed borehole radar transceiver operating in the 10-125-MHz band was run repeatedly down two 1.25-km-deep, uncased, water-filled 60-mm boreholes in the Northern Limb of the Bushveld Complex, South Africa. Suspended on an insulating cord, it mapped a steep fault in the Main Zone from a range of 75 m down through its intersection with the borehole. Lowered on a wire rope, the transceiver launched guided ~75 m/mus first-order transverse magnetic pulses which shuttled axially between the radar and the bedding planes. Decoupled from the wire by 2 m of insulating cord, it yielded a profile in which radar reflections and guided bedding plane echoes superimposed. As the radar descended through the mineralized, stratified Platreef, traces were found to be imprinted with voltage level shifts that showed, with Laterolog-comparable resolution, the conductivity profile of the Platreef. [J98]

"A Refined GTD Ray System for an Embedded Object and Its Polarimetric Behavior"

A refined ray system based on the geometrical theory of diffraction (GTD) for an object embedded in soil for a monostatic transmitter-receiver alignment is presented. Apart from the investigation of the ldquoclassicalrdquo reflections from the target, creeping waves are also taken into account, and their formalism is presented. The objective of such a ray set is to better understand the different scattering mechanisms, which are presented in the complex scattering framework. In electromagnetic modeling based on GTD, the complex shape of a target is replaced by simpler canonical objects, e.g., facets, cones, wedges, spheres, or cylinders. Here, a cylinder is located in parallel and closely to the plane interface of two dielectric half-spaces. The example of air-soil is taken into account. The numerical results obtained for various directions of incidence are employed to describe the polarimetric characteristics of the diffracted field from grazing to perpendicular incidence to the surface. By representing the diffracted GTD field on the Poincare sphere, the location on the sphere has a one-to-one relationship to the dielectric properties of the soil. The relation can be employed to extract information as the soil moisture. [J99]

"The European Switch"

The increase of efficiency within wireless train control systems is essential. The circuit-switched technologies actually used will not provide the needed transmission quality for ERTMS/ETCS if the number of concurrent users increases as prognosticated until 2015. The promising solution might be the packet-switched approach of GPRS, but there are still a lot of open questions to be answered; mostly, the transfer delay of the GPRS network

must be analyzed in detail. The next main important steps to establishing the whole GPRS-R simulation environment will be the integration and validation of the wireless medium access via the GPRS-R MAC/RLC module as well as the integration and validation of the GPRS-R air interface module. These two modules will provide, on the one hand, a detailed analysis of the possibilities of packet-switched GPRS regarding an efficient use of wireless communications channels and, on the other hand, significant values regarding the BER and transfer delay expected because of collisions and the characteristics of the air interface possibly having the highest impact of those parameters. [J100]

"An Imaging HF GPR Using Stationary Antennas: Experimental Validation Over the Antarctic Ice Sheet"

Terrestrial And Planetary Imaging Radar (TAPIR) is an innovative high-frequency ground-penetrating radar (GPR) developed in the frame of the Martian NetLander mission to probe the subsurface down to kilometric depths. Unlike most GPRs, TAPIR is able to image underground reflectors with stationary antennas. In this paper, after a brief presentation of the instrument, we describe the method developed to interpret data collected during the RAdar of NEtlander in Terre Ade acutelie (RANETA) field survey in Antarctica. This method consists of retrieving the direction of arrival of each detected echo through the measurement of five components of the electromagnetic field (the three magnetic components and the horizontal components of the electric field). Thus, both the range and the direction of each individual reflection or diffraction due to the ice-bedrock interface are resolved. We validated this method on finite-difference time-domain numerically simulated data for different subsurface configurations before applying it to RANETA observations. In particular, the irregular topography of the bedrock in two sounding sites was revealed. We discuss the accuracy of our results. [J101]

"A Kirchhoff-Based Shape Reconstruction Algorithm for the Multimonostatic Configuration: The Realistic Case of Buried Pipes"

A shape reconstruction algorithm is formulated for the multimonostatic configuration and the 2-D geometry. The imaging algorithm is based on the Kirchhoff approximation, works in the frequency domain, and exploits the singular value decomposition tool to achieve a stable solution. The effectiveness of the reconstruction algorithm is shown by processing synthetic data in the time domain generated via a finite-difference time-domain code. A performance analysis of the solution algorithm is addressed with varying host medium and measurement configurations, also by processing synthetic data for a 3-D geometry. Finally, an experimental validation of the technique is performed due to data collected by a time-domain ground-penetrating radar for buried pipe detection and localization. [J102]

"Multiple-Mode Selection of Walled-LTSA Array Elements for High-Resolution Imaging to Visualize Antipersonnel Plastic Landmines"

We propose a resolution improvement technique for a high-density array of walled linearly tapered slot antennas (LTSAs) in ground-penetrating radar imaging. In the system, we use the walled-LTSA array in a near-field measurement configuration and select various pairs of transmitter and receiver antennas out of the array elements. We prepare four selection modes so that we can practically enhance the imaging resolution. We remove the direct-coupling effect and compensate the path-length fluctuation caused by element individuality and element selection. Experiments demonstrate that the technique realizes higher resolution image acquisition to yield a clearer segmentation of antipersonnel plastic landmines in combination with adaptive image processing, based on complex-amplitude texture, even on a wet laterite soil condition. [J103]

"A Fully-Integrated Quad-Band GSM/GPRS CMOS Power Amplifier"

Concentric distributed active transformers (DAT) are used to implement a fully-integrated quad-band power amplifier (PA) in a standard 130 nm CMOS process. The DAT enables the power amplifier to integrate the input and output matching networks on the same silicon die. The PA integrates on-chip closed- loop power control and operates under supply voltages from 2.9 V to 5.5 V in a standard micro-lead-frame package. It shows no oscillations, degradation, or failures for over 2000 hours of operation with a supply of 6 V at 135degC under a VSWR of 15:1 at all phase angles and has also been tested for more than 2 million device-hours (with ongoing reliability monitoring) without a single failure under nominal operation conditions. It produces up to +35 dBm of RF power with power-added efficiency of 51%. [J104]

"Feature Extraction and Discriminator Design for Landmine Detection on Double-Hump Signature in Ultrawideband SAR"

An air- or vehicleborne ultrawideband synthetic aperture radar (UWB SAR) has ground penetrating capability,

which provides a sufficient approach to detect landmines over wide areas from a safe standoff distance. In this paper, a support vector machine (SVM) with hypersphere classification boundary, which is referred to as HyperSphere-SVM (HS-SVM), using a hidden Markov model (HMM) kernel on the feature vector extracted by a postfilter-based method is proposed for landmine detection. The postfilter-based method can extract the feature containing not only the amplitude but also the amplitude varying information of the double-hump signature of metallic and plastic landmines. Compared with simple kernels, e.g., the Gaussian kernel, the HMM kernel employs the state-transition information in the extracted feature into the discrimination procedure and, thus, can improve detection performance. The proposed postfilter-based feature extraction method and the HMM kernel HS-SVM are verified on the field data collected by a UWB SAR system in different scenarios. [J105]

"IWPAAMS2007-01: Multiagent System For Management And Monitoring Of Surveillance Routes"

This paper presents a multiagent system to manage and monitor the surveillance routes of the security personnel in the construction sector. Several concepts, derived from the Artificial Intelligence, have been taken into account for the system design, obtaining context information in order to automatically monitor the surveillance routes in execution time. The system is composed of intelligent agents with reasoning and planning capabilities, as well as of a set of technologies allowing users to interact with the system and the environment in a natural, unobstructive and easy way. [J106]

"Forest Height Inversion Using High-Resolution P-Band Pol-InSAR Data"

In this paper, a high-resolution P-band Pol-InSAR data set acquired by the airborne RAMSES system over pine forest stands of different height is investigated. A significant penetration depth in all the polarimetric channels and a wide range of polarimetric phase center heights are observed, attesting of an interaction of the radar waves with different forest structural elements. The main objective of this paper concerns forest height inversion at P-band. First, forest-modeling assumptions are evaluated using aprioriinformation, such as ground-level and forest height measurements. The full extend of the forest height is shown to be responsible of the volume decorrelation, and a significant orientation effect is clearly identified over the highest stands. As a consequence, the Oriented Volume over Ground model (OVoG) is determined to be the most appropriated model for the forest height inversion. At P-band, the ground contribution is present in all the polarimetric channels due to the important penetration at this frequency. To overcome this difficulty, a time-frequency optimization method based on sublook decomposition is developed to separate the pure ground and canopy contributions, allowing forest height estimation with OVoG with an rms error on the order of 2 m. In the last section of this paper, a sensitivity analysis of the inversion with respect to two important system parameters, the signal-to-noise ratio and the resolution, is presented, leading to a discussion on the inversion robustness in spaceborne conditions, where these system parameters are the most deteriorated as compared to airborne configurations. [J107]

"Particle Filtering Based Approach for Landmine Detection Using Ground Penetrating Radar"

In this paper, we present an online stochastic approach for landmine detection based on ground penetrating radar (GPR) signals using sequential Monte Carlo (SMC) methods. The processing applies to the two-dimensional B-scans or radargrams of 3-D GPR data measurements. The proposed state-space model is essentially derived from that of Zoubir etal., which relies on the Kalman filtering approach and a test statistic for landmine detection. In this paper, we propose the use of reversible jump Markov chain Monte Carlo in association with the SMC methods to enhance the efficiency and robustness of landmine detection. The proposed method, while exploring all possible model spaces, only expends expensive computations on those spaces that are more relevant. Computer simulations on real GPR measurements demonstrate the superior performance of the SMC method with our modified model. The proposed algorithm also considerably outperforms the Kalman filtering approach, and it is less sensitive to the common parameters used in both methods, as well as those specific to it. [J108]

"Mutual interference and low probability of interception capabilities of noise radar"

Recently, there has been considerable interest in noise radar over a wide spectrum of applications, such as through-wall surveillance, tracking, Doppler estimation, polarimetry, interferometry, ground penetrating or subsurface profiling, detection, synthetic aperture radar (SAR) imaging, inverse SAR imaging, foliage penetration imaging etc. Major advantages of using noise in the transmit signal are its inherent immunity from radio frequency and electromagnetic interference, improved spectrum efficiency, and hostile jamming as well as being very difficult to detect. The basic theory of digital signal processing in noise radar design is treated. The theory supports the use of noise waveforms for radar detection and imaging in such applications as covert military surveillance and reconnaissance. It is shown that by using wideband noise waveforms, one can achieve high resolution and reduced range estimation ambiguity. Mutual interference and low probability of interception

capabilities of noise radar are also evaluated. The simulation results show the usefulness of the noise radar technology to improve on conventional radars. [J109]

"A Wavefront Reconstruction Method for 3-D Cylindrical Subsurface Radar Imaging"

In recent years, the use of radar technology has been proposed in a wide range of subsurface imaging applications. Traditionally, linear scan trajectories are used to acquire data in most subsurface radar applications. However, novel applications, such as breast microwave imaging and wood inspection, require the use of nonlinear scan trajectories in order to adjust to the geometry of the scanned area. This paper proposes a novel reconstruction algorithm for subsurface radar data acquired along cylindrical scan trajectories. The spectrum of the collected data is processed in order to locate the spatial origin of the target reflections and remove the spreading of the target reflections which results from the different signal travel times along the scan trajectory. The proposed algorithm was successfully tested using experimental data collected from phantoms that mimic high contrast subsurface radar scenarios, yielding promising results. Practical considerations such as spatial resolution and sampling constraints are discussed and illustrated as well. [J110]

"From Glacier Facies to SAR Backscatter Zones via GPR"

We present a comparison between data acquired with frequency-modulated ground-penetrating radar (GPR) and satellite synthetic aperture radar (SAR). Both radars are polarimetric and operate at a center frequency of 5.3 GHz. The field site is the polythermal glacier Kongsvegen, Svalbard. Along glacier GPR profiles cover the ablation area and the accumulation area, where the latter consists of superimposed ice (SI) and firn. The glacier facies are clearly identifiable on the GPR profiles, although we show that the copolarized response is better for distinguishing different ice zones, whereas the SI-firn boundary is most obvious in the cross-polarized response. A calibrated backscatter coefficient is calculated for the GPR data and compared with the SAR backscatter coefficient. The SAR zones are in very good agreement with the GPR-derived glacier facies. We show that, in the ablation area, the SAR response is dominated by backscatter from the previous summer surface. In the SI and firn areas, it is dominated by sources below the previous summer surface. [J111]

"A Reconfigurative Approach for SF-GPR Prospecting"

We study the impedance parameters and the energy transmitted and received by a couple of antennas working in a nonhomogeneous background. The focus is on stepped frequency ground penetrating radar (SF-GPR) prospecting. In particular, we propose a reconfiguration of the GPR system versus the frequency that accounts for the background scenario, and we show that the reconfiguration can improve the frequency behavior of the antennas significantly. Tests performed on two bow-tie antennas will be shown. [J112]

"Localizing Thin Metallic Cylinders by a 2.5-D Linear Distributional Approach: Experimental Results"

The problem of detecting and localizing "thin" metallic scatterers from electromagnetic scattered field measurements is addressed. The scatterers are assumed to be infinitely long and a 2.5-dimensional mathematical model is adopted. According to the distributional approach, the problem is cast as the inversion of a linear integral operator acting on 6-distributions whose supports are representative of the scatterers' locations. In this paper we present the experimental validation of such an approach. To this end, we perform the reconstructions by exploiting experimental scattered field data collected in controlled conditions at the electromagnetic diagnostics laboratory of the Second University of Naples. The experiments are conducted in an anechoic chamber where the scatterers are embedded in a homogenous and lossless background medium. The multistatic/single-view/multifrequency and the multistatic/multiview/multifrequency configurations are both considered. [J113]

"Reducing Credit Re-authorization Cost in UMTS Online Charging System"

During an online charging general packet radio service (GPRS) session, a number of mid-session events, such as changes of quality of service (QoS), could dynamically affect the rating of the in-progress service. When such events occur, the GPRS support node needs to re-authorize the granted credit units with the online charging system (OCS). This paper proposes a threshold-based scheme that utilizes a threshold parameter delta to reduce the signaling traffic for the credit re-authorization procedure. By selecting an appropriate delta value, the signaling overhead in the OCS can be significantly reduced while the inaccuracy of the credit information insignificantly increases. The mobile operator can choose appropriate parameter values in the threshold-based scheme based on our study. [J114]

"Digital rights management for the home TV based on scalable video coding"

In this paper, the business model and digital rights management (DRM) solution are proposed for the home TV based on scalable video coding and convergent networks. In this environment, the TV program is broadcasted via digital video broadcasting for handheld terminals (DVB-H) to mobile phones, the access right is transmitted by Global System for Mobile communication (GSM/GPRS) channel, and the TV program can also be transmitted from mobile phones to home TV through WiFi. The typical application scenario is that the TV program with low quality (base layer) in the mobile phone can be enriched by enhancement information and shown on home TV. The business model is presented to pay for the enhancement information, and the DRM solution is proposed for solving the copyright issues in the convergence between the DVB-H broadcasting, GSM/GPRS and home network. Since few work has been done to solve this problem, the work proposed in this paper is expected to attract more researchers. [J115]

"Design and Calibration of a Large Open-Ended Coaxial Probe for the Measurement of the Dielectric Properties of Concrete"

The subject of this paper is the design and calibration of an open-ended coaxial probe for the nondestructive measurement of the dielectric properties of concrete. Measurements are made between 100-900 MHz, frequencies which are often used in geophysics and civil engineering for ground penetrating radar inspection. The probe is calibrated using measurements on saline solutions in conjunction with three different mathematical techniques for comparative study. Measurements of mortar and concrete specimens having different water/cement ratios were made in order to observe the standard deviations due to their heterogeneous nature. Similar to the case of relatively homogeneous rock specimens (limestone and granite), the standard deviation for heterogeneous concrete samples do not exceed 5%. In addition, the effect of the concrete's porosity on its dielectric properties was clearly observed: measured permittivity between 4-4.5 at 900 MHz for porous concrete, and between 6.5-7.5 at 900 MHz for dense concrete. [J116]

"Interworking of WLAN-UMTS networks: an IMS-based platform for session mobility"

In this article a framework for interworking between a WLAN and the UMTS is presented. The uniqueness of this architecture is that the IP multimedia subsystem proposed by the 3GPP has been used as an arbitrator for network coupling and real-time session management. Apart from the advantage of a cellular network user being able to enjoy higher levels of bandwidth over a WLAN, IMS also provides a common platform for unified session control, as well as higher levels of terminal and service mobility over a heterogeneous networking environment. The article concludes by presenting the potential of this model for service continuity during and after vertical handoff with simulation results for validation. [J117]

"On Generalizations of the Engset Model"

The Engset model has been extensively studied and widely used for blocking probability evaluation in telecommunications networks. In 1957, J.W. Cohen considered two generalizations of the Engset model: 1) permitting the distributions of the holding time and interarrival time to differ from source to source; 2) permitting the idle time distribution to depend on whether or not the previous call was successful. He derived the call and time congestions for the first generalization, however, he simply posed the second generalization as a problem. In a leading teletraffic text by Syski, the call and time congestions are approximated for the second generalization, though it appears that Syski has overlooked that his results are in fact an approximation. In this paper, we point out Syski's apparent oversight, we improve the accuracy of his approximation, and we provide an efficient algorithm for its numerical computation and prove its convergence [J118]

"Use of C-Band Ground Penetrating Radar to Determine Backscatter Sources Within Glaciers"

The question of penetration of synthetic aperture radar (SAR) signals at C-band frequency into polar glaciers is addressed by comparing ground penetrating radar (GPR) and SAR backscatter signatures. Profiles of the Kongsvegen glacier, Svalbard, were obtained with a C-band GPR. The received signal is converted to the equivalent radar cross section using the standard radar equation, thus mapping the effective scattering sources within the glacier at this frequency. The depth of the observed scattering sources is greatest in the superimposed ice where layers are clearly seen to a depth of approximately 14 m. The very high scattering properties of the upper firn layers preclude layers deeper than approximately 6 m from being imaged. Integrating the radar cross sections over the depth gives a single backscatter value that we compare with the backscatter coefficient (scattering cross section per unit area) of the processed SAR data for the same profile. The comparison indicates that for coincidentally acquired GPR and SAR data, the radar cross section measured by the GPR does represent the features that contribute to the SAR signal [J119]

"Service-Oriented E-Learning Platforms: From Monolithic Systems to Flexible Services"

The learning management system (LMS) has dominated Internet-based education for the past two decades. However, the traditional LMS is failing to keep pace with advances in Internet technologies and social interactions online. To support technological diversity, current frameworks such as the e-learning framework (ELF), the IMS abstract framework, and the open knowledge initiative (OKI) have defined the initial steps toward service-oriented e-learning platforms. Next-generation platforms will be based on these service-oriented visions. The authors discuss LMS evolution and present core challenges that must be addressed to achieve information interoperability in next-generation e-learning platforms [J120]

"Electromagnetic Propagation of GPR Signals in Martian Subsurface Scenarios Including Material Losses and Scattering"

A study on the electromagnetic propagation in various models of the Martian subsurface is performed with a relevance to ground penetrating radar (GPR) operating onboard rover missions. Measurements of the electromagnetic properties of Mars soil simulants are obtained; on this basis, the attenuation features of the GPR signals are estimated, including both electric and magnetic losses. The effect on propagation of inhomogeneities inside the soil is also taken into account by means of a specific model with randomly distributed scatterers. The GPR performance in terms of resolution and maximum penetration depth is evaluated in the considered scenarios for different operating frequencies, thus providing a basic information for the design of systems for future subsurface sounding investigations on Mars [J121]

"Accuracy of Ground Penetrating Radar Horn-Antenna Technique for Sensing Pavement Subsurface"

Ground penetrating radar (GPR) is an intelligent sensor technique that has led to a powerful nondestructive testing (NDT) method for road pavement evaluation. Recent improvements in hardware and, in particular, software processing have contributed to the rapidly expanding popularity and usability of this technique in the pavement engineers community. In the present work, a GPR sensor system mounted on a driving van was used to acquire data from an asphalt pavement. Two different central frequency air-coupled horn antennas were used for data acquisition. The collected radar data was processed and analyzed in order for the accuracy of the antennas to be evaluated. For this purpose, the asphalt layer dielectric values and related thickness values were also estimated. Based on the GPR data analysis results, the performance of the two horn antennas in terms of sensing pavement subsurface is presented and discussed in the paper [J122]

"Performance Modeling of Integrated Mobile Prepaid Services"

Prepaid personal communication service users have outnumbered postpaid users. This paper studies the charging issues of an integrated Global System for Mobile Communications (GSM) and General Packet Radio Service (GPRS) prepaid service, where a single prepaid account provides a user both voice and data services. The call setup and charging procedures for GSM and GPRS are presented using the Customized Applications for Mobile network Enhanced Logic network architecture. To reduce the probability of terminating both ongoing voice and data calls, we suggest that no new call be admitted when the user credit is below a threshold. An analytic model has been developed to evaluate the performance of the approach. Computer simulations have also been used to verify the results. The numeric results indicate that the force-termination probability can be significantly reduced by choosing an appropriate threshold of the user credit [J123]

"Call Completion in Wireless Networks Over Lossy Link"

The call completion characteristics in wireless networks with the presence of an inherently lossy wireless link are presented in this paper. The closed-form formula for the significant performance metric in terms of the call completion probability is developed under the generalized wireless channel model and the general call holding time distribution based on the complex theory and transform techniques (Laplace-Stieltjes transform and z transform). The particular results under the typical wireless channel model and the commonly used call holding time are presented. In order to reflect the unique characteristics of the wireless channel erroneous state, we further introduce the resource occupancy time per call and the completed call holding time per call and present their properties in terms of probability density function and statistical moments. The comparison indicates that different call holding time distributions may lead to a substantial discrepancy. The effects of the first-order as well as second-order statistical moments of the call holding time and the wireless channel state duration upon the performance metrics are discussed [J124]

"A Wireless Hydrocarbon Pollution Measuring and Monitoring System"

The goal of the proposed system is to protect sensitive areas of the country from hydrocarbon pollution with the use of a global system for mobile communications/general packet radio service (GSM/GPRS) accessed from mobile observation points (MOPs). The primary applications of this system are detection of leaks from an underground or aboveground storage tank (UST/AST), monitoring waste water discharge/ monitoring bilge water, monitoring water quality, monitoring groundwater, monitoring oil-water separators, monitoring storm drain effluents, and static soil gas headspace analysis. The basic version of the system is equipped with: a GPS position locator, a contamination probe sensitive to hydrocarbons, and a GSM/GPRS connection with the central www server [J125]

"Closed-Form Expressions of the Axial Step and Impulse Responses of a Parabolic Reflector Antenna"

Electromagnetic pulses radiated by parabolic antennas and similar structures are needed in many applications like air and ground penetrating radar or high power microwaves (HPM) weapons. In this paper, an approach based on Skulkin and Turchin's work and on physical optics approximation in the time domain is developed to determine the radiated fields. Closed-form time-domain expressions of the electromagnetic step and impulse responses, along the axis of a classical parabolic reflector antenna, are derived. A closed-form expression of the impulse response duration is also given. The obtained E-field and H-field formula are valid along the axis, both near and far from the reflector. Using these closed-form expressions, the radiated fields are computed by means of a convolution product of the primary source excitation and the impulse response. Numerical results have been obtained in the case of a causal sine and a generalized Gaussian impulse excitations to illustrate some specific transients effects which occur with such an antenna [J126]

"Characteristics of Voltage Swell in Multigrounded Systems"

The effects of multigrounded neutral (MGN) in three-phase distribution systems are not easy to analyze due to the presence of a fourth conductor-the neutral and its multigrounded arrangement. As a result, the mechanism of voltage swell in MGN feeders becomes difficult to understand. The amount of voltage swell in a MGN feeder is affected by unique factors such as the current in the neutral wire and the neutral-to-phase voltage induction. The purpose of this letter is to reveal and quantify all factors that contribute to voltage swell and substation ground potential rise in an MGN system. The results are expected to help utility engineers to understand the impact of MGN on distribution system operations and to assist their deployment of the MGN schemes [J127]

"UWB Array-Based Sensor for Near-Field Imaging"

In this paper, the development of an ultra-wideband (UWB) array-based time-domain radar sensor for near-field imaging is described. The radar sensor is designed to be used within a vehicle-mounted multisensor system for humanitarian demining. The main novelty of the radar lies in the system design with a single transmitter and multichannel receiver. Design of the UWB antenna array is also novel. The radar produces 3D images of subsurface by 1D mechanical scanning. The imaging capability of the radar is realized via electronic steering of the receive antenna footprint in a cross-scan direction and synthetic aperture processing in an along-scan direction. Imaging via footprint steering allows for a drastic increase in the scanning speed. [J128]

"Adaptive Multimodality Sensing of Landmines"

The problem of adaptive multimodality sensing of landmines is considered based on electromagnetic induction (EMI) and ground-penetrating radar (GPR) sensors. Two formulations are considered based on a partially observable Markov decision process (POMDP) framework. In the first formulation, it is assumed that sufficient training data are available, and a POMDP model is designed based on physics-based features, with model selection performed via a variational Bayes analysis of several possible models. In the second approach, the training data are assumed absent or insufficient, and a lifelong-learning approach is considered, in which exploration and exploitation are integrated. We provide a detailed description of both formulations, with example results presented using measured EMI and GPR data, for buried mines and clutter [J129]

"Locally Linear Regression for Pose-Invariant Face Recognition"

The variation of facial appearance due to the viewpoint (/pose) degrades face recognition systems considerably, which is one of the bottlenecks in face recognition. One of the possible solutions is generating virtual frontal view from any given nonfrontal view to obtain a virtual gallery/probe face. Following this idea, this paper proposes a simple, but efficient, novel locally linear regression (LLR) method, which generates the virtual frontal view from a given nonfrontal face image. We first justify the basic assumption of the paper that there exists an approximate linear mapping between a nonfrontal face image and its frontal counterpart. Then, by formulating the estimation

of the linear mapping as a prediction problem, we present the regression-based solution, i.e., globally linear regression. To improve the prediction accuracy in the case of coarse alignment, LLR is further proposed. In LLR, we first perform dense sampling in the nonfrontal face image to obtain many overlapped local patches. Then, the linear regression technique is applied to each small patch for the prediction of its virtual frontal patch. Through the combination of all these patches, the virtual frontal view is generated. The experimental results on the CMU PIE database show distinct advantage of the proposed method over Eigen light-field method. [J130]

"Wireless Profiled TCP Performance over Integrated Wireless LANs and Cellular Networks"

An analytical framework for studying the performance of wireless profiled TCP (WP-TCP) flows over the integrated wireless LAN and cellular networks is proposed. The framework can be used to analyze the short-term performance during vertical handover and long-term performance of WP-TCP for a given set of network and protocol parameters. It captures the WP-TCP behavior under the influence of wireless channel errors, step change in network parameters and excessive packet losses due to vertical handovers. Extensive simulations are conducted to verify the accuracy of the analytical framework. The main findings in this study are: (1) when the network is subjected to hard handovers, increasing the maximum window size improves the efficiency in a high transmission error environment, but degrades the efficiency in a low transmission error environment; (2) increasing the congestion window reduces the chances of premature timeouts during soft upward vertical handover; and (3) depending on duplicate ACK threshold, increasing the congestion window can increase or reduce the chances of false fast retransmit during soft upward vertical handover. [J131]

"Magnetic-Field-Induced ELF Currents in a Human Body by the Use of a GSM Phone"

A finite element method (FEM) with nonuniform mesh is employed for the calculation of extremely low frequency (ELF) currents induced in a human body by a global system for mobile communications (GSM) phone. The magnetic field of the phone is measured, and an equivalent source with magnetic dipoles is constructed for the numerical simulation. A cell of variable size is used in the simulation to accurately model the most important areas of the body model, namely areas close to the source and parts of the central nervous system. Three different mobile phone positions are considered: normal operation on the side of the head, breast pocket, and the small of the back where the spinal cord is close to the phone. Obtained results are compared with the guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). [J132]

"Real-Time Remote Onboard Diagnostics Using Embedded GPRS Surveillance Technology"

Onboard-diagnostic (OBD) system is developed to detect engine operation conditions for air-pollution monitoring. The diagnostic trouble code from vehicle microprocessor is generated resulting from a system error or malfunction. Based on a practical demand, this paper presents a modified system construction from vehicle surveillance technology for OBD data report in real time. A circuit system is designed and fabricated to convert OBD protocol into RS-232 protocol for data transmission via general-packet-radio-service mobile communication. The proposed system integrates the developing technology for both OBD and intelligent-transportation-system applications. In this paper, hardware and software in both design and implementation are discussed and verified by road tests [J133]

"Technologies on the futute converged wireless and mobility platform [JGuest Editorial]"

The articles in this special issue focus on technologies on the future converged wireless and mobility platform. The issue presents recent research and development on this emerging topic focusing on security, quality of service (QoS), mobility management, system architecture, resource management, admission control, and medium access control. [J134]

"Power Feeding and Data-Transmission System Using Magnetic Coupling for an Ocean Observation Mooring Buoy"

A noncontact power feeding and data-transmission system for an underwater sensor installed at an ocean observation mooring buoy is proposed. Magnetic properties of the proposed system are evaluated with the use of software package ELF/MAGIC. We have experimentally confirmed that sufficient power of about 180 mW can be supplied to the sensors and bidirectional signal transmission between sensors and the water-surface located buoy can be accomplished [J135]

"Microwave surfing-The IMS 2007 Quiz"

{no data available} [J136]

"UWB short-range radar sensing-The architecture of a baseband, pseudo-noise UWB radar sensor"

The pioneers of radio science made their first trials of wireless information transmission and demonstrated localization of a steel vessel by radio waves more than 100 years ago. Back then, the world of radio frequencies was organized in a very simple way. The researchers could use any frequency band. There was no interference by others and no controlling government bodies. Since then, governmental authorities have established tight regulations that have split up the available frequency band into small partitions for exclusive use. This article discusses the architecture of a baseband, pseudo-noise UWB radar and gives some examples of applications [J137]

"Ultrawideband Hybrid EBG/Ferrite Ground Plane for Low-Profile Array Antennas"

The design and analysis of an ultrawideband and low-profile hybrid electromagnetic band-gap (EBG)/ferrite ground plane is presented for implementation with antenna systems in airborne foliage penetrating radar and EW applications. The hybrid EBG/ferrite ground plane consists of an EBG structure with a ferrite slab placed on top of the structure's perfect electric conductor (PEC) ground plane. Reflectivity and phase analyses show that the hybrid EBG/ferrite ground plane offers ultrawideband operation beginning in the 100s of MHz with one design version offering an operational bandwidth exceeding 22:1 starting at 170 MHz. Additionally, analysis of the hybrid ground plane implemented with dipole antennas verifies that the hybrid ground plane effectively produces uni-directional radiation for bi-directional radiating antennas. The designed hybrid ground plane is also simulated with Raytheon's long slot array antenna and the obtained results further verify its ultrawideband performance [J138]

"Accurate Imaging of Multicomponent GPR Data Based on Exact Radiation Patterns"

Scalar migration algorithms developed for three-dimensional seismic data are commonly used for imaging ground-penetrating radar (GPR) data. Yet, radar is a vector phenomenon, such that the GPR amplitudes and phases depend on the antenna orientations and wave propagation paths. To address this issue, vector imaging algorithms that fully account for the vector characteristics of GPR data are required. All previously developed vector imaging algorithms are based on far-field approximations of radiation patterns. We demonstrate the limited applicability of these algorithms and introduce a computationally efficient practically exact-field method that accounts for the far-, intermediate-, and near-field contributions to the radiation patterns. To compute rapidly the required "exact" radiation patterns, inverse fast Fourier transforms are applied to their horizontal wavenumber-frequency domain formulations, balancing the tradeoff between accuracy and efficiency by an appropriate oversampling in the wavenumber-frequency domain, and taking advantage of vertical wavenumber phase shifting. We include the exact radiation patterns in a multicomponent vector imaging scheme that jointly images copolarized and cross-polarized data. This scheme is tested on synthetic and field data containing dipping planar and near-planar structures. For both suites of data, high-quality multicomponent images with reflection amplitudes that are nearly independent of the antenna and reflector orientations are obtained [J139]

"Efficient Calculation of Born Scattering for Fixed-Offset Ground-Penetrating Radar Surveys"

A formulation is presented for efficient calculation of linear electromagnetic scattering by buried penetrable objects, as involved in the analysis of fixed-offset ground-penetrating radar (GPR) systems. The actual radiation patterns of the GPR antennas are incorporated in the scattering calculation by using their plane-wave transmitting and receiving spectra [J140]

"Optimizing the Area Under a Receiver Operating Characteristic Curve With Application to Landmine Detection"

A common approach to training neural network classifiers in a supervised learning setting is to minimize the mean-square error (mse) between the network output for each labeled training sample and some desired output. In the context of landmine detection and discrimination, although the performance of an algorithm is correlated with the mse, it is ultimately evaluated by using receiver operating characteristic (ROC) curves. In general, the larger the area under the ROC curve (AUC), the better. We present a new method for maximizing the AUC. Desirable properties of the proposed algorithm are derived and discussed that differentiate it from previously proposed algorithms. A hypothesis test is used to compare the proposed algorithm to an existing algorithm. The false alarm rate achieved by the proposed algorithm is found to be less than that of the existing algorithm with 95% confidence [J141]

"Evaluation of Peak Current Polarity Retrieved by the ZEUS Long-Range Lightning Monitoring

System"

This letter presents the first assessment of a newly developed polarity retrieval scheme augmenting a very low frequency (VLF) long-range lightning detection network (named ZEUS). The polarity scheme uses extremely low frequency (ELF) in conjunction with the VLF waveform. The measured ELF signal is compared with the simulated ELF signal to extract the polarity sign. This comparison also produces correlation coefficients that are used to assign four confidence index categories on the polarity sign. This letter presents polarity results for a period of ZEUS network operation from November 26 to December 15, 2004. Assessment of the polarity measurements is conducted through comparisons against the Brazilian lightning network Rede Integrada Nacional de Detecccedilatildeo de Descargas Atmosfeacutericas (RINDAT) that uses a well-established lightning location technology. Contingency test analysis shows that algorithm performance is consistent with the assigned confidence level, e.g., at medium confidence level, the algorithm has a 5% bias, whereas at high level, perfect agreement is shown with RINDAT. Peak current strength was found not to influence the accuracy of the polarity retrieval [J142]

"Subsurface Sensing of Buried Objects Under a Randomly Rough Surface Using Scattered Electromagnetic Field Data"

This paper proposes a new inverse method for microwave-based subsurface sensing of lossy dielectric objects embedded in a dispersive lossy ground with an unknown rough surface. An iterative inversion algorithm is employed to reconstruct the geometry and dielectric properties of the half-space ground as well as that of the buried object. B-splines are used to model the shape of the object as well as the height of the rough surface. In both cases, the control points for the spline function represent the unknowns to be recovered. A single-pole rational transfer function is used to capture the dispersive nature of the background. Here, the coefficients in the numerator and denominator are the unknowns. The approach presented in this paper is based on the state-of-the-art semianalytic mode matching forward model, which is a fast and efficient algorithm to determine the scattered electromagnetic fields. Numerical experiments involving two-dimensional geometries and TM incident plane waves demonstrate the accuracy and reliability of this inverse method [J143]

"Evaluation of Protective Hoods in Strong RF Electromagnetic Fields"

Protective garments made with conductive fibers are used to reduce human exposure to both extremely low frequency (ELF) and radio-frequency (RF) electromagnetic fields. The former are usually associated with high-voltage systems and the latter with communication systems. The fundamental difference between RF and ELF protective garments is the head covering; the former has a conductive screen in front of the face while the latter does not. Near high-voltage transmission lines on which communication antennas are mounted, both ELF and RF electromagnetic fields exist. High-voltage transmission line workers may use a high-voltage protective suit in this environment. There is reason to believe, however, that the partially open head covering of a high-voltage suit may act as a resonant cavity when exposed to incident RF energy. Thus, it is possible that the RF field in the workers head may actually be enhanced by wearing the suit. A series of experiments was conducted to determine whether this phenomenon occurs. It was shown that there appears to be a modest resonance within the partially open head covering in the vicinity of 800-900 MHz that causes the RF electromagnetic fields in the head to exceed those in the head without a conductive suit [J144]

"Detection of Antipersonnel Mines by Using the Factorization Method on Multistatic Ground-Penetrating Radar Measurements"

The factorization method (FM) has been applied to measurement data from a multistatic ground-penetrating radar operating in close proximity to the ground, which was used in a measurement campaign on the Joint Research Centre mine test lane in Ispra, Italy. This paper is targeted toward a future hand-held demining system. The according space limits restrict an independent positioning of transmit and receive antennas. Hence, very small multistatic datasets are obtained, representing a difficult case for the reconstruction with the FM [J145]

"Investigation of Time–Frequency Features for GPR Landmine Discrimination"

Ground-penetrating radar (GPR) is capable to detect plastic antipersonnel landmines as well as other subsurface targets. In order to reduce false alarms, an option of automatic landmine discrimination from neutral minelike targets would be very useful. This paper presents a possibility for such discrimination and analyzes it experimentally. The authors investigate time-frequency features of an ultrawideband (UWB) target response for the discrimination between buried landmines and other objects. The discrimination method includes the extraction of an early-time target impulse response, its time-frequency transformation, and the extraction of time-frequency features based on a singular value decomposition of the transformed image. In order to take into

account the changes in the UWB target signals, the experimental conditions are completely controlled to focus on the behavior of the target's response with respect to its depth and the horizontal position of the GPR above it. The dependence of the features on the GPR bandwidth is analyzed as well. The Mahalanobis distance is used as a criterion for optimal discrimination. The obtained results define the best features and conditions when the landmine discrimination is successful. For comparison, the discriminant power of the proposed features has been tested on a dataset, acquired during a field campaign in Angola [J146]

"Integration of Ground-Penetrating Radar and Laser Position Sensors for Real-Time 3-D Data Fusion"

Full-resolution 3-D ground-penetrating radar (GPR) imaging of the near surface should be simple and efficient. Geoscientists, archeologists, and engineers need a tool capable of generating interpretable subsurface views at centimeter-to-meter resolution of field sites ranging from smooth parking lots to rugged terrain. The authors have integrated novel rotary laser positioning technology with GPR into such a 3-D imaging system. The laser positioning enables acquisition of centimeter accurate x, y, and z coordinates from multiple small detectors attached to moving GPR antennas. Positions streaming with 20 updates/s from each detector are fused in real time with the GPR data. The authors developed software for automated data acquisition and real time 3-D GPR data quality control on slices at selected depths. Industry standard (SEGY) format data cubes and animations are generated within an hour after the last trace has been acquired. Such instant 3-D GPR can be used as an on-site imaging tool supporting field work, hypothesis testing, and optimized excavation and sample collection in the exploration of the static and dynamic nature of the shallow subsurface [J147]

"Boundary Element Modeling of the Realistic Human Body Exposed to Extremely-Low-Frequency (ELF) Electric Fields: Computational and Geometrical Aspects"

This paper presents the human exposure assessment to high-voltage extremely-low-frequency (ELF) fields by the three-dimensional (3-D) boundary element method (BEM). The formulation is based on a realistic, anatomically based representation of the human body. The main objective is to analyze the influence of the relative position of the arms with respect to the body on the axial distribution of current density along the body and to determine the most vulnerable regions. Numerical results along head, neck, torso, abdomen, arms, legs, and ankles are presented and discussed in the case of grounded subject standing under power-distribution lines and in the vicinity of power transformer substations [J148]

"Reconstruction From Antenna-Transformed Radar Data Using a Time-Domain Reconstruction Method"

This paper discusses the reconstruction of the subsurface from radar data using a time-domain reconstruction method. Before the reconstruction is conducted, data preprocessing is carried out. The preprocessing transforms measured data transmitted and received by 3-D dipole antennas into equivalent data excited and received by 3-D ideal electric dipoles and, then, into equivalent data excited and received by 2-D ideal electric dipoles. Distributions of permittivity, conductivity, and permeability are reconstructed from the preprocessed data by a 2-D forward-backward time-stepping waveform inverse scattering technique. Two 2-D examples of permittivity and conductivity reconstruction from synthetic noisy and field borehole radar data are demonstrated to show the effectiveness of the proposed method [J149]

"On designing issues of the next generation mobile network"

Next generation mobile network (NGMN) is envisaged to support seamless mobility across disparate access technologies in a transparent manner. The success of NGMN design will depend on its ability to address key design issues, mainly architectural adaptation and modification of service continuity functions (i.e., mobility and resource management) that arise from such interoperability. The solutions presented in this article attempt to resolve these issues by considering an IP-based interworking framework that promotes evolution of individual networks and integration of new technologies [J150]

"Analysis of Random Step Frequency Radar and Comparison With Experiments"

Linear stepped frequency radar is used in wide-band radar applications, such as airborne synthetic aperture radar (SAR), turntable inverse SAR, and ground penetration radar. The frequency is stepped linearly with a constant frequency change, and range cells are formed by fast Fourier transform processing. The covered bandwidth defines the range resolution, and the length of the frequency step restricts the nonambiguous range interval. A random choice of the transmitted frequencies suppresses the range ambiguity, improves covert detection, and reduces the signal interference between adjacent sensors. As a result of the random modulation,

however, a noise component is added to the range/Doppler sidelobes. In this paper, relationships of random step frequency radar are compared with frequency-modulated continuous wave noise radar and the statistical characteristics of the ambiguity function and the sidelobe noise floor are analyzed. Algorithms are investigated, which reduce the sidelobes and the noise-floor contribution from strong dominating reflectors in the scene. Theoretical predictions are compared with Monte Carlo simulations and experimental data [J151]

"Modeling mobility database failure restoration using checkpoint schemes"

This paper studies checkpointing and failure restoration of mobility database for Universal Mobile Telecommunications System (UMTS). By utilizing per-user checkpointing technique, individual home location register (HLR) records are saved into non-volatile backup storage form time to time. When a failure occurs, the backup record is restored back to the mobility database. We consider three per-user checkpoint schemes for the HLR. An analytic model is developed to investigate these schemes in terms of the probability that a HLR backup record is obsolete and the expected checkpoint interval. This model is validated against simulation experiments. Our study provides guidelines for selecting an appropriate checkpoint scheme and parameters for various traffic conditions [J152]

"Low-Frequency Dosimetry of Inhomogeneous Magnetic Fields Using the Coil Source Model and the Household Appliance"

In this paper, the magnetic field properties and the dosimetry at ELF (50 Hz) are investigated using a coil model, which is prescribed in the European standard EN50366 (CENELEC) as a substitute source model for real household appliances. The accuracy of magnetic field vectors and values of the induced current density, which is achieved with the coil model, were compared with the results of two test appliances (a drilling machine and a hand mixer) obtained from the equivalent source model. It was demonstrated that the magnetic fields obtained (dominant component and strength) using the coil model and the real appliance show an agreement with each other with a maximum difference of 5 dB. The calculated induced current densities in the numerical human body models (homogeneous and anatomical body models) and the real appliances also show a good agreement with each other with a maximum difference by a factor of 1.6 (by the anatomical body model). Furthermore, the values of both field vectors and induced current density values calculated using the coil model were shown to be higher than those calculated in the case of the real appliances. Based on these results, the applicability of the coil model prescribed in EN50366 confirms that of the two applied test appliances [J153]

"Decision Fusion of Ground-Penetrating Radar and Metal Detector Algorithms—A Robust Approach"

Numerous detection algorithms, using various sensor modalities, have been developed for the detection of mines in cluttered and noisy backgrounds. The performance for each detection algorithm is typically reported in terms of the receiver operating characteristic (ROC), which is a plot of the probability of detection versus false alarm as a function of the threshold setting on the output decision variable of each algorithm. In this paper, we present multisensor decision-fusion algorithms that combine the local decisions of existing detection algorithms for different sensors. This offers an expedient, attractive, and much simpler alternative to the design of an algorithm that fuses multiple sensors at the data level, especially in cases of limited training data where it is difficult to make accurate estimates of multidimensional probability density functions. The goal of our multisensor decision-fusion approach is to exploit the complimentary strengths of existing multisensor algorithms so as to achieve performance (ROC) that exceeds the performance of any sensor algorithm operating in isolation. Our approach to multisensor decision fusion is based on the optimal signal detection theory using the likelihood ratio. We consider the optimal fusion of local decisions for two sensors: a ground-penetrating radar and a metal detector. A new robust algorithm for decision fusion that addresses the problem in which the statistics of the training data are not likely to exactly match the statistics of the test data is presented. ROCs are presented and compared for field data [J154]

"Spheroidal Mode Approach for the Characterization of Metallic Objects Using Electromagnetic Induction"

We propose a spheroidal mode approach to characterize the electromagnetic induction (EMI) response of buried objects, assumed to be much more conductive than their environment. Both the excitation and the response are formulated as the linear superpositions of basic spheroidal modes. The scattering coefficients characterize objects, regardless of their geometrical complexity and material inhomogeneity, due to the orthogonality of the spheroidal modes. The ill-conditioning encountered in retrieving the scattering coefficients is dealt with by mode truncation and Tikhonov regularization. The approach is tested for both simulated and measured data, and the retrieval results show encouragingly that only few excitation and response modes effectively represent the EMI

response of the objects. The proposed approach is therefore promising in the detection and classification of buried objects [J155]

"Frequency Subband Processing and Feature Analysis of Forward-Looking Ground-Penetrating Radar Signals for Land-Mine Detection"

There has been significant amount of study on the use of ground-penetrating radar (GPR) for land-mine detection. This paper presents our analysis of GPR data collected at a U.S. Army test site using a new approach based on frequency subband processing. In this approach, from the radar data that have over 2.5 GHz of bandwidth, we compute separate radar images using the one wide (2 GHz) and four narrow (0.6 GHz) frequency subbands. The results indicate that signals for different frequency subbands are significantly different and give very different performance in land-mine detection. In addition, we also examine a number of features extracted from the GPR data, including magnitude and local-contrast features, ratio between copolarization and cross-polarization signals, and features obtained using polarimetric decomposition. Feature selection procedures are employed to find subsets of features that improve detection performance when combined. Results of land-mine detection, including performance on blind test lanes, are presented [J156]

"Filtering Soil Surface and Antenna Effects From GPR Data to Enhance Landmine Detection"

The detection of antipersonnel landmines using ground-penetrating radar (GPR) is particularly hindered by the predominant soil surface and antenna reflections. In this paper, we propose a novel approach to filter out these effects from 2-D off-ground monostatic GPR data by adapting and combining the radar antenna subsurface model of Lambot with phase-shift migration. First, the antenna multiple reflections originating from the antenna itself and from the interaction between the antenna and the ground are removed using linear transfer functions. Second, a simulated Green's function accounting for the surface reflection is subtracted. The Green's function is derived from the estimated soil surface dielectric permittivity using full-wave inversion of the radar signal for a measurement taken in a local landmine-free area. Third, off-ground phase-shift migration is performed on the 2-D data to filter the effect of the antenna radiation pattern. We validate the approach in laboratory conditions for four differently detectable landmines embedded in a sandy soil. Compared to traditional background subtraction, this new filtering method permits a better differentiation of the landmine and estimation of its depth and geometrical properties. This is particularly beneficial for the detection of landmines in low-contrast conditions [J157]

"Potential GPRS 900/180-MHz and WCDMA 1900-MHz Interference to Medical Devices"

This study compared the potential for interference to medical devices from radio frequency (RF) fields radiated by GSM 900/1800-MHz, general packet radio service (GPRS) 900/1800-MHz, and wideband code division multiple access (WCDMA) 1900-MHz handsets. The study used a balanced half-wave dipole antenna, which was energized with a signal at the standard power level for each technology, and then brought towards the medical device while noting the distance at which interference became apparent. Additional testing was performed with signals that comply with the requirements of the international immunity standard to RF fields, IEC 61000-4-3. The testing provides a sense of the overall interference impact that GPRS and WCDMA (frequency division duplex) may have, relative to current mobile technologies, and to the internationally recognized standard for radiated RF immunity. Ten medical devices were tested: two pulse oximeters, a blood pressure monitor, a patient monitor, a humidifier, three models of cardiac defibrillator, and two models of infusion pump. Our conclusion from this and a related study on consumer devices is that WCDMA handsets are unlikely to be a significant interference threat to medical electronics at typical separation distances. [J158]

"Full-Waveform Inversion of Crosshole Radar Data Based on 2-D Finite-Difference Time-Domain Solutions of Maxwell's Equations"

Crosshole radar techniques are important tools for a wide range of geoscientific and engineering investigations. Unfortunately, the resolution of crosshole radar images may be limited by inadequacies of the ray tomographic methods that are commonly used in inverting the data. Since ray methods are based on high-frequency approximations and only account for a small fraction of the information contained in the radar traces, they are restricted to resolving relatively large-scale features. As a consequence, the true potential of crosshole radar techniques has yet to be realized. To address this issue, we introduce a full-waveform inversion scheme that is based on a finite-difference time-domain solution of Maxwell's equations. We benchmark our new scheme on synthetic crosshole data generated from suites of increasingly complex models. The full-waveform tomographic images accurately reconstruct the following: (1) the locations, sizes, and electrical properties of isolated subwavelength objects embedded in homogeneous media; (2) the locations and sizes of adjacent subwavelength objects embedded in homogeneous media; (3) abrupt media boundaries and average and stochastic electrical

property variations of heterogeneous layered models; and (4) the locations, sizes, and electrical conductivities of water-filled tunnels and closely spaced subwavelength pipes embedded in heterogeneous layered models. The new scheme is shown to be remarkably robust to the presence of uncorrelated noise in the radar data. Several limitations of the full-waveform tomographic inversion are also identified. For typical crosshole acquisition geometries and parameters, small resistive bodies and small closely spaced dielectric objects may be difficult to resolve. Furthermore, electrical property contrasts may be underestimated. Nevertheless, the full-waveform inversions usually provide substantially better results than those supplied by traditional ray methods. [J159]

"Design and Analysis of a Mobility Gateway for GPRS-WLAN Integration"

This paper presents the design and analysis of general packet radio service (GPRS)-wireless local area network (WLAN) mobility gateway (GWMG) for the integration of GPRS and WLANs. The interworking between GPRS and WLANs is achieved by the GWMG that resides on the border of GPRS and WLAN systems. The design goal is to minimize the modifications in GPRS and WLANs as both systems are already widely available. By deploying the GWMG, users can seamlessly roam among the two systems. Unlike other related work, the proposed GWMG could be used when either the GPRS or WLAN is a user's home network. Both mathematical analysis and simulation are developed to analyze the performance. The proposed GWMG has also been implemented in a testbed comprising a commercial GPRS system. The results show that the GWMG could achieve a design goal that will effectively integrate GPRS and WLANs. [J160]

"SEABED Algorithm and Comments on “Modeling and Migration of 2-D Georadar Data: A Stationary Phase Approach”"

An imaging algorithm with a transform between the real and data spaces was proposed by Greenhalgh and Marescot for georadar data in 2006. This technique utilizes a reversible transform between the real space (X, Z = F(X)) and the data space (x, z = f(x)). The inverse transform is equivalent to the imaging method that is proposed by Li et al. (2005) if an antenna interval is short. This method was applied to preprocessing for breast cancer detection in 2005. These transforms were originally proposed by Sakamoto and Sato (2004) for an imaging with ultrawideband radar systems. By utilizing these transforms, a high-speed imaging algorithm, which is called as SEABED algorithm, was developed, which was extended to compensate for the phase rotation at caustic points, which was also described by Greenhalgh and Marescot. In addition, the SEABED algorithm was extended to apply to noisy data, 3D systems, experimental data, and bistatic radars. Note that the transform is fundamentally sensitive to noise because it includes derivative operations. A new algorithm was developed by extending the SEABED algorithm to avoid the derivative operations, which is stable and has a high resolution even for noisy data. The reversible transform in is now simultaneously and independently studied by some research groups because it is the sole solution for the imaging with wave fields. In addition, the transform has a variety of applications because it can be applied to electromagnetic waves, sonic and ultrasonic waves, seismic waves, and other waves. [J161]

"Improving Mobile Core Network Security with Honeynets"

Despite improved security, core network vulnerabilities continue to threaten third-generation (3G) mobile systems. This article offers a security assessment conducted in the packet-switched domain of a mobile operator's infrastructure. A honeynet architecture could help address 3G security. [J162]

"Bipolar waveform generator for time limited response when driving RC loads"

A method is presented whereby a compact circuit generates bipolar VHF waveforms of which the relative duration and amplitude of the positive and negative half cycles are adjustable. This facilitates fine timing of the waveform for a time limited response when driving resistor-capacitor loads. Performance is verified by measurements on a system functioning as a ground penetrating radar system where the antenna presents such an equivalent load. [J163]

"Scale Model Experimental Validation and Calibration of the Half-Space Green's Function Born Approximation Model Applied to Cross-Well Radar Sensing"

Efficient forward models that describe the physical nature of the geophysical problem are desired for subsurface sensing and reconstruction of a contrasting contaminant pool volume. An analytical model to approximate sensing with radar is developed and implemented in the frequency domain in terms of the half-space lossy dyadic Green's function. The Born approximation is employed as a linear forward model, which will eventually be used for tomographic inversion for object detection. The forward model is compared with measurements generated by a cross-well radar (CWR) experiment in a controlled soil test tank using broadband borehole

antennas. Soil parameter (dielectric constant and loss tangent) variance with frequency is represented by a quadratic polynomial. Calibration for soil parameters is performed via CWR data using an iterative nonlinear parameterized inversion technique. With the appropriate calibration, good agreement is obtained with wideband experimental measurements for several different borehole antenna placements, confirming the accuracy of the model. [J164]

"IMS Signaling over Current Wireless Networks: Experiments Using the Open IMS Core"

The IP Multimedia Subsystem (IMS) as defined by the 3GPP emerges as blueprint for a central architecture to provide Next Generation Network (NGN) services. As overlay architecture for IP based access networks, it provides standardized interfaces to services which will merge the advantages of traditional telephony networks with the benefits of Internet services. This paper will evaluate how good the current wireless access network technologies are for usage in combination with IMS services. Based upon a reference implementation of IMS core elements, the Open IMS Core, measurements were carried out on signaling to give an indication as to what networks will be most applicable for usage, particularly for a vehicular environment. [J165]

"An Autonomous Unmanned Ground Vehicle for Non-Destructive Testing of Fiber-Reinforced Polymer Bridge Decks"

The use of fiber-reinforced polymer (FRP) composite bridge decks is increasing in many civil engineering applications because of its many useful properties. The traditional reinforced concrete bridge decks have steel reinforcing bars embedded in concrete. Because of the use of deicing salt on the bridges to melt snow and ice in winter, the reinforcing bars tend to corrode, thus reducing the life span of the reinforced concrete bridge decks by half (from about 50 yr to about 25 yr). The FRP composite decks are made of noncorrosive material and offer a higher strength-to-weight ratio as compared to the reinforced concrete decks. It is highly important that engineers know how to detect subsurface defects that can form in FRP decks, which may cause serious structural degradation and endanger structural integrity. Both infrared thermography (IRT) and ground penetrating radar (GPR) have shown promise in the field of non-destructive detection of defects. Instead of performing both analysis methods individually, it would be more cost effective for someone to conduct both IRT and GPR at the same time. Research at West Virginia University has produced an unmanned ground vehicle (UGV) that will acquire data from both GPR and IRT systems to create a combined defect map of the FRP bridge deck to better analyze the results. Thus, the proposed UGV enables rapid data acquisition from the FRP bridge deck in an automated and non-destructive fashion, which minimizes human error. The UGV also incorporates data analysis algorithms, which help in producing a detailed map showing the layout of defects on the bridge deck. [J166]

"Short-Pulse Electromagnetic Scattering by Buried Perfectly Conducting Cylinders"

In this letter, the electromagnetic scattering problem of a short-pulse plane wave by a finite set of buried perfectly conducting circular cylinders is addressed in the time domain. The described procedure is applicable for arbitrary polarization and for any cylinder size and configuration in both near- and far-field regions. The solution is performed through an angular-spectrum representation of the scattered field. A parametric analysis on the effects of the various geometrical parameters is reported, and numerical results are presented. [J167]

"Network Architectures for 4G: Cost Considerations [JWireless Broadband Access]"

As 3G wireless networks evolve toward 4G, various wireless network technology organizations are considering a major redesign of the network architecture. We present a perspective on such a redesign motivated primarily by cost considerations. We examine some tenets for the design of 4G wireless network architectures that are aimed at improving costs in various aspects of the network. One tenet is the maximization of economies of scale by partitioning the functionality among network elements in a way that maximizes the potential domain of applicability of the network elements. Another is reduction of the number of distinct types of network elements needed by flattening the levels of hierarchy in the execution of various functions. We explain our reasoning by illustrating a way of redesigning the current 3GPP network architecture based on these tenets. [J168]

"On the study of location measurements in urban cellular networks"

This work presents a statistical field study of the availability of time sources used by location techniques in a true wireless network. Terrestrial (base stations) and satellite (GPS) sources were investigated in three different urban scenarios. The density function of a specific number of sources available for triangulation is presented along with other statistical data in order to assess coverage. Since the fusion of terrestrial and satellite sources to obtain the location in wireless networks has been proposed as a way of improving coverage, the joint density function and cross-correlation between the availability of both types of sources are also presented. This correlation depends on the scenario, leading to the conclusion that the improvement obtained through the fusion

of sources depends on both the fusion type and the scenario. [J169]

"Derivation of the Norton Surface Wave Using the Compensation Theorem"

This paper presents a tutorial exposition of the derivation of the Norton surface wave using the compensation theorem. Only the case of a vertical electric dipole above an infinite ground plane satisfying an impedance boundary condition is treated. This is the most interesting case in practice, and the one on which applications such as MF AM broadcasting and HF surface-wave radar rely. It is attractive to use the compensation theorem to treat this relatively complex problem. This theorem, itself simply derived starting from Lorentz reciprocity, is easily understood, and the development that follows draws only on ideas already familiar in at least some context to almost all electrical engineers. This makes it for the most part easier to follow than equivalent alternative presentations. While not the first such derivation to have appeared in the literature, and to some extent paralleling these earlier developments to allow direct comparison, the present paper aims to differentiate itself both by being easier to follow and in removing some errors. [J170]

"Exposure of Pregnant Dairy Heifers to High-Tension Power Lines [JHealth Effects]"

This article investigates the biological effects and potential health hazards to pregant dairy heifers from exposure to extremely-low-frequency (ELF) electromagnetic fields, in the 50/60 Hz range, particularly those associated with transmission lines. It was found that the EMF exposed cattles gained weight. [J171]

"Authentication Vector Management for UMTS"

In Universal Mobile Telecommunication System (UMTS), the security function provides mutual authenticity and key agreement between the core network and the Mobile Station (MS). Specifically, the Serving GPRS Support Node (SGSN) in the core network obtains an array of Authentication Vectors (AVs) from the Home Subscriber Server/Authentication Center (HSS/AuC), and consumes one AV for each mutual authentication. After the departure of the MS, the SGSN may keep the unused AVs for a time interval called the Reservation Timeout (RT) period. If the MS returns within the RT period, the SGSN uses the stored AVs for mutual authentication instead of obtaining new AVs from the HSS/AuC. Note that a long RT period results in fewer accesses to the HSS/AuC at the cost of extra AV storage in the SGSN. In this paper, we propose an analytic model to investigate the impact of the RT period on the system performance. Our study provides the guidelines for the mobile operators to select an appropriate RT period. [J172]

"A Novel Clutter Suppression Algorithm for Landmine Detection With GPR"

In this paper, we propose a new algorithm for the enhancement of plastic-cased antipersonnel mine detection using a video-impulse ground-penetrating radar (GPR). The algorithm is implemented as a nonlinear signal processor, which searches for the presence of a reference waveform in a 1D GPR echo return. The reference waveform represents a class of targets within a certain environment. The processor marks the presence of all responses similar to the reference waveform with a sharp mono-cycle. Simultaneously, responses with different waveforms, which presumably correspond to clutter, are suppressed. The reference waveform and other algorithm parameters are determined from training data sets acquired in a controlled environment. After training, the algorithm can be successfully applied at sites where soil, targets, and measurement scenarios are similar but not identical to those of the training site. The processor is integrated into an automated data processing and mine detection scheme as an additional clutter suppression step. The scheme consists of clutter suppression, synthetic aperture radar focusing, construction of a confidence map, and automated detection in it. The suggested algorithm is tested on experimental data, and its performance is compared against schemes where clutter suppression is organized by means of background removal and the cross correlation with a reference wavelet. The performance comparison is done in terms of receiver operating characteristic curves. It has been found that the suggested algorithm reduces the false alarm rate in about two and a half times in comparison to the cross-correlation-based clutter suppression. [J173]

"An Interacting Multiple-Model-Based Abrupt Change Detector for Ground-Penetrating Radar"

In this letter, we propose an interacting multiple-model (IMM)-based abrupt change detector for ground-penetrating radar (GPR) applications. Ground clutter varies with surface roughness, soil nature, as well as depth of the soil layer, necessitating a multiple-model approach. The IMM is first trained for a chosen number of models and then used to characterize the GPR data. The IMM predictor segments the entire GPR data into regions of identical models and then identifies targets by detecting abrupt changes in model parameters. The number of models is determined using the minimum prediction error criterion. The prediction performance of the IMM predictor is theoretically analyzed, and its detection performance is also evaluated through an receiver operating characteristics analysis to illustrate the improved performance of the proposed detector. [J174]

"Refraction and Dispersion Effects Compensation for UWB SAR Subsurface Object Imaging"

It is a trend to use airborne or vehicle-borne ultrawideband synthetic aperture radar (UWB SAR) to quickly detect subsurface objects, i.e., landmines or minefields, over large areas from a safe standoff distance. The traditional image formations without considering the refraction and dispersion of electromagnetic wave will lead to locating error and defocusing for subsurface objects. In this paper, an efficient refraction and dispersion effects compensation method is proposed, which can be integrated with the traditional three-stage automatic target detection framework for detection of subsurface landmines. The compensation method can focus and correctly locate multiple objects buried in different soils with different depths over large areas, which satisfies the operating requirement of an airborne or vehicle-borne UWB SAR system. The proposed method is proved efficient for subsurface object imaging by the field data collected by a UWB SAR system. [J175]

"Wireless Power Transmission to a Buried Sensor in Concrete"

The feasibility of sending wireless power to a buried sensor antenna within concrete was studied. A receive patch rectenna with 75.8% conversion efficiency was designed for operation at 5.7 GHz. The received DC power at the rectenna was measured within dry and wet concrete samples with various cover thicknesses and air-gaps. For the rectenna buried within 30 mm of the concrete, the received DC power was 10.37 mW, which was about 70% of the received DC power in free-space. [J176]

"A Large-Scale Systematic Evaluation of Algorithms Using Ground-Penetrating Radar for Landmine Detection and Discrimination"

A variety of algorithms for the detection of landmines and discrimination between landmines and clutter objects have been presented. We discuss four quite different approaches in using data collected by a vehicle-mounted ground-penetrating radar sensor to detect landmines and distinguish them from clutter objects. One uses edge features in a hidden Markov model; the second uses geometric features in a feed-forward order-weighted average network; the third employs spectral features as its basis; and the fourth clusters edge histograms. We present the results of a large-scale cross-validation evaluation that uses a diverse set of data collected over 41 807.57 m2of ground, including 1593 mine encounters. Finally, we discuss the results of that ranking and what one can conclude concerning the performance of these four algorithms in various settings. [J177]

"MoM Analysis of Dipole Antennas in Crosshole Borehole Radar and Field Experiments"

In this paper, we propose a method-of-moments (MoM) analysis that includes the borehole effects on crosshole borehole radar, and we verify that the MoM represents the crosshole borehole radar data correctly. We derive the far-field approximation of an electric field radiated by an electric point source. In this derivation, we assume that the point source is in a cylindrically layered medium, while the observed electric field is in another cylindrically layered medium. The equations that are derived are used as a transfer function to connect the two impedance matrices-one for the transmitting antenna and the other one for the receiving one. In these matrices, the influence of the scattered field by the borehole is included completely. We conducted field experiments in granite with a controlled borehole medium in order to investigate the influence of the borehole. In this paper, we estimated the relative amplitude and the group delay of the received signals between the water-filled borehole case and the air-filled borehole case. This paper showed that the estimated amplitude and delay depend on the frequency and that the proposed MoM could predict these frequency dependencies. [J178]

"Multistatic Ground-Penetrating Radar Experiments"

A multistatic ground-penetrating radar (GPR) system has been developed and used to measure the response of a number of targets to produce data for the investigation of multistatic inversion algorithms. The system consists of a linear array of resistive-vee antennas, microwave switches, a vector network analyzer, and a 3-D positioner, all under computer control. The array has two transmitters and four receivers which provide eight bistatic spacings from 12 to 96 cm in 12-cm increments. Buried targets are scanned with and without surface clutter, which is a layer of rocks whose spacing is empirically chosen to maximize the clutter effect. The measured responses are calibrated so that the direct coupling in the system is removed, and the signal reference point is located at the antenna drive point. Images are formed using a frequency-domain beamforming algorithm that compensates for the phase response of the antennas. Images of targets in air validate the system calibration and the imaging algorithm. Bistatic and multistatic images for the buried targets are very good, and they show the effectiveness of the system and processing. [J179]

"Measurement of Layer Thickness and Permittivity Using a New Multilayer Model From GPR Data"

The conventional method, i.e., the common middle point (CMP) method, has been used for many years for estimating the depth and permittivity of layered media from ground-penetrating radar (GPR) data. However, the CMP method results in noticeable errors in thickness and permittivity readings with the increase of antenna separation. To improve the measurement accuracy, a new mathematical model is presented, covering GPR measurement in one- and two-layer cases. In this model, we first check all the possible wave paths when the GPR signal propagates in the multilayer environment. We not only consider the effects from the air-ground interface but also introduce a ray-path-searching process in the GPR measurement using Fermat's shortest path law. The shortest path is then used in the process of GPR data inversion in order to calculate the depth and permittivity of each layer. Finally, we use the transmission-line matrix (TLM) method to simulate the propagation of a GPR signal in the multilayered formation. A time-sequence image that was produced by the finite-difference time-domain method has also been used to explain this presented model. By comparing the numerical simulation results with the measured results, it is found that the estimated layer thickness and permittivity by the new model agree well with the simulated results. It proves that the new model is more accurate and closer to the real measured situation. [J180]

"Foreword to the Special Issue on Subsurface Sensing Using Ground-Penetrating Radar (GPR)"

The 17 papers in this special issue focus on subsurface sensing using ground-penetrating radar (GPR). These papers describe new approaches to subsurface sensing, including developments in electromagnetic wave propagation imaging/inversion of GPR data and antenna/radar technologies. Associated applications range from glaciology to pavement evaluation to landmine detection. [J181]

"On the Effect of a Random Access Protocol on the Performance of the Session-Based Data Subsystem in GSM/GPRS"

Research into mixed services in mobile cellular networks is highly topical. Session-based applications (e.g., Web browsing) form significant and increasing data traffic in cellular networks. In such mixed services, random access (RA) protocols impose significant effects in performance metrics of the new data users. To date, analytical facility has been limited by the absence of closed-form models for the RA protocols that exist in time-division multiple access (TDMA) cellular networks with mixed voice (as circuit switched) and data with finite number of sessions (as packet switched). In this novel paper, we research an RA protocol based on S-Aloha with data as a session for mobile TDMA cellular networks and present an analytical framework. This work is germane to Global System for Mobile Communications/General Packet Radio Service systems. This paper begins with a general model description of a voice and data subsystem, and an explanation of its admission schemes. As well as the model, an analytical framework based on equilibrium point analysis is derived, and an algorithm is then formulated to complement the analytical framework. Using this novel analytical framework, together with the associated algorithm, performance metrics of the system such as throughput, mean access delay, and mean delay in the queue are obtained. Stability conditions are also highlighted. Numerical results are corroborated using simulation. [J182]

"Broadcast Approach for UMTS Mobility Database Recovery"

The universal mobile telecommunications system (UMTS) provides high bandwidth packet data services to mobile users. To support mobility management, an MM context is established for every mobile station in its corresponding serving GPRS support node (SGSN). When the SGSN fails, all MM contexts in the SGSN are corrupted. These MM contexts must be recovered or data delivery to the mobile stations will fail. This paper describes a broadcast approach that allows the MS to detect lost MM context in SGSN and therefore speeds up the process for SGSN recovery. We propose an analytic model to evaluate the performance of the broadcast approach. The analytic model is validated against simulation experiments. Based on our study, the network operator can select the appropriate parameter values in the broadcast approach for various traffic conditions. [J183]

"Charging Information Collection Modeling and Analysis of GPRS Networks"

Charging is one of the most important functionalities in a telecommunication service system. In a general packet radio service (GPRS) wireless network, the load of charging information flow depends on the intensity of call traffic and the size of charging records. During busy hours, the GPRS network might not be able to transfer charging records on a timely basis if new charging records are generated too fast. On the other hand, when a call happens, the related charging information must be collected and transferred to the billing system. If a failure of the data link occurs, a secondary data link must be employed to transfer the charging information. However, this redundant operation might result in charging information duplication. This paper formally addresses these two issues. A timed Petri net model is built to support the analysis of the charging system performance versus

various factors when the system works in the normal status, which, in particular, gives the maximum supportable busy hour call attempts of the GPRS network. The Petri net approach is also used to model and verify the correctness of the redundancy operation in case a connection failure occurs. [J184]

"PRICING-BASED APPROACHES IN THE DESIGN OF NEXT-GENERATIONWIRELESS NETWORKS: A REVIEW AND A UNIFIED PROPOSAL"

First Page of the Article [J185]

"Texture Features for Antitank Landmine Detection Using Ground Penetrating Radar"

In this paper, we consider the application of texture features for antitank landmine detection in ground-penetrating-radar data in the difficult scenario of very high clutter environments. In particular, we develop a technique for 3-D texture feature extraction, and we compare the results for landmine/clutter discrimination using classifiers that are built on 3-D as well as on 2-D texture feature sets. Our results indicate performance improvements across several different challenging testing scenarios when using the relevance-vector-machine classifiers that are trained on our 3-D feature sets as compared to the performance using the 2-D texture feature sets. [J186]

"Thin-Pavement Thickness Estimation Using GPR With High-Resolution and Superresolution Methods"

In the field of civil engineering, sounding the top layer of carriageways, i.e., the pavement layer, is classically performed using standard ground-penetrating radar (GPR), whose resolution is bandwidth dependent. The layer thickness is deduced from both the time delays of backscattered echoes and the known dielectric constant of the medium. This paper focuses on superresolution and high-resolution techniques, which serve to improve the time resolution of GPR signals, and presents a parametric technique and five subspace methods, namely, estimation of signal parameters via rotational invariance techniques (ESPRIT), multiple-signal classification (MUSIC) algorithm, Min-Norm, and their polynomial versions root-MUSIC and root-Min-Norm. The performance of these algorithms will be compared in terms of resolution power as well as root-mean-square error on the estimated thickness. The paper also presents the results of computer tests and radar measurements in the far field. [J187]

"GPR Without a Source: Cross-Correlation and Cross-Convolution Methods"

Several formulations exist for retrieving the Green's function from cross correlation of (passive) recordings at two locations. For media without losses, these known formulations retrieve Green's functions from sources on a closed boundary. Until recent, these formulations were only developed for acoustic waves in fluids and elastodynamic waves in solids. Now, Green's function representations for electromagnetic (EM) waves in matter exist and can be exploited for passive ground-penetrating radar (GPR) applications using transient or ambient noise sources, either natural or man-made. We derive general exact EM Green's function retrieval formulations based on cross correlations and cross convolutions of recorded wave fields. For practical applications, simplified forms are derived that directly apply to field recordings due to unknown uncorrelated noise or transient sources. Only naturally present sources are needed, which allows for all kinds of applications of ldquoGPR without a source.rdquo We illustrate the consequences of using the simplified forms for Green's function retrieval with 2-D numerical examples. We show that in dissipative media, the Green's function is most accurately retrieved using the cross-convolution method when the sources are located on a sufficiently irregular boundary. [J188]

"A Novel Directional Borehole Radar System Using Optical Electric Field Sensors"

A directional borehole radar system using an array antenna connected to passive optical electric field sensors was developed and evaluated by laboratory and field experiments. This system uses a single dipole antenna for a transmitter and a four-dipole element circular array for a receiver. The received signals are transmitted through optical fibers from optical electric field sensors. The receiver array measures the phase differences between four dipole antennas and estimates the azimuth direction of the incoming reflection wave. The accuracy of the phase measurement was first evaluated in a laboratory test and then tested in a field experiment. To compensate for the sensitivity differences among the sensors, we propose an in situcalibration technique. The dominant operating frequency of the system is 70 MHz. Subsequently, we used borehole radar for subsurface measurements in a vertical borehole in granite. Estimation of the azimuth orientations of subsurface fractures was successfully demonstrated. [J189]

"Localization of the Interfaces of a Slab Hidden Behind a Wall"

In this paper, a 1-D inverse-scattering problem laying within the framework of through-wall imaging is addressed.

In particular, the problem of localizing the interfaces of a slab hidden behind an obstacle, another slab whose electromagnetic features and thickness are known, is considered. To this end, an approximate linear mathematical relationship between the scattered field and the unknown slab-interface positions is stated. Such an approximate relationship arises from neglecting the multiple-reflections between the two unknown slab's interfaces and between the slab and the obstacle. The unknown locations of the slab's interfaces are represented as the support of Dirac-delta functions, and the problem is cast as the inversion of a linear integral operator whose inversion is achieved by means of the Truncated-Singular-Value-Decomposition (TSVD) inversion scheme. The effect of the parameters of the obstacle on the inversion algorithm and the performances achievable by the solution approach are assessed by exploiting synthetic data. Furthermore, a comparison with the reconstructions obtained under the Born approximation and with the time-backscattered field is achieved. Finally, results obtained by employing experimental data collected owing to a stepped-frequency ground-penetrating radar system are also presented. [J190]

"Fundamental and Higher Mode Inversion of Dispersed GPR Waves Propagating in an Ice Layer"

Dispersion of ground-penetrating radar (GPR) waves can occur when they are trapped in a layer. In this paper, we analyze the modal propagation of GPR pulses through a layer of ice that is overlying water. Dispersed transverse electric (TE) waves that are trapped in the waveguide have larger amplitudes than the critically refracted waves that travel through air, whereas the transverse magnetic (TM) critically refracted waves traveling through air are more dominant than the trapped dispersed TM waves. This can be explained by the leaky waveguide behavior of the ice layer. The reflection coefficients for the waves incident on the ice-water interface show that the TM modes are more leaky than the TE modes. Still, clear dispersion is observed in both cases, which depends on the permittivity and thickness of the ice. Similar to inversion of dispersed Rayleigh waves, these parameters can be estimated by calculating phase-velocity spectra, picking dispersion curves, and inverting the dispersion curves using a combined local and global minimization procedure. Synthetic data show several higher order modes of which separate and combined inversions return the input modeling parameters accurately. Experimental data acquired on a frozen lake show strong dispersion for the TE and TM modes. The phase-velocity spectra of the field data show three TE and four TM modes of which separate and combined inversion of different modes return similar values for the ice thickness and known permittivity of ice. Due to the more leaky behavior of the TM modes, the TE inversion is better constrained and more suitable for inversion. [J191]

"A Novel Direction-Finding Algorithm for Directional Borehole Radar"

A directional borehole radar system has been developed for the purpose of 3-D imaging of subsurface targets in a single-hole measurement. The radar system is equipped with a uniform circular array consisting of four dipole antennas as a receiver in order to realize azimuth bearing sensitivity. We propose a new direction-finding (DF) algorithm that is suitable for directional borehole radar measurement, and we apply this algorithm to actual field measurement data. This algorithm is based on the Adcock DF antenna principle where the complex time series (analytic signal) expression, the optimization, and the filtering procedure are incorporated to provide more accurate estimation. The algorithm was first verified in a transmission measurement in boreholes with a cross-hole configuration (15 m apart from each other) by estimating a direction of the incident wave from a transmitter to the receiver. Finally, the algorithm was applied to single-hole measurement data to demonstrate the ability to detect the 3-D location of a subsurface tunnel which was located 5.5 m from the borehole. The result showed fairly good agreement with the actual location of the tunnel, i.e., to an azimuth estimation error of within 10deg. [J192]

"Improving GPR Image Resolution in Lossy Ground Using Dispersive Migration"

As a compact wave packet travels through a dispersive medium, it becomes dilated and distorted. As a result, ground-penetrating radar (GPR) surveys over conductive and/or lossy soils often result in poor image resolution. A dispersive migration method is presented that combines an inverse dispersion filter with frequency-domain migration. The method requires a fully characterized GPR system including the antenna response, which is a function of the local soil properties for ground-coupled antennas. The GPR system response spectrum is used to stabilize the inverse dispersion filter. Dispersive migration restores attenuated spectral components when the signal-to-noise ratio is adequate. Applying the algorithm to simulated data shows that the improved spatial resolution is significant when data are acquired with a GPR system having 120 dB or more of dynamic range, and when the medium has a loss tangent of 0.3 or more. Results also show that dispersive migration provides no significant advantage over conventional migration when the loss tangent is less than 0.3, or when using a GPR system with a small dynamic range. [J193]

"Walled LTSA Array for Rapid, High Spatial Resolution, and Phase-Sensitive Imaging to Visualize

Plastic Landmines"

We propose a walled linearly tapered slot antenna (LTSA) array to visualize plastic landmines. Previously, we reported an adaptive nonlinear visualization system based on a complex-valued self-organizing map (CSOM) that deals with complex amplitude texture in reflection images at multiple frequencies. The system distinguishes landmines from clutter by paying attention to textural features obtained by high spatial resolution and wideband reflection measurement. Because the system employed a mechanical scan of a pair of horn antennas, the measurement required a long time. An array antenna can reduce the time. The antenna element to be used there should therefore be compact and wideband. This paper reports the design and fabrication of a walled LTSA array visualization system. The antenna element has a 14 times 28 mm aperture size, and works at the 8-12 GHz frequency band. Because the structure is a simple combination of glass epoxy substrates and metal plates, we can easily fabricate low-cost and lightweight arrays. Electrical switches realize a high-speed scanning of 12 times 12 = 144 elements in total. We also report the results of a visualization experiment, in which plastic landmines are clearly visualized with the array in combination with the adaptive CSOM processing. Detection of landmines at frequencies of 10 GHz is only likely to be possible for targets buried a few centimeter deep or where the soil attenuation is very low. This might be a severe limitation of applicability of the method, as in field conditions soil attenuations of 10 dB or considerably more are commonly encountered, requiring the radar to operate at frequencies below 2-3 GHz. The best solution may be a multisensor system comprising these complementary high- and low-frequency radars. [J194]

"Wave Interferometry Applied to Borehole Radar: Virtual Multioffset Reflection Profiling"

Based on wave-interferometry principles, we describe a procedure to synthesize monostatic and multioffset borehole radar reflection data from cross-hole radar tomography data. The procedure is equivalent to placing multiple transmitting sources in the receiving hole and conducting wide-angle reflection and refraction surveys. The procedure is illustrated using transmission and reflection data generated by numerical simulation of electromagnetic waves for a simple fracture model. The numerically simulated reflection data compare favorably with the reflection data synthesized using the wave-interferometry method. An experimental test of this procedure is also applied to a piece of field data from a pair of boreholes in crystalline igneous bedrock. The results demonstrate the potential of practical use of wave-interferometry methods for extracting reflection information from cross-hole radar tomography data. [J195]

"Accurate Determination of Underground GPR Wavefront and B-Scan Shape From Above-Ground Point Sources"

While the determination of the wavefront shape radiated by ground-penetrating radar (GPR) in contact with the ground is trivial, the refraction of rays at the ground surface from a point source in the air makes accurate determination of the transmitted wavefront challenging. Impulse GPRs usually have their emitters in air, transmitting waves through a quasi-planar interface into the soil. The waves radiated initially in air can be approximated as circular, but once they enter the soil half-space, they propagate with a wavefront shape that resembles a hyperbola. The exact shape is derived and shown to be well approximated by a hyperbola with specific parameters depending on the relative dielectric constant of the half-space epsiv' (= n2), the height of the source h, and the propagation time from source to wavefront multiplied by the wave velocity in the half-space p. A correction formula is provided to reduce the error between the approximate hyperbola and the exact shape. In addition, an equation for the shape of the B-scan contour of a point scatterer is derived. [J196]

"PTT packet delay analysis for GPRS/GSM links"

Push-to-talk (PTT) is a new mobile service that enables fast-access and two-way communication between two or more users. This paper develops an approximate evaluation model for PTT delay performance in GPRS/GSM networks based on a quasi-stationary assumption and an M/G/1 processor sharing queueing model. Numerical results are presented in order to illustrate the effect of traffic load and other design parameters on PTT packet delay [J197]

"QoS support on fourth generation networks"

The arrival of fourth generation mobile networks, based on IP core networks, lead us to the development of certain services, such as: Quality of service, mobility and AAA. This paper proposes architecture to supply quality of service support based in the differentiated services technique, known as Diffserv. In the same way we analyze the main components of this architecture: QoS Broker (central policy broker of quality of service, whose goal is the appropriate configuration of the routers in the network), Access Router (in charge of the management of the queuing system in order to provide QoS) and the AAA server (management of QoS user profiles). [J198]

"Baseband and audio mixed-signal front-end IC for GSM/EDGE applications"

A complete mixed-signal front-end CMOS chip is presented, supporting GSM/EDGE as well as enhanced audio applications. The chosen solution for the transmit section is based on Laurent's approximation of the nonlinear GMSK modulator. This enables burst shaping in the I/Q domain thereby solving the problem of power ramping. Also, up to GPRS class 12 is supported. The receive section on the other hand consists of a low power dual mode continuous-time ΣΔ ADC for I and Q, supporting ZIF and LIF modes of operation and achieving typically 12.5 bit of resolution under production conditions. An on-chip PLL, which supplies all blocks with various clock frequencies, additionally supports clock jitter suppression. The audio section comprises a codec supporting standard formats such as IIS and PCM. It features mono/stereo signaling from various sources in 16bit quality as well as high-drive buffers for 4 Ω single-ended loads (capacitively coupled). The whole chip is powered from a 1.5/2.65 V supply voltage and consumes 22 mW in paging mode. [J199]

"FDTD modeling of a novel ELF Radar for major oil deposits using a three-dimensional geodesic grid of the Earth-ionosphere waveguide"

This paper reports the first application of an optimized geodesic, three-dimensional (3-D) finite-difference time-domain (FDTD) grid to model impulsive, extremely low-frequency (ELF) electromagnetic wave propagation within the entire Earth-ionosphere cavity. This new model, which complements our previously reported efficient 3-D latitude-longitude grid, is comprised entirely of hexagonal cells except for a small, fixed number of pentagonal cells. Grid-cell areas and locations are optimized to yield a smoothly varying area difference between adjacent cells, thereby maximizing numerical convergence. Extending from 100 km below sea level to an altitude of 100 km, this technique can accommodate arbitrary horizontal as well as vertical geometrical and electrical inhomogeneities/anisotropies of the excitation, ionosphere, lithosphere, and oceans. We first verify the global model by comparing the FDTD-calculated daytime ELF propagation attenuation with data reported in the literature. Then as one example application of this grid, we illustrate a novel ELF radar for major oil deposits. [J200]

"Performance of an adaptive feature-based processor for a wideband ground penetrating radar system"

A two-stage algorithm for landmine detection with a ground penetrating radar (GPR) system is described. First, 3-D data sets are processed using a computationally inexpensive pre-screening algorithm which flags potential locations of interest. These flagged locations are then passed to a feature-based processor which further discriminates target-like anomalies from naturally occurring clutter. Current field trial (over 6500 square meters) and blind test results (over 39000 square meters) are presented and these show at least an order of magnitude improvement over other radar system-based detection algorithms on the same test lanes. [J201]

"On the role of measurement configuration in contactless GPR data processing by means of linear inverse scattering"

This paper deals with a linear two-dimensional inverse scattering problem within a half space geometry with data gathered far away from the interface, which is relevant in ground penetrating radar contactless data processing. In particular, the role of the measurement configuration is discussed with regard to the information retrievable from multifrequency data. [J202]

"A Six-Loop Magnetic-Field Exposure System for Extremely Low-Frequency Applications"

This paper describes a versatile exposure system for the reproduction of static and extremely low-frequency (ELF) magnetic fields. The system can be used for in vitro and in vivo experiments. The exposure setup consists of six circular loops, each placed on the face of a cubical box and suitably fed. The paper shows, by means of a genetic-algorithm approach to optimize the degrees of freedom of the system, that such a configuration allows a given magnetic field to be reproduced, with great accuracy, in amplitude, phase, and polarization, on a specific surface of interest. The paper provides details of the design procedure and presents extensive numerical simulations that confirm the validity of the proposed design procedure. [J203]

"Special issue on subsurface sensing using ground penetrating radar (GPR)"

{no data available} [J204]

"The First Fully Integrated Quad-Band GSM/GPRS Receiver in a 90-nm Digital CMOS Process"

We present the receiver in the first single-chip GSM/GPRS transceiver that incorporates full integration of quad-

band receiver, transmitter, memory, power management, dedicated ARM processor and RF built-in self test in a 90-nm digital CMOS process. The architecture uses Nyquist rate direct RF sampling in the receiver and an all-digital phase-locked loop (PLL) for generating the local oscillator (LO). The receive chain uses discrete-time analog signal processing to down-convert, down-sample, filter and analog-to-digital convert the received signal. A feedback loop is provided at the mixer output and can be used to cancel DC-offsets as well to study linearization of the receive chain. The receiver meets a sensitivity of -110 dBm at 60mA in a 1.4-V digital CMOS process in the presence of more than one million digital gates [J205]

"GA design of a thin-wire bow-tie antenna for GPR applications"

A microgenetic algorithm has been applied to design a new ultrawideband thin-wire bow-tie antenna for ground-penetrating radar applications. The broadband performance of the antenna is achieved by resistive loading and by optimizing the number of wires and the angular distances between those wires. The radiation characteristics of the optimized antenna are discussed, and its performance is compared to that of a resistively loaded Wu-King dipole. [J206]

"Special issue on subsurface sensing using ground penetrating radar (GPR)"

{no data available} [J207]

"Electromagnetic reverberation at VHF on wires in uncased water-filled boreholes"

Guided electromagnetic wave pulses were excited on long, thin conducting wires in water-filled, uncased boreholes by a VHF monostatic borehole radar. Reverberations were recorded at the excitation point. Spectral warping focused the dispersed echoes in space-time. Echo patterns are correlated with geological and geotechnical structures, e.g. bedding plane intersections. [J208]

"Demining sensor modeling and feature-level fusion by Bayesian networks"

A method for obtaining the Bayesian network (BN) representation of a sensor's measurement process is developed so that the problems of sensor fusion and management can be approached from a unified point of view. Uncertainty, reliability, and causal information embedded in the sensor data are used to build the BN model of a sensor. The method is applied to model ground-penetrating radar, electromagnetic induction, and infrared sensors for humanitarian demining. Structural and parameter learning algorithms are employed to encode relationships among mine features, sensor measurements, and environmental conditions in the BN model. Inference is used to estimate target features in the presence of heterogeneous soil and varying environmental conditions. A multisensor fusion technique operating on BN models is developed to exploit the complementarity of the sensor measurements. Through the same approach, a BN classifier is obtained to estimate the target typology. The BN models and classifier also compute so-called confidence levels that quantify the uncertainty associated with the feature estimates and the classification decisions. The effectiveness of the approach is demonstrated by implementing these BN tools for the detection and classification of metal and plastic landmines that are characterized by different shape, size, depth, and metal content. Through BN fusion, the accuracy of the feature estimates is improved by up to 64% with respect to single-sensor measurements, and the number of objects that are both detected and classified is increased by up to 62%. [J209]

"Computing the double-bounce reflection coherent effect in an incoherent electromagnetic scattering model"

One of the main limitations of electromagnetic incoherent vegetation models based on the radiative transfer theory concerns their inability to take into account the coherent effect occurring in a double-bounce scattering mechanism. This is particularly important for low-frequency synthetic aperture radar applications over forested areas, where large branch and trunk contributions may be preponderant. In this letter, an easily computable solution based on the reciprocity theorem is proposed. The coherent effect contribution is obtained directly from the radiative transfer incoherent solution through a straightforward correction algorithm. Compared to the classical vector radiative transfer first-order solution, this method provides the exact cross-polarized contribution to the radar cross section or to the polarimetric parameters computation. The theoretical developments are illustrated using electromagnetic full-wave and approximate scattering models. [J210]

"Derivation and comparison of SAR and frequency-wavenumber migration within a common inverse scalar wave problem formulation"

Two common Fourier imaging algorithms used in ground penetrating radar (GPR), synthetic aperture radar (SAR), and frequency-wavenumber (F-K) migration, are reviewed and compared from a theoretical perspective.

The two algorithms, while arising from seemingly different physical models: a point-scatterer model for SAR and the exploding source model for F-K migration, result in similar imaging equations. Both algorithms are derived from an integral equation formulation of the inverse scalar wave problem, which allows a clear understanding of the approximations being made in each algorithm and allows a direct comparison. This derivation brings out the similarities of the two techniques which are hidden by the traditional formulations based on physical scattering models. The comparison shows that the approximations required to derive each technique from the integral equation formulation of the inverse problem are nearly identical, and hence the two imaging algorithms and physical models are making similar assumptions about the solution to the inverse problem, thus clarifying why the imaging equations are so similar. Sample images of landmine-like targets buried in sand are obtained from experimental GPR data using both algorithms. [J211]

"Two-dimensional and three-dimensional NUFFT migration method for landmine detection using ground-penetrating Radar"

Ground-penetrating radar (GPR) has been widely used for landmine detection due to its high signal-to-noise ratio (SNR) and superior ability to image nonmetallic landmines. Processing GPR data to obtain better target images and to assist further object detection has been an active research area. Phase-shift migration is a widely used method; however, its wavenumber space is nonuniformly sampled because of the nonlinear relationship between the uniform frequency samples and the wavenumbers. Conventional methods use linear interpolation to obtain uniform wavenumber samples and compute the fast Fourier transform (FFT). This paper develops two- and three-dimensional migration methods that process GPR data to obtain images close to the actual target geometries using a nonuniform fast Fourier transform (NUFFT) algorithm. The proposed method is first compared to the conventional migration approaches on simulated data and then applied to landmine field data sets. Results suggest that the NUFFT migration method is useful in focusing images, estimating landmine structure, and retaining relatively high signal-to-noise ratio in the migrated data. The processed data sets are then fed to the normalized energy and least-mean-square-based anomaly detectors. Receiver operating characteristic curves of data sets processed by different migration methods are compared. The NUFFT migration shows potential improvements on both classifiers with a reduced false alarm rate at most probabilities of detection. [J212]

"Special issue on subsurface sensing using ground penetrating radar (GPR)"

{no data available} [J213]

"Connection failure detection mechanism of UMTS charging protocol"

In Universal Mobile Telecommunications System (UMTS), the extension of GPRS tunneling protocol called GTP' is utilized to transfer the charging data records (CDRs) from GPRS support nodes (GSNs) to charging gateways (CGs). To ensure that the mobile operator receives the charging information, availability for the GTP' transmission is essential. One important issue on GTP' availability is connection failure detection. It is desirable to select appropriate parameter values to avoid false failure detections (e.g., temporary network congestions) while to detect the true failures quickly. We propose an analytic model to compute the false failure detection probability and the expected true failure detection time. Based on our study, the network operator can select the appropriate parameter values for various traffic conditions to reduce the probability of false failure detection and/or true failure detection time. [J214]

"Channel allocation for priority packets in the GPRS network"

As the general packet radio service (GPRS) network begins to provide such as "push-to-talk" (PTT) service, delay-sensitive packets should be given higher priority in transmission. In this paper, we study two channel allocation schemes that implement priority queues for priority packets in the GPRS network: bitmap channel allocation (BCA) and uplink state flag channel allocation (USFCA). Our study shows that the transmission delay of priority packets in the GPRS network can be better guaranteed using USFCA [J215]

"An Investigation of Some Geometrical Shapes and Selection of Shielding and Lumped Resistors of Planar Dipole Antennas for GPR Applications Using FDTD"

A ground-penetrating radar (GPR) antenna system is modeled using the three-dimensional finite-difference time-domain technique. This paper investigates some basic geometrical shapes for planar dipoles to find what shape gives the best performance for GPR applications. The antenna is resistor loaded and shielded by a rectangular conducting cavity to suit the application. The effect of adding a wave-absorbing coat to the shield is also studied. Furthermore, a genetic algorithm is used to optimize the cavity height and the resistor values [J216]

"A Microwave Tomographic Imaging Approach for Multibistatic Configuration: The Choice of the Frequency Step"

This paper deals with the application of a frequency-domain microwave-tomography-imaging algorithm to a multibistatic configuration in ground-penetrating-radar applications. First, the authors formulate the inverse problem as a linear one by exploiting the Born approximation. Then, the reconstruction capabilities of the solution algorithm are investigated, and an optimal frequency step to be adopted for the reconstruction is discussed and determined. Finally, inversion results are presented with synthetic data obtained from time-domain simulations and then Fourier transformed in frequency domain [J217]

"Parametric Inversion Technique for Location of Cylindrical Structures by Cross-Hole Measurements"

A new parametric inversion technique to locate cylindrical structures has been developed for borehole radar cross-hole measurements. The technique calculates prediction errors, focusing on curve shapes of first-arrival times, and explicitly uses known parameters on a target. Two schemes to compare the measured first-arrival time curves with the calculated ones are proposed. One is by taking the errors between curve gradients of measured and calculated first-arrival times, and the other is by taking the cross correlation between calculated first-arrival times and measured data. The schemes do not need to select the true first-arrival times, which makes this inversion technique robust and easy to use. This technique is validated with synthetic data sets modeling a metallic pipe in homogeneous and heterogeneous medium models. By both models, the inversion technique is able to retrieve the exact location of the pipe, though it employs a rather simple forward model, which can be solved by only geometrical calculations. The technique is applied to measured data sets, and it successfully estimates a pipe location in good agreement with known information. The inversion is also used for an air-filled subsurface cavity with a very simplified forward model, which considers only Snell's law at the cavity-subsurface media interface. It is also able to locate the cavity at a similar location estimated by other conventional techniques [J218]

"A Microwave Tomography Approach for a Differential Configuration in GPR Prospecting"

The capabilities of a microwave inverse scattering algorithm for ground penetrating radar (GPR) data processing are analyzed. The algorithm is based on the Born approximation (BA) and exploits a differential measurement configuration. This configuration exploits measurements achieved as the difference of the electrical fields gathered in two symmetrical positions with respect to the source. We will discuss how this choice allows to mitigate some bad effects of uncertainties on the knowledge of the background scenario but, on the other hand, affects in a negative way the properties of the relevant scattering operator [J219]

"Parking 2.0"

A host of new smart parking technologies are helping municipalities meet their twin aims of collecting revenue for city services and preventing a small number of cars from monopolizing a limited number of parking slots. These advances are also benefiting motorists by making the tasks of finding a space and paying to park less of a hassle. Some examples include the solar-powered smart meters which allow drivers to pay for parking with coins, credit or debit cards, or smart cards preloaded with money, and the use of wireless communications to let drivers pay for parking in advance, reserve a space, or add additional time from wherever they are. Other innovations allow drivers to use their personal computers or cellphones to select and reserve parking slots well in advance [J220]

"Inspection of Internal Structure of Walls by Subsurface Radar"

This paper deals with the application of ultra-wide band time-domain subsurface radars, equipped with special signal processing techniques, to realize non-invasive image testing of the building walls' internal structure that are made with brick, stone, concrete, reinforced concrete, and other construction materials. There are two normally associated problems: qualitative and quantitative, considered. Limitations and shortcomings of radar imaging, due to inherent physical features as well as signal processing improving the quality of radar images, are discussed. Actual field data are used to illustrate applications of subsurface radar for non-destructive testing of walls' internal regions [J221]

"Strategy of GPR Searching for Low Radar Contrast Plastic Pipes in Ground"

The results of computer simulation of pulse signal scattering by a plastic pipe buried in the ground as well as simulation results of ground penetrating radar (GPR) image of ground-filled trenches have been represented in

the work. The "skeleton diagram" of a trench image has been developed. The strategy of GPR searching for low radar contrast plastic pipes in ground (in back-filled trenches) has been considered on the basis of indirect criterion which is the existence of a trench containing buried pipes [J222]

"Design and Development of a Generic Information System based on Event Notifications Applied to Multiple Devices"

The present article deals with the problems existing in managing traffic delivery of information to devices that have different characteristics and needs. Initially, there is a general proposal for the design of an information platform with events. Flexibility and escalability are the main requirements of the platform. An architecture that is independent from the information source being used has been first suggested as well as an architecture of the user's devices types the system is being addressed at. Next, the implementation of the platform has been described tha is intended to create a traffic alert service to send email notifications and phone calls. [J223]

"Home agent placement and IP address management for integrating WLANs with cellular networks"

Seamless roaming between cellular networks (3G or upcoming 4G) and wireless local area networks can be provided using Mobile IP. However, GPRS/UMTS and 802.11-based WLAN networks have no native support for mobile IP. Mobile IP requires the deployment of home agents and a protocol between the mobile nodes, home agent, and corresponding nodes. We address the home agent placement and home address assignment issues for supporting mobile IP for heterogeneous roaming. Placement techniques for mobile IP home agents are presented including dynamic HA assignment in either WLAN or cellular network domains using the diameter mobile IP application. Next, we present several IPv4 home address assignment schemes for mobile nodes visiting in the WLAN domain such as NAT/NAPT traversal, reverse tunneling, and mobile VPNs. It is shown that HA placement and address management are orthogonal, and any combination is possible. Various architectures for both issues are evaluated against the optimal solutions [J224]

"Immunity tests of implantable cardiac pacemaker against CW and pulsed ELF fields: experimental and numerical results"

The aim of the present work is to investigate pacemaker (PMK) immunity against high-level extremely low frequency (typically 50 Hz) magnetic fields that can be found in industrial environment where high power machines operate. To that purpose, a test bench has been set up using a Helmholtz coil for producing extremely low frequency magnetic fields and a trunk simulator rightly fed by cardiac signals. A widely used PMK was tested, and results have been reported, under different operating conditions, for both continuous waves and variously pulsed excitations. A numerical tool has also been developed to analyze the realized test bench, based on a proper discretization of a human trunk simulation and on the construction of an equivalent three-dimensional (3-D) network. Numerical results have showed a good agreement with the experimental results [J225]

"Improvements of Complex-Valued Hopfield Associative Memory by Using Generalized Projection Rules"

In this letter, new design methods for the complex-valued multistate Hopfield associative memories (CVHAMs) are presented. We show that the well-known projection rule proposed by Personnaz can be generalized to complex domain such that the weight matrix of the CVHAM can be designed by using a simple and effective method. The stability of the proposed CVHAM is analyzed by using energy function approach which shows that in synchronous update mode the proposed model is guaranteed to converge to a fixed point from any given initial state. Moreover, the projection geometry of the generalized projection rule (GPR) is discussed. In order to enhance the recall capability, a strategy of eliminating the spurious memories is also reported. The validity and the performance of the proposed methods are investigated by computer simulation [J226]

"Landmines Ground-Penetrating Radar Signal Enhancement by Digital Filtering"

Until now, humanitarian demining has been unable to provide a solution to the landmine removal problem. Furthermore, new low-cost methods have to be developed quickly. While much progress has been made with the introduction of new sensor types, other problems have been raised by these sensors. Ground-penetrating radars (GPRs) are key sensors for landmine detection as they are capable of detecting landmines with low metal contents. GPRs deliver so-called Bscan data, which are, roughly, vertical slice images of the ground. However, due to the high dielectric permittivity contrast at the air-ground interface, a strong response is recorded at an early time by GPRs. This response is the main component of the so-called clutter noise, and it blurs the

responses of landmines buried at shallow depths. The landmine detection task is therefore quite difficult, and a preprocessing step, which aims at reducing the clutter, is often needed. In this paper, a difficult case for clutter reduction, that is, when landmines and clutter responses overlap in time, is presented. A new and simple clutter removal method based on the design of a two-dimensional digital filter, which is adapted to Bscan data, is proposed. The designed filter must reduce the clutter on Bscan data significantly while protecting the landmine responses. In order to do so, a frequency analysis of a clutter geometrical model is first led. Then, the same process is applied to a geometrical model of a signal coming from a landmine. This results in building a high-pass digital filter and determining its cutoff frequencies. Finally, simulations are presented on simulated and real data, and a comparison with the classical clutter removal algorithm is made [J227]

"Modeling and Migration of 2-D Georadar Data: A Stationary Phase Approach"

This paper presents the basic kinematic and dynamic imaging and migration equations for zero-offset two-dimensional georadar profiling. The kinematic equations are derived from simple considerations of spatial impulse responses and a generating function. The dynamic equations follow from a multidimensional stationary phase approximation to the infinite spectral integrals. They show how the radar signal (amplitude and phase) depends on the shape and curvature of the reflector. The imaging equations are evaluated for the special cases of a point scatterer, a continuous reflector, and a terminating reflector. A general formula is developed by which to migrate an arbitrary shaped event of variable amplitude on the georadar section [J228]

"Double-Sided Exponentially Tapered GPR Antenna and Its Transmission Line Feed Structure"

A double-sided broadband antenna for applications including ground-penetrating radar for detecting buried target is described. When compared with traditional coplanar-strip antennas, a better performance is achieved with a more practical design for construction. The steps in the design procedure are demonstrated herein. In addition, using incremental segments of current elements, a distributed dipole array model is derived and presented for determining S11in the time domain and for determining the radiation pattern of this antenna. By comparing measured results and HFSS simulations, our straightforward dipole array model of the more complicated antenna structure is justified by the accuracy of the results obtained. Finally, an experimental example is presented to show that this antenna in a GPR system application is effective in detecting even small plastic targets [J229]

"Mobile services interworking for IMS and XML webservices"

An approach for interoperability between IMS and WebServices deployed within the IMS domain through the introduction of session management techniques for stateless WebServices based on existing SIP session management mechanisms is presented. The approach enables integration of WebServices applications into future telecommunications systems without the need for explicit usage of IMS/SIP protocols [J230]

"ELF Radar System Proposed for Localized D-Region Ionospheric Anomalies"

This letter proposes a novel extremely low frequency (ELF) radar for localized D-region (altitude < 95 km) ionospheric anomalies that have been generated by natural geophysical processes. The proposed system would use the former U.S. Navy Wisconsin Transmitting Facility as a distant well-characterized impulsive ELF source. Sample calculations that demonstrate how passive vertical E-field detectors could characterize ionospheric conductivity depressions of variable diameter located above Los Angeles are provided. These calculations have been obtained using our recently developed three-dimensional whole-Earth electromagnetic wave propagation model based upon the rigorous finite-difference time-domain solution of Maxwell's equations. A key potential application of the proposed ELF radar system is the detection of hypothesized ionospheric earthquake precursors [J231]

"Properties of surface waveguides derived from inversion of fundamental and higher mode dispersive GPR data"

Thin surface layers of high-permittivity material (e.g., water-saturated soil) can cause a pronounced dispersion of ground-penetrating radar waves. The dispersion characteristics depend on the permittivity and thickness of the effective surface waveguide and the permittivity of the material below it. As for the analogous seismic case, the values of these parameters can be estimated by applying a scheme that includes calculating the phase-velocity spectra, picking dispersion curves from the spectra, and inverting the dispersion curves using a combined local and global minimization procedure. Here, this scheme is extended by incorporating higher order modes. Explicit expressions for the cutoff frequencies of the fundamental and higher order transverse electric (TE) and transverse magnetic (TM) modes are derived. These expressions demonstrate that the cutoff frequency decreases as the thickness and/or permittivity of the waveguide increase and/or the permittivity of the lower half-space decreases. In addition, the TE cutoff frequencies are shown to be generally lower than the TM cutoff

frequencies. Numerical modeling of realistic models demonstrates the presence of the higher order modes with the correct cutoff frequencies. Application of the modified inversion scheme to synthetic and field data demonstrates its efficacy in providing the required physical property information. In particular, better-constrained models are obtained by including higher order modes in the inversion [J232]

"A receiver-based vertical handover mechanism for TCP congestion control"

We propose and evaluate a vertical handover mechanism for TCP, based on receiver bandwidth delay product (BDP) measurement and congestion control using the receiver's advertised window. It addresses the negative impact of abrupt changes in link capacity and latency on TCP performance during make-before-break vertical handover in heterogeneous networks, enabling TCP to seamlessly adapt to new conditions. It resolves the problem of buffer overflow in a low capacity network on handover from a high capacity network, and the under-utilisation problem on handover in the reverse direction. All modifications are restricted to the mobile device, and the proposed technique is fully interoperable with existing TCP and mobile IP infrastructure. It maintains end-to-end semantics, supports IP security, and can be easily deployed [J233]

"Linear and Nonlinear Microwave Tomography Approaches for Subsurface Prospecting: Validation on Real Data"

In this letter, the capabilities of two tomographic approaches for subsurface prospecting have been tested against laboratory-controlled data. The first approach is a noniterative method based on the Born approximation, while the second one is a nonlinear iterative approach. Despite some simplifications adopted in modeling the scenario, both approaches have provided satisfying results. [J234]

"A novel ELF radar for major oil deposits"

This letter proposes a novel extremely low frequency (ELF) radar for major oil deposits. Using our recently developed whole-Earth electromagnetic wave propagation model based upon the finite-difference time-domain method, we have determined that detection of the radial (vertical) component of the scattered H-field provides a sensitive means to detect oil fields that are located within several kilometers of the Earth's surface. As an example, we provide numerical simulations of ELF radar returns from a hypothetical Alaskan oil field excited by a 20-Hz pulse emitted from the former U.S. Navy site in Wisconsin. The proposed method would potentially provide means to rapidly and inexpensively conduct aerial surveys of thousands of square kilometers for significant oil deposits. [J235]

"Caching in I-CSCF of UMTS IP multimedia subsystem"

Field=03 -The IP multimedia core network subsystem (IMS) provides multimedia services for Universal Mobile Telecommunications System (UMTS). In IMS, any incoming call will first arrive at the interrogating call session control function (I-CSCF). The I-CSCF queries the home subscriber server (HSS) to identify the serving CSCF (S-CSCF) of the called mobile user. The S-CSCF then sets up the call to the called mobile user. This paper investigates the performance of the IMS incoming call setup. We also propose cache schemes with fault tolerance to speed up the incoming-call-setup process. Our study indicates that the I-CSCF cache can significantly reduce the incoming-call-setup delay, and checkpointing can effectively enhance the availability of I-CSCF. [J236]

"Special issue on subsurface sensing using ground penetrating radar (GPR)"

{no data available} [J237]

"An abrupt change detection algorithm for buried landmines localization"

Ground-penetrating radars (GPRs) are very promising sensors for landmine detection as they are capable of detecting landmines with low metal contents. GPRs deliver so-called Bscan data which are, roughly, vertical slice images of the ground. However, due to the high dielectric permittivity contrast at the air-ground interface, a strong response is recorded at early time by GPRs. This response is the main component of the so-called clutter noise and it blurs the responses of landmines buried at shallow depths. The landmine detection task is therefore quite difficult. This paper proposes a new method for automated detection and localization of buried objects from Bscan records. A support vector machine algorithm for online abrupt change detection is implemented and proves to be efficient in detecting buried landmines from Bscan data. The proposed procedure performance is evaluated using simulated and real data. [J238]

"Short-pulse three-dimensional scattering from moderately rough surfaces: a comparison between narrow-waisted Gaussian beam algorithms and FDTD"

In this paper, with reference to short-pulse three-dimensional scattering from moderately rough surfaces, we present a comparison between Gabor-based narrow-waisted Gaussian beam (NW-GB) and finite-difference time-domain (FDTD) algorithms. NW-GB algorithms have recently emerged as an attractive alternative to traditional (ray-optical) high-frequency/short-pulse approximate methods, whereas FDTD algorithms are well-established full-wave tools for electromagnetic wave propagation and scattering. After presentation of relevant background material, results are presented and discussed for realistic parameter configurations, involving dispersive soils and moderately rough surface profiles, of interest in pulsed ground penetrating radar applications. Results indicate a generally satisfying agreement between the two methods, which tends to improve for slightly dispersive soils. Computational aspects are also compared. [J239]

"Resonance analysis of a circular dipole array antenna in cylindrically layered media for directional borehole radar"

In this paper, we discuss the influence of a resonance on estimating direction of arrival (DOA) with a circular dipole array in a borehole (CAB). The resonance is caused by the phase-sequence of currents on the dipole antennas. Making use of method of moments (MoM) analysis, we predict resonant frequencies of the CAB and describe a mechanism for the resonance theoretically, making use of the fact that a plane wave can be broken down into cylindrical harmonics. In order to examine the agreement between the MoM and experimental data, we propose a signal processing method to extract phase-sequence components from the actual received array signal. This method is useful for confirming excitation of the phase-sequence resonance in experimental data, as predicted by the MoM. Using the MoM, we examine the influence of the resonances on DOA estimation, and we conclude that the resonances give some spurious solutions. In order to confirm these results, we conduct experiments at a field test site. We arrange the CAB, which consisted of seven receiving dipole antennas. In this experiment, a plane wave is incident on the CAB from a transmitter in another borehole. We apply the proposed signal method, and the measured results demonstrate the existence of the phase-sequence resonance in a physically real CAB. The spurious solutions found to occur in the DOA estimation at the resonant frequencies are also found experimentally. [J240]

"Joint design of optimum partial response target and equalizer for recording channels with jitter noise"

We address joint design of optimum generalized partial response (GPR) target and equalizer for perpendicular recording channels with jitter noise. We develop a new cost function which accounts for the data-dependent nature of jitter noise based on the minimum mean square error (MMSE) criterion. Using the step-response-based channel model, we derive expressions for the statistics required to compute the optimum equalizer and target in the presence of jitter noise. We also derive a bit-response-based model for the jitter noise channel. We present an approach for doing simulations as well as analytical computations for the jitter noise channel without resorting to the widely used Taylor series approximations. Our computational and simulation results show that, while the targets designed without accounting for the jitter lead to error-floor effect in the bit-error-rate performance, the targets designed by our approach give significant performance improvement under high jitter conditions, with no sign of error-floor effect for the range of signal-to-noise ratios considered. [J241]

"Special Issue on subsurface sensing using Ground Penetrating Radar (GPR)"

{no data available} [J242]

"Accounting for the effects of widespread discrete clutter in subsurface EMI remote sensing of metallic objects"

In practice, most signal processing strategies for discrimination of buried objects are clutter limited. This applies even to discrimination of shallow sizable metallic objects, such as unexploded ordnance (UXO), which are to be found predominantly in the top meter of soil. The environment typically features widespread metallic clutter from detonated ordnance or other sources. Such fragments can be numerous and are often shallower than the objects of interest. Currently, the preeminent remote sensing mode for buried UXO is ultrawideband electromagnetic induction (EMI), operating over part or all of the band from some tens of hertz up to perhaps hundreds of kilohertz. Particularly because EMI fields fall off sharply with range, signals from shallow clutter may be relatively strong and can easily obscure essential scatterer signatures. To treat this, a rational theory of EMI scattering from widespread metallic clutter is formulated and tested. For dense, well-distributed clutter, analytical rules are derived for dependence of signal strength on sensor elevation, under various fundamental excitation types. For more erratic, sparse clutter distributions, signal statistics from Monte Carlo simulations show patterns like those

from the analytical rules. The dependence of clutter signal magnitude on antenna elevation is determined for both thin surface layers and for volume layers of widespread small items, and for both dense and sparse clutter distributions. These are contrasted with the patterns expected from single, larger, discrete objects of interest, and the contrast is exploited in discrimination exercises for the screening problem. For sparse clutter distributions, results from inversion processing formulations that account for the patterns of clutter statistics are compared to simple least squares treatments. [J243]

"Special issue on subsurface sensing using ground penetrating radar (GPR)"

{no data available} [J244]

"Beyond physical optics SVD shape reconstruction of metallic cylinders"

We consider the problem of reconstructing the shape of perfectly conducting cylinders under the physical optics approximation. For direct scattering, physical optics provides small model errors when the scatterers are convex, smooth, have large radii of curvature as compared to the impinging wavelength, and are noninteracting. In this paper, we investigate whether these hypotheses can be relaxed for the inverse problem. In particular, we consider three classes of scatterers (circular cylinder with radius smaller than the wavelength, multiple cylinders, and a concave cylinder) and we show that for them the model error is provided by a multiplicative almost frequency-independent factor. Since this factor can be incorporated within the unknown distribution representing the scatterers' illuminated boundaries, then we are able to show that successful reconstructions also beyond the physical optics limits can be obtained. [J245]

"Windtalker [Jelectronic travel guide]"

This article discusses the development of a concept for utilizing abundant human intelligence resources in a shared network over the Internet. Windtalker is a concept that will help people solving the problem of understanding the local culture and language in order to make the trip of a traveler comfortable. By utilizing current Internet, PDA, and wireless networks, the windtalker system virtually brings the bilingual volunteer to the traveler in need. Windtalker servers will find for the traveler a person online who can help with the interpretation. The concept is not limited to language service and is also viable for more extensive human interactions. Future development of windtalker will be focused on making the system architecture more open and user friendly. [J246]

"Risk-based technology portfolio optimization for early space mission design"

The successful design, development, and operation of space missions requires informed decisions to be made across a vast array of investment, scientific, technological, and operational issues. In the work reported in this paper, we address the problem of determining optimal technology investment portfolios that minimize mission risk and maximize the expected science return of the mission. We model several relationships that explicitly link investment in technologies to mission risk and expected science return. To represent and compute these causal and computational dependencies, we introduce a generalization of influence diagrams that we call inference nets. To illustrate the approach, we present results from its application to a technology portfolio investment trade study done for a specific scenario for the projected 2009 Mars MSL mission. This case study examines the impact of investments in precision landing and long-range roving technologies on the mission capability, and the associated risk, of visiting a set of preselected science sites. We show how an optimal investment strategy can be found that minimizes the mission risk given a fixed total technology investment budget, or alternatively how to determine the minimum budget required to achieve a given acceptable mission risk. [J247]

"Strategy of GPR Searching for Low Radar Contrast Plastic Pipes in Ground"

The results of computer simulation of pulse signal scattering by a plastic pipe buried in the ground as well as simulation results of Ground Penetrating Radar (GPR) image of ground-filled trenches have been represented in the work. The "skeleton diagram" of a trench image has been developed. The strategy of GPR searching for low radar contrast plastic pipes in ground (in back-filled trenches) has been considered on the basis of indirect criterion which is the existence of a trench containing buried pipes. [J248]

"Performance evaluation of a push mechanism for WLAN and mobile network integration"

In this paper, we propose a universal mobile telecommunications system (UMTS) and a wireless LAN (WLAN) interworking solution called WLAN-based general packet radio service (GPRS) support node (WGSN), which allows a UMTS/WLAN dual mode mobile station (MS) to access heterogeneous wireless services. To reduce the power consumption of an MS, most WGSN applications are not activated at the MS, and MS-terminated services, such as incoming voice over IP (VoIP) calls, are not supported. To address this issue, a push

mechanism called session initiation protocol (SIP)-based push center (SPC) was implemented in the WGSN node. For an incoming call to an MS, the SPC utilizes the UMTS short message service to activate the SIP User Agent of the MS. We study the performance of the SPC. An analytic model is proposed to derive the expected number of lost calls during the activation period. The analytic results are validated against the simulation experiments. Our study quantitatively indicates how the SPC performance is affected by the activation time and the timeout period, and we also suggest how to select appropriate values of these two factors to optimize the SPC performance. [J249]

"Spectrum considerations for public safety in the United States"

Since the inception of mobile radio, public safety agencies have relied on wireless communication systems to coordinate day-to-day and emergency operations. The decentralized and autonomous nature of the various public safety agencies in the United States has led to the deployment of a variety of systems operating in a fragmented spectrum, ranging from lower VHF to upper UHF. Due to the narrowband technologies used in public safety communications systems, public safety agencies have been limited primarily to voice services and low-speed data transfer on their private networks. In contrast, the commercial cellular sector now offers a large portfolio of services that include voice, messaging, email, Web browsing, picture transfer, video streaming, and other wideband services. In this article, some of the factors driving the expansion of spectrum allocated to public safety agencies arc described. [J250]

"A DLL-biased, 14-bit DS analog-to-digital converter for GSM/GPRS/EDGE handsets"

A 14-bit analog-to-digital converter (ADC) design for GSM/GPRS/EDGE handsets is implemented in 0.25 μm CMOS. The measured SNR/SNDR/DR is 85.2/84.1/88 dB respectively. The modulator and the clock generator consume 1.05 mA from 2.7 V supply. A delay-locked-loop (DLL)-based bias scheme is implemented to guarantee that amplifier slewing takes a fixed percentage of the clock cycle over process corners, temperature, and clock frequency. The proposed biasing scheme is shown to minimize settling error variations and contain design margins. [J251]

"Reconstruction of three-dimensional objects in layered media: numerical experiments"

We have developed a fully three-dimensional electromagnetic inverse scattering technique in a multilayered medium via the contrast source inversion. The key issues on the three-dimensional (3-D) forward and adjoint operations related to the dyadic Green's operators are briefly addressed to ensure the efficient performance of the algorithm in layered media. It is shown that it is feasible to achieve good reconstruction quality with only a few sources and a two-dimensional receiver array, provided that the signal-to-noise ratio is adequate. The effects of the interface and of the uncertainty in the background layered medium are illustrated in the simulation. The developed 3-D electromagnetic inverse scattering technique can be effectively applied to surface ground penetrating radar survey in multilayered media. [J252]

"A gateway approach to mobility integration of GPRS and wireless LANs"

This article presents a gateway approach to the integration of GPRS and wireless LANs (WLANs). The proposed architecture leverages mobile IP as the mobility management protocol over WLANs. The interworking between GPRS and WLANs is achieved by a gateway that resides on the border of GPRS and WLAN systems. The design goal is to minimize the modifications in GPRS and WLANs as both systems are widely available in the market already. By deploying the gateway, users can seamlessly roam among the two systems. The proposed architecture and design principles have been implemented in a commercial GPRS network operated by the Taiwan Cellular Corporation. Empirical experiments with multimedia applications were conducted to analyze the performance in terms of handoff latency, packet delay, and throughput. [J253]

"A 0.25-μm CMOS quad-band GSM RF transceiver using an efficient LO frequency plan"

This paper describes a single-chip CMOS quad-band (850/900/1800/1900 MHz) RF transceiver for GSM/GPRS applications. It is the most important design issue to maximize resource sharing and reuse in designing the multiband transceivers. In particular, reducing the number of voltage-controlled oscillators (VCOs) required for local oscillator (LO) frequency generation is very important because the VCO and phase-locked loop (PLL) circuits occupy a relatively large area. We propose a quad-band GSM transceiver architecture that employs a direct conversion receiver and an offset PLL transmitter, which requires only one VCO/PLL to generate LO signals by using an efficient LO frequency plan. In the receive path, four separate LNAs are used for each band, and two down-conversion mixers are used, one for the low bands (850/900 MHz) and the other for the high bands (1800/1900 MHz). A receiver baseband circuit is shared for all four bands because all of their channel spaces are the same. In the transmit path, most of the building blocks of the offset PLL, including a TX VCO and

IF filters, are integrated. The quad-band GSM transceiver that was implemented in 0.25-μm CMOS technology has a size of 3.3Ч3.2 mm2, including its pad area. From the experimental results, we found that the receiver provides a maximum noise figure of 2.9 dB and a minimum IIP3 of -13.2dBm for the EGSM 900 band. The transmitter shows an rms phase error of 1.4° and meets the GSM spectral mask specification. The prototype chip consumes 56 and 58 mA at 2.8 V in the RX and TX modes, respectively. [J254]

"Consistency in ground potential rise estimation utilizing fall of potential method data"

Analyzing fall of potential (FOP) test data from a grounding system current injection test is the prevalent method used to determine ground potential rise (GPR). Achievable tolerance in analyzing near ideal FOP results using recognized and alternative methods were assessed previously, whereas this paper investigates distortions by buried metallic systems, such as leaky cables and pipelines, based on both simulated and field data. To work correctly with "real" data, pre-conditioning FOP data may be necessary; removing "outliers" due to real world "pathologies" in the earthing system. Applying several "cost" functions to the methods created by the combination of conditioning schemes and FOP response models produced a significant number of estimation methods. To determine the most consistent estimation methods a methodology was developed which assessed all identified methods by comparing the estimates produced with the simulation result. This allowed the most consistent and accurate GPR estimation methods to be identified. [J255]

"Multifunction millimeter-wave systems for armored vehicle application"

There is an emerging need for millimeter-wave capabilities on military vehicles; in order to make such capabilities more affordable, we have been experimenting with the notion of combining multiple functions into a single device. The functions to be performed simultaneously include: 1) active protection (AP) radar for point defense against antitank threats; 2) surveillance radar for airborne and ground targets; 3) trunking radio for mobile ad hoc networking at a high data rate (>100 Mb/s); and 4) combat identification (ID). Due to a unique combination of characteristics, millimeter-wave radios, radars, and other sensors are attractive for military vehicle use. These characteristics include: 1) smaller profile/footprint of the high-gain antennas; 2) adequate weather penetration; 3) antijam, low probability of intercept, low probability of detection; and 4) wide bandwidth. For the combination of applications identified, this need is best met via a system operating near the 35-GHz atmospheric transmission window. Current mobile millimeter-wave ground-based systems (AP radar, wide-band communication, and combat ID) utilize highly directional steerable beams. Mechanical beam steering is usually done, resulting in restricted beam agility. Nevertheless, mechanical beam-steering performance is acceptable for AP radar and combat ID systems (but not for Joint Tactical Radio networked communications). A true multifunction system, however, requires beam-steering speeds that far exceed capabilities of even the best mechanical technologies. This is due to the need to support either networking or simultaneous multifunctions via time-shared beam steering. Thus, a true multifunction system must steer its beam anywhere in the upper hemisphere in less than 1 ms. Phased arrays are the obvious solution to these needs. Unfortunately, past phased-array technologies were unaffordable for Army vehicle application-hence, the multiplicity of systems. However, a new trend in development of affordable phased-array Ka-band antennas enables development of affordable Ka-band multifunction systems. [J256]

"Hierarchical provisioning for cellular networks"

We propose a hierarchical provisioning methodology to balance the network load within each location and routing area, as well as minimize the location and routing area update signaling cost. The hierarchical provisioning methodology consists of four optimization planes for cellular coverage area: 1) cell-oriented intra-SGSN layer, which is optimized routing areas covering the intra-SGSN signaling cost, paging cost, and routing area load balancing; 2) routing area-oriented intra-mobile switching center (MSC) layer, which is optimized location areas covering the intra-MSC signaling cost and location area load balancing; 3) routing area-oriented inter-SGSN layer, which is optimized SGSN coverage areas covering the inter-SGSN signaling cost, RNC, and SGSN load balancing; and 4) location area-oriented inter-MSC layer, which is optimized MSC coverage areas covering the inter-MSC signaling cost and MSC load balancing. We apply the niched Pareto genetic algorithm (GA) to the provisioning problem, which optimizes multiple objectives by incorporating the concept of Pareto domination in its selection operator, and applying a niching pressure to spread its population out along the Pareto optimal tradeoff surface. We then propose a schema-based partially matching crossover using a tournament size, where the crossover pairs are chosen in two steps, first based on the class ranking and then schema ranking. The new offspring are modified using the RA-based for intra- and inter-SGSN layers. [J257]

"Monitoring emerging IPv6 wireless access networks"

Foreseeing a future where IPv6 and mobile terminals play an important role in public access communication

networks, this article introduces a monitoring system capable of identifying relevant traffic flows and tracking them while terminal equipment moves between network attachment points. The mobile flows are characterized and represented so that individual users and flows can perceive the quality of service they receive, and operators can have global traffic views of their heterogeneous access networks. [J258]

"Using smart phones to access site-specific services"

We investigate how smart phones can augment site-specific services-that is, electronic services or applications that reside in a specific location. Site-specific services already exist in the form of ticket machines, electronic information kiosks, interactive product catalogues, and so on. However, integrating users' smart phones into these interactions can enhance service functionality while reducing deployment costs. Our approach offers several benefits. By using personal information stored on smart phones, site-specific services can automatically tailor their actions to suit a particular user. Our research led us to develop the Mobile Service Toolkit: a client-server software framework supporting the development of site-specific services that exploit interaction with smart phones. We discuss the Mobile Service Explorer (MST) and present case studies of two site-specific services implemented using it. [J259]

"Modified wavefront reconstruction imaging formation for stand-off GPEN SAR"

A modified wavefront reconstruction algorithm (MWRA) is proposed for imaging a subsurface layer for a vehicle- or air-borne SAR. The MWRA with refraction and dispersive effect compensation can improve image quality and locating accuracy compared with the traditional one. Associated with the relax-based depth estimation method, the MWRA can provide 3D location information of multiple buried targets. Some simulated results show the effectiveness of the modified algorithm. [J260]

"Reliability of signal processing technique for pavement damages detection and classification using ground penetrating radar"

Ground penetrating radar (GPR) signal processing is a nondestructive technique, currently performed by many agencies involved in road management and particularly promising for soil characteristics interpretation. The focus of this paper is to assess the reliability of an optimal signal processing algorithm for pavement inspection. Preliminary detection and subsequent classification of pavement damages, based on an automatic GPR analysis, have been performed and experimentally validated. A threshold analysis of the error is carried out to detect possible damages and check if they can be predicted, while a second threshold analysis determines the nature of the damage. An optimum detection procedure is performed. It implements the classical Neyman-Pearson radar test. All the settings needed by the procedure have been estimated from training sets of experimental measures. The overall performance has been evaluated by looking at the usual receiver's operating characteristic. The results show that a reasonable performance has been achieved by exploiting the spatial correlation properties of the received signal, obtained from an appropriate analysis of GPR images. The proposed system shows that automatic evaluation of subgrade soil characteristics by GPR-based signal analysis and processing can be considered reliable in a number of experimental cases. [J261]

"An integral method for extremely low frequency magnetic shielding"

A novel approach for analyzing conducting shields of extremely low frequency magnetic fields in linear media is presented. It consists of an integral formulation based on the cell method, expressed in terms of network-like loop currents and magnetic vector potential line integrals on the shield surface. This formulation leads to a considerable reduction of field problem variables, thus limiting the amount of allocated memory and speeding-up the numerical procedure compared to other differential and integral techniques. Eddy currents are computed first, then the magnetic vector potential and the magnetic flux density distributions are evaluated by applying the superimposition principle. A detailed comparison between this method and a three-dimensional finite element method code demonstrates the accuracy of the results and the advantages of the method. [J262]

"Using TCP flow-aggregation to enhance data experience of cellular wireless users"

All over the world Global System for Mobile Communication (GSM) cellular mobile networks have been upgraded to support the "always-on" general packet radio service (GPRS). Despite the apparent availability of levels of bandwidth not dissimilar to that provided by conventional fixed-wire telephone modems, the user experience using GPRS is still considerably poor. In this paper, we examine the performance of protocols such as transmission control protocol (TCP) over GPRS, and show how certain network characteristics interact badly with TCP to yield problems such as: link underutilization for short-lived flows, excess queueing for long-lived flows, acknowledgment bunching, poor loss recovery, and gross unfairness between competing flows. We present the design and implementation of a transparent TCP proxy that mitigates many of these problems

without requiring any changes to the TCP implementations in either mobile or fixed-wire end systems. The proxy is interposed in the cellular provider's network, and splits TCP connections transparently into two halves-the wired and wireless sides. Connections destined for the same mobile host are treated as an aggregate due to their statistical dependence. We demonstrate packet scheduling and flow control algorithms that use information shared between the connections to maximize performance of the wireless link, while interworking with unmodified TCP peers. We also demonstrate how fairness between flows and response to loss is improved, and that queueing and, hence, network latency is reduced. We discuss how TCP enhancing proxies could be transparently deployed, and conclude that installing such a proxy into GPRS network would be of significant benefit to users. [J263]

"One-pass GPRS and IMS authentication procedure for UMTS"

Universal Mobile Telecommunications System (UMTS) supports Internet protocol (IP) multimedia services through IP multimedia core network subsystem (IMS). Since the IMS information is delivered through the general packet radio service (GPRS) transport network, a UMTS mobile station (MS) must activate GPRS packet data protocol (PDP) context before it can register to the IMS network. In the Third-Generation Partnership Project (3GPP) specifications, authentication is performed at both the GPRS and the IMS networks before an MS can access the IMS services. We observe that many steps in this 3GPP "two-pass" authentication procedure are identical. Based on our observation, this paper proposes an one-pass authentication procedure that only needs to perform GPRS authentication. At the IMS level, authentication is implicitly performed in IMS registration. Our approach may save up to 50% of the IMS registration/authentication traffic, as compared with the 3GPP two-pass procedure. We formally prove that the one-pass procedure correctly authenticate the IMS users. [J264]

"Landmine detection and classification with complex-valued hybrid neural network using scattering parameters dataset"

Neural networks have been applied to landmine detection from data generated by different kinds of sensors. Real-valued neural networks have been used for detecting landmines from scattering parameters measured by ground penetrating radar (GPR) after disregarding phase information. This paper presents results using complex-valued neural networks, capable of phase-sensitive detection followed by classification. A two-layer hybrid neural network structure incorporating both supervised and unsupervised learning is proposed to detect and then classify the types of landmines. Tests are also reported on a benchmark data. [J265]

"Adaptive wire bow-tie antenna for GPR applications"

In this paper, the basic design of an adaptive ground penetrating radar antenna is introduced. The antenna is able to adapt its input impedance to a variation in the antenna elevation and soil type to keep reflections at the antenna's terminal minimum. As a result, energy transfer from the generator to the antenna is maximized, which in turn maximizes the energy radiated by the antenna into the ground for different antenna elevations and soil types. The antenna is based on a wire bow-tie structure with variable flare angle for adjusting the antenna's input impedance. The flare angle variation is realized by short-circuiting the gaps separating the wires from the feed point of the antenna, for which electronic switching devices such as PIN diodes could be used to allow fast and convenient control of the antenna's flare angle. [J266]

"An electromagnetic approach based on neural networks for the GPR investigation of buried cylinders"

In this letter, neural networks (NNs) are used to reconstruct the geometric and dielectric characteristics of buried cylinders. The NN is designed to work with input data extracted from the transient electric fields scattered by the target. To this aim, a simple simulation of a typical ground-penetrating radar setting is performed and different sets of data examined. Moreover, different neural network algorithms have been exploited, and results have been compared. Finally, the "robustness" of the proposed approach has been tested against noisy data and against uncertainties in the modelization. [J267]

"Recent advances on TD-SCDMA in China"

China has fully embraced the remarkable growth and unprecedented penetration of mobile services, and has become the world's largest mobile cellular market. TD-SCDMA was proposed by the China Wireless Technology Standard (CWTS) Group in 1998, approved as one of the 3G standards by ITU in May 2000, and joined 3GPP in March 2001. This has been a major effort by China to advance its mobile communication systems and facilitate its own technological development in this critical area. TD-SCDMA, a combination of TDD and synchronous CDMA, offers several unique advantages over its alternatives, WCDMA and cdma2000, such as

flexible spectrum allocation, low-cost implementation, and easier migration from GSM systems. This article reviews the development, key technical features, and deployment of TD-SCDMA in China. [J268]

"Using priority, buffering, threshold control, and reservation techniques to improve channel-allocation schemes for the GPRS system"

Taking a comprehensive approach, we investigate effects on the channel allocation for the general packet radio service (GPRS) system caused by priority strategy, buffering, threshold control on the buffer, and channel reservation. Moreover, four new dynamic channel-allocation schemes based on various combinations of these techniques are proposed and analyzed using the Markov chain approach. Analytical results obtained include blocking/forced-termination/dropping probabilities, cost-function definition based on the above metrics, and (mean) delay times. Through numerical examples, we demonstrate that: 1) priority and threshold control are efficient strategies to differentiate the quality of service (QoS) between a new voice call and a handoff voice call; 2) buffering allows more admitted rates of voice calls or data packets, but increases the delay time; and 3) channel reservation may directly improve a specific service, but it degrades performance of other services much. At last, better schemes suitable for the GPRS system are suggested after a thorough comparison of system performance. [J269]

"Self-organizing maps application in a remote water quality monitoring system"

This work was developed in the context of a system for remote water quality monitoring based on a wireless local area network (WLAN) and includes a Kohonen self-organizing map (K-SOM) implementation in order to perform sensor data validation and reconstruction and sensor failure and pollution event detections. Simulation and experimental results are presented. [J270]

"Discontinuous galerkin time-domain method for GPR simulation in dispersive media"

This paper presents a newly developed high-order discontinuous Galerkin time-domain (DGTD) method for solving Maxwell's equations in linear dispersive media with UPML boundary treatment. A unified formulation is derived for linear dispersive media of Debye type and the artificial material in the UPML regions with the help of auxiliary differential equations. The DGTD employs finite-element-type meshes, and uses piecewise high-order polynomials for spatial discretization and Runge-Kutta method for time integrations. Arbitrary high-order accuracy can be obtained for scattering of various objects in dispersive media. After validating the numerical convergence of the DGTD method together with the second-order Yee's scheme, we apply this new method to the ground-penetrating radar for the detection of buried objects in a lossy half space. [J271]

"Application of feature extraction methods for landmine detection using the Wichmann/Niitek ground-penetrating radar"

Ground-penetrating radar (GPR) has been proposed as an alternative to classical electromagnetic induction techniques for the landmine detection problem. The Wichmann/Niitek system provides a good platform for novel GPR-based antitank mine detection and classification algorithm development due to its extremely high SNR. When the GPR sensor is mounted on a moving vehicle, the target signatures are hyperbolas in a time-domain data record. The goal of this work is to extract useful features that exploit this knowledge in order to improve target detection. The algorithms can be divided into two steps: feature extraction and classification. Preprocessing is also considered to remove both stationary effects and nonstationary drift of the data and to improve the contrast of the desired hyperbolas. The algorithm is evaluated using real data over primarily plastic antitank mines collected with a fielded GPR sensor at a government test site. [J272]

"Migration velocity analysis and prestack migration of common-transmitter GPR data"

The accuracy of a migration image of ground-penetrating radar (GPR) depends strongly on the accuracy of permittivity distribution determined from multioffset data. This paper proposes a migration velocity analysis method using a genetic algorithm (GA). The objective function is defined as the summation of normalized zero-delay cross correlation of all common-image point gathers. Under the assumptions that the media are blockwise and that the permittivity of each block can be expressed as a polynomial with limited terms, all coefficients of the permittivity function of each block, which maximize the objective function, are determined by migration velocity analysis method with GA. Prestack migration is performed by a reverse-time migration method based on Maxwell's equations solved by the finite-difference time-domain method with a perfectly matched layer absorbing boundary conditions. The migration velocity analysis method is applied to synthetic common-transmitter datasets to test the method. Then, the velocity analysis and prestack migration method are applied to field data. From the distribution of dielectric constant obtained from the field data, water content is derived, and the depth of a water

aquifer is deduced from the water content distribution and a migration stack profile. [J273]

"Modeling and analysis of an efficient multicast mechanism for UMTS"

This paper proposes a multicast mechanism for the universal mobile telecommunication system (UMTS). Our scheme relies on establishing multicast tunnels throughout the network that allow multicast packets to be transferred in an optimal manner on shared links toward multiple destinations. We describe the mechanisms of the scheme in establishing and maintaining the multicast tunnels, managing multicast groups, executing location updates, and performing multicast packet forwarding. As a result of dynamically delivering multicast packets to the downstream nodes that are serving multicast users on a per-packet basis, the multicast mechanism is able to respond well to group dynamics as well as to subscriber mobility. The mechanism also requires little state at intermediate network nodes and can be implemented with only minimal modifications to existing UMTS protocols. Based on a cost analysis in comparison with three related schemes for one-to-many packet delivery, we show that our mechanism performs well under various user distributions. [J274]

"Signal processing for perpendicular recording channels with intertrack interference"

Signal processing techniques for perpendicular magnetic recording channels with intertrack interference (ITI) are studied in this paper. Both single-track and joint-track equalization and detection algorithms are considered. Modified minimum mean-square error equalization methods are used to select optimum generalized partial response targets for ITI channels with either dominant additive white Gaussian noise or media noise. Simulation results show that good targets for single-track detection of ITI-free channels may not be acceptable for channels with ITI. Short targets are just slightly worse than longer targets for joint-track detection, making it possible its use in practical systems with ITI. [J275]

"The interaction between ELF electric fields and RF survey meters: theory and experiment"

An RF survey meter is often used to evaluate the safety of human exposure to RF electromagnetic fields. However, it has been noted that erroneous meter indications occur when the meters are used in strong, extremely low-frequency (ELF) electric fields, such as those found near electric power transmission and distribution facilities. In this paper, coupling between an ELF electromagnetic field and an RF survey meter has been studied theoretically and experimentally. It has been shown that coupling large enough to result in erroneous readings can be caused by unbalanced currents as small as 0.1% of the balanced currents on the transmission line that connects the probe to the readout unit. Unbalanced currents of this magnitude can be caused by capacitive coupling to the probe and readout unit. [J276]

"IP connectivity for gateway GPRS support node"

In the Universal Mobile Telecommunications System, the gateway GPRS support node (GGSN) provides IP connection between the mobile telecommunications network and external packet data networks (e.g., the Internet). Specifically, the GGSN exercises session management to transfer user packets between mobile stations and external data networks. In this article we focus on the GGSN functions for IP connection including access point name processing, IP address allocation, tunneling technologies, and QoS management. Based on our experience as a mobile operator, we give several examples to show how these functions can actually be implemented in a commercial mobile network. [J277]

"Practical landmine detector using forward-looking ground penetrating radar"

A practical landmine detector using forward-looking ground penetrating radar is presented. The detector uses a wavelet packet transform and the sequential feature selection algorithm to extract the most discriminant information distributed in the joint time-frequency domain for detecting landmines. A cascade training method that allows the detector to continue learning from errors made on unseen environments to improve its detection performance is also proposed. The testing results based on a recently conducted blind test are presented. [J278]

"Highly integrated direct conversion receiver for GSM/GPRS/EDGE with on-chip 84-dB dynamic range continuous-time ΣΔ ADC"

This paper describes a highly digitized direct conversion receiver of a single-chip quadruple-band RF transceiver that meets GSM/GPRS and EDGE requirements. The chip uses an advanced 0.25-μm BiCMOS technology. The I and Q on-chip fifth-order single-bit continuous-time sigma-delta (ΣΔ) ADC has 84-dB dynamic range over a total bandwidth of ±135 kHz for an active area of 0.4 mm2. Hence, most of the channel filtering is realized in a CMOS IC where digital processing is achieved at a lower cost. The systematic analysis of dc offset at each stage of the design enables to perform the dc offset cancellation loop in the digital domain as well. The receiver

operates at 2.7 V with a current consumption of 75 mA. A first-order substrate coupling analysis enables to optimize the floor plan strategy. As a result, the receiver has an area of 1.8 mm2. [J279]

"Per-user checkpointing for mobility database failure restoration"

This paper studies the failure restoration of mobility database for Universal Mobile Telecommunications System (UMTS). We consider a per-user checkpointing approach for the home location register (HLR) database. In this approach, individual HLR records are saved into a backup database from time to time. When a failure occurs, the backup record is restored back to the mobility database. We first describe a commonly used basic checkpoint algorithm. Then, we propose a new checkpoint algorithm. An analytic model is developed to compare these two algorithms in terms of the checkpoint cost and the probability that an HLR backup record is obsolete. This analytic model is validated against simulation experiments. Numerical examples indicate that our new algorithm may significantly outperform the basic algorithm in terms of both performance measures. [J280]

"Optimizing Web delivery over wireless links: design, implementation, and experiences"

World over wide-area wireless Global System for Mobile Communication (GSM) networks have been upgraded to support the general packet radio service (GPRS). GPRS brings "always-on" wireless data connectivity at bandwidths comparable to that of conventional fixed-line telephone modems. Unfortunately many users have found the reality to be rather different, experiencing very disappointing performance when, for example, browsing the Web over GPRS. In This work, we show what causes the web and its underlying transport protocol TCP to underperform in a GPRS wide-area wireless environment. We examine why certain GPRS network characteristics interact badly with TCP to yield problems such as: link underutilization for short-lived flows, excess queueing for long-lived flows, ACK compression, poor loss recovery, and gross unfairness between competing flows. We also show that many Web browsers tend to be overly aggressive, and by opening too many simultaneous TCP connections can aggravate matters. We present the design and implementation of a web optimizing proxy system called GPRSWeb that mitigates many of the GPRS link-related performance problems with a simple software update to a mobile device. The update is a link-aware middleware (a local "client proxy") that sits in the mobile device, and communicates with a "server proxy" located at the other end of the wireless link, close to the wired-wireless border. The dual-proxy architecture collectively implements a number of key enhancements-an aggressive caching scheme that employs content-based hash keying to improve hit rates for dynamic content, a preemptive push of Web page support resources to mobile clients, resource adaptation to suit client capabilities, delta encoded data transfer of modified pages, DNS lookup migration, and a UDP-based reliable transport protocol that is specifically optimized for use over GPRS. We show that these enhancements results in significant improvement in web performance over GPRS links. [J281]

"The role of the measurement configuration in inverse scattering from buried objects under the Born approximation"

In this paper, the inverse scattering problem for dielectric objects in a two-dimensional half-space geometry is dealt with. The discussion is worked out in the framework of the linear model of the Born Approximation (BA) and the role of the measurement configuration is investigated with regard to the information content of the scattered field data. In particular, the configurations analyzed are multiview-multistatic, multibistatic and multistatic with a single view, all exploiting a frequency diversity and with the observation line at the interface. The comparison shows that the multibistatic configuration seems to offer a good compromise between the required measurement time, the computational "burden" and the quality of the achievable results. [J282]

"Development and application of millimeter wave radar sensors for underground mining"

This paper defines the issues that are required for the development of a successful underground range measurement sensor. It considers various options, including laser and sonar implementations, before focusing on a millimeter-wave frequency modulated continuous wave radar. The implementations of radar sensors for simple ranging and three-dimensional cavity profiling are then discussed before some data obtained in underground mines is presented to verify the radar performance through thick dust and vapor. [J283]

"Adaptive imaging for forward-looking ground penetrating radar"

Most of the current forward-looking ground-penetrating radar (FLGPR) systems use conventional delay-and-sum (DAS) based methods to form radar images for detection of the target (such as a landmine). However, DAS is a data-independent approach which is known to suffer from low resolution and poor interference and clutter rejection capability. We present a data-adaptive imaging approach for FLGPR image formation based on APES (amplitude and phase estimation) and rank-deficient RCB (robust Capon beamforming). Due to the data-adaptive nature of both APES and RCB, our approach has better resolution and much better interference and clutter

rejection capability than the standard DAS-based imaging methods. The excellent performance of the proposed method is demonstrated using experimental data collected via two FLGPR systems recently developed by PSI (Planning Systems, Inc.) and SRI (Stanford Research Institute). [J284]

"Adaptive learning approach to landmine detection"

We consider landmine detection using forward-looking ground penetrating radar (FLGPR). The two main challenging tasks include extracting intricate structures of target signals and adapting a classifier to the surrounding environment through learning. Through the time-frequency (TF) analysis, we find that the most discriminant information is TF localized. This observation motivates us to use the over-complete wavelet packet transform (WPT) to sparsely represent signals with the discriminant information encoded into several bases. Then the sequential floating forward selection method is used to extract these components and thereby a neural network (NNW) classifier is designed. To further improve the classification performance and deal with the problem of detecting mines in an unconstraint environment, the AdaBoost algorithm is used. We integrate the feature selection process into the original AdaBoost algorithm. In each iteration, AdaBoost identifies the hard-to-learn examples and a new set of features which provide the specific discriminant information for these hard samples is extracted adaptively and a new classifier is trained. Experimental results based on measured data are presented, showing that a significant improvement on the classification performance can be achieved. [J285]

"Convolutional models for buried target characterization with ground penetrating Radar"

Identification of buried antipersonnel landmines with ground penetrating radar (GPR) establishes a need for application-specific scattering models and associated estimation algorithms relating the measured scattered field to target characteristics such as size, material composition and burial depth. To this end, starting from integral representations of the scattered field, we derive frequency- and time-domain convolutional models for the GPR response of buried dielectric and metal mine-like targets, including simple analytical expressions for the target transfer function/impulse response. The main steps in the derivation are the linearization of the scattering problem by either the Born or the Physical Optics approximation, the application of a new far-field backscattering representation of the half-space Green's tensor, and the introduction of point source/receiver models for the GPR antennas and the receiver chain. Using three-dimensional finite-difference time-domain (FDTD) and measured data examples, we illustrate the validity of the convolutional models and how they can be used to characterize buried targets. For the characterization, we make use of a deconvolution algorithm, termed "subset selection deconvolution", which uses our target impulse response approximations as a priori information on the form of the impulse response to be estimated. The results demonstrate the possibility to determine target size and depth from the estimated impulse response with millimeter accuracy under laboratory conditions, both of which are valuable information for landmine identification. [J286]

"Location management of correlated mobile users in the UMTS"

In this paper, we propose concurrently searching for correlated mobile users in mobile communications networks. Previous work either focuses on locating a single mobile user or assumes that the locations of mobile users are statistically independent. We first propose a mobility model in which the movements of mobile users are statistically correlated. Next, we use the theory of Markov chain to derive the joint probability density function of the locations of mobile users. In addition, we propose a novel approach to discover the correlations among the locations of mobile users without explicitly calculating the joint probability density function. Our simulation results indicate that exploring the correlations among the locations of mobile users could significantly reduce the average paging delay and increase the maximum stable throughput. [J287]

"Detection of media defects in perpendicular magnetic recording channels"

Two new algorithms for detection of media defects in perpendicular magnetic recording channels are proposed. These algorithms are based on amplitude thresholding of the channel reliability information. The performance of these algorithms is evaluated for low-density parity-check coded channels using generalized partial response targets with different dc-components. [J288]

"An IPv4-IPv6 translation mechanism for SIP overlay network in UMTS all-IP environment"

Both IPv6 and session initiation protocol (SIP) are default protocols for Universal Mobile Telecommunications System (UMTS) all-Internet protocol (IP) network. In the existing mobile telecommunications environments, an IPv6-based UMTS all-IP network needs to interwork with other Internet protocol version 4 (IPv4)-based SIP networks. Therefore, mobile SIP applications are typically offered through an overlay structure over the IPv4-Internet protocol version 6 (IPv6) interworking environments. Based on 3GPP 23.228, we propose an IPv4-IPv6 translation mechanism (i.e., SIPv6 translator) that integrates different IP infrastructures (i.e., IPv4 and IPv6) to

provide an overlay network for transparent SIP application deployment. In this paper, we present the architecture and the call flows of the SIPv6 translator. An analytic model is proposed to investigate the fault tolerance issue of our approach. Our study provides guidelines to select appropriate number of processors for fault tolerance. [J289]

"Special Issue on subsurface sensing using Ground Penetrating Radar (GPR)"

{no data available} [J290]

"Evaluation of potential GPRS 900/1800-MHz and WCDMA 1900-MHz interference to consumer electronics"

This study assessed the potential for interference to consumer electronics from radio frequency (RF) fields radiated by general packet radio service (GPRS) 900/1800-MHz and wideband code division multiple access (WCDMA) 1900-MHz handsets. The study was enhanced by additional testing with fields that were characteristic of radio transmissions from GSM 900/1800-MHz handsets and 900/1800-MHz fields that comply with the requirements of the international immunity standard to RF fields, IEC 61000-4-3. Four examples of consumer electronics were tested-a television, radio, CD player, and telephone. Generally, each device exhibited some form of interference at most of the test field levels (1, 3, 10, and 30 V/m). GPRS/GSM 1800-MHz and WCDMA signals never caused interference to any device at 1 V/m. The IEC 61000-4-3-specified test signal consistently produced more audio/visual interference than GPRS- or GSM-type signals at the same test frequency and carrier field strength level. Audio/visual interference produced by WCDMA signals was generally lower than that produced by GPRS. These results, combined with the inherently lower maximum output power of WCDMA, indicate that WCDMA will usually pose a lower risk of interference compared with GPRS for similar separation distances between handsets and common items of consumer electronics. [J291]

"Long range propagation of lightning pulses using the FDTD method"

The numerical dispersion of the finite-difference time-domain (FDTD) method is a serious drawback in view of computing long range propagation of lightning pulses in the Earth-ionosphere waveguide. In this paper, it is shown that most of this dispersion can be removed by postprocessing the FDTD results. This makes possible the propagation of lightning pulses up to thousands of kilometres with reasonable computational times. [J292]

"Handover management architectures in integrated WLAN/cellular networks"

{no data available} [J293]

"CardioSmart: Cardiological Monitoring Intelligent system using GPRS"

This paper presents a Medicine/Engineering multidisciplinary research project, in which a European Telecardiology system has been developed for the continuing monitoring of patients using GPRS/GSM. The system consists in a portable terminal and a call center that provide 24h-duty medical supervision and assistance. The system includes advanced signal processing for the recognition of cardiac pathologies using neural networks, compression with wavelets, encryption and GPS to locate the patient in case of fading. The main requirements for this project have been its technical and economical viability and the user's acceptance of the system. The results obtained validate the system, showing its transnational supervision and remote attendance capability. The main achievements generate ambient intelligence and can be easily applied to other telemedical fields. This research project has been partially funded by the European Union under the VFP Information Society Technologies programme (IST-2001-35073) [J294]

"Mobility management in All-IP mobile network: end-to-end intelligence or network intelligence?"

The mobile telecommunication network is morphing into an All-IP mobile network with diversified radio access systems. The All-IP mobile network should be established by converging the mobile telecommunication network and the fixed Internet. This article opens a debate on whether mobility management should be implemented as end-to-end intelligence or network intelligence. [J295]

"A hierarchical radio resource management framework for integrating WLANs in cellular networking environments"

Over the last few years wireless local area networking (WLAN) has become a very important technology that offers high-speed communication services to mobile users in indoor environments. WLAN technology offers some very attractive characteristics such as high data rates, increased QoS capabilities, and low installation

costs which has made many professionals claim that it will be the main opponent of IMT-2000, despite the enormous effort needed for the specification and implementation of 3G systems. However, WLANs also present many important constraints related mainly to their restricted coverage capabilities. On the other hand, 3G systems are deployed gradually and carefully since their business prospects have not been validated yet and it is expected that 2G and 2G+ cellular systems will continue to play an important role for at least five more years. Thus, today's wireless networking environment is in fact a conglomeration of all these technologies for which there is a strong need for cooperation. In this article we describe a heterogeneous wireless networking environment together with its features and user requirements. We explain the importance of the existence of WLANs and describe a framework and system architecture that supports seamless integration of WLAN in heterogeneous cellular networking environments, focusing on support for efficient resource provision and management. [J296]

"Uncoded symbol error rate estimation: methods and analysis"

In wireless communications systems, channel quality estimates are often used to provide a measure of the quality of service or to enable resource allocation techniques that improve system capacity and/or user quality. The uncoded bit or symbol error rate (SER) is specified as a channel quality metric in second and third generation cellular systems (e.g., general packet radio service (GPRS), enhanced general packet radio service (EGPRS), and universal mobile telecommunications system (UMTS). Nonetheless, techniques to estimate the uncoded SER are typically outside the scope of these wireless standards and are not specified. In this paper, we analyze the performance of a number of uncoded SER estimation techniques, including a novel technique in which we use the soft information of the received symbols to obtain a fast and accurate estimate of the uncoded SER. The technique we introduce has been found to outperform, in terms of accuracy and required estimation interval, conventional hard-decision based techniques that use test-patterns, or use a decode/re-encode/compare approach . Our technique also outperforms the brute-force technique, which is to send a known test-pattern, demodulate it at the receiver, and count the observed discrepancies. [J297]

"Kalman filtering for enhanced landmine detection using quadrupole resonance"

Quadrupole resonance (QR) is a novel technology recently applied to landmine detection. The detection process is specific to the chemistry of the explosive, and therefore is less susceptible to the types of false alarms experienced by metal detectors and ground-penetrating radars. Although QR is vulnerable to radio-frequency interference (RFI) when the sensor is deployed in the field, adaptive RFI mitigation can remove most of the RFI. In this paper, advanced signal processing algorithms applied to the postmitigation signal are studied to enhance explosive detection. A new Kalman filtering strategy is proposed to estimate and detect the QR signal in the postmitigation signal. The results using both simulated data and experimental data show that the proposed algorithm can provide robust landmine detection performance. [J298]

"A compact antenna for ultrawide-band applications"

A novel compact and ultrawide-band (UWB) antenna is presented in this paper. The basis for achieving such an UWB operation is through proper magnetic coupling of two adjacent sectorial loop antennas in a symmetrical arrangement. A large number of coupled sectorial loop antennas (CSLA) with different geometrical parameters are fabricated and their measured responses are used to experimentally optimize the geometrical parameters of the antenna for achieving the maximum bandwidth. Through this optimization process an antenna with a VSWR of lower than 2.2 (S110at the lowest frequency of operation and provides an excellent polarization purity. Furthermore, the antenna exhibits a relatively consistent radiation pattern. Modified versions of the CSLA are also designed to reduce the overall metallic surface and weight of the antenna while maintaining its wide-band characteristics. This allows modifying its dimensions to design low frequency light-weight UWB antennas. [J299]

"Effect of multiple scattering on the phase signature of wet subsurface structures: applications to polarimetric L- and C-band SAR"

We propose a two-layer integral equation model (IEM) model including multiple-scattering terms to reproduce the phase signature of buried wet structures that we observed on L-band synthetic aperture radar (SAR) images. We have good agreement between the extended (single+multiple scattering) IEM model and previous results obtained using a single-scattering IEM model combined with finite-difference time-domain simulations. We show that the multiple scattering not only significantly influences the copolarized phase difference but can also be related to the soil moisture content. In order to assess the validity of our extended model, we performed radar measurements on a natural outdoor site and showed that they could be fairly well fitted to the extended model. A parametric analysis presents the dependence of the copolarized phase difference on roughness parameters (rms height and correlation length) and radar parameters (frequency and incidence angle). Our study also shows

that the phase signature should allow detection of buried wet structures down to a larger depth for C-band (3.8 m) than for L-band (2.6 m). This signature could then be used to map subsurface moisture in arid regions using polarimetric SAR systems. [J300]

"Computation of longwave electromagnetic response of nonhomogeneous media"

A method for the numeric estimation of the effective permittivity of any nonhomogeneous medium that admits the effective medium approximation under the longwave approximation is presented. Media are modeled as inclusions embedded in a continuous matrix. We show how the potentials at the inclusion boundaries are sufficient information for the estimation of the effective permittivity. We also show efficient implementation techniques to estimate them computationally, either by Monte Carlo random walk or by relaxation. We provide numerical results for several regular two- and three-dimensional structures and show the dependence of the effective response on the shape of the inclusions and their spatial arrangement, and the influence of the percolation threshold. [J301]

"BerlinTainment: an agent-based context-aware entertainment planning system"

Service providers, especially in the mobile entertainment domain, are facing increasing competition. The ability to design, develop, and deploy unique context-aware entertainment services fast and easily as well as the capability to provide intuitive user interfaces becomes essential for market players. Furthermore, today's mobile world is made up of heterogeneous networks accessible via various devices with different characteristics. Progressive users have the desire to utilize the same services and access the same information content on all available devices. At the same time, service providers have to diversify their services in order to remain competitive and attract the various customer segments making up the mass market. We introduce an agent-based serviceware framework to assist service providers in developing innovative services, thus reducing the time to market of the respective applications. The realized serviceware framework offers personalization, location awareness, and the multi-access service platform, a flexible solution for ubiquitous service access. Thus, our solution allows a heterogeneous landscape of end devices to access an application server's mobile services in a multimodal, multilingual, and multimedia-based manner. We describe the utilization of the different modules of the service framework as well as the BerlinTainment application, an entertainment planning system based on the framework. [J302]

"Global communications newsletter-A romanian way toward mobile broadband: an interview with Richard Moat, CEO, Orange Romania"

First Page of the Article [J303]

"Measurements of electric and magnetic fields due to the operation of indoor power distribution substations"

In this paper, the electric and magnetic fields with a frequency of 50 Hz, caused by the operation of indoor power distribution substations of 20/0.4 kV, are examined. First, the results of previous relevant research studies as well as the reference levels for safe general public and occupational exposure given in the guidelines of the International Commission on Non-Ionizing Radiation Protection are presented. Next, basic data for standardized indoor power distribution substations used in Greece, where the measurements have been carried out as well as a brief description of the field measurement instruments used are given. The results of the electric- and magnetic-field measurements in indoor power distribution substations of all the standardized nominal power ratings in the town of Xanthi, Greece, accompanied by relevant tables and diagrams follow. After the evaluation of these results, according to international guidelines, final conclusions are set out concerning safe public and occupational exposure to the above-mentioned fields. [J304]

"Can cell phones promote brain tumors the INTERPHONE study?"

Within the past few months, several papers reporting epidemiological studies of cell-phone use and brain tumors have appeared in scientific journals. Several other related manuscripts are likely to appear, in print, in the not too distant future. If one wonders about the timing, it is very simple: a multi-year, international research effort, the INTERPHONE Project, is approaching its final phase. This human health project is being conducted with 13 participating countries. [J305]

"Linear distribution imaging of thin metallic cylinders under mutual scattering"

In this paper, we address the problem of imaging "thin" metallic cylinders from the knowledge of the electric far-field scattered under the incidence of plane waves. A scattering model based on a multipole expansion

accounting for the mutual scattering is introduced and then simplified under the single- and second-order scattering hypotheses. The locations of the unknown cylinders for the inverse problem are described in terms of support of δ-functions. The performances of a truncated singular value decomposition based linear inversion algorithm in the presence of model errors due to mutual scattering is investigated, by both analytical and numerical arguments, in three different measurement configurations: single-frequency/multiview, multifrequency/single-view, and multifrequency/multiview. The different effects of the angular and frequency diversities are pointed out. [J306]

"Is there a brain tumor risk from cell phone use?"

The increasingly widespread use of cellular telephones-and the limited knowledge concerning the possible adverse health effects of a microwave emitter situated near the head of a cell-phone user-had prompted many to urge that research be conduct to ascertain the health risk to the cellphone user, if any exists. This column reports on a multiyear, international research effort-the Interphone Project-as it approach its final phase. [J307]

"A bandwidth-on-demand strategy for GPRS"

General packet radio service (GPRS) is a global system for mobile communications (GSM) packet data service. In order to efficiently accommodate GPRS traffic while maintaining the desired service quality of GSM calls, we propose a GPRS bandwidth-allocation strategy called the bandwidth-on-demand (BoD) strategy. The BoD strategy is adaptive to the change of traffic conditions, and thus can dynamically adjust the number of channels for GSM and GPRS traffic. Taking the effect of packet dropping due to movements of mobile stations into account, this paper develops an analytical model to study the BoD performance in terms of GSM-call-blocking probability and GPRS-packet-dropping probability. [J308]

"International Radar Symposium 2005"

{no data available} [J309]

"Design of a Resistively Loaded Vee Dipole for Ultrawide-Band Ground-Penetrating Radar Applications"

A new resistively loaded vee dipole (RVD) is designed and implemented for ultrawide-band short-pulse ground-penetrating radar (GPR) applications. The new RVD is improved in terms of voltage standing wave ratio, gain, and front-to-back ratio while maintaining many advantages of the typical RVD, such as the ability to radiate a short-pulse into a small spot on the ground, a low radar cross section, applicability in an array, etc. The improvements are achieved by curving the arms and modifying the Wu–King loading profile. The curve and the loading profile are designed to decrease the reflection at the drive point of the antenna while increasing the forward gain. The new RVD is manufactured by printing the curved arms on a thin Kapton film and loading them with chip resistors, which approximate the continuous loading profile. The number of resistors is chosen such that the resonant frequency due to the resistor spacing occurs at a frequency higher than the operation bandwidth. The antenna and balun are made in a module by sandwiching them between two blocks of polystyrene foam, attaching a plastic support, and encasing the foam blocks in heat-sealable plastic. The antenna module is mechanically reliable without significant performance degradation. The use of the new RVD module in a GPR system is also demonstrated with an experiment. [J310]

"A Classification Approach Based on SVM for Electromagnetic Subsurface Sensing"

In clearing terrains contaminated or potentially contaminated by landmines and/or unexploded ordnances (UXOs), a quick wide-area surveillance is often required. Nevertheless, the identification of dangerous areas (instead of the detection of each subsurface object) can be enough for some scenarios/applications, allowing a suitable level of security in a cost-saving way. In such a framework, this paper describes a probabilistic approach for the definition of risk maps. Starting from the measurement of the scattered electromagnetic field, the probability of occurrence of dangerous targets in an investigated subsurface area is determined through a suitably defined classifier based on a support vector machine. To assess the effectiveness of the proposed approach and to evaluate its robustness, selected numerical results related to a two-dimensional geometry are presented. [J311]

"Ground penetrating radar VIY-2"

VIY-2 ground penetrating radar (GPR) with unique sounding possibilities and use simplicity is presented at this paper. VIY-2 GPR combines all units (synchronizer, transmitting and receiving modules, powering, and antenna system) into single case. The VIY-2 GPR communicates with computer via standard interface RS232 or USB1.0.

Technical solutions utilized by the VIY-2 GPR reduce deployment time and simplify surveying process. The VIY-2 GPR design features and its components interaction are considered at this paper. Some field results are also presented here. The VIY-2 GPR design concept allows reducing the data acquisition time,, optimizing the time-varying gain control function, applying depth-stacking dependence, controlling the surveying window position and interference reducing by pulse repetition frequency randomizing. [J312]

"A simple hybrid method for ELF shielding by imperfect finite planar shields"

A simple method is described for calculating the shielding performance of a two-dimensional (2-D) thin finite-width shield made of imperfect material in the presence of the magnetic field from line source conductors. First, solutions to two canonical problems with closed-form simple analytic formulas are presented; shielding by reflection from and absorption in thin planar shields of infinite extent and shielding by perfect conductor shields of finite width. Then the method for calculation of magnetic-field shielding by perfect conductor finite-width shields is extended using the simple interpolation method, to thick shields made of imperfect material. Finally, the hybrid solution is developed by adding the two results in quadrature. The result is a simple theory for shielding by finite-width shields made of any real shielding material of arbitrary thickness. Its accuracy has been validated by comparison to finite-element method solutions and existing measurements. [J313]

"Gain/bandwidth programmable PA control loop for GSM/GPRS quad-band cellular handsets"

The analog power amplifier (PA) control loop of a fully integrated GSM/GPRS quad-band transceiver, suitable for GSM 850, GSM 900, DCS 1800, PCS 1900, and GPRS class 12 applications is presented. The control loop is based on a fully integrated PA controller (PAC) which meets applicable 3GPP GSM/GPRS specifications. Both the gain and the bandwidth of the PA control loop are programmable as well as the standby voltage delivered to the external PA: these features, together with a high driving capability (8.4 mA at 2.5 V), make this solution capable of interfacing many combinations of PAs, couplers, and detectors. The PAC has been integrated in a BiCMOS SiGe 0.35-μm process and measures 0.33 mm2. The current consumption from a single 2.8-V power supply is 2.8 mA without load and 7.2 mA in the application using Hitachi's PF08109B PA. [J314]

"Wireless IP and Building the Mobile Internet [JBook Review]"

{no data available} [J315]

"Performance evaluation of GSM/GPRS networks with channel re-allocation scheme"

Previous work studying the channel allocation schemes in GSM/GPRS network commonly assume that one or two channels are required by a GPRS data for the sake of analytical simplicity. In this letter, we remove the assumption and generalize the GPRS data channel requirement (M channels). Additionally, we propose a channel re-allocation scheme (RAS), executed upon the channel release, by re-allocating the idle channels to the GPRS data which is currently using less than M channels. The example findings show that RAS can significantly decrease the voice call blocking probability and GPRS packet transmission time with slight channel utilization increase and negligible expense on GPRS packet blocking probability. Small M (e.g.M=2) will underestimate the performance achievements of the prior channel allocation scheme as well as RAS. [J316]

"Serving radio network controller relocation for UMTS all-IP network"

To support real-time multimedia services in UMTS all-IP network, Third-Generation Partnership Project TR 25.936 proposed two approaches to support real-time serving radio network controller (SRNC) switching, which require packet duplication during SRNC relocation. These approaches significantly consume extra system resources. This paper proposes the fast SRNC relocation (FSR) approach that does not duplicate packets. In FSR, a packet buffering mechanism is implemented to avoid packet loss at the target RNC. We propose an analytic model to investigate the performance of FSR. The numerical results show that packet loss at the source RNC can be ignored. Furthermore, the expected number of packets buffered at the target RNC is small, which does not prolong packet delay. [J317]

"A review of analytically determined electric fields and currents induced in the human body when exposed to 50-60-Hz electromagnetic fields"

In this review paper, analytical methods are used to determine the electric field and current induced in the conducting human body when this is exposed to an electromagnetic field at extremely low frequencies (ELFs) or very low frequencies (VLFs). This is done by treating it as a parasitic antenna when this is modeled successively as a sphere, an ellipsoid, and a cylinder. Because the body is electrically very short at ELF and VLF, the axial current depends primarily on the length of the body. Comparison with the ellipsoidal shape shows that the

induced current is virtually independent of the cross-sectional shape. It is concluded that the axial current induced in the cylinder is a good approximation of the current induced in an actual body with the same length and mean cross sectional area. References to persons standing on the earth and with the arms raised are given. The significance of the accurate knowledge of induced currents and fields for biomedical purposes is discussed. [J318]

"Numerical modeling of ultrawide-band dielectric horn antennas using FDTD"

A detailed characterization of the input impedance of ultrawide-band (UWB) dielectric horn antennas is presented using the finite-difference time-domain (FDTD) technique. The FDTD model is first validated by computing the characteristic impedance of two conical plate transmission lines (including planar bow-tie antennas) and comparing the results to analytical solutions. The FDTD model is next used to calculate the surge impedance of dielectric horn antennas using the conical plates as launchers. Design curves of the surge impedance for different choices of geometries and dielectric loadings are provided. The modeled antennas are particularly attractive for applications such as UWB ground penetrating radars (GPR) applications. [J319]

"Plane-wave characterization of antennas close to a planar interface"

The plane-wave scattering matrix is used to characterize antennas that are located just above a planar interface that separates two media. The plane-wave transmitting spectrum for the field radiated downward into the lower medium is expressed directly in terms of the current distribution of the transmitting antenna. The transmitting spectrum for a reciprocal antenna determines the plane-wave receiving spectrum for the field that propagates upward in the lower medium. A measurement procedure is discussed for determining the plane-wave transmitting and receiving spectra from measurements with a probe that is located in the lower medium. [J320]

"Radio Resource Management for Multimedia QoS Support in Wireless Networks-[JBook Review]"

{no data available} [J321]

"The 3G-324M protocol for conversational video telephony"

As mobile operators worldwide migrate to third-generation (3G) networks, conversational video-telephony services are becoming a key differentiator between new 3G offerings and existing 2G/2.5G services. Although it's possible to have limited video-based services-such as a multimedia messaging service-that deliver pictures and video clips over 2.5G services, these are delay-insensitive applications that could run over a packet-based wireless network like general packet radio service (GPRS) or code division multiple access (CDMA)'s 1XRTT. For delay-sensitive applications such as conversational video telephony, present 3G packet bearers are inadequate, and the Third Generation Partnership Project (3GPP; http://www.3gpp.org) mandates using the 3G bandwidth-guaranteed circuit-switched bearer and the 3G-324M system. The 3G-324M system is a derivative of the International Telecommunication Union (ITU) H.324 protocol standard for low-bitrate multimedia communication, which ITU-T developed for the public switched telephone network (PSTN). This article describes the 3G-324M system, which has been adopted by both 3GPP and 3GPP2 (htpp://www.3gpp2.org), as well as its H.324 roots. [J322]

"Ground influence on the input impedance of transient dipole and bow-tie antennas"

In this paper, the influence of a lossy ground on the input impedance of dipole and bow-tie antennas excited by a short pulse is investigated. It is shown that the ground influence on the input impedance of transient dipole and bow-tie antennas is significant only for elevations smaller than 1/5 of the wavelength that corresponds to the central frequency of the exciting pulse. Furthermore, a principal difference between the input impedance due to traveling-wave and standing-wave current distributions is pointed out. [J323]

"GPRS: Gateway to Third-Generation Mobile Networks-[JBook Review]"

{no data available} [J324]

"A numerical study of buried biomass effects on ground-penetrating radar performance"

It is widely acknowledged that tree roots and other forms of buried biomass can have an adverse effect on the performance of ground-penetrating radars (GPRs). In this paper, we present analyses that examine that effect for ground-contacting GPR systems. A test site containing extensive root infiltration at Eglin Air Force Base, Florida, was excavated, and the root structure and soil were thoroughly characterized. A numerical simulator based on the discrete dipole approximation, which is an integral-equation-based method, was developed, validated, and

subsequently used to compute scattering from root structures modeled by an ensemble of buried cylinders. An examination of the results is presented that quantifies the potential for false alarms and increased clutter due to buried roots. [J325]

"A Σ-Δ fractional-N frequency synthesizer using a wide-band integrated VCO and a fast AFC technique for GSM/GPRS/WCDMA applications"

A fractional-N frequency synthesizer (FNFS) in a 0.5-μm SiGe BiCMOS technology is implemented. In order to operate in a wide-band frequency range, a switched-capacitors bank LC tank voltage-controlled oscillator (VCO) and an adaptive frequency calibration (AFC) technique are used. The measured VCO tuning range is as wide as 600 MHz (40%) from 1.15 to 1.75 GHz with a tuning sensitivity from 5.2 to 17.5 MHz/V. A 3-bit fourth-order Σ-Δ modulator is used to reduce out-of-band phase noise and to meet a frequency resolution of less than 3 Hz as well as agile switching time. The experimental results show -80 dBc/Hz in-band phase noise within the loop bandwidth of 25 kHz and -129 dBc/Hz out-of-band phase noise at 400-kHz offset frequency. The fractional spurious is less than -70 dBc/Hz at 300-kHz offset frequency and the reference spur is -75 dBc/Hz. The lock time is less than 150 μs. The proposed synthesizer consumes 19.5 mA from a single 2.8-V supply voltage and meets the requirements of GSM/GPRS/WCDMA applications. [J326]

"Application of the biorthogonal multiresolution time-domain method to the analysis of elastic-wave interactions with buried targets"

The biorthogonal multiresolution time-domain (Bi-MRTD) method is introduced for the analysis of elastic-wave interaction with buried targets. We provide a detailed discussion on implementation of the perfectly matched layer and on treatment of the interface between two different materials. The algorithm has also been parallelized by the use of the message-passing interface. The numerical results show that numerical dispersion can be significantly improved by using biorthogonal wavelets as bases, as compared to the conventional pulse expansion employed in the finite-difference time-domain (FDTD) method. We demonstrate that with comparison to the second-order FDTD, the Bi-MRTD yields significant CPU time and memory savings for large problems, for a fixed level of accuracy. [J327]

"Discrimination mode processing for EMI and GPR sensors for hand-held land mine detection"

Signal processing algorithms for hand-held mine detection sensors are described. The goals of the algorithms are to provide alarms to a human operator indicating the likelihood of the presence of a buried mine. Two modes of operations are considered: search mode and discrimination mode. Search mode generates an initial detection at a suspected location and discrimination mode confirms that the suspected location contains a land mine. Search mode requires that the signal processing algorithm generate a detection confidence value immediately at the current sample location and no delay in producing an alarm confidence is tolerable. Search mode detection has a high false-alarm rate. Discrimination mode allows the operator to interrogate the entire suspected location to eliminate false alarms. It does not require that the signal processing algorithm produce an alarm confidence immediately for the current sample location, but rather allows the system to process all the data acquired over the region before producing an alarm. This paper proposes discrimination mode processing algorithms for metal detectors (MDs), or electromagnetic induction sensors (EMIs), ground-penetrating radars (GPRs), and their fusion. The MD discrimination mode algorithm employs a model-based approach and uses the target model parameters to discriminate between mines and clutter objects. The GPR discrimination mode algorithm uses the consistency of detection as well as the shape of the detection peaks over several sweeps to improve the discrimination accuracy. The performances of the proposed algorithms were examined on a dataset collected at a government test site, and performance was compared with baseline techniques. Experimental results showed that the proposed method can reduce the probability of false alarm by as much as 70% at a 100% correct detection rate and performed comparable to the best human operator on a blind test with data collected at approximately 1000 locations. [J328]

"Bayesian support vector regression using a unified loss function"

In this paper, we use a unified loss function, called the soft insensitive loss function, for Bayesian support vector regression. We follow standard Gaussian processes for regression to set up the Bayesian framework, in which the unified loss function is used in the likelihood evaluation. Under this framework, the maximum a posteriori estimate of the function values corresponds to the solution of an extended support vector regression problem. The overall approach has the merits of support vector regression such as convex quadratic programming and sparsity in solution representation. It also has the advantages of Bayesian methods for model adaptation and error bars of its predictions. Experimental results on simulated and real-world data sets indicate that the approach works well even on large data sets. [J329]

"GPR phase-based techniques for profiling rough surfaces and detecting small, low-contrast landmines under flat ground"

We present a new technique whereby phase variation signatures are used to profile two-dimensional (2-D) rough surfaces and to discern shallowly buried, small, low-contrast landmines under a flat ground. The method has been tested using data measured over a composite surface containing two rough dielectric surface patches, and over a flat ground under which small, low-contrast antipersonnel landmines are shallowly buried. The results show that the phase-based technique is capable of profiling rough surfaces and of detecting small, low-contrast landmines with different internal structures buried underneath a flat ground. [J330]

"Polarimetric scattering from two-layered two-dimensional random rough surfaces with and without buried objects"

A three-dimensional polarimetric analysis of the two-layered rough ground with and without buried objects is investigated here. A rigorous electromagnetic surface integral-equation-based model is used in this analysis. The statistical average of the polarimetric scattering matrix elements is computed based on the Monte Carlo simulations for both the vertically and horizontally polarized incident waves. The results show a significant impact on the scattered intensities due to the two-layer nature of the ground. However, these intensities show almost no difference between the ground signature with or without the object. On the other hand, the statistical average of the covariance matrix elements shows a distinct difference between these two signatures despite the small size of the buried object. [J331]

"Near-field three-dimensional coherent imaging: Theory and simulations"

This work presents a rigorous mathematical derivation of an effective approximate solution to the three-dimensional inverse scattering/imaging problem that is applicable for all imaging zones ranging from the near to the far field. Simulation results for the point spread function illustrate the range and cross-range resolution as a function of the optical fnumber. The model system operates in a synthetic aperture type mode, where the coherent signals are transmitted, and the scattered signals are subsequently received at individual transmitters and receivers. Potential applications of this technology include: Medical ultrasound, foliage penetrating synthetic aperture radar, ground penetrating radar for land mine detection, and electromagnetic millimeter-wave scanning for concealed weapon detection. copyright 2004 American Institute of Physics. [J332]

"Directional borehole radar with dipole antenna array using optical modulators"

In this paper, we describe a directional borehole radar comprising a dipole antenna array with an optical modulator capable of determining the position of targets in three dimensions (3-D). Optical modulators using a Mach-Zehnder interferometer are used to transform electrical signals into optical signals at the feeding points of the dipole antennas. The advantages of using these modulators are that we can easily arrange the dipole antennas in a borehole, and that we can expect a good agreement between the experimental data and a theoretical model representing the array. We have made a prototype borehole radar system with five dipole antennas for the reception. In order to model the antennas, we used the method of moment (MoM), utilizing a modified Green's function for dipole antennas in multiple cylindrical layers. The Green's function is evaluated analytically by numerical integration. Cross-hole and single-hole measurements were carried out in granite at the Kamaishi mine (Iwate, Japan), and we obtained good agreement between the experimental data and the MoM results. After applying superresolution techniques to the data received by the array, we estimated the 3-D scattering position of a geological interface in granite. The results were in fairly good agreement with borehole scanner images. [J333]

"A study of scattering from an object below a rough surface"

A numerical model is applied in a Monte Carlo study of scattering from a three dimensional penetrable object below a lossy dielectric rough interface. Both time and frequency domain results are investigated to illustrate the relative importance of coherent and incoherent scattering effects in the sample problem considered. Results show that introducing a reduced transmission coefficient is reasonable for object coherent scattering predictions in this example, and that incoherent object/surface interaction effects approximately follow a simple scaling behavior as surface roughness is increased. [J334]

"Numerical and experimental analysis of circular-end wire bow-tie antennas over a lossy ground"

This paper presents a numerical and experimental analysis of a wire bow-tie antenna situated horizontally near a lossy ground. The antenna is basically an array of identical wire dipoles having a common feed point and equal

angular separation between two neighboring wires. This antenna is particularly suitable for ultrawide-band applications as it possesses a wideband property and allows a simple realization of resistive loading. It also provides a possibility to easily vary the antenna flare angle for the purpose of antenna matching or to adjust its footprint. In this work a theoretical model of the antenna is developed and verified experimentally. The wires are modeled as a tape-like structure by triangular patches and the antenna is analyzed using a mixed-potential integral equation formulation. Moreover, time-domain solutions are computed using the Fourier transformation, and a time-window technique is employed to calculate the antenna characteristic impedance. Using the model a comprehensive analysis of the antenna performance is carried out. [J335]

"A deep parametric study of resistor-loaded bow-tie antennas for ground-penetrating radar applications using FDTD"

Resistor-loaded bow-tie antennas are analyzed thoroughly to find out their performance on ground-penetrating radar (GPR) applications. The analysis is done with the finite-difference time-domain (FDTD) technique. The antenna is pulse driven and enclosed in a rectangular conducting cavity. The ability to detect a buried conducting sheet using two such identical antennas for transmitting and receiving is investigated. Simulations are carried out for various antenna parameters like end resistor values, flare angle, and antenna length. The gap between the two antennas and their height above the ground are also varied. Moreover, the results are obtained for different sizes, depths, and positions of the buried sheet. It is studied how the broadband impedance characteristics and better target discrimination with low clutter can be achieved by optimally selecting these antenna parameters. Also, it is shown that apart from the total parallel end resistance, the individual end resistor values and the number of resistors connected have no significant effect on the input impedance and the received signal. [J336]

"Numerical simulations of the scattered field near a statistically rough air-ground interface"

The two-dimensional problem of horizontally polarized wave scattering from an air-ground interface is considered. The diffraction problem is formulated by means of the extinction theorem, leading to a system of two simultaneous surface integral equations. The small-slope approximation has been used to solve this system. This solution was used as a fast forward solver in the Monte Carlo simulations of the scattered field near to the rough interface. Properties of the reflected field have been investigated for a single realization of the rough interface as well as for a statistical ensemble of such interfaces. Special attention has been paid to the phase of the reflected field (in the case of a single realization) and to the variance of the reflected field (in the case of a statistical ensemble), which has direct relation with the surface clutter in ground penetrating radars. A principal possibility to retrieve a surface profile from interferometric measurements of the reflected field near the surface is demonstrated. [J337]

"Pattern recognition of multiple signals from ground penetrating radar for metal and plastic objects"

The author describes methods for pattern recognition of multiple time signals of embedded targets in water or soil. The received time signals are investigated using characteristic features of metal and plastic pipes in water for better detection of plastic and for soil with noisy signals. The classification of time signals is done by statistical signal parameters, ARMAX, Prony modelling, a new difference vector method of the model transfer function H(z) in the coefficient vector feature space, principal component analysis (PCA), and the classification (more than the estimation or identification) of radar targets via complex frequencies (CNR-complex natural resonances) of these multiple time signals. [J338]

"Cramer-Rao lower bound for estimating quadrupole resonance signals in non-Gaussian noise"

Quadrupole resonance (QR) technology for the detection of explosives is of crucial importance in an increasing number of applications. For landmine detection, where the detection system cannot be shielded, QR has proven to be highly effective if the QR sensor is not exposed to radio-frequency interference (RFI). However, strong non-Gaussian RFI in the field is unavoidable. A statistical model of such non-Gaussian RFI noise is given in this letter. In addition, the asymptotic Cramer-Rao lower bound for estimating a deterministic QR signal in this non-Gaussian noise is presented. The performance of several convenient estimators is compared to this bound. [J339]

"Super-resolution imaging for point reflectors near transmitting and receiving array"

This paper presents subsurface imaging techniques using the well-known MUSIC algorithm to localize point reflectors in cross-borehole radar arrangements. Radar signals received by a spatial array have to be decorrelated, in general, as a preprocessing step when the MUSIC algorithm is implemented. Since most of the decorrelation techniques are based on planar wave incidence model, it is difficult to apply the decorrelation

technique for signals from radar targets in the near field of the array. In this paper, we introduce a decorrelation technique with transmitting and receiving array for targets near the array and apply the MUSIC algorithm for estimating the two dimensional position of the point targets in crosshole tomographic measurement. Further, an expanded version of the algorithm to eliminate the direct wave is also derived. Simulation results show that this method offers much higher resolution and accuracy than the conventional diffraction stack method. The paper also discusses the relationship between the SNR ratio and the minimum target separation to be resolved. [J340]

"Protocols for high-efficiency wireless networks [JBook Review]"

{no data available} [J341]

"Three-dimensional FDTD modeling of impulsive ELF propagation about the earth-sphere"

This paper reports the application of an efficient finite-difference time-domain (FDTD) algorithm to model impulsive extremely low frequency (ELF) propagation within the entire Earth-ionosphere cavity. Periodic boundary conditions are used in conjunction with a three-dimensional latitude-longitude FDTD space lattice which wraps around the complete Earth-sphere. Adaptive combination of adjacent grid cells in the east-west direction minimizes cell eccentricity upon approaching the poles and hence maintains Courant stability for relatively large time steps. This technique permits a direct, three-dimensional time-domain calculation of impulsive, round-the-world ELF propagation accounting for arbitrary horizontal as well as vertical geometrical and electrical inhomogeneities/anisotropies of the excitation, ionosphere, lithosphere, and oceans. The numerical model is verified by comparing its results for ELF propagation attenuation with corresponding data reported in the literature. [J342]

"Detecting landmines with ground-penetrating radar using feature-based rules, order statistics, and adaptive whitening"

An approach to detecting landmines using ground-penetrating radar (GPR) based on feature-based rules, order statistics, and adaptive whitening (FROSAW) is described. FROSAW relies on independent adaptation of whitening statistics in different depths and combining feature-based methods with anomaly detection using rules. Constant false alarm rate (CFAR) detectors are used for anomaly detection on the depth-dependent adaptively whitened data. A single CFAR confidence measure is computed via a function of order statistics. Anomalies are detected at locations with high CFAR confidence. Depth-dependent features are computed on regions containing anomalies. Rules based on the features are used to reject alarms that do not exhibit mine-like properties. The utility of combining the CFAR and feature-based methods is evaluated. The algorithms and analysis are applied to data acquired from tens of thousands of square meters from several outdoor test sites with a state-of-the-art array of GPR sensors. [J343]

"Modeling of ground-penetrating Radar for accurate characterization of subsurface electric properties"

The possibility to estimate accurately the subsurface electric properties from ground-penetrating radar (GPR) signals using inverse modeling is obstructed by the appropriateness of the forward model describing the GPR subsurface system. In this paper, we improved the recently developed approach of Lambot et al. whose success relies on a stepped-frequency continuous-wave (SFCW) radar combined with an off-ground monostatic transverse electromagnetic horn antenna. This radar configuration enables realistic and efficient forward modeling. We included in the initial model: 1) the multiple reflections occurring between the antenna and the soil surface using a positive feedback loop in the antenna block diagram and 2) the frequency dependence of the electric properties using a local linear approximation of the Debye model. The model was validated in laboratory conditions on a tank filled with a two-layered sand subject to different water contents. Results showed remarkable agreement between the measured and modeled Green's functions. Model inversion for the dielectric permittivity further demonstrated the accuracy of the method. Inversion for the electric conductivity led to less satisfactory results. However, a sensitivity analysis demonstrated the good stability properties of the inverse solution and put forward the necessity to reduce the remaining clutter by a factor 10. This may partly be achieved through a better characterization of the antenna transfer functions and by performing measurements in an environment without close extraneous scatterers. [J344]

"Trained detection of buried mines in SAR images via the deflection-optimal criterion"

In this paper, we apply a deflection-optimal linear-quadratic detector to the detection of buried mines in images formed by a forward-looking ground-penetrating synthetic aperture radar. The detector is a linear-quadratic form that maximizes the output SNR (deflection), and its parameters are estimated from a set of training data. We

show that this detector is useful when the signal to be detected is expected to be stochastic, with an unknown distribution, and when only a small set of training data is available to estimate its statistics. The detector structure can be understood in terms of the singular value decomposition; the statistical variations of the target signature are modeled using a compact set of orthogonal "eigenmodes" (or principal components) of the training dataset. Because only the largest eigenvalues and associated eigenvectors contribute, statistical variations that are underrepresented in the training data do not significantly corrupt the detector performance. The resulting detection algorithm is tested on data that are not in the training set, which has been collected at government test sites, and the algorithm performance is reported. [J345]

"Multiple-incidence and multifrequency for profile reconstruction of random rough surfaces using the 3-D electromagnetic fast multipole model"

A fast algorithm for reconstructing the profile of random rough surfaces using electromagnetic scattering data is presented. The algorithm is based on merging a fast forward solver and an efficient optimization technique. The steepest descent fast multipole method is used as the three-dimensional fast forward solver. A rapidly convergent descent method employing a "marching-on" strategy for processing multifrequency and multi-incidence angle data is introduced to minimize an underlying cost function. The cost function represents the error between true (synthetic) and simulated scattered field data. Several key issues that impact the accuracy in reconstructing the rough profile are examined in this work, e.g., the location and number of receivers, the incident and scattered directions, the surface roughness, and details regarding the manner in which sensitivity information is computed in the inversion scheme. The results show that using the multiple-incidence (one angle at a time) and the multifrequency (one frequency at a time) strategies lead to improve the profile reconstruction. [J346]

"Fundamentals of short-range FM radar-Book Review"

{no data available} [J347]

"Multisensor fusion in the frame of evidence theory for landmines detection"

In the frame of humanitarian antipersonnel mines detection, a multisensor fusion method using the Dempster-Shafer evidence theory is presented. The multisensor system consists of two sensors-a ground penetrating radar (GPR) and a metal detector (MD). For each sensor, a new features extraction method is presented. The method for the GPR is mainly based on wavelets and contours extraction. First simulations on a limited set of data show that an improvement in detection and false alarms rejection, for the GPR as a standalone sensor, could be obtained. The MD features extraction method is mainly based on contours extraction. All of these features are then fused with the GPR ones in some specific cases in order to determine a new feature. From these results, belief functions, as defined in the evidence theory, are then determined and combined thanks to the orthogonal sum. First results in terms of detection and false alarm rates are presented for a limited set of real data and a comparison is made between the two cases: with or without multisensor fusion. [J348]

"Measurement system of complex permittivity of ornamental rocks in L frequency band"

The use of ground-penetrating radar (GPR) techniques at high frequencies for historical building investigations requires an accurate knowledge of the material complex permittivity. A new measurement system is presented, which by exploiting a resonance phenomenon, yields accurate values of permittivity and resistivity also in the case of low-loss materials. These parameters are obtained from an amplitude-only measurement of the transmission response curve of a rectangular waveguide cavity, loaded by the sample under test. The setup requires the availability of brick-shaped samples, which can be obtained easily in the case of rock materials. Permittivities and resistivities were measured in the frequency range 1.1-1.7 GHz on samples of marbles, sandstones, and limestones. The measurement method and the experimental results are presented and discussed. [J349]

"Migration based SAR imaging for ground penetrating radar systems"

The authors consider migration based synthetic aperture radar (SAR) imaging of surface or shallowly buried objects using both down-looking and forward-looking ground penetrating radar (GPR). The well known migration approaches devised to image the interior of the Earth are based on wave equations and have been widely and successfully used in seismic signal processing for oil exploration for decades. They have the potential to image underground objects buried in complicated propagation media. Compared to ray-tracing based SAR imaging methods, migration based SAR imaging approaches are more suited to imaging underground objects owing to their simple and direct treatment of oblique incidence at the air-ground interface and propagation velocity variation in the soil. The authors apply the phase-shift migration approach to both constant-offset and common-

shot experimental data collected by PSI GPR systems. They address the spatial aliasing problems related to the application of migration to the GPR data and the spatial zero-padding approach to circumvent the problem successfully. [J350]

"Buried small objects detected by UWB GPR"

A ground penetrating radar (GPR) using short-pulse is developed to detect small and shallow metal objects buried underground. A bistatic mode in which the GPR system uses separate transmitting and receiving antennas is applied. A modified fat dipole antenna is developed for the transmitting and receiving antennas. The prototype of the system is tested in the real environment and 2D visualization of raw data is achieved. We show that the developed system has a good ability to detect underground metal objects, and even small targets of several centimeters. [J351]

"UWB implications for spectrum management"

This paper presents some of the challenges facing the introduction of ultra-wideband (UWB) technology in wireless applications intended for commercial use, summarizes relevant regulatory and standards developments, and addresses potential implications on spectrum management and radio regulations. [J352]

"Design of an LTCC tri-band transceiver module for GPRS mobile applications"

This paper presents the design and results of a low-temperature co-fired ceramic (LTCC) module for tri-band general packet radio service (GPRS) mobile applications. The proposed transceiver module integrates the tri-band (EGSM900/DCS1800/PCS1900) antenna switch, the surface-acoustic-wave filters for band selection, and a fully integrated tri-band transceiver integrated circuit into one LTCC package. By taking advantages of the three-dimensional layout capability of the LTCC substrate, the embedded circuit elements can be arranged vertically for size reduction. In addition, the utilization of mutual coupling leads to a novel design of miniature lumped-element realization of the transmission line. By combining these miniature passive component designs, the proposed module features a compact size of 13.8 mm Ч 8.1 mm, with a packaged height of 1.8 mm. The module is compliant with the European Telecommunications Standards Institute regulations for GPRS mobile applications and is currently in use in commercially available mobile phones. [J353]

"Quad-band GSM/GPRS/EDGE polar loop transmitter"

An enhanced data-rates for GSM evolution (EDGE) transmitter using a nonlinear GSM-type PA is presented. It is based on a novel polar loop architecture that employs separate feedback control of the amplitude and the phase of the output signal. With this approach, the problems with AM-to-PM as well as AM-to-AM of the nonlinear PA are essentially eliminated. In addition, this architecture allows for a large dynamic output power control range, as required by the GSM specification. The transmitter uses a standard I/Q interface and does not require the extraction of amplitude and phase modulation in the digital domain. The dual feedback loop ensures robust performance even under voltage-standing wave ratio variations without using an isolator. No external PA filtering is required to meet the transmitter noise in the receive band. The EDGE spectral mask is met with an rms error vector magnitude of [J354]

"A novel, compact, low-cost, impulse ground-penetrating radar for nondestructive evaluation of pavements"

This paper reports on the development of a novel, compact, low-cost, impulse ground-penetrating radar (GPR) and demonstrate its use for nondestructive evaluation of pavement structures. This GPR consists of an ultrashort-monocycle-pulse transmitter (330 ps), an ultrawide-band (UWB) sampling receiver (0-6 GHz), and two UWB antennas (0.2-20 GHz)-completely designed using microwave-integrated circuits with seamless electrical connections between them. An approximate analysis is used to determine the signal loss and power budget. Performance of this GPR has been verified through the measurements of relative permittivity and thicknesses of various samples, and a good agreement between the experimental and theoretical results has been achieved. [J355]

"A multicast mechanism for mobile multimedia messaging service"

Based on the cell broadcast service architecture, this paper proposes an efficient multicast mechanism for the universal mobile telecommunications system to support multimedia messaging service (MMS). We define a new interface between the serving GPRS support node and the cell broadcast center to track the current locations of the multicast members. Then we describe the location tracking procedures (including attach, detach, and location update) of the multicast members and the multicast message delivery procedure. We use an analytic model to

investigate the performance of our approach. This paper indicates that our MMS multicast mechanism outperforms the previous proposed approaches. [J356]

"Design and implementation of user interface for mobile devices"

The inspiration behind the wireless world came from the need to provide users with mobility and to offer an alternative to the limitations of wired mediums. As a result, there are various wireless mobile technologies like GSM, GPRS, WLAN, and Bluetooth available. The user interface and the size of mobile devices are one of the main concerns in the design of mobile devices. In this paper, we design a single-layered touch screen based user interface. Unlike conventional multi-layered user interface, a single-layered user interface will make the user interface more user-friendly with smaller size. The memory requirements can be further reduced by implementing it in low-level languages. After design and implementation of the user interface, we integrate the user interface with the hardware of mobile devices through serial port with the help of AT commands. [J357]

"Mobility and session management: UMTS vs. cdma2000"

This article describes the mobility and session management mechanisms for UMTS and cdma2000 packet-switched (PS) service domains, and compares the design guidelines for these two third-generation technologies. We first introduce the network architectures and protocols for UMTS and cdma2000, and then elaborate on the PS service domain's mobility management, session management, and IP-level mobility mechanisms. Based on the mobility and session management mechanisms of the UMTS and cdma2000 PS service domains, an integrated architecture and intersystem roaming procedures are proposed to show the implementation feasibility of UMTS-cdma2000 IP-level interworking. [J358]

"Correction to "Ground-Penetrating Radar Measurement of Soil Water Content Dynamics Using a Suspended Horn Antenna""

{no data available} [J359]

"Fast-switching analog PLL with finite-impulse response"

This paper describes a method for speeding up the linear settling response of integer-N phase-locked loops. Extending the discrete-time model of the PLL first proposed by Gardner, simple design rules are derived which guarantee accurate frequency settling in few reference cycles. Simulations show that the proposed design technique improves up to six times the settling time of a conventional design. The stability margins and the noise behavior of the proposed system are analyzed. [J360]

"Ground-penetrating radar measurement of soil water content dynamics using a suspended horn antenna"

A ground-penetrating radar (GPR) with a suspended horn antenna was used to obtain continual measurement of near-surface soil water content dynamics within a well-defined footprint. Water contents inferred from radar surface reflectivity (SR) were in agreement with gravimetric measurements from the top 1-cm soil layer. This sensitivity to top 1 cm was confirmed by comparison of SR with deeper measurements (1-5 cm) obtained by time-domain reflectometry. Measurements over sand and silt loam showed the role of soil type in controling near-surface dynamics of soil water due to evaporation and drainage processes. GPR with a horn antenna provided insights into physical processes that could affect larger scale radar platforms (air- or spaceborne) and enabled verification of radar measurements at well-defined spatial scales and detailed temporal resolutions not available by other radar remote sensing systems. [J361]

"Modeling and investigation of a geometrically complex UWB GPR antenna using FDTD"

A detailed analysis of ultrawide-band (UWB), dual-polarized, dielectric-loaded horn-fed bow-tie (HFB) antennas is carried out using the finite-difference time-domain (FDTD) method. The FDTD model includes realistic features of the antenna structure such as the feeding cables, wave launchers, dielectric loading, and resistive-film loading. Important antenna characteristics that are usually difficult to obtain via measurements can be obtained more directly from this FDTD model. Since the HFB antennas under consideration are intended for ground penetrating radar (GPR) applications, the effects of the half-space medium are also investigated. The simulated results serve to verify the performance of the HFB antenna design, and to optimize various antenna parameters. [J362]

"Layer-encoded video streaming a proxy's perspective"

This article describes a proxy's perspective in an architecture that supports efficient distribution of recorded video data in today's Internet. The support of layer-encoded video streaming with the aid of proxies enables a video distribution infrastructure that is efficient in today's Internet, and allows new mechanisms and techniques to be leveraged in a future Internet. An overview of a scalable and adaptive streaming architecture is presented. Open problems in the distribution and caching process are identified. Throughout the article solutions to improve the performance of such a video distribution architecture are discussed, mainly from the perspective of a proxy cache. The investigations that led to these solutions are based on an empirical experiment with layer encoded video. The goal of this experiment was to understand the effect of varying the number of layers on the viewer's perceived quality. The results of this initial investigation can be seen as the foundation for subsequent studies on mechanisms that improve the transport and caching of layer-encoded video in a scalable adaptive streaming architecture. [J363]

"First steps toward providing a system for converged digital broadcast and cellular telecommunications services"

{no data available} [J364]

"Silicon-germanium BiCMOS HBT technology for wireless power amplifier applications"

This paper discusses and illustrates the key device design issues for SiGe BiCMOS HBTs suitable for wireless power amplifier (PA) applications. Experimental results addressing ruggedness, ac performance, and safe operating area for high-breakdown SiGe HBTs built in several generations of BiCMOS technology are presented. Implications of recent high-performance SiGe HBT scaling achievements for BiCMOS technologies targeting wireless PA applications are considered. Circuit results for GSM, PCS, GPRS, and EDGE front-end modules have been obtained. A one-chip solution is demonstrated, including control circuitry and switching functionality, that supports all GPRS, PCS, and EDGE modes featuring output power at 33.8 dBm and overall power added efficiency of 37% withstanding voltage standing wave ratio conditions of 15:1. [J365]

"Radiation from groove-backed antennas with a gap"

In a ground penetrating radar system, there is inevitably a gap between the antennas and ground surface. The presence of a gap strongly influences the antenna radiation and the coupling mechanism between the transmitting and receiving antennas. The radiation and coupling between two groove-backed antennas is investigated when a gap is present between the ground and antenna. The boundary conditions are used to constitute simultaneous equations for discrete modal coefficients. The characteristics of coupling reduction and radiation are illustrated in terms of antenna geometries. [J366]

"Multimedia QoS Support Specified in Various Wireless Network Standards"

{no data available} [J367]

"Beam characteristics of three-dimensional SAR in curved or random paths"

Interferometric synthetic aperture radar (InSAR) provides average height information by combining data from two parallel paths. True three-dimensional (3-D) SAR also detects the height distribution, which is of significant interest in airborne reconnaissance, forest inventory, and subsurface or wall-penetrating sensing applications as examples. In this paper, the beam performance of 3-D SAR is studied and compared for different curved line paths, such as circles, ellipses, and spirals ending up with random sampling. Curved path geometry reduces the ambiguity in height angle of traditional multipass SAR, and random path variation further improves the sidelobe suppression. The poor sidelobe suppression of a single circle path is significantly improved in near-range geometry in combination with high range resolution. By introducing a window function dependent on focus point and path position, high sidelobe suppression was achieved in an extended ground area below the circle path. [J368]

"RC-loaded bow-tie antenna for improved pulse radiation"

In this paper, a loading technique for improving pulse radiation from bow-tie antennas is introduced. This technique allows transmission of short transient pulses with very small late-time ringing and relatively high radiation efficiency. It makes use of a combination of a constant resistive loading along the antenna and a capacitive loading with linearly increasing reactance toward the antenna ends. The constant resistive loading is applied using volumetric microwave absorbers to cover one side of the antenna and the linear capacitive loading is realized by constructing narrow slots on the antenna surface. Relatively high radiation efficiency is achieved by choosing the location of the slot nearest to the feed point in such a way that radiation from it combines

constructively with radiation from the feed point. Using a 0.8-ns monocycle for excitation, the technique results in a level of late-time ringing of lower than -40 dB and at the same time the peak value of the transmitted pulse is 54% higher than that of the same antenna without loading. [J369]

"Performance analysis of RLC/MAC and LLC Layers in a GPRS protocol stack"

In this paper, we analyze the performance of various layers of the general packet radio service (GPRS) protocol stack, including radio link control/medium-access control (RLC/MAC) layer and logical link-control (LLC) layer on the uplink. In the GPRS MAC protocol, several time-slotted uplink radio-frequency channels are shared by the mobiles on a request-reservation-based multiple-access scheme. Using the theory of Markov chains, we derive expressions for the average throughput and delay performance of the GPRS MAC protocol. We evaluate the performance of the RLC layer (in acknowledged mode) using block-level retransmission (BLR), as defined in the current GPRS standard, and compare it with that of using slot-level retransmission (SLR). We show that SLR at the RLC layer performs significantly better than the BLR, particularly when the channel-error rates are moderate to high. We further investigate the choice of parameters (e.g., number of retransmission attempts) for the automatic repeat request schemes at the RLC and LLC layers. Our results show that it is more beneficial to do error recovery by allowing more retransmission attempts at the RLC layer than at the LLC layer. We also evaluate the performance of transmission-control protocol with BLR and SLR at the RLC layer. [J370]

"At what layer does mobility belong?"

Internetworking is a complex problem, traditionally tackled by splitting responsibilities between several layers of protocols arranged in a stack. A shortcoming of the current Internet suite's layers is that the responsibilities of individual layers are somewhat ill defined. The result is that frequently a feature may cause problems for higher layers when it unexpectedly exists lower in the stack, or may be unnecessarily and inefficiently implemented in multiple layers. Mobility is one such feature with no well defined place in classical protocol stacks. If a link layer hands over between two distinctly administered networks, a network layer protocol will likely need to acquire a new address. Similarly, if mobility is implemented at the network layer, such as with mobile IP, transport layer protocols must be prepared to deal with a slew of problems (rapid changes in available capacity and delay, the asymmetry of triangle routes, and security policies, to name a few). Code for higher-level protocols (above transport) is less frequently reused, so higher-layer mobility schemes fail to leverage the large base of TCP sockets code. We discuss the various strengths and weaknesses of implementing mobility at three different layers of the protocol stack, concluding that a transport layer mobility scheme is likely to suit today's mobile Internet users best, and that ideally there should be more communication between layers to avoid conflict and inefficiency. [J371]

"Honeypot forensics, part II: analyzing the compromised host"

Although flows are an effective method for monitoring honeypots in real time, they are not sufficient if we want to learn more about the intruder. To accomplish this goal, we must investigate the compromised host itself. In this article, we show how to build two timelines of events: one from network clues and the other from what the host tells us. We can then merge these timelines and answer additional questions. [J372]

"The AMD Opteron processor for multiprocessor servers"

Representing AMD's entry into 64-bit computing, Opteron combines the backwards compatibility of the X86-64 architecture with a DDR memory controller and hypertransport links to deliver server-class performance. These features also make Opteron a flexible, modular, and easily connectable component for various multiprocessor configurations. [J373]

"Reducing authentication signaling traffic in third-generation mobile network"

In the Universal Mobile Telecommunication System (UMTS), authentication functions are utilized to identify and authenticate a mobile station (MS) and validate the service request type to ensure that the user is authorized to use the particular network services. The authenticating parties are the authentication center (AuC) in the home network and the MS. In the UMTS, the serving general packet radio service support node (SGSN) accesses the AuC to obtain the authentication data, and delegates the AuC to perform mutual authentication with the MS. Since the cost for accessing AuC is expensive, the SGSN may obtain an array of authentication vectors (AVs) at a time so that the number of accesses can be reduced. On the other hand, if the size K of the AV array is large, the AV array transmission from the AuC to the SGSN may be expensive. Thus, it is desirable to select an appropriate K value to minimize the authentication network signaling cost. We propose an analytic model to investigate the impact of K on the network signaling traffic, which is validated by simulation experiments. Then, we propose an automatic K-selection mechanism that dynamically selects the size of the AV array to reduce the

network signaling cost. Our study indicates that the automatic K-selection mechanism effectively identifies appropriate size of the authentication vector array. [J374]

"Penetration depth as a DInSAR observable and proxy for soil moisture"

We use prior theory and experimental results to construct a quantitative relationship between soil moisture and the penetration depth of synthetic aperture radar (SAR) microwaves at L-, C-, and X-bands. This relationship is nonlinear and indicates that a change of 5% volumetric water content (VWC) can cause between 1 and 50 mm of change in C-band penetration depth depending on initial VWC. Because these depths are within the range of differential interferogram SAR (DInSAR) measurement capability, penetration depth may be a viable proxy for measuring soil moisture. DInSAR is unlikely to detect a measurable change in penetration depth above 30% VWC, though certain clay rich soils may continue to cause surface deformation above that level. The possibility of using clay swelling as a proxy for soil moisture was found to be less feasible than penetration depth. Soil moisture may also be a significant, and previously unrecognized, source of noise in the measurement of subtle deformation signals or the creation of digital elevation models using repeat-pass DInSAR. [J375]

"A fast lock digital phase-locked-loop architecture for wireless applications"

A fast lock digital phase-locked-loop (PLL) frequency synthesizer for wireless applications is reported. The main advantages of the architecture include small area and digitally selectable frequency resolution. Also, a fully digital solution to reducing the phase lock time is introduced. This work is also supported by a nonlinear analytical analysis of the locking mechanism for PLLs. [J376]

"Determining the optimal buffer size for short message transfer in a heterogeneous GPRS/UMTS network"

Multimedia messaging service (MMS) enables the transmission of messages with full content versatility between mobile devices and from applications to these devices, which can be used over the general packet radio service (GPRS)/universal mobile telecommunications system (UMTS) short message service (SMS) network. In the GPRS/UMTS SMS network, the serving GPRS support node (SGSN) stores the mobile-terminated message in a queue until it is successfully transferred to the mobile device or its maximum waiting time expires. If the mobile device moves from one SGSN area to another before the waiting time has expired, the queued message is forwarded to the new SGSN and is immediately removed from the waiting queue of the old SGSN. Taking the forwarding and the expiration effects of queued messages into account, the paper develops an analytical model to study the system performance of a heterogeneous GPRS/UMTS SMS network, in which the parameters (e.g., message arrival rate, SGSN area residence time, buffer size, etc.) of SGSNs can be varied. On the basis of the analytical model, an iterative method is proposed to determine the optimal buffer size so that the available bandwidth is fully utilized and the message loss probability is minimized. [J377]

"On the feasibility of impulse reflection response data from one-dimensional multilayered lossy media"

Solving inverse scattering problems using layer stripping algorithms is known to be fast and effective when the data are noise-free. However, layer stripping algorithms have a reputation of being unstable when applied to noisy time-domain reflection response data. The reason is that the noisy data may be infeasible; i.e., could not have been produced by an actual media. In this paper, three feasibility conditions are introduced for data from absorbing (lossy) one-dimensional (1-D) media. Satisfying these conditions is both necessary and sufficient for the data to have been produced by an actual lossy media. That is, layer stripping algorithms applied such noisy but feasible data are stable. A methodology for correcting infeasible data is also proposed. Numerical examples illustrate key points and the correction method. [J378]

"Scalable portrait video for mobile video communication"

Wireless networks have been rapidly developing in recent years. General Packet Radio Service (GPRS) and Code Division Multiple Access (CDMA 1X) for wide areas, and 802.11 and Bluetooth for local areas have already emerged. Broadband wireless networks urgently call for rich contents for consumers. Among various possible applications, video communication is one of the most promising for mobile devices on wireless networks. This paper describes the generation, coding, and transmission of an effective video form, scalable portrait video for mobile video communication. As an expansion to bilevel video, portrait video is composed of more gray levels, and therefore possesses higher visual quality while it maintains a low bit rate and low computational costs. Portrait video is a scalable video in that each video with a higher level always contains all the information of the video with a lower level. The bandwidths of 2-4-level portrait videos fit into the bandwidth range of 20-40 kbps

that GPRS and CDMA 1X can stably provide; therefore, portrait video is very promising for video broadcast and communication on 2.5-G wireless networks. With portrait video technology, we are the first to enable two-way video communication on pocket PCs and handheld PCs. [J379]

"Moderately rough dielectric interface profile reconstruction via short-pulse quasi-ray Gaussian beams"

A new technique for estimating the coarse-scale profile of a moderately rough interface between air and a homogeneous dielectric halfspace is presented. The proposed approach is based on space-time sparsely sampled reflected field observations and uses a quasi-ray Gaussian beam fast-forward model, coupled with a compact parameterization of the surface profile in terms of B-splines, from which the profile estimation problem is posed as a nonlinear optimization problem. Numerical experiments are presented to assess accuracy, reliability, and computational efficiency. The proposed approach finds applications in adaptive schemes for rough surface underground imaging of shallowly buried targets via ultra wide-band ground penetrating radars. [J380]

"Relationship Management: Secure collaboration in a ubiquitous environment"

Intel recently engaged in an experiment that focused on local identity management. Researchers developed a relationship management module that runs on various devices. Using RM, groups of people can securely share documents, text messages, and other electronic media. [J381]

"Performance of IP-based services over GPRS"

We examine the traffic-handling capabilities of general packet radio service (GPRS) with respect to supporting IP-based Internet services. We begin with an overview of GPRS in which we discuss its general characteristics, connection set-up procedures, and data transfer procedures, both for the reverse link and the forward link. We then present an analytical model to assess throughput of the reverse link as a function of the number of users connected and the distribution of user message lengths. Next, we investigate the capability of GPRS to support World Wide Web access using the analytical model. Specifically, we present a realistic scenario for user sessions operating under the Hypertext Transfer Protocol (HTTP) and we assess the transaction-handling capabilities as a function of the number of user sessions, taking into account network delays, forward link transmission, random access delay, and other factors. The results obtained by using the analytical model in both cases are verified by simulation. We also consider, via simulation, a scenario where both continuously backlogged users and users operating HTTP sessions are present. We find that, in the case of continuously backlogged users, an increase in the number of contention slots does not always translate to an increase in throughput, while, in the case of users operating HTTP sessions, the downlink serves as the main bottleneck in the system. We conclude with a discussion of some open issues in the design of GPRS-based Internet access. [J382]

"Optimization of the transmitter-receiver separation in the ground-penetrating radar"

The finite-difference time-domain method is applied to simulate three-dimensional subsurface-scattering problems, involving a ground-penetrating radar (GPR) model consisting of two transmitters and a receiver. The receiving antenna is located in the middle of the two identical transmitters, which are fed 180° out of phase. This configuration implies the existence of a symmetry plane in the middle of two transmitters and the cancellation of the direct signals coupled from the transmitters at the receiver location. The antenna polarizations and their separations are arbitrary. The transmitter-receiver-transmitter configured GPR model is optimized in terms of the scattered energy observed at the receiver by varying the antenna separation. Many simulation results are used to demonstrate the effects of the antenna separation and the optimal separation encountered for a specific target and GPR scenario. [J383]

"A new ultrawide-bandwidth dielectric-rod antenna for ground-penetrating radar applications"

A new ultrawide-bandwidth dielectric-rod antenna is presented with its application in detecting shallow targets, such as antipersonnel (AP) mines. The lowest hybrid mode is launched and guided along a circular-dielectric waveguide. The end of the waveguide is tapered to a point where electromagnetic waves are radiated out with field behavior similar to that radiated from a Hertzian dipole in the forward direction. The low antenna clutter and weak antenna-ground interaction are two unique features. Its near-field radiation properties are investigated by directly probing the fields and by numerical simulation with a three-dimensional finite-difference time-domain technique. Both measurement and numerical simulation results are presented for the detection of buried AP mines using a prototype dielectric-rod antenna operated at a frequency range from 1 to 6 GHz. [J384]

"The 2.5-D multidomain pseudospectral time-domain algorithm"

A 2.5-D multidomain pseudospectral time-domain (PSTD) method with a suitable well-posed perfectly matched layer is developed as an accurate and flexible tool for the simulation of electromagnetic wave propagation and scattering in conductive and inhomogeneous media. This approach allows for an accurate treatment of curved geometries with a high efficiency. Numerical results show an excellent agreement with analytical solutions for lossy dielectric cylinders. The 2.5-D multidomain PSTD algorithm is applied to several scattering and waveguiding problems. [J385]

"A curve evolution approach to object-based tomographic reconstruction"

We develop a new approach to tomographic reconstruction problems based on geometric curve evolution techniques. We use a small set of texture coefficients to represent the object and background inhomogeneities and a contour to represent the boundary of multiple connected or unconnected objects. Instead of reconstructing pixel values on a fixed rectangular grid, we then find a reconstruction by jointly estimating these unknown contours and texture coefficients of the object and background. By designing a new "tomographic flow", the resulting problem is recast into a curve evolution problem and an efficient algorithm based on level set techniques is developed. The performance of the curve evolution method is demonstrated using examples with noisy limited-view Radon transformed data and noisy ground-penetrating radar data. The reconstruction results and computational cost are compared with those of conventional, pixel-based regularization methods. The results indicate that the curve evolution methods achieve improved shape reconstruction and have potential computation and memory advantages over conventional regularized inversion methods. [J386]

"Human equivalent antenna model for transient electromagnetic radiation exposure"

Thin-wire antenna model of the human body exposed to the transient excitation is presented in the paper. The analysis is based on the solution of the corresponding integral equation and it is carried out directly in the time domain (TD) . The integral equation is handled via the TD Galerkin-Bubnov scheme of the boundary element method. Numerical results are presented for the time-harmonic and transient exposures. [J387]

"Electromagnetics-the uncertain health risks"

Considering all the evidences to date in the scientific literature, an association between EM fields at the environmental levels and harmful effects to human is inconclusive or uncertain. However, the available evidences are enough to raise concern by certain segments of the public. In order to manage health risk in the face of scientific uncertainty, authorities may be persuaded to consider precautionary approaches while establishing safety standards and protection guidelines for EM fields. The precautionary principle is another management tool that could be adopted to deal with the health risks associated with EM exposure. It is an extremely conservative decision making principle that leads to prudent actions in the face of uncertainty. Where there is reasonable risk to the public, a prudent action to reduce the risk should be carried out. This procedure should hold even when the scientific proof is inconclusive as long, as the balance of quantitative and qualitative risk, benefit and cost of action justifies it. [J388]

"IP micro-mobility protocols"

Wireless cellular networks are quickly evolving toward broadband offering higher bandwidth. At the same time, these networks are also moving toward all-IP networks. In this article, we first describe the global mobility landscape for these future networks. This landscape is designed to be as generic as possible to allow us to compare several IP mobility management proposals with very different characteristics. We illustrate the utilization of this landscape with a short presentation of the IP-level mobility management in general packet radio service (GPRS) and Universal Mobile Telecommunication System (UMTS) networks. We then point out and describe the important issues that must be addressed to manage mobile nodes. These issues include mainly handoff management, the support of passive connectivity and paging, scalability and robustness. Within this framework we examine mobile IP as a first IP mobility management protocol. We then present the well known distinction between macro-mobility and micro-mobility and the advantages of this approach. Finally, we compare seven of the recently proposed IP micro-mobility protocols: hierarchical mobile IP, proactive handoff, fast handoff, telecommunication-enhanced mobile IP architecture (TeleMIP), cellular IP, HAWAII, and Edge mobility architecture (EMA). We find that, while the micro-mobility protocols proposed thus far do address a number of interesting issues, more work remains to be done in order to arrive at a scalable, reliable solution. [J389]

"GRS 2002: German Radar Symposium in Bonn, Germany"

The German Radar Symposium (GRS 2002), organized jointly by the German Institute of Navigation (DGON)

and by the Information Technology Society (VDE-ITG), attracted wide interest in the international radar community. It was held from September 3-5, 2002, in Bonn, the former capital city of Germany. The GRS 2002 programme covered a large scale of important radar topics. All classical topics like air traffic control, CFAR, antenna technology, signal processing and simulation papers have been presented and new results were demonstrated. These topics were combined with new applications like meteorology, subsurface, and automotive to underline the increase of interest in radar technology. Phased array antennas are the key elements of high performance multi-function radar systems which are studied all over the world. SAR and ISAR are, nowadays, essential radar techniques for civil and military observation and monitoring. [J390]

"Finite-alphabet information and multivariate blind deconvolution and identification of linear systems"

This article addresses the problem of estimating a multivariate linear system from its output when the input is an unobservable sequence of random vectors with finite-alphabet distribution. By explicitly utilizing the finite-alphabet property, an estimation method is proposed under the traditional inverse filtering paradigm as a generalization of a univariate method that has been studied previously. Identifiability of multivariate systems by the proposed method is proved mathematically under very mild conditions that can be satisfied even if the input is nonstationary and has both cross-channel and serial statistical dependencies. Statistical super-efficiency in estimating both parametric and nonparametric systems is also established for an alphabet-based cost function. [J391]

"Performance comparisons of dynamic resource allocation with/without channel de-allocationin GSM/GPRS networks"

In this letter, we analyzed and compared the performance of dynamic resource allocation with/without channel de-allocation in GSM/GPRS networks. It is quite known that dynamic resource allocation allows communication systems to utilize their resources more efficiently than the traditional fixed allocation schemes. In GPRS, multiple channels may be allocated to a user to increase the transmission rate. In the case when there are no free channels in the system, some of these channels may be de-allocated to serve higher priority calls. The results show that with channel de-allocation mechanism, the voice blocking probability can be greatly reduced, especially at high GPRS traffic load. Besides, the scheme with channel de-allocation mechanism can achieve higher channel utilization. [J392]

"A push mechanism for GPRS supporting private IP addresses"

The General Packet Radio Service (GPRS) provides a packet switched data service for mobile users. However, the existing GPRS specification does not provide the push mechanism and it is difficult to support GPRS services such as call termination (incoming call) for wireless voice over IP (VoIP). Based on the short message service, this paper proposes a push mechanism for GPRS supporting private IP addresses. Our approach does not need to modify the existing GPRS structure. [J393]

"Analysis of the distorted Born approximation for subsurface reconstruction: truncation and uncertainties effects"

The problem of determining the dielectric permittivity profile of buried objects starting from the knowledge of the scattered field is considered in the two-dimensional geometry when incomplete near-zone data are collected at a single frequency under a multiview/multistatic measurement configuration. In particular, attention is paid to the practical issues of the truncated observation domain and the presence of uncertainties on data. The problem is tackled with reference to the scalar polarization by linearization of the mathematical relationship between the unknown dielectric permittivity profile and the scattered field. A homogeneous, possibly lossy, half-space geometry for the subsurface modeling is adopted, thus leading to the so-called distorted Born approximation (DBA). A thorough investigation of the class of unknown functions that can be reliably retrieved is performed by dealing with singular value decomposition of the relevant linear operator. It results that even if sources and receivers are located at the interface, a very restricted set of profile variations can be reconstructed by a stable inversion algorithm. In particular, reduced vertical features of the buried objects with respect to the horizontal ones can be reconstructed under DBA. Moreover, the truncation of the observation domain further restricts this set, affecting mainly the vertical resolution. Numerical results confirming the validity of the analysis are also provided. [J394]

"Single-reference near-field calibration procedure for step-frequency ground penetrating radar"

The antenna system of ground penetrating radar is usually positioned in the vicinity of the ground surface to

obtain sufficient spatial resolution for detecting small targets. Therefore, received signals are subject to errors caused by unwanted reflections and coupling. A near-field calibration procedure taking into account these effects as well as antenna dispersion is presented. For practical convenience, only a metal plane is used here as a calibration standard. Calibration data are measured for a set of distances between the antenna and metal plane. The reference reflections in all positions are computed using polynomial representation of the reflected signal. Then, error coefficients are obtained by a solution of a linear system of equations in the least squares sense. Experimental verification of the proposed calibration technique demonstrated efficient removal of artefacts caused by unwanted reflections. Moreover, peaks in the radar range profile become sharper after calibration if the antenna is dispersive. Consequently, the ground response in the form of an exponential term can be effectively subtracted from the received signal. This helps to reveal and discriminate shallow underground targets obscured by strong reflection of the ground surface. Experimental examples are given to illustrate the performance of the method. [J395]

"QoS in integrated 3G networks"

First Page of the Article [J396]

"Always best connected"

Over the last few years, we have experienced a variety of access technologies being deployed. While 2G cellular systems evolve into 3G systems such as UMTS or cdma2000, providing worldwide coverage, wireless LAN solutions have been extensively deployed to provide hotspot high-bandwidth Internet access in airports, hotels, and conference centers. At the same time, fixed access such as DSL and cable modem tied to wireless LANs appear in home and office environments. The always best connected (ABC) concept allows a person connectivity to applications using the devices and access technologies that best suit his or her needs, thereby combining the features of access technologies such as DSL, Bluetooth, and WLAN with cellular systems to provide an enhanced user experience for 2.5G, 3G, and beyond. An always best connected scenario, where a person is allowed to choose the best available access networks and devices at any point in time, generates great complexity and a number of requirements, not only for the technical solutions, but also in terms of business relationships between operators and service providers, and in subscription handling. This article describes the concept of being always best connected, discusses the user experience and business relationships in an ABC environment, and outlines the different aspects of an ABC solution that will broaden the technology and business base of 3G. [J397]

"The design policy for a GSM-based IMT-2000 network"

The third-generation mobile network has been a topic of considerable interest worldwide and has begun to be commercialized throughout the world. The 3G mobile network has evolved from two types of 2G networks; one type has evolved from GSM and another from ANSI-41. We operate the Personal Digital Cellular network as a 2G network and have designed a GSM-based IMT-2000 network as a 3G network. This article gives our design policy for the GSM-based IMT-2000 network and the technology that enabled us to develop the network based on this policy (e.g., ATM switching in the core network). Furthermore, the foundations for 2G/3G dual network operation (e.g., number portability and succession of 2G services in a 3G network) and efficient transition from a 2G network to a 3G network are also considered. [J398]

"Critical issues for roaming in 3G"

Roaming for voice, the ability for a user to make and receive calls when visiting another country, is taken for granted by GSM users today. Currently GSM mobile operators are introducing packet-based data networks (also known as General Packet Radio Service) that bring a huge variety of services. However, this new network also introduces new complexity in the support of the packet-based roaming scenario. Due to the number of services, operators, and users envisaged, it will be impossible for operators to test all services for roaming in all partner networks for GPRS; instead, the capabilities of the network have to be tested. Furthermore, mobile data service developers must be aware that the network capabilities of a visited (GPRS) network might differ from the home network; thus, consideration is required to ensure service continuity. This is especially true as mobile operators start offering 3G networks and support roaming agreements from 3G to 2G networks. In the continuing development of the mobile network, 3GPP (the international standardization body developing the UMTS standards) has defined the IP multimedia subsystem (IMS) as an evolutionary path for basic 3G networks (developing on the already defined Release 99 and Release 4 capabilities). The IMS provides an overlay architecture on top of the basic 3G architecture and implies roaming outside the basic 3G architecture. The resulting 3G-IMS network creates a two-layered roaming architecture, potentially resulting in issues related to optimal routing, QoS, and support of local services. The challenge for the industry cannot be pointed out as one

difficult technical issue that needs to be solved to ensure 3G roaming. Instead there many smaller issues with many alternative solutions that need to be solved. Only when operators have a clear view of these issues and their roaming requirements can all issues be solved and roaming agreement negotiations run smoothly. As it looks today, it will be time consuming to establish and conclude the roaming agreements for 3G; thus, delays in the roaming service are expected. When IMS arrives, new addendums will be needed to the roaming agreements, and the same risk for delays exists if the demand issues are not properly addressed before the negotiations. [J399]

"Key concepts for evolution toward beyond 3G networks"

Now, when the first commercial 3G services based on Third Generation Partnership Project (3GPP) specifications have been launched around the world, is the right time to start considering the evolution potential of 3G systems. It is assumed that the majority of the traffic in future mobile networks will be generated by content consumption related services, which are realized with IP technologies. Thus, it is necessary to optimize the cellular networks for carrying IP traffic as efficiently as possible. We describe an evolution scenario for the 3G network architecture specified by 3GPP. The IP delivery part of the network architecture is first optimized within each subsystem, while maintaining interoperability with the legacy network. Later, the network is streamlined as a whole to provide the most efficient solution. We show how graceful evolution of the 3GPP system can benefit from possibilities of the new technologies, especially IP-based transport, while maintaining compatibility with existing user equipment and capitalizing on existing infrastructure investments. [J400]

"Wireless Internet access of the visited mobile ISP subscriber on GPRS/UMTS network"

In this paper we illustrate how the visiting mobile ISP subscriber can access the home ISP via Gateway GPRS Support Node (GGSN) on the GPRS/UMTS network. We show the wireless Internet access model for the visiting ISP subscriber using dynamic IP in the home ISP based on the GPRS network, and there was a core network testbed and protocol stack, information flow, operation, and parameters of signaling messages for wireless Internet access of the visiting ISP subscriber. We implement SGSN, GGSN, and ISP servers such as RADIUS, Web server, DHCP for simulation and simulated GPRS functions, Internet services, and performance of IP-in-IP between GGSN and ISP web server using our core network testbed with RAN simulator. We also propose some implementation ideas for wireless Internet access of visiting ISP subscribers using dynamic IP in home ISP based on the GPRS/UMTS network. [J401]

"Time-frequency analysis for plastic landmine detection via forward-looking ground penetrating radar"

Time-frequency analysis techniques are used for buried plastic landmine detection with a forward-looking ground penetration radar (GPR) system. Several time-frequency distributions are considered to characterise and interpret the scattering phenomena of both targets and clutter. An ambiguity function based detector is also presented, which employs principal component analysis and feature selection for data dimensionality reduction and linear discriminant analysis for signal classification. Experimental results based on the SRI (Stanford Research Institute) experimentally measured forward-looking GPR data are presented, showing a significant detection performance improvement over the conventional detector [J402]

"Gradient-based 2-D/3-D rigid registration of fluoroscopic X-ray to CT"

We present a gradient-based method for rigid registration of a patient preoperative computed tomography (CT) to its intraoperative situation with a few fluoroscopic X-ray images obtained with a tracked C-arm. The method is noninvasive, anatomy-based, requires simple user interaction, and includes validation. It is generic and easily customizable for a variety of routine clinical uses in orthopaedic surgery. Gradient-based registration consists of three steps: 1) initial pose estimation; 2) coarse geometry-based registration on bone contours, and; 3) fine gradient projection registration (GPR) on edge pixels. It optimizes speed, accuracy, and robustness. Its novelty resides in using volume gradients to eliminate outliers and foreign objects in the fluoroscopic X-ray images, in speeding up computation, and in achieving higher accuracy. It overcomes the drawbacks of intensity-based methods, which are slow and have a limited convergence range, and of geometry-based methods, which depend on the image segmentation quality. Our simulated, in vitro, and cadaver experiments on a human pelvis CT, dry vertebra, dry femur, fresh lamb hip, and human pelvis under realistic conditions show a mean 0.5-1.7 mm (0.5-2.6 mm maximum) target registration accuracy. [J403]

"A mobility management strategy for GPRS"

In general packet radio service (GPRS), a mobile station (MS) is tracked at the cell level during packet transmission, and is tracked at the routing-area (RA) level when no packet is delivered. A READY timer (RT)

mechanism was proposed in 3GPP 23.060 to determine when to switch from cell tracking to RA tracking. In this mechanism, a threshold interval T is defined. If no packet is delivered within T, the MS is tracked at the RA level. When a packet arrives, the MS is tracked at the cell level again. However, the RT mechanism has a major fallacy in that the RTs in both the MS and the serving GPRS support node may lose synchronization. This paper considers another mechanism called READY counter (RC) to resolve this problem. In this approach, a threshold K is used. Like the RT approach, the MS is tracked at the cell level during packet transmission. If no packets are delivered after the MS has made K cell crossings, the MS is tracked at the RA level. We also devise an adaptive algorithm called dynamic RC (DRC). This algorithm dynamically adjusts the K value to reduce the location update and paging costs. We propose analytic and simulation models to investigate RC, RT, and DRC. Our study indicates that RC may outperform RT. We also show that DRC nicely captures the traffic-mobility patterns and always adjusts the K threshold close to the optimal values. [J404]

"Propagation velocity uncertainty on GPR SAR processing"

To detect buried landmines, Planning Systems Incorporated (PSI) has developed a ground-penetrating synthetic aperture radar (GPSAR) system. Since the electromagnetic wave propagation velocity in the soil depends on many factors, velocity uncertainty is inevitable. However, we have observed that, unlike conventional airborne/spaceborne synthetic aperture radar (SAR) systems, the PSI GPSAR system is very robust against the velocity uncertainty under mild conditions. Theoretical analysis is provided to explain this observation. Although our discussion is based on the PSI GPSAR system, it applies to other GPR-based (ground-penetrating radar) landmine detection systems as well. [J405]

"Optimum passive shields for mitigation of power lines magnetic field"

This paper presents a systematic semi-heuristic method to locate the most effective passive shield with the aim of mitigating the magnetic field generated from overhead power lines, at both sides from the line. As an example, the method is applied to two different phase arrangements used frequently in EHV: flat and double-circuit vertical, with shields of a single loop (two conductors), two loops with a common conductor (three conductors), or two separate loops (four conductors). Numerical results of mitigation, obtained with different solutions and further discussion, are also provided. [J406]

"Three-dimensional imaging of buried objects in very lossy earth by inversion of VETEM data"

The very early time electromagnetic system (VETEM) is an efficient tool for the detection of buried objects in very lossy earth, which allows a deeper penetration depth compared to the ground-penetrating radar. In this paper, the inversion of VETEM data is investigated using three-dimensional (3-D) inverse scattering techniques, where multiple frequencies are applied in the frequency range from 0-5 MHz. For small and moderately sized problems, the Born approximation and/or the Born iterative method have been used with the aid of the singular value decomposition and/or the conjugate gradient method in solving the linearized integral equations. For large-scale problems, a localized 3-D inversion method based on the Born approximation has been proposed for the inversion of VETEM data over a large measurement domain. Ways to process and to calibrate the experimental VETEM data are discussed to capture the real physics of buried objects. Reconstruction examples using synthesized VETEM data and real-world VETEM data are given to test the validity and efficiency of the proposed approach. [J407]

"Enhancing homeland security with advanced UWB sensors"

This article discusses recent research into short-range UWB radars that have the potential to create more robust perimeter security sensor systems for exterior installations. It also briefly discusses existing UWB sensors to show how they establish a technical precedent for today's research. [J408]

"Performance analysis of reservation media-access protocol with access and serving queues under bursty traffic in GPRS/EGPRS"

Performance modeling of the contention-based reservation protocol in the general packet radio service (GPRS)/enhanced GPRS (EGPRS) under bursty traffic is of practical use in system design. Instead of using discrete event simulation, we construct an analytical model based on stochastic Petri net formalism to investigate GPRS uplink performance efficiently. The model is built to capture the major features of a realistic system, taking into account factors such as the traffic profile, the system's capture capability, the contention persistence, the multislot capability, and the use of the access queue and the round-robin virtual serving queue. As shown in numerical results, these factors have different impacts on the performance measures, such as link-control-layer frame-blocking probability, frame delay, system throughput, and packet-channel utilization. To avoid modeling

and computational complexity in a GPRS/EGPRS system model that supports several mobile terminals, we make first-order approximations and use an iterative fixed-point scheme. Comparisons with discrete event simulations are conducted and show promising agreement with the proposed analytical-numerical model. We then use the model to investigate GPRS packet-data performance under different parameter settings and present numerical results, providing insights into network design and optimization. [J409]

"Wireless makes multiplayer gaming a winner"

First Page of the Article [J410]

"A fully integrated zero-IF transceiver for GSM-GPRS quad-band application"

A fully integrated GSM/GPRS quad-band transceiver is presented. It includes the receiver, the transmitter, the synthesizer, all necessary voltage-controlled oscillators, all loop filters, the voltage regulators, the voltage-controlled crystal oscillator, and the power amplifier controller. The chip meets all GSM specification. The design was done in a BiCMOS SiGe 0.35-μm technology and the die area is 14 mm2. [J411]

"Performance evaluation of location management in UMTS"

The universal mobile telecommunications system utilizes a three-level location-management strategy to reduce the net costs of location update and paging in the packet-switched service domain. Within a communication session, a mobile station (MS) is tracked at the cell level during packet transmission. In the idle period of an ongoing session, the MS is tracked at the UTRAN registration area (URA) level to avoid frequent cell updates while still keeping the radio connection. If the MS is not in any communication session, the MS is tracked at the routing-area (RA) level. The inactivity counter mechanism was proposed in 3GPP 25.331 to determine when to switch between the three location-tracking modes. In this mechanism, two inactivity counters are used to count the numbers of cell and URA updates in an idle period between two packet transmissions. If the number of cell updates reaches a threshold K1, the MS is switched from cell tracking to URA tracking. After that, if the number of URA updates reaches a threshold K2, the MS is tracked at the RA level. The paper proposes analytical and simulation models to investigate the performance of the inactivity counter mechanism. Our study provides guidelines for K1and K2selection to achieve lower net costs of location update and paging. [J412]

"Security aspects of 3G-WLAN interworking"

Third-generation cellular systems will provide wide coverage and nearly universal roaming, but will not realistically live up to the bit rate expectations placed on them. On the other hand, WLAN systems already offer bit rates surpassing those of 3G systems, but are often found lacking with respect to roaming and mobility support. In short, WLAN systems are great for hot spot coverage, while 3G systems provide global coverage and the necessary network and management infrastructure to cater for security, roaming, and charging requirements. The focus of the article is on security aspects of 3GPP-WLAN interworking. [J413]

"Efficient mobility management for vertical handoff between WWAN and WLAN"

As we move toward next-generation all-IP wireless networks, we are facing the integration of heterogeneous networks, such as WWAN and WLAN, where vertical handoff is required. In vertical handoff between WWAN and WLAN, mobile hosts should be able to move freely across different networks while satisfying QoS requirements for a variety of applications. In order to achieve seamless handoff and maintain continuity of connection, we propose a novel mobility. management system that integrates a connection manager to detect network condition changes in a timely and accurate manner, and a virtual connectivity manager that uses an end-to-end principle to maintain a connection without additional network infrastructure support. A prototype system was built to test the effectiveness of the proposed system. Experiments show that seamless roaming between WLAN and WWAN can be achieved, and much better performance can be obtained than with the traditional scheme. [J414]

"Seamless handover in terrestrial radio access networks: a case study"

Next-generation networks will overlay heterogeneous networking technologies. In order to enable seamless communications in such an environment, providing support for efficient handover between the various access technologies will play a crucial role. The present article provides a quantitative analysis of it Mobile IPv4-based WLAN-GPRS handover prototype, identifies a number of side effects related to the link layer and routing mechanisms, and presents the impact of handover on UDP and TCP data traffic as well as on Mobile IP signaling itself. [J415]

"Service-level availability estimation of GPRS"

The General Packet Radio Service (GPRS) extends the Global System Mobile Communication (GSM) by introducing a packet-switched transmission service. This paper analyzes the GPRS behavior under critical conditions. In particular, we focus on outages, which significantly impact the GPRS dependability. In fact, during outage periods, the cumulative number of users trying to access the service grows proportionally over time. When the system resumes its operations, the overload caused by accumulated users determines a higher probability of collisions on resources assignment and, therefore, a degradation of the overall QoS. This paper adopts a stochastic activity network modeling approach for evaluating the dependability of a GPRS network under outage conditions. The major contribution of this study lies in the novel perspective the dependability study is framed in. Starting from a quite classical availability analysis, the network dependability figures are incorporated into a very detailed service model that is used to analyze the overload effect GPRS has to face after outages, gaining deep insights on its impact on user's perceived QoS. The result of this modeling is an enhanced availability analysis, which takes into account not only the bare estimation of unavailability periods, but also the important congestion phenomenon following outages that contribute to service degradation for a certain period of time after operations resume. [J416]

"Sensor fusion in anti-personnel mine detection using a two-level belief function model"

A two-level approach for modeling and fusion of antipersonnel mine detection sensors in terms of belief functions within the Dempster-Shafer framework is presented. Three promising and complementary sensors are considered: a metal detector, an infrared camera, and a ground-penetrating radar. Since the metal detector, the most often used mine detection sensor, provides measures that have different behaviors depending on the metal content of the observed object, the first level aims at identifying this content and at providing a classification into three classes. Depending on the metal content, the object is further analyzed at the second level toward deciding the final object identity. This process can be applied to any problem where one piece of information induces different reasoning schemes depending on its value. A way to include influence of various factors on sensors in the model is also presented, as well as a possibility that not all sensors refer to the same object. An original decision rule adapted to this type of application is proposed, as well as a way for estimating confidence degrees. More generally, this decision rule can be used in any situation where the different types of errors do not have the same importance. Some examples of obtained results are shown on synthetic data mimicking reality and with increasing complexity. Finally, applications on real data show promising results. [J417]

"Minimum entropy regularization in frequency-wavenumber migration to localize subsurface objects"

Optimized versions of frequency-wavenumber (F-K) migration methods are introduced to better focus ground-penetrating radar (GPR) data in applications of shallow subsurface object localization, e.g., landmine remediation. Migration methods are based on the wave equation and operate by backpropagating the received data into the earth so as to localize buried objects. Traditional F-K migration is based on an underlying assumption that the wavefields propagate in a homogeneous medium. The presence of a rough air-ground interface in the GPR case degrades the localization ability. To overcome this problem in the context of the F-K algorithm, we introduce lateral variations in the velocity of waves in the medium. An optimization approach is employed to choose that velocity function that results in a well-focused image where an entropy-like criterion is used to quantify the notion of focus. Extension of the basic method to lossy medium is also described. The utility of these techniques is demonstrated using field data from a number of GPR systems. [J418]

"DORT method as applied to ultrawideband signals for detection of buried objects"

The decomposition of the time reversal operator (DORT) method, originally developed in acoustics, allows detection of scatterers embedded in the probed domain and provides some very robust means for focusing an incident wave onto a given scatterer. Hence, this method is very helpful for clutter reduction. Here, it is applied to the detection of buried cylindrical objects with the help of electromagnetic ultrawideband signals. It is shown that when the set of antennas is located on a piece of line above an interface, the use of the DORT method remains simple, whatever the polarization, provided the contribution from the target can be separated from that of the interface. Using wideband signals also permits one to excite natural resonances of the buried scatterer, which can easily be extracted from the eigenvalues of the time reversal operator. Numerical examples based on a finite-difference time-domain algorithm are given. [J419]

"Acoustic and electromagnetic wave interaction: estimation of Doppler spectrum from an acoustically vibrated metallic circular cylinder"

The idea of using acoustically induced Doppler spectra as a means of target detection and identification is introduced. An analytical solution for the calculation of the bistatic scattered Doppler spectrum from an acoustically excited, vibrating, metallic, circular cylinder is presented. First, the electromagnetic scattering solution of a slightly deformed circular cylinder is obtained using a perturbation method. Then, assuming the vibration frequency is much smaller than the frequency of the incident electromagnetic wave, a closed form expression for the time-frequency response of the bistatic scattered field is obtained which can be used directly for estimating the Doppler spectrum. The acoustic scattering solution for an incident acoustic plane wave upon a solid elastic cylinder is applied to give the displacement of the cylinder surface as a function of time. Results indicate that the scattered Doppler frequencies correspond to the mechanical vibration frequencies of the cylinder, and the sidelobe Doppler spectrum level is, to the first order, linearly proportional to the degree of deformation and is a function of bistatic angle. Moreover, the deformation in the cylinder, and thus the Doppler sidelobe level, only becomes sizeable near frequencies of normal modes of free vibration in the cylinder. Utilizing the information in the scattered Doppler spectrum could provide an effective means of buried object identification, where acoustic waves are used to excite the mechanical resonances of a buried object. [J420]

"Training DHMMs of mine and clutter to minimize landmine detection errors"

Minimum classification error (MCE) training is proposed to improve performance of a discrete hidden Markov model (DHMM)-based landmine detection system. The system (baseline) was proposed previously for detection of both metal and nonmetal mines from ground-penetrating radar signatures collected by moving vehicles. An initial DHMM model is trained by conventional methods of vector quantization and the Baum-Welch algorithm. A sequential generalized probabilistic descent (GPD) algorithm that minimizes an empirical loss function is then used to estimate the landmine/background DHMM parameters, and an evolutionary algorithm (EA) based on fitness score of classification accuracy is used to generate and select codebooks. The landmine data of one geographical site was used for model training, and those of two different sites were used for evaluation of system performance. Three scenarios were studied: 1) apply MCE/GPD alone to DHMM estimation, 2) apply EA alone to codebook generation, and 3) first apply EA to codebook generation and then apply MCE/GPD to DHMM estimation. Overall, the combined EA and MCE/GPD training led to the best performance. At the same level of detection rate as the baseline DHMM system, the false-alarm rate was reduced by a factor of two, indicating significant performance improvement. [J421]

"QoS in next-generation wireless multimedia communications systems"

First Page of the Article [J422]

"Introducing the GERAN flexible layer one concept"

A major enhancement of GERAN is the flexible layer one (FLO) concept, due to be introduced in Release 6 of the 3GPP standards. FLO greatly simplifies the introduction of new services to the GERAN system, allowing "tailor-made" QoS provision, significantly enhancing GERAN's flexibility and ensuring that it can continue to provide services on a par with other 3G systems. Other benefits of FLO include improved link layer performance when carrying services such as voice over IP, improved multiplexing ability, and spectral efficiency. This article introduces the FLO concept, how it works, the changes it requires, and its benefits and disadvantages. [J423]

"Dynamic scheduling framework on an RLC/MAC layer for general packet radio service"

We present a traffic-scheduling framework that can dynamically allocate radio resources to a general packet radio service (GPRS) mobile station (MS) based on the interference levels of the radio links and the quality of service (QoS) specification of the MS. The underlying idea of this scheduling scheme is to preserve more bandwidth for use by those MSs that are within a low interference region so that the limited radio resources can be used more effectively. In this scheme, an MS uses a low transmission rate for data transfer when the MS is within a high interference region to avoid wasting bandwidth by transmitting data in a condition with high interference. In order to compensate for the service loss of the MS, we allocate more bandwidth to the MS when it is within a low interference region. In addition, we also propose an analytical model that can be used to derive the transmission rate for an MS in a low interference region based on the delay-bound requirement of the MS. The performance results show that our dynamic scheme can utilize the bandwidth more effectively to satisfy various QoS requirements of the MSs in the GPRS system without changing the convolution-coding rate. [J424]

"Moderately rough surface underground imaging via short-pulse quasi-ray Gaussian beams"

An adaptive framework is presented for ultra-wideband ground penetrating radar imaging of shallow-buried low-contrast dielectric objects in the presence of a moderately rough air-soil interface. The proposed approach works with sparse data and relies on recently developed Gabor-based narrow-waisted quasi-ray Gaussian beam

algorithms as fast forward scattering predictive models. First, a nonlinear inverse scattering problem is solved to estimate the unknown coarse-scale roughness profile. This sets the stage for adaptive compensation of clutter-induced distortion in the underground imaging problem, which is linearized via Born approximation and subsequently solved via various pixel-based and object-based techniques. Numerical simulations are presented to assess accuracy, robustness and computational efficiency for various calibrated ranges of problem parameters. The proposed approach has potential applications to antipersonnel land mine remediation. [J425]

"Analysis of packet networks having contention-based reservation with application to GPRS"

We develop a model to quantify the performance of message transmission systems in which users must reserve transmission resources via a contention mechanism prior to transmission. Our work is motivated by a desire to understand the performance characteristics of systems such as the general packet radio service (GPRS), where the single forward link of the wireless access system is organized as a sequence of frames, each of which has first a contention period and then a service period. There are a fixed number of fixed-length contention slots in each contention period. Each contending customer chooses at random the slot in which to contend, and success is determined by a capture model. A contender who fails waits for the next contention period, then again chooses at random the slot in which to contend; this process is repeated until the contender is successful. Customers who have contended successfully are served during the service period, which has a prescribed number of fixed-length slots, on a first-come-first-served (FCFS) basis, with the required number of service units being drawn independently from a general discrete distribution having finite support. We model the system as a Markov renewal process embedded at service departure times. We solve the model and then compute the equilibrium distributions of the number of customers in the system at arbitrary points in time and at customer arrival times. Finally, we give a numerical example in which we demonstrate the usefulness of our results in understanding the behavior of GPRS. [J426]

"Fair scheduling with tunable latency: a round-robin approach"

Weighted fair queueing (WFQ)-based packet scheduling schemes require processing at line speeds for tag computation and tag sorting. This requirement presents a bottleneck for their implementation at high transmission speeds. We propose an alternative and lower complexity approach to packet scheduling, based on modifications of the classical round-robin scheduler. Contrary to conventional belief, we show that appropriate modifications of the weighted round-robin (WRR) service discipline can, in fact, provide tight fairness properties and efficient delay guarantees to multiple sessions. Two such modifications are described: 1) list-based round robin, in which the server visits different sessions according to a precomputed list which is designed to obtain the desirable scheduling properties; 2) multiclass round robin, a version of hierarchical round robin with controls designed for good scheduling properties. The schemes considered are compared with well-known WFQ schemes and with deficit round robin (a credit-based WRR), on the basis of desirable properties such as bandwidth guarantees, fairness in excess bandwidth sharing, worst-case fairness, and efficiency of latency (delay guarantee) tuning. The scheduling schemes proposed and analyzed here operate with fixed packet sizes, and hence can be used in applications such as cell scheduling in ATM networks, time-slot scheduling on wireless links as in GPRS air interface, etc. A credit-based extension of the proposed schemes to handle variable packet sizes is also possible. [J427]

"Subsurface imaging in south-central Egypt using low-frequency radar: Bir Safsaf revisited"

We present the capabilities of low-frequency radar systems to sound the subsurface for a site located in south-central Egypt, the Bir Safsaf region. This site was already intensively studied since the SIR-A and SIR-B orbital radars revealed buried paleodrainage channels. Our approach is based on the coupling between two complementary radar techniques: the orbital synthetic aperture radar (SAR) in C and L bands (5.3 and 1.25 GHz) for imaging large-scale subsurface structures, and the ground-penetrating radar (GPR) at 500 and 900 MHz for sounding the soil at a local scale. We show that the total backscattered power computed from L-band SAR and 900-MHz GPR profiles can be correlated, and we combined both data to derive the geological structure of the subsurface. GPR data provide information on the geometry of the buried scatterers and layers, while the analysis of polarimetric SAR data provides information on the distribution of rocks in the sedimentary layers and at the interface between these layers. The analysis of 500-MHz GPR data revealed some deeper structures that should be detected by lower frequency SARs, such as a P-band system. [J428]

"Recent advances in extra-wide-band polarimetry, interferometry and polarimetric interferometry in synthetic aperture remote sensing and its applications"

The development of radar polarimetry and radar interferometry is advancing rapidly, and these novel radar technologies are revamping 'synthetic aperture radar imaging' decisively. The successive advancements are

sketched eginning with the fundamental formulations and highlighting the salient points of these diverse remote sensing techniques. Whereas with radar polarimetry the textural fine-structure, target orientation and shape, symmetries and material constituents can be recovered with considerable improvements above that of standard 'amplitude-only polarisation radar'; with radar interferometry the spatial (in depth) structure can be explored. In 'polarimetric-interferometric synthetic aperture radar (POL-IN-SAR) imaging' it is possible to recover such co-registered textural plus spatial properties simultaneously. This includes the extraction of 'digital elevation maps (DEM)' from either 'fully polarimetric (scattering matrix)' or 'interferometric (dual antenna) SAR image data takes' with the additional benefit of obtaining co-registered three-dimensional 'POL-IN-DEM' information. Extra-wide-band POL-IN-SAR imaging-when applied to 'repeat-pass image overlay interferometry'-provides differential background validation and measurement, stress assessment, and environmental stress-change monitoring capabilities with hitherto unattained accuracy, which are essential tools for improved global biomass estimation and also for wetland assessment and monitoring. More recently, by applying multiple parallel repeat-pass EWB-POL-D(RP)-IN-SAR imaging along stacked (altitudinal) or displaced (horizontal) flight-lines will result in 'tomographic (multi-interferometric) polarimetric SAR stereo-imaging', including foliage- and ground-penetrating capabilities. In addition, various closely related topics of (i) acquiring additional and protecting existing spectral windows of the 'natural electromagnetic spectrum (NES)' pertinent to remote sensing; and (ii) mitigation against common 'radio frequency interference (RFI)' and intentional 'directive jamming of airborne and spaceborne POL-IN-SAR imaging platforms' are appraised. [J429]

"On simple methods for calculating ELF shielding of infinite planar shields"

Simple approximate methods are developed and described for calculating the extremely low-frequency magnetic-shielding effectiveness for single- and double-layer infinite planar shields. In addition, exact expressions are given and "nearly exact" expressions are derived. Each expression has been compared to the exact expression in order to determine the range of parameters over which it is valid. Each approximate expression can be calculated rapidly and has a simple physical interpretation that leads to physical insight into the shielding process. [J430]

"Statistical method to detect subsurface objects using array ground-penetrating radar data"

We introduce a combination of high-dimensional analysis of variance (HANOVA) and sequential probability ratio test (SPRT) to detect buried objects from an array ground-penetrating radar (GPR) surveying a region of interest in a progressive manner. Using HANOVA, we exploit the transient characteristic of GPR signals in the time domain to extract information about buried objects at fixed positions of the array. Based on the output of the HANOVA, the SPRT is employed to make detection decisions recursively as the array moves downtrack. The method is on-line implementable and of low computational complexity. Our approach is validated using field-data from two quite different GPR sensing systems designed for landmine detection applications [J431]

"Effective imaging of buried dielectric objects"

Ultrawide-band CW radar have shown good potential for remote imaging of surface laid or shallow buried landmine-like objects. However when sensing fields near to the ground, a number of factors including direct antenna coupling, air/ground coupling, receiver noise floor, and effective dynamic range conspire to degrade or mask the scattered return, resulting in a loss of signal magnitude, range accuracy, and range resolution. The present paper addresses the latter problems using a near-field detection methodology and providing a thorough experimental and systems analysis of the signal-to-clutter issues. The method proves advantageous in sensing weak echoes in the vicinity of the sensor from objects of low dielectric contrast with their environment. To enhance image processing gains, an effective space frequency synthetic aperture technique applicable to the two-media problem is outlined. The algorithm is straightforward and robust enough to be implemented on compact GPR systems operating in real time. The remaining problem of object identification will not be addressed here. To demonstrate the utility of these combined techniques, field experiments, over different frequency bands, were conducted and their results are reported [J432]

"State of the art in sensor technologies for sewer inspection"

This paper reviews the state of the art in sensors and automated inspection devices for enhanced sewer inspection. Efficiency, safety, environmental, and legislative concerns have made inspection and assessment of communal sewers a central issue to water and sewerage companies. Nowadays, the standard sewer inspection system is based on a wheeled platform on which a closed circuit television (CCTV) camera is mounted. One of the disadvantages of camera inspection systems is that they can only detect a small proportion of all possible damage in a sewer. The inspection outcome of such systems relies not only on the quality of the acquired images, but also on the off-line. recognition and classification conducted by human operators. In consequence,

CCTV-based platforms are frequently not effective. Infrared, microwave, optical, and ultrasonic-based sensors have been proposed to complement the existing CCTV-based approach and to improve inspection results. New inspection devices employing multiple sensors and being capable of carrying out remote sewer inspection tasks are under research [J433]

"Transport of mobile application part signaling over Internet protocol"

The convergence of voice, data, and video networks is creating a new environment for telecommunications. In response to the changes, telecommunications equipment manufacturers and service providers are competing fiercely to bring an optimum solution to customers. The evolution of GSM to GPRS and to UMTS is a cellular wireless industry endeavour to meet this demand. This evolution will see the core wireless network infrastructure change from circuit-switched to packet-switched where voice and data are transported using IP as the common protocol. However, this poses a number of challenges, one of which is how to run the key mobile application part signaling protocols over IP. MAP defines the application protocols between switches and databases (e.g., MSC, VLR, SGSN, HLR) for supporting mobility management, security management, radio resource management, and mobile equipment management. UMTS supports both circuit-switched and packet-switched services [J434]

"Evaluation of different analytical and semi-analytical methods for the design of ELF magnetic field shields"

The aim of this paper is the evaluation of different analytical methods devoted to the study of shielding of extremely low-frequency magnetic fields with conducting and ferromagnetic materials. In this paper, an extensive analysis of some approaches is presented, by comparing these methods to a numerical one based on a hybrid finite-element method/boundary-element method formulation. The study wants to underline the accuracy of the different techniques, evaluating their limits of validity, depending on physical and geometrical shield parameters [J435]

"Evaluation of EarthRadar unexploded ordnance testing at Fort A.P. Hill, Virginia"

Previously, K. Bakhtar and E. Sagal [ibid. vol. 17, pp. 4-11, 2002] made remarkable claims for the performance of the Bakhtar Associates ground-penetrating radar (GPR) in detecting and classifying buried unexploded ordnance (UXO). In this article, we report the results of the series of blind tests on the EarthRadar carried out during the Fall of 2000 and Spring of 2001, which led to very different conclusions regarding the radar's performance. The contents of this article are excerpted from the final report on the testing, prepared by the Institute for Defense Analyses [J436]

"The multiple interaction model for nonshallow scatterers buried beneath 2-d random rough surfaces"

The multiple interaction model is hybridized with the robust Steepest Descent Fast Multipole Method (SDFMM) to compute the signature of nonshallow penetrable scatterers buried beneath two-dimensional random rough surfaces. The most attractive feature of the multiple interaction model with using the SDFMM is removing the quasi-planar structure constraint for analyzing nonquasi-planar scatterers. The results show that the buried object's signature is largely due to the first interaction mechanism; however, the contribution of each additional interaction is explicitly calculated, though they may become insignificant especially for lossy background soil [J437]

"Design and performance analysis for data transmission in GSM/GPRS system with voice activity detection"

To efficiently utilize the bandwidth of cellular mobile systems and offer service of high quality to both voice and data users, we propose a protocol to integrate packet-switched data traffic into current time-division multiple-access (TDMA)-type circuit-switched digital voice systems. We analyze the performance of the proposed system, which transmits data packets in the silent periods of a conversation with voice activity detection and adapts itself to the GSM/GPRS system, which uses the idle channels to provide data services. We show that the proposed protocol can increase the bandwidth utilization efficiency and improve the throughput/delay performance of the data transmission while minimizing the impact on the current GSM/GPRS service [J438]

"Mobile and wireless internet: architectures and protocols"

First Page of the Article [J439]

"Multidomain pseudospectral time-domain simulations of scattering by objects buried in lossy media"

A multidomain pseudospectral time-domain (PSTD) method with a newly developed well-posed PML is introduced as an accurate and flexible tool for the modeling of electromagnetic scattering by 2-D objects buried in an inhomogeneous lossy medium. Compared with the previous single-domain Fourier PSTD method, this approach allows for an accurate treatment of curved geometries with subdomains, curvilinear mapping, and high-order Chebyshev polynomials. The effectiveness of the algorithm is confirmed by an excellent agreement between the numerical results and analytical solutions for perfectly conducting as well as permeable dielectric cylinders. The algorithm has been applied to model various ground-penetrating radar (GPR) applications involving curved objects in a lossy half space with an undulating surface. This multidomain PSTD algorithm is potentially a very useful tool for simulating antennas near complex objects and inhomogeneous media. [J440]

"Design and applications of airborne radars in the VHF/UHF band"

The simultaneous need for ground penetration and high resolution dictates the use of frequencies less than 500 MHz for imaging ground penetrating radar (GPR) designs. It is possible to build such systems with good performance and yet not interfere with ground installations operating in the same bands. The total number of airborne GPR systems needed to saturate the market is small, (possibly less than ten), and so the buildup of noise in this spectral region occupied by these radars will be negligible. This is fortunate, since there is a clear need for such radars in such areas as humanitarian demining and unexploded ordnance (UXO) mapping. Some formal set of guidelines is needed beyond that given in Part 15 of the FCC regulations, which both recognizes the need for airborne UWB radar operations, and still protects licensed users in the band [J441]

"A statistical modeling approach to location estimation"

Some location estimation methods, such as the GPS satellite navigation system, require nonstandard features either in the mobile terminal or the network. Solutions based on generic technologies not intended for location estimation purposes, such as the cell-ID method in GSM/GPRS cellular networks, are usually problematic due to their inadequate location estimation accuracy. In order to enable accurate location estimation when only inaccurate measurements are available, we present an approach to location estimation that is different from the prevailing geometric one. We call our approach the statistical modeling approach. As an example application of the proposed statistical modeling framework, we present a location estimation method based on a statistical signal power model. We also present encouraging empirical results from simulated experiments supported by real-world field tests. [J442]

"Error-resilient video transcoding for robust internetwork communications using GPRS"

A novel fully comprehensive mobile video communications system is proposed. The system exploits the useful rate management features of video transcoders and combines them with error resilience for the transmission of coded video streams over general packet radio service (GPRS) mobile-access networks. The error-resilient video transcoding operation takes place at a centralized point, referred to as a video proxy, which provides the necessary output transmission rates with the required amount of robustness. With the use of this proposed algorithm, error resilience can be added to an already compressed video stream at an intermediate stage at the edge of two or more different networks through two resilience schemes, namely the adaptive intra refresh (AIR) and feedback control signaling (FCS) methods. Both resilience tools impose an output rate increase which can also be prevented with the proposed novel technique. Thus, the presented scheme gives robust video outputs at near target transmission rates that only require the same number of GPRS timeslots as non-resilient schemes. Moreover, an ultimate robustness is also accomplished with the combination of the two resilience algorithms at the video proxy. Extensive computer simulations demonstrate the effectiveness of the proposed system [J443]

"Signal processing techniques for landmine detection using impulse ground penetrating radar"

Landmines are affecting the lives and livelihoods of millions of people around the world. A number of detection techniques, developed for use with impulse ground penetrating radar, are described, with emphasis on a Kalman filter based approach. Comparison of results from real data show that the Kalman filter algorithm provides the best detection performance, although its computational burden is also the highest [J444]

"Transition to IPv6 in GPRS and WCDMA mobile networks"

The limited size and structure of the Internet address space of IPv4 has caused difficulties in coping with the explosive increase in the number of Internet users. IPv6 is a feasible solution for the problems identified with IPv4. Efficient interworking between IPv4 and IPv6 is very important, because IPv4 networks and services will

exist for quite a long time. The transition period will be lengthy, and network/terminal equipment supporting both IP versions will be needed during the transition period. Thus, IPv4 to IPv6 transition issues need special care and attention. The three main transition methods are dual IPv4/IPv6 stacks in network elements/terminals, tunneling, and translators in the network. Three transition phases from IPv4 to IPv6 can be identified. These phases are described. Different transition scenarios from the 2G/3G mobile network point of view are also analyzed. Finally, some conclusions are drawn, and some recommendations on the use of transition methods are given [J445]

"Wireless Internet access for mobile subscribers based on the GPRS/UMTS network"

With the advent of IP technologies and the tremendous growth in data traffic, the wireless industry is evolving its core networks toward IP technology. Enabling wireless Internet access is one of the upcoming challenges for mobile radio network operators. The General Packet Radio Service is the packet-switched extension of GSM and was developed to facilitate access to IP-based services better than existing circuit-switched services provided by GSM. We illustrate how a visited mobile subscriber on a GPRS/UMTS network can access his/her home network via the gateway GPRS support node (GGSN). We also propose some implementation ideas on wireless Internet access for a remote mobile subscriber based on a GPRS/UMTS network [J446]

"Wideband wireless access technologies to broadband internet [JGuest Editorial]"

First Page of the Article [J447]

"General Packet Radio Service [JGPRS]"

Discusses the evolution from GSM to GPRS communications. The network architecture, protocol stack, and mobility management are discussed [J448]

"Analysis of grounding systems in soils with finite volumes of different resistivities"

A theoretical model for the analysis of grounding systems located in soils with finite volumes of arbitrary resistivities is presented. The boundary element method is used for the analysis. The procedures in the analysis are described in detail and the essential equations are presented. Analytical and numerical validations are also carried oust in the process. The results obtained using the new approach are in agreement with well-known simple case results and converge asymptotically to the uniform soil case. There is a wide range off practical grounding system scenarios which can be accurately modeled by using this new soil type. Examples showing several finite volume soil models are also presented [J449]

"Electro-optic sensor for measurement of DC fields in the presence of space charge"

This paper presents a theoretical analysis and experimental verification of electro-optic sensors used to measure DC electric fields in space charge environments. Both unipolar and bipolar charge environments were analyzed. The results suggest that in both cases the sensor output is linearly dependent on the measured electric field and independent of the density of space charge. To conduct the measurement, however, the prior knowledge of the type of charge present (unipolar-bipolar) is essential [J450]

"On reconciling ground-based with spaceborne normalized radar cross section measurements"

This study examines differences in the normalized radar cross section, derived from ground-based versus spaceborne radar data. A simple homogeneous half-space model, indicates that agreement between the two improves as 1) the distance from the scatterer is increased; and/or 2) the extinction coefficient increases [J451]

"Microwave underground propagation and detection"

The detection of buried targets has been a problem of significant interest for decades, with microwave-based sensing constituting an important tool. In this paper, we review the basic issues that characterize microwave-based subsurface sensing. Issues considered include the use of microwaves in the context of an airborne synthetic aperture radar, as well for radars deployed close to the air-soil interface. Rough-surface induced clutter is also discussed. Particular examples are presented for detection of land mines and unexploded ordnance [J452]

"Radio interface system planning for GSM/GPRS/UMTS [JBook Review]"

First Page of the Article [J453]

"Applications and frustrations in using ground penetrating radar"

In this paper the author concentrates on the narrow portion of the electromagnetic spectrum from a few MHz to a few GHz where geophysicists used ground penetrating radar which is sometimes called georadar, ground probing radar, or subsurface radar. Ground penetrating radar is deployed today from the space shuttle, aircraft, on the surface, in and between boreholes and sometimes from within or between mine shafts. The author discusses these applications and some of the problems involved [J454]

"Multifrequency reconstruction of moderately rough interfaces via quasi-ray Gaussian beams"

In this paper, we present a new technique for determining the surface profile of a moderately rough interface between air and a homogeneous dielectric half-space. Based on sparsely sampled step-frequency ground penetrating radar measurements, the proposed inversion scheme uses a quasi-ray Gaussian beam fast forward model, coupled with a low-order parameterization of the surface profile in terms of B-splines. The profile estimation problem is posed as a parameter optimization problem, which is solved using a multiresolution continuation method via frequency hopping. Numerical experiments establish that the algorithm is efficient and yields accurate reconstructions throughout most of the illuminated region even in noisy environments, losing accuracy only in regions with very weak illumination [J455]

"A novel 3-D subsurface radar imaging technique"

The problem of the formation of subsurface images using stand-off forward looking radar is by far more severe than that of forming the radar images in the free-space. A subsurface image needs to be accurately focused taking into account both the refraction and dispersion of the wavefield. This paper presents a novel imaging algorithm specially tailored for subsurface sensing. A simple and effective characterization technique for the retrieval of the dielectric permittivity is outlined. The proposed soil characterization and subsurface imaging techniques are validated experimentally. Results show that the geometric distortion in the subsurface images due to the refraction and dispersion of the wavefields is successfully corrected [J456]

"Electromagnetic field exposure system for the study of possible anti-cancer activity"

The characteristics of a static and extremely low frequency (ELF) magnetic fields (H-field) exposure system are analyzed. The system has been successfully used in a series of animal experiments devoted to the study of a new potential application of electromagnetism in cancer therapy. The characterization of this exposure system contributes to the improvement needed in the understanding of the role played by the various exposure parameters such as field intensity and field components (static, ELF, or a combination thereof) in the induction of the observed anti-tumor efficacy. This knowledge is important for extrapolating exposure conditions from animals to humans. The exposure system provides static and ELF H-field with an intensity in the kA/m range. The system allows six animals to be treated simultaneously with almost the same total (static + ELF) H-field intensity, but with different static and ELF components and, consequently, with different induced electric field levels and currents. The H-field uniformity experienced by each mouse is 12.4% [J457]

"Cellular access control and charging for mobile operator wireless local area networks"

This article presents a system architecture, design considerations, and rationale for a mobile operator wireless LAN. The article also discusses the system implementation and performance issues. The system presented reuses GSM and GPRS mechanisms for user authentication, access control, subscriber management, operator roaming, and billing, while still being compatible with wireless Internet service provider networks and IETF and IEEE protocols such as RADIUS, EAP, and IEEE 802.1x. The architecture is a result of research carried out by Nokia between 1999 and 2002. The designed architecture has also been verified in a complete system implementation. [J458]

"The dielectric wedge antenna"

A new modification of the TEM-horn antenna has been developed for ground-penetrating radar (GPR) applications. The antenna is based on a dielectric wedge, and thus, was named the dielectric wedge antenna. Tapering of the metal flairs has been used to match the antenna to the ground and to reduce the late-time ringing. The finite-difference time-domain model of the antenna has been created to investigate physical processes within the antenna and to optimize its performance. The dielectric wedge antenna has shown a superior (in comparison with the TEM-horn) performance by radiation in different types of the ground and has been used in a novel antenna configuration within a GPR system, which is dedicated for landmine detection. [J459]

"Electromagnetic scattering from a dielectric cylinder buried beneath a slightly rough surface"

An analytical solution is presented for the electromagnetic scattering from a dielectric circular cylinder embedded in a dielectric half-space with a slightly rough interface. The solution utilizes the spectral (plane-wave) representation of the fields and accounts for all the multiple interactions between the rough interface and the. buried cylinder. First-order coefficients from the small perturbation method are used for computation of the scattered fields from the rough surface. The derivation includes both TM and TE polarizations and can be easily extended for other cylindrical buried objects (e.g., cylindrical shell, metallic cylinder). Several scattering scenarios are examined utilizing the new solution for a dielectric cylinder beneath a flat, sinusoidal, and arbitrary rough surface profile. Results indicate that the scattering pattern of a buried object below a slightly rough surface differs from the flat surface case only when the surface roughness spectrum contains a limited range of spatial frequencies. Furthermore, the illuminated area of the incident wave is seen to be a critical factor in the visibility of a buried object below a rough surface. [J460]

"Subsurface object sensing with a multifrequency microwave radiometer"

Experimental results are reported for sensing of subsurface objects with a multifrequency radiometer (MFRAD) system. Properties of the MFRAD system are reviewed, and the calibration and experimental procedures are discussed. Results with subsurface metallic, styrofoam, and plastic targets are then provided that demonstrate an oscillatory behavior in brightness temperatures versus frequency in the presence of a subsurface object. Measured data are also compared with a simple layered medium brightness temperature model and show reasonable agreement with predicted trends of brightness temperatures versus frequency. The oscillatory behaviors versus frequency obtained in the presence of both metallic and nonmetallic subsurface objects should prove advantageous for designing object detection procedures. [J461]

"Performance analysis for UMTS networks with queued radio access bearers"

The Universal Mobile Telecommunications System (UMTS) network consists of a core network (CN) and a UMTS terrestrial radio access network (UTRAN). The UTRAN offers radio access bearer (RAB) services between the user equipment (UE) and the CN to support mobile multimedia applications with different quality of service (QoS) requirements. Depending on the requested QoS, different types of RABs can be established at the request of the CN. The UTRAN then has to establish and maintain the RAB with the requested QoS. We study the queueing of RABs as a means for improving the bandwidth utilization while minimizing the RAB blocking probability. We develop an analytical model to study the performance for UTRAN with queued RABs in terms of RAB blocking probability and average queueing time of queued RABs. From an analytic point of view, the main contribution of this paper is the introduction of a novel recursion for the computation of the performance measures. [J462]

"New model for estimating the thickness and permittivity of subsurface layers from GPR data"

A new mathematical model for estimating the depth and permittivity of subsurface layers from measured ground-penetrating radar (GPR) data is presented. The new model considers the effects from the air-ground interface and introduces a ray-path-searching process in the depth calculation. It includes the conventional model as a special case. The experimental results agree well with the new model. [J463]

"Resistively loaded helical antennas for ground-penetrating radar"

Resistively loaded helical antennas, used in the normal mode and horizontally polarised, are modelled using the moment method above typical lossy ground. The distributed resistive loading was adjusted to maintain a two octave bandwidth. The centre frequency of 1 m dipoles was reduced from 250 MHz for the straight resistive wire to 50 MHz for a helix of pitch 2.5 cm and diameter 5 cm. The reduction in efficiency required to maintain the bandwidth for this helix was 12 dB. This agrees reasonably with the theory for small antennas in free space. The results were also verified by comparing measurements performed on a monopole resistively loaded helical antenna in a watertank with the numerical model used elsewhere. [J464]

"A single-chip quad-band (850/900/1800/1900 MHz) direct conversion GSM/GPRS RF transceiver with integrated VCOs and fractional-n synthesizer"

Recent trends in the integration of entire systems on-chip have spurred the development of homodyne radios as alternatives to the more mature yet harder to integrate superheterodyne architectures. This paper presents a monolithic device that integrates all of the functions necessary to implement a multiband homodyne global system for mobile telecommunications (GSM) radio except for the power amplifier (PA) and radio frequency (RF) passives. The single BiCMOS chip includes a quad-band direct conversion receiver that down converts RF to

quadrature analog baseband. The front-end circuitry is followed by a low-DC-offset, high-dynamic-range, analog I/Q baseband chain. The transmit section is comprised of a quad-band up-conversion transmit phase-locked loop (PLL) including on chip transmit voltage-controlled oscillators (VCOs). The stringent GSM receive band phase noise specifications are met without the use of surface acoustic wave filters. A single ΣΔ fractional-N synthesizer locking a fully integrated ultrahigh frequency VCO generates the system local oscillator signal. [J465]

"On demand network-wide VPN deployment in GPRS"

Mobile Internet requires enhanced security services available to all mobile subscribers in a dynamic fashion. A network-wide virtual private network deployment scenario over the General Packet Radio Service is proposed and analyzed from a security viewpoint. The proposed security scheme improves the level of protection that is currently supported in GPRS and facilitates the realization of mobile Internet. It secures data transmission over the entire network route from a mobile user to a remote server by utilizing the default GPRS ciphering over the radio interface, and by deploying an IP VPN over the GPRS core, as well as on the public Internet. Thus, on-demand VPN services are made available for all GPRS network subscribers and roaming users. The VPN functionality, which is based on the IPsec framework, is outsourced to the network infrastructure to eliminate the potential computational overhead on the mobile device. The VPN initialization and key agreement procedures are based on an Internet Key Exchange protocol proxy scheme, which enables the mobile station to initiate VPN establishment, while shifting the complex key negotiation to the network infrastructure. The deployed VPN operates transparently to the mobile subscribers' movement. The required enhancements for security service provision can be integrated in the existing network infrastructure; therefore, the propose security scheme can be employed as an add-on feature to the GPRS standard. [J466]

"The performance of H263-based video telephony over turbo-equalized GSM/GPRS"

First Page of the Article [J467]

"Ion-track structure and its effects in small size volumes of silicon"

A model for ion-energy deposition in silicon, based on experimental data of the optical energy loss function, is presented. The model yields the characteristics of ion- and electron-interactions in silicon. Monte Carlo transport calculations based on this model give the energy distribution and its moments including a full and consistent description of the spatial ion track structure. The model was used for estimating the influence of the track structure on energy deposition in submicron devices and on the shape of the single event upsets (SEUs) cross-section curves. [J468]

"Performance simulations of a mobile radio network using contention-based WIMA protocol under Rayleigh- and log-normal-fading environments"

The performance of mobile radio network using the contention-based wireless integrated multiple access (WIMA) protocol on a packet reservation basis for frequency division duplex (FDD) hierarchies in Rayleigh- and log-normal-fading environments is simulated. The contention-based movable-boundary WIMA protocol is applied for an exiting mobile radio network to provide the data service and to compare its expected data-packet delay with those of the fixed-boundary WIMA and General Packet Radio Service (GPRS) protocol. The simulation results demonstrate that the mobile radio network using the contention-based movable-boundary WIMA protocol to integrate voice and data services can reduce the expected data-packet delay. The analytical results are used to validate the simulation results. [J469]

"Noniterative techniques for GPR imaging through a nonplanar air-ground interface"

It is often advantageous to acquire pulse-echo ground-penetrating radar (GPR) measurements from antennas that are offset from the air-ground interface by a nonnegligible distance, either because the ground's surface is rough, or because measurements must be collected remotely. This paper describes the effects of incorrectly estimating the location of the air-ground interface on GPR images created with the plane-to-plane backpropagation (PPB) method. To compensate for a nonplanar air-ground interface, the wideband time-domain synthetic aperture method is reviewed and reformulated, using Snell's law of refraction, to account for measurements taken some distance above an undulating interface. A modification of the PPB algorithm that accounts for a nonplanar interface is also formulated, and examples of imaging with both methods are given to validate, the algorithms' performance for surface variations that are relatively smooth with respect to the radar waveform wavelengths. Additionally, a method for inferring the surface topography from the radar returns is described. Finally, the modified PPB is demonstrated by imaging buried targets sensed in field-acquired data. [J470]

"The conical spiral antenna over the ground"

The two-arm, conical spiral antenna (CSA) is a well-known antenna that has several desirable features when isolated in free space, such as uniform input impedance, gain, and circular polarization over a broad frequency range. This antenna is investigated when placed directly over the ground with its axis normal to the surface of the ground. In this configuration, the CSA may be useful for applications in which signals must be transmitted into the ground and/or received from within the ground, such as communication links to underground tunnels and ground-penetrating radars. First, the performance of the CSA in free space is reviewed, and then qualitative arguments based on the geometrical and electrical properties of the isolated antenna are used to predict the performance when this antenna is placed over the ground. Next, results from a complete analysis of the CSA over the ground, performed with the finite-difference time-domain method, are used to quantitatively verify these predictions. The paper ends with an illustrative example in which the CSA is used in a monostatic ground-penetrating radar. [J471]

"Delay analysis of integrated voice and data service for GPRS"

The quality-of-service (QoS) requirements of typical mobile packet data applications are very diverse. QoS profiles of the General Packet Radio Service (GPRS) are defined using the parameters service precedence, reliability, delay, and throughput. A one-dimensional decomposing Markov chain is used as the queueing model to analyze the GPRS performance in terms of the mean delay and 95% delay. In addition, the impact of buffer assignment and guard channels on the GPRS traffic is also investigated. The analytical results are verified by simulation and the comparison shows that they are very close. [J472]

"On the fast approximation of Green's functions in MPIE formulations for planar layered media"

The numerical implementation of the complex image approach for the Green's function of a mixed-potential integral-equation formulation is examined and is found to be limited to low values of κoρ (in this context κ0ρ = 2piρ/λ0, where ρ is the distance between the source and the field points of the Green's function and λ0 is the free space wavelength). This is a clear limitation for problems of large dimension or high frequency where this limit is easily exceeded. This paper examines the various strategies and proposes a hybrid method whereby most of the above problems can be avoided. An efficient integral method that is valid for large κ0ρ is combined with the complex image method in order to take advantage of the relative merits of both schemes. It is found that a wide overlapping region exists between the two techniques allowing a very efficient and consistent approach for accurately calculating the Green's functions. In this paper, the method developed for the computation of the Green's function is used for planar structures containing both lossless and lossy media [J473]

"Continuous pavement profiling with ground-penetrating radar"

Ultra-wideband (UWB) monostatic ground-penetrating radar (GPR) has been proven to be very useful in road and highway pavement profiling. Pavement profiling involves estimating the thickness and permittivity of each underground layer, which can be done through layer stripping inversion, using efficient time-delay-estimation algorithms. In monostatic GPR applications, time delay estimation is routinely performed on a scan-by-scan basis. The authors first propose a multiscan data model for the continuous survey, by taking into account the vertical motion of moving vehicles as well as the lateral continuity of echoes arising from a multilayered media along the scan direction. Then a new algorithm, referred to as MCPEG (motion compensation and parameter estimation for GPR), is presented for simultaneous motion compensation and time-delay estimation. MCPEG outperforms the conventional scan-by-scan estimation approach in terms of both computational efficiency and estimation accuracy. Numerical and experimental examples are provided to demonstrate the performance of the new algorithm [J474]

"A linear prediction land mine detection algorithm for hand held ground penetrating radar"

Land mine detection using ground penetrating radar (GPR) is a difficult task because the background clutter characteristics are nonstationary and the land mine signatures are inconsistent. A particularly difficult scenario is the case for which a GPR is mounted on a hand held device with no position or velocity information available to a signal processing algorithm. This paper proposes the use of linear prediction in the frequency domain for land mine detection in this scenario. A frequency domain clutter vector sample is partitioned into subbands. Each subband is modeled by a linear prediction model; the current vector sample is expressed as a linear combination of the past few vector samples plus random noise. The detector first computes the maximum likelihood estimate of the prediction coefficients, and then uses the generalized likelihood method to determine if a land mine is present. The effect of subband processing on the accuracy of the detector is evaluated. Detection results are presented on data collected from a variety of geographical locations. The data sets contain over 2300 mine

encounters of different size, shape and content, and a larger number of measurements from locations with no mines. The proposed detector is compared to the baseline differential energy detector. The proposed algorithm reduces the false alarm rate by 60% for all the targets at 90% probability of detection, and 70% for the deep anti-tank mines at 90% probability of detection. [J475]

"Frequency responses of ground-penetrating radars operating over highly lossy grounds"

The finite-difference time-domain (FDTD) method is used to investigate the effects of highly lossy grounds and the frequency-band selection on ground-penetrating-radar (GPR) signals. The ground is modeled as a heterogeneous half space with arbitrary background permittivity and conductivity. The heterogeneities encompass both embedded scatterers and surface holes, which model the surface roughness. The decay of the waves in relation to the conductivity of the ground is demonstrated. The detectability of the buried targets is investigated with respect to the operating frequency of the GPR, the background conductivity of the ground, the density of the conducting inhomogeneities in the ground, and the surface roughness. The GPR is modeled as transmitting and receiving antennas isolated by conducting shields, whose inner walls are coated with absorbers simulated by perfectly matched layers (PML). The feed of the transmitter is modeled by a single-cell dipole with constant current density in its volume. The time variation of the current density is selected as a smooth pulse with arbitrary center frequency, which is referred to as the operating frequency of the GPR. [J476]

"Time-domain inverse scattering method for cross-borehole radar imaging"

In this paper, we consider a solution method of the inverse problem of imaging two-dimensional (2D) objects buried underground by cross-hole radar data in the time domain. In addition to less information on the targets due to restriction on the arrangement of transmitters and receivers than for full-view cases such as imaging of objects in free space, the large search region between boreholes makes solving the inverse problem difficult. Although iterative optimization approaches take long computing time, these approaches give much better image qualities for high-contrast objects than linear inversions such as a diffraction tomography. However, the reconstruction in a large search region with limited-view measurements often fails trapped in a local minimum. To overcome this difficulty, we propose a two-step iterative approach: the first step is to reduce the search region to a smaller one and the second step is the accurate reconstruction of the targets in the small region. Both steps are based on an iterative optimization approach, i.e., the forward-backward time-stepping method previously proposed. This two-step approach is tested for detection of tunnel-like objects surrounded by a heterogeneous background medium to evaluate its performance. Numerical results indicate the efficiency of the approach and its ability of circumventing local minima. [J477]

"An all-IP approach for UMTS third-generation mobile networks"

This article describes the UMTS all-IP approach for third-generation mobile systems, with emphasis on the core network architecture. Following the introduction of the core network nodes, we elaborate on application-level registration, circuit-switched call origination, packet-switched call origination, and packet-switched call termination. [J478]

"Extended analysis of ground impedance measurement using the fall-of-potential method"

An extended analysis of ground impedance measurement using the fall-of-potential method will be presented. An interesting curve that represents the exact locations of the potential probe when the potential and current probes are in different directions is obtained for the first time. Curves representing measurement error are also presented for the case when the potential probe is placed in locations where the correct ground impedance cannot be measured. A similar analysis for ground impedance measurements in multilayer soils is also discussed. The study presented in this paper has extended the theory of the conventional fall-of-potential method and the results obtained can serve as a practical guide for ground impedance measurements made using this method. [J479]

"Land mine detection"

Currently, very little technology is used in real-world demining activities. Active programs by the U.S. Army in both land mine detection sensor development and systems integration are evaluating new technologies, incrementally improving existing technologies, increasing the probability of detection, reducing the false alarm rate, and planning out usable deployment scenarios. Through iterative design/build test cycles, and blind and scored testing at Army mine lanes, steady progress is being made. [J480]

"Focused Gaussian beams in the problem of holographic imaging"

A simplified scheme of microwave near-field radar is considered. Focused Gaussian beams form a functional basis for holographic migration. Two-frequency phase measurements are used for the target localization. Numerical examples are given. [J481]

"Digital elevation map generation using VHF-band SAR data in forested areas"

The paper investigates digital elevation model (DEM) generation based on data from the ultra wideband coherent all radio band sensing (CARABAS) very high frequency (VRF)-band synthetic aperture radar (SAR). The results show excellent capability to penetrate forest areas, i.e., the generated DEMs are found to be close to the true ground height. A conventional DEM, based on stereo photography and surveying, and additional phase differential Global Positioning System (GPS) measurements have been used for comparison. The results in heavily vegetated areas (stem volume up to 600 m3/ha) show a mean height difference of less than 1.5 m and a root-mean-square (rms) error of less than 1.0 in compared to the conventional DEM. Stable backscattering properties allows us to use large baselines in order to obtain high height sensitivity. However, the amount of poor data due to low coherence increases with the increase of the baseline. The optimum baseline which balances these two effects is found to correspond to an incidence angle difference of 4°-8°. [J482]

"A group-theoretic analysis of symmetric target scattering with application to landmine detection"

Landmines are generally constructed such that they possess a high level of geometric symmetry and are then buried in a manner that preserves this symmetry. The scattered response of such a symmetric target will likewise exhibit the symmetry of the target, as well as the electromagnetic reciprocity exhibited by all scatterers. Group theory provides a mathematic tool for describing geometric symmetry, and it can likewise be used to describe the symmetries inherent in the bistatic scattering from mines. Specifically, group theory can be used to determine specific forms of the dyadic Green's function of symmetric scatterers, such that multiple scattering solutions can be determined from a knowledge of a single bistatic geometry. Likewise, group theory can be used both to determine and analyze degenerate cases, wherein specific bistatic responses can be identified as zero regardless of target size, shape, or material. These results suggest a method for classifying subsurface targets as either symmetric or asymmetric. From the group-theoretic analysis, scattering features can be constructed that are indicative of target symmetry, but invariant with respect to other target parameters such as size, shape, or material. These features provide a physically based, target-independent value to aid in mine detection and/or clutter rejection. To test the efficacy of this idea, an extensive collection of bistatic ground-penetrating radar (GPR) measurements was taken for both a symmetric and an asymmetric target. The two targets were easily discernable using symmetry features only, a result that suggests symmetry features can be effective in identifying subsurface targets. [J483]

"Generalized partial-response targets for perpendicular recording with jitter noise"

In this paper, we propose new generalized partial-response (GPR) targets for perpendicular recording whose transition response is modeled as an error function and compare their performance with the partial-response (PR) targets both in the presence and absence of jitter noise. Regardless of any jitter noise amount, results indicate that the GPR targets outperform the PR targets, especially at high linear-recording densities. We also determine that the dominant error sequence for this perpendicular recording is the same for all targets when jitter noise is low. Therefore, the system performance can be further improved by designing and using codes to avoid this dominant error sequence. Another significant point is the fact that the dominant error sequence of perpendicular recording is different from longitudinal recording, thus requiring design of different types of codes than the ones used for longitudinal recording. Finally, we show that the effective signal-to-noise ratio can be equivalently used instead of the bit-error-rate as a measure to compare the performance of different targets. [J484]

"Focused synthetic aperture radar processing of ice-sounder data collected over the Greenland ice sheet"

The authors developed a synthetic aperture radar (SAR) processing algorithm for airborne/spaceborne ice-sounding radar systems and applied it to data collected in Greenland. By using focused SAR (phase-corrected coherent averaging), they improved along-track resolution by a factor of four and provided a 6-dB processing gain over unfocused SAR (coherent averaging without phase correction) based on a point-target analysis for a Greenland ice-sounding data set. Also, They demonstrated that the focused-SAR processing reduced clutter and enabled them to identify bedrock-interface returns buried in clutter. Using focused-SAR technique, they processed data collected over a key 360-km-long portion of the 2000-m contour line of southwest Greenland. To the best of their knowledge, these are the first high-quality radar ice thickness measurements over this key location. Moreover, these ice-thickness measurements have been used for improving mass-balance estimates of

the Greenland ice sheet [J485]

"Adaptive ground bounce removal"

An adaptive ground bounce (GB) removal algorithm is presented for landmine detection with a downward looking stepped frequency ground penetrating radar (GPR). The main idea is to estimate and eliminate the GB from a given scan as a shifted and scaled version of an adaptively estimated reference GB. Experimental results are provided to demonstrate that the new algorithm outperforms existing approaches [J486]

"Scattering from lossy dielectric objects buried beneath randomly rough ground: validating the semi-analytic mode matching algorithm with 2-D FDFD"

A new semi-analytic mode matching (SAMM) algorithm is verified by two-dimensional (2-D) finite difference frequency domain (FDFD) simulations of scattering resulting from uniform plane waves incident on randomly rough dielectric half-spaces containing buried dielectric targets. The SAMM algorithm uses moderately low-order modal superpositions of cylindrical waves, each of which satisfies the 2-D-Helmholtz equation in its appropriate region (air, ground, or mine) and then matches all nonzero electric and magnetic field components at each interface by inverting a highly overconstrained dense linear matrix equation by singular value decomposition. That is, the set of cylindrical mode coefficients is found which best fits the boundary conditions in a least squares sense. For smooth ground, coordinate scattering centers (CSCs) are chosen at the mine center and at its image above the plane to model scattering. For randomly rough ground, additional CSCs are located within the rough boundary layer. Excellent agreement between 2-D-FDFD and the 2-D version of SAMM is observed, with 2-D-SAMM being at least an order of magnitude faster. 3-D-SAMM is estimated to be four orders of magnitude faster than 3-D-FDFD, with drastically reduced memory requirements [J487]

"Modeling of ground-penetrating-radar antennas with shields and simulated absorbers"

A three-dimensional (3-D) finite-difference time-domain (FDTD) scheme is employed to simulate ground-penetrating radars. Conducting shield walls and absorbers are used to reduce the direct coupling to the receiver. Perfectly matched layer (PML) absorbing boundary conditions are used for matching the multilayered media and simulating physical absorbers inside the FDTD computational domain. Targets are modeled by rectangular prisms of arbitrary permittivity and conductivity. The ground is modeled by homogeneous and lossless dielectric media [J488]

"The development of a measuring system for the electromagnetic phenomena caused by volcanic activity of Mount Sakurajima"

In order to examine the relationship between volcanic explosions and electromagnetic phenomena, we constructed the continuous extremely low frequency (ELF) band measuring system, which is composed of geoelectric potential differences (GPDs) and geomagnetic fields (GF's) at the foot of Mt. Sakurajima, Kyushu Island, Japan. The results of the measurements show that the measuring system is able to measure the natural phenomena properly and the GPDs in the horizontal direction are observed which are assumed to be associated with the volcanic activity of Mt. Sakurajima when the seismometer was active [J489]

"Time-domain sensing of targets buried under a Gaussian, exponential, or fractal rough interface"

The authors numerically examine subsurface sensing via an ultrawideband ground penetrating radar (GPR) system. The target is assumed to reside under a randomly rough air-ground interface and is illuminated by a pulsed plane wave. The underlying wave physics is addressed through application of the multiresolution time-domain (MRTD) algorithm. The scattered time-domain fields are parametrized as a random process and an optimal detection scheme is formulated, accounting for the clutter and target signature statistics. Detector performance is evaluated via receiver operating characteristics (ROCs) for variable sensor parameters (polarization and incident angle) and for several rough-surface statistical models [J490]

"SAR imaging of buried objects from MoM modelled scattered field"

Synthetic aperture radar (SAR) images of resonant buried objects are modelled in the presence of ground surface clutter. The method of moments (MoM) is used to model scattered fields from a resonant buried conductor and clutter is modelled as a bivariant Gaussian distribution. A diffraction stack SAR imaging technique is applied to the ultra-wideband waveforms to give a bipolar signal image. A number of examples have been computed to illustrate the combined effects of SAR processing with resonant targets and clutter. SAR images of different targets show differences which may facilitate target identification. To maximise the peak signal-to-clutter ratio, an image correlation technique is applied and the results are shown [J491]

"Reconstruction of multilayered lossy dielectrics from one-sided plane wave impulse reflection responses: the bistatic case"

Motivated by numerous scattering problems where the media is lossy and yet can only be investigated from a single side, the authors discuss algorithms for reconstructing a lossy, stratified dielectric from one-sided plane wave impulse reflection responses. Novel features of these algorithms include: 1) solving the lossy media problem using only one-sided reflection response data; 2) exploiting oblique probing angles; 3) having origins in digital signal processing (DSP) theory; 4) employing fast algorithms that have been modified to solve the forward scattering problem; and 5) solving the scattering problems exactly, including accounting for multiple reflections. A new algorithm is introduced that reconstructs such a media from one-sided transverse electric (TE) and transverse magnetic (TM) impulsive plane wave reflection responses from a single oblique angle. The oblique-probing angle necessitates a bistatic measurement configuration. New probing constraints are developed for a previously presented algorithm based on probing at two angles of incidence. Algorithm stability and data correction are addressed. Numerical examples illustrate the new algorithm in synthesizing the media transient response and reconstructing the media [J492]

"Microwave detection of buried mines using non-contact, synthetic near-field focusing"

Existing ground penetrating radars (GPR) are limited in their 3-D resolution. For the detection of buried land-mines, their performance is also seriously restricted by `clutter'. Previous work by the authors has concentrated on removing these limitations by employing multi-static synthetic focusing from a 2-D real aperture. This contribution presents this novel concept, describes the proposed implementation, examines the influence of clutter and of various ground features on the system's performance, and discusses such practicalities as digitisation and time-sharing of a single transmitter and receiver. Experimental results from a variety of scenarios are presented [J493]

"The financial perspective of the mobile networks in Europe"

This article presents a techno-economic evaluation of 3G rollout scenarios in two "typical" European countries with contrasting profiles, analyzing both the incumbent and newcomer business cases. The analysis is based on a techno-economic methodology developed within the ACTS-TERA project. Market and tariff forecasts as well as the technological evolutionary paths are discussed and financial figures are analyzed. Sensitivity analysis follows these basic results in order to identify the impact of uncertainties and risks. The success of such an investment project mainly depends on the regulatory framework, demand and tariff structure, and the market share [J494]

"On the path to 3G"

The authors discuss two complementary technologies at the forefront of the road to third generation systems; these are the General Packet Radio Service (GPRS) and Wireless Application Protocol (WAP) systems [J495]

"FOPEN SAR imaging using UWB step-frequency and random noise waveforms"

The detection and identification of targets obscured by foliage have been topics of great interest. Several synthetic aperture radar (SAR) experiments have demonstrated promising images of terrain and man-made objects obscured by dense foliage, by using either linear frequency modulation (LFM) or step-frequency waveforms. We present here the methodology and results of a comparative study on foliage penetration (FOPEN) SAR imaging using ultrawideband (UWB) step-frequency and random noise waveforms. A statistical-physical foliage transmission model is developed for simulation applications. The foliage obscuring pattern is analyzed by means of the technique of paired echoes. The results of the comparative study demonstrates the ability of a UHF band UWB random noise radar to be used as a FOPEN SAR. Advantages of the random noise radar system include covert detection and immunity to radio frequency interference (RFI) [J496]

"Linear GPR inversion for lossy soil and a planar air-soil interface"

A three-dimensional inversion scheme for fixed-offset ground penetrating radar (GPR) is derived that takes into account the loss in the soil and the planar air-soil interface. The forward model of this inversion scheme is based upon the first Born approximation and the dyadic Green function for a two-layer medium. The forward model is inverted using the Tikhonov-regularized pseudo-inverse operator. This involves two steps: filtering and backpropagation. The filtering is carried out by numerically solving Fredholm integral equations of the first kind and the backpropagation is performed using fast Fourier transforms. Numerical results are provided to illustrate the performance of the inversion scheme [J497]

"Mobility management incorporating fuzzy logic for heterogeneous a IP environment"

The next generation in mobility management will enable different mobile networks to interoperate with each other to ensure terminal and personal mobility and global portability of network services. However, in order to ensure global mobility, the deployment and integration of both satellite and terrestrial components are necessary. This article is focused on issues related to mobility management in a future mobile communications system, in a scenario where a multisegment access network is integrated into an IP core network by exploiting the principles of Mobile IP. In particular, attention is given to the requirements for location, address, and handover management. In a heterogeneous environment, the need to perform handover between access networks imposes particular constraints on the type of information available to the terminal and network. In this case, consideration will need to be given to parameters other than radio characteristics, such as achievable quality of service and user preference. This article proposes a new approach to handover management by applying the fuzzy logic concept to a heterogeneous environment. The article concludes with a presentation of mobility management signaling protocols [J498]

"Malaysia: telecommunications at a crossroad"

First Page of the Article [J499]

"Subsurface inverse scattering problems: quantifying, qualifying, and achieving the available information"

In inverse scattering problems, only a limited amount of independent data is actually available whenever the finite accuracy of the measurement set up is taken into account. The authors deal with the problem of quantifying such an amount in the subsurface sensing case. In particular, an alternative formulation of the problem is given which also allows one to understand how to dimensionate the measurement setup in an optimal fashion. Analytical results are reported for the case of a lossless soil, while a numerical study is carried out in the general case. By relying on the same formulation and tools, the authors also discuss the kind of unknown profiles that can actually be retrieved. In particular, it is shown that the class of retrievable functions exhibits intrinsic multiresolution features. This suggests that adoption of wavelet expansions to represent the unknown function may enhance the reconstruction capabilities. Numerical examples support this conclusion [J500]

"Third-generation mobile communications in europe: light and shadows"

First Page of the Article [J501]

"Wireless LAN access network architecture for mobile operators"

The evolution of IP-based office applications has created a strong demand for public wireless broadband access technology offering capacity far beyond current cellular systems. Wireless LAN access technology provides a perfect broadband complement for the operators' existing GSM and GPRS services in an indoor environment. Most commercial public wireless LAN solutions have only modest authentication and roaming capability compared to traditional cellular networks. This article describes a new wireless LAN system architecture that combines the WLAN radio access technology with mobile operators' SIM-based subscriber management functions and roaming infrastructure. In the defined system the WLAN access is authenticated and charged using GSM SIM. This solution supports roaming between cellular and WLAN access networks and is the first step toward an all-IP network architecture. The proto-type has been implemented and publicly verified in a real mobile operator network [J502]

"Effects of the ground surface on polarimetric features of broadband radar scattering from subsurface metallic objects"

Throughout the world, the problem of buried unexploded ordnance (UXO) poses an enormous, persistent, and expensive problem. While UXO generally consists of sizable bodies of ferrous metal and can therefore be detected, with current technology it is extremely difficult to distinguish them reliably from typically widespread pieces of clutter. Thus the problem is one of subsurface discrimination. The authors previous modeling work on scattering of ground penetrating radar (GPR) from metallic objects surrounded by an infinite soil-like medium has suggested the utility of a number of key discriminants in broadband fully polarimetric sensing. In particular, resonance structure, induced field rotation and ellipticity, and bistatic observation of scattered signals were shown to offer key information about target shape and size. The authors investigate the effects on signature features of the proximity of a ground surface to the target, for the common case of shallow burial (<1 m). Overall, their analyses suggest that the key discriminants seen in scattering in an infinite medium survive the complex

interactions with the ground surface. In some instances, these revealing signatures appear to be strengthened by the presence of a nearby surface. Multiposition backscatter also allows fundamental inferences about target elongation and symmetry when those cannot be obtained from single position viewing [J503]

"Polarimetric processing of coherent random noise radar data for buried object detection"

Random noise polarimetry is a new radar technique for high-resolution probing of subsurface objects and interfaces. The University of Nebraska has developed a polarimetric random noise radar system based on the heterodyne correlation technique. Simulation studies and performance tests on the system confirm its ability to respond to phase differences in the received signals. In addition to polarimetric processing capability and the simplified system design, random noise radar also possesses other desirable features, such as immunity from radio frequency interference. The paper discusses the theoretical foundations of random noise polarimetry, and presents examples out of the entire data set collected that demonstrate the usefulness of the image processing and Stokes matrix presentation to enhance target detection using the coherent random noise radar [J504]

"Recognition technology for the detection of buried land mines"

As described by Zadeh, recognition technology refers to systems that incorporate new sensors, novel signal processing, and soft computing. In this paper, we discuss these principles applied to the problem of land mine detection. We describe a complex recognition system that is evolving from basic research into a fielded system. Some components of this system have been field tested with excellent results, whereas other components have achieved such results in the laboratory. Fuzzy set-based information fusion algorithms are central to the excellent results obtained. Multiple-detection algorithms are applied to signals acquired from an innovative ground penetrating radar that produces volumetric sub-surface imagery. The outputs of the detection algorithms are combined using the fuzzy logic and Sugeno and Choquet fuzzy integrals to produce overall detection scores. Experimental results are provided on training data and on completely blind test data collected in the field and scored by the US Army [J505]

"Correction to: “Novel diffraction tomographic algorithm for imaging two-dimensional targets buried under a lossy earth”"

The paper by T. J. Cui and W. C. Chew, IEEE Trans. Geosci. Remote Sensing, vol. 38, p.2033-41 (2000) is corrected. The authors, in that paper, defined the branch cut of Kayand kbyin an equation (7) as Re(kay,by)⩾0 and Im(kay ,by)⩾0 to make the Sommerfeld-like integral in another equation(5) satisfy the radiation condition. In the inverse-Fourier expression of yet another equation (24), however, they had to choose the branch cut of kbyin a different way, where Re(kby)⩾O and Im(kay,by)⩽, so that the integral in this equation can be convergent. Hence, the kbyin equation (27) must be set in different branch cuts. Although such a procedure gave correct reconstruction results, the mathematical interpretation was confusing. In this correspondence, the authors now modify the mathematical interpretation so that it is clear and easily understood [J506]

"Radar images of penetrable targets generated from ramp profile functions"

Images can be generated for penetrable targets from their scattered fields when the time dependence of the incident electromagnetic (EM) wave takes the form of a ramp function. Previous researchers have developed these concepts for conducting targets. This paper focuses attention on penetrable targets. Ramp response signatures of the targets for cases where the dielectric constant of the target is greater than and also less than that of the ambient medium are included. The latter case can be applied as a signature of antipersonnel mines. The results contained herein are based on: (1) scattering measurements in The Ohio State University ElectroScience Laboratory compact range; (2) scattering computation using an eigenfunction solution and a method of moments solution; and (3) a very limited set of measurements generated from a buried land mine using the ElectroScience Laboratory ground penetrating radar. The targets presented in this paper include metallic and dielectric spheres and actual land mines [J507]

"Simultaneous voice and data operation for GPRS/EDGE: class A dual transfer mode"

Class A dual transfer mode of GPRS/EDGE operation addresses barriers in the migration path from the so-called 2.5G services offered by GSM to similar ones offered by UMTS and the ability to offer users a reasonably priced service that combines voice and data interchange capabilities with a low-cost mobile station [J508]

"Rate 8/9 sliding block distance-enhancing code with stationary detector"

A new distance-enhancing code for partial-response magnetic recording channels eliminates most frequent

errors, while keeping the two-step code trellis time invariant. Recently, published trellis codes either have lower code rates or result in time-varying trellises with a period of nine, thus requiring a higher complexity of detectors and code synchronization. The new code introduces dependency between code words in order to achieve the same coding constraints as the 8/9 time-varying maximum transition runlength (TMTR) code, with the same code rate, but resulting in a trellis that has a period of 2. This code has been applied to the E2PR4 and a 32-state generalized partial response (GPR) ISI target. The resulting two-step trellises have 14 and 28 states, respectively. Coding gain is demonstrated for both targets in additive white Gaussian noise [J509]

"Iterative soft decoded partial response channels for hybrid magneto-optical recording"

In this paper, a physical model of readback signals from a hybrid magneto-optical (MO) recording using magnetic flux detection is presented. The minimum mean-square error (MMSE) technique has been used to design generalized partial response (GPR) targets in order to facilitate the application of the trellis based channel detector. A PR target with integer coefficients is proposed as a good approximation to the GPR target. We also address the application of turbo codes and LDPC codes with iterative soft decoding structure to the hybrid magneto-optical (MO) recording channel. The effects of bloom, transition noise and giant magneto-resistive (GMR) sensor nonlinearity on the bit error rate (BER) performance are investigated both for uncoded partial response maximum likelihood (PRML) and iterative soft decoded recording channels. Our results for the hybrid recording channels indicate that turbo/LDPC codes of rate 16/17 can achieve coding gains of about 5 dB over PRML methods for a 10-5target BER at the normalized density S=1.5. Turbo codes with iterative soft decoding are seen to be robust to transition noise [J510]

"Ground penetrating radar antennas: theoretical and experimental directivity functions"

The prediction of the directivity function of a GPR antenna still remains a partially unsolved problem because of the subject complexity. First, the far-field conditions are often not satisfied and second, the antenna design has little in common with the Hertzian dipole for which an analytical approach can be used. The authors' contribution is both theoretical and experimental. On one side, they solve the (electromagnetic) EM integral equations numerically to derive the wavefield components from near to far-field distances. On the other side, they experiment with two novel techniques for measuring the directivity functions in the near to far-field range on dry and saturated sand. Theoretical and experimental results show that neither the analytic approximation of far-field directivity for the numerical integration of near-field directivity can perfectly match the measured functions, although near-field solutions are generally more consistent. The mismatch should be attributed to the present-day GPR antenna design that includes absorbers and shields. Although the effects of these elements are not included in the present numerical near-field solutions, they believe the approach to be of practical value to predict an average directivity function. A smoothed version of the analytic far-field solution can also be used in the range of the near to far-field transition but near-field solutions are really recommended when TX-RX distances are shorter than five wavelengths [J511]

"Resource management and quality of service in third generation wireless networks"

The third generation networks and services present opportunities to offer multimedia applications and services that meet end-to-end quality of service requirements. The key parts of the standards are already in place, and limited 3G services have already been turned on. While the evolution to 3G occurs, many operators will implement 2.5G interim solutions for a good period of time. We discuss the various evolution scenarios from the present 2G networks to 3G networks. Then we present the UMTS QoS architecture and its requirements, followed by a discussion on QoS in 3G air interfaces, radio access network, and core network [J512]

"Supporting packet-data QoS in next generation cellular networks"

In the past few years, the Internet has grown beyond anyone's reasonable imagination into a universal communication platform. At the same time the cellular networks, with their ability to reach a person “anywhere, anytime,” have grown impressively as well. Thus the combination of mobile networks and the Internet into the so called “mobile Internet” promises to be an important technology area. The indications are clear: the cellular networks are rapidly adopting suitable network models for supporting packet data services. A key component of this packet data service model is quality of service (QoS), which is crucial for supporting disparate services envisioned in the future cellular networks. We describe the packet data QoS architecture and specific mechanisms that are being defined for multi-service QoS provisioning in the Universal Mobile Telecommunication Systems [J513]

"Building the wireless Internet"

Everybody's talking about the wireless Internet, but what on earth is it? And who's building it? The trade press is

adrift in a bewildering jumble of acronyms from the cellular telephony industry that claim to point the way. Or maybe dozens of LEOS (low-earth-orbiting satellites) will furnish the wireless Internet. Or perhaps it's really two way pagers on steroids-powered by WAP (the wireless access protocol). Proceeding from first principles, the author believes that none of the well-known technologies will, in the end, provide the wireless Internet. Instead a dark-horse technology-a “pure Internet” system based on technology familiar from a multitude of wireless local-area networks (LANs)-has good grounds to prevail. The author discusses which RF frequency bands should be used for the Internet, the use of nanocells to build the network, and gives a brief outline of the economics involved [J514]

"Object detection using high resolution near-field array processing"

The authors present an algorithm for the detection and localization of an unknown number of objects buried in a halfspace and present in the near field of a linear receiver array. To overcome the nonplanar nature of the wavefield over the array, the full array is divided into a collection of subarrays such that the scattered fields from objects are locally planar at each subarray. Using the multiple signal classification (MUSIC) algorithm, directions of arrival (DOA) of locally planar waves at each subarray are found. By triangulating these DOAs, a set of crossings, condensed around expected object locations, are obtained. To process this spatial crossing pattern, the authors develop a statistical model for the distribution of these crossings and employ hypotheses testing techniques to identify a collection of small windows likely to contain targets. Finally, the results of the hypothesis tests are used to estimate the number and locations of the targets. Using simulated data, they demonstrate the usefulness and performance of this approach for typical background electrical properties and signal to noise ratios [J515]

"Discrimination of UXO in soil using broadband polarimetric GPR backscatter"

Polarimetric analysis of ground penetrating radar (GPR) backscatter offers a new means of discriminating subsurface metallic target shapes from one another. Such discrimination is urgently needed to distinguish buried unexploded ordnance (UXO) from other subsurface objects. To illuminate the underlying phenomenology of scattering from objects enveloped in soil, three-dimensional (3D) simulations are performed over a broad frequency band, characteristic of new low frequency GPRs. For moist soil, this means that the subsurface wavelength may range from a fraction of the target size to an order of magnitude larger With a transmitting antenna representation that produces typical subsurface GPR beam features, combined effects of positional, orientation, and frequency diversity are investigated. Despite long wavelengths, results show distinctive features in reflections obtained from contrasting example target shapes. Full polarimetric analysis suggests the capability for inferring the length of elongated targets, aspect ratio and rotational symmetry, and gross shape along the axis for either elongated or flattened bodies of revolution in problematical orientations [J516]

"An improved calibration technique for free-space measurement of complex permittivity"

A calibration technique for free-space measurement of the permittivity and conductivity has been developed, taking account of antenna-medium coupling. Thus, the accuracy is improved compared to previously used calibration. Two examples are given to illustrate this improvement [J517]

"Inverse scattering of two-dimensional dielectric objects buried in a lossy earth using the distorted Born iterative method"

An efficient inverse-scattering algorithm is developed to reconstruct both the permittivity and conductivity profiles of two-dimensional (2D) dielectric objects buried in a lossy earth using the distorted Born iterative method (DBIM). In this algorithm, the measurement data are collected on (or over) the air-earth interface for multiple transmitter and receiver locations at single frequency. The nonlinearity due to the multiple scattering of pixels to pixels, and pixels to the air-earth interface has been taken into account in the iterative minimization scheme. At each iteration, a conjugate gradient (CG) method is chosen to solve the linearized problem, which takes the calling number of the forward solver to a minimum. To reduce the CPU time, the forward solver for buried dielectric objects is implemented by the CG method and fast Fourier transform (FFT). Numerous numerical examples are given to show the convergence, stability, and error tolerance of the algorithm [J518]

"The hybrid extended Born approximation and CG-FFT method for electromagnetic induction problems"

The authors propose the hybridization of the extended Born approximation (EBA) with the conjugate-gradient fast Fourier transform (CG-FFT) method to improve the efficiency of numerical solution of electromagnetic induction problems. This combination improves the solution efficiency in two ways. First, using the FFT in the extended

Born approximation decreases the computational cost of the conventional EBA method from O(N2) to O(N log2N) arithmetic operations, where N is the number of unknowns in the problem. This approach, referred to as the FFT-EBA method, applies to problems with a fairly large contrast. Secondly, using the EBA as a partial preconditioner for the CG-FFT method increases the convergence speed of the conventional CG-FFT method. This second approach, referred to as the EBA-CGFFT method, is in principle applicable to all problems with a homogeneous background, but is particularly efficient for problems with a higher contrast. Numerical experiments suggest that the combination of these two methods is more accurate and more efficient for electromagnetic induction problems [J519]

"Landmine detection with ground penetrating radar using hidden Markov models"

Novel, general methods for detecting landmine signatures in ground penetrating radar (GPR) using hidden Markov models (HMMs) are proposed and evaluated. The methods are evaluated on real data collected by a GPR mounted on a moving vehicle at three different geographical locations. A large library of digital GPR signatures of both landmines and clutter/background was constructed and used for training. Simple, but effective, observation vector representations are constructed to naturally model the time-varying signatures produced by the interaction of the GPR and the landmines as the vehicle moves. The number and definition of the states of the HMMs are based on qualitative signature models. The model parameters are optimized using the Baum-Welch algorithm. The models were trained on landmine and background/clutter signatures from one geographical location and successfully tested at two different locations. The data used in the test were acquired from over 6000 m2of simulated dirt and gravel roads, and also off-road conditions. These data contained approximately 300 landmine signatures, over half of which were plastic-cased or completely nonmetal [J520]

"Subsurface structures detection by combining L-band polarimetric SAR and GPR data: example of the Pyla Dune (France)"

The authors investigate the penetration capabilities of microwaves, particularly at L-band, for the mapping of subsurface heterogeneities such as lithology variations, moisture or sedimentary structures. The experiment site, the Pyla Dune, is a bare sandy area allowing high signal penetration and presenting large subsurface structures (paleosoils) at varying depths. Several radar data sets over this area are available. A polarimetric analysis of airborne synthetic aperture radar (SAR) data as web as the ground penetrating radar (GPR) sounding experiment show that subsurface scattering occurs at several places. The SAR penetration depth is estimated by inverting a scattering model for which the subsurface structure geometric and dielectric properties are determined by the GPR data analysis. These results suggest that airborne radar systems in a lower frequency range (P-band) should be able to detect subsurface moisture down to several meters, leading to innovative Earth observation systems for hydrogeology in arid regions [J521]

"Coupled canonical grid/discrete dipole approach for computing scattering from objects above or below a rough interface"

A numerical model for computing scattering from a three-dimensional (3D) dielectric object above or below a rough interface is described. The model is based on an iterative method of moments solution for equivalent electric and magnetic surface current densities on the rough interface and equivalent volumetric electric currents in the penetrable object. To improve computational efficiency, the canonical grid method and the discrete dipole approach (DDA) are used to compute surface to surface and object to object point couplings, respectively, in O(N log N), where N is the number of surface or object sampling points. Two distinct iterative approaches and a preconditioning method for the resulting matrix equation are discussed, and the solution is verified through comparison with a Sommerfeld integral-based solution in the flat surface limit. Results are illustrated for a sample landmine detection problem and show that a slight surface roughness can modify object backscattering returns [J522]

"Ultrawide-bandwidth fully-polarimetric ground penetrating radar classification of subsurface unexploded ordnance"

An ultrawide-bandwidth (UWB) ground penetrating radar (GPR) was used to collect fully-polarimetric backscattered data from 10 to 800 MHz using a dual-polarization version of the previously developed dielectric-loaded horn-fed bow-tie (HFB) antenna. Special processing algorithms were developed to extract the polarization, orientation, depth, and length features of the target under investigation. The polarization and resonance features were utilized to discriminate subsurface ordnance from false-alarm objects that do not have elongated bodies. The classification of a specific type of unexploded ordnance (UXO) was also performed using the known length information. The processed results obtained from an initial blind field test show a very encouraging discrimination performance [J523]

"Feature-level and decision-level fusion of noncoincidently sampled sensors for land mine detection"

We present and compare methods for feature-level (predetection) and decision-level (postdetection) fusion of multisensor data. This study emphasizes fusion techniques that are suitable for noncommensurate data sampled at noncoincident points. Decision-level fusion is most convenient for such data, but it is suboptimal in principle, since targets not detected by all sensors will not obtain the full benefits of fusion. A novel algorithm for feature-level fusion of noncommensurate, noncoincidently sampled data is described, in which a model is fitted to the sensor data and the model parameters are used as features. Formulations for both feature-level and decision-level fusion are described, along with some practical simplifications. A closed-form expression is available for feature-level fusion of normally distributed data and this expression is used with simulated data to study requirements for sample position accuracy in multisensor data. The performance of feature-level and decision-level fusion algorithms are compared for experimental data acquired by a metal detector, a ground-penetrating radar, and an infrared camera at a challenging test site containing surrogate mines. It is found that fusion of binary decisions does not perform significantly better than the best available sensor. The performance of feature-level fusion is significantly better than the individual sensors, as is decision-level fusion when detection confidence information is also available (“soft-decision” fusion) [J524]

"An analytical model for studies of soil modification effects on ground penetrating radar"

Due to the similar dielectric constants of buried nonmetallic targets and dry soils, it is often difficult to detect and identify nonmetallic targets with ground penetrating radar. The addition of properly chosen chemical agents to modify soil properties can potentially provide improved detection. Previous studies using waveguide experiments have shown that the addition of water improves dielectric contrasts but also increases loss so that target detectability is not necessarily improved. The addition of liquid nitrogen to wet soils can reduce background medium loss and restore target visibility, and waveguide studies of target detection through controlled depth of nitrogen penetration have shown that scattering can be significantly enhanced if an optimal amount of nitrogen is added. A simple physical optics (PO) model for scattering from a three-dimensional target buried below a half space is presented, and it is shown that the radar cross section of the target depends on the dielectric contrast with and attenuation in the background medium. The model is validated through comparison with a method of moments code and found to yield accurate predictions for near normal incidence geometries. Analytical studies of target detection with two concepts of soil modification are then described: obtaining an “optimal” homogeneous soil water content and the addition of a large quantity of water along with an optimal amount of liquid nitrogen. Finally, initial tests of these soil modification techniques with a dielectric rod antenna ground penetrating radar are performed and demonstrate that the addition of liquid nitrogen to excessively wet soils can reduce loss and enhance target visibility [J525]

"Multi-aspect detection of surface and shallow-buried unexploded ordnance via ultra-wideband synthetic aperture radar"

An ultra-wideband (UWB) synthetic aperture radar (SAR) system is investigated for the detection of former bombing ranges, littered by unexploded ordnance (UXO). The objective is detection of a high enough percentage of surface and shallow-buried UXO, with a low enough false-alarm rate, such that a former range can be detected. The physics of UWB SAR scattering is exploited in the context of a hidden Markov model (HMM), which explicitly accounts for the multiple aspects at which a SAR system views a given target. The HMM is trained on computed data, using SAR imagery synthesized via a validated physical-optics solution. The performance of the HMM is demonstrated by performing testing on measured UWB SAR data for many surface and shallow UXO buried in soil in the vicinity of naturally occurring clutter [J526]

"Polarimetric radar interferometry for improved mine detection and surface clutter rejection"

A recently developed technique, polarimetric radar interferometry, is applied to tackle the problem of the detection of buried objects embedded in surface clutter. An experiment with a fully polarimetric radar in an anechoic chamber has been carried out using different frequency bands and baselines. The processed results show the ability of this technique to detect buried plastic mines and to measure their depth. This technique enables the detection of plastic mines even if their backscatter response is much lower than that of the surface clutter [J527]

"Channel allocation for GPRS"

Based on the GSM radio architecture, the general packet radio service (GPRS) provides users data connections with variable data rates and high bandwidth efficiency. In the GPRS service, allocation of physical channels is flexible, i.e., multiple channels can be allocated to a user. We propose four algorithms for the GPRS radio

resource allocation: fixed resource allocation (FRA), dynamic resource allocation (DRA), fixed resource allocation with queue capability (FRAQ), and dynamic resource allocation with queue capability (DRAQ). We develop analytic and simulation models to evaluate the performance for these resource allocation algorithms in terms of the acceptance rate of both GPRS packet data and GSM voice calls. Our study indicates that DRAQ (queuing for both new and handoff calls) outperforms other algorithms [J528]

"Simple estimation of equivalent magnetic dipole moment to characterize ELF magnetic fields generated by electric appliances incorporating harmonics"

A simple method of quantifying the ELF (extremely low frequency) magnetic field distribution around electric appliances, which takes the harmonics into account, is newly proposed. The proposed method involves: (1) a simple estimation of the position of an equivalent magnetic dipole moment inside an appliance, using two magnetic field meters; (2) identification of the amplitude of the dipole moment magnetic-field measurements at certain points; and (3) calculation of the magnetic field distribution around the appliance using the estimated dipole moment. In this method, the dipole moment vector is assumed to be a similar value by allowing an uncertainty of 6 dB in the estimated magnetic field, which enables easy estimation of the dipole moment. In addition, the frequency characteristics of the magnetic field are taken into account by considering the harmonic components in the magnetic field waveform. The proposed method was applied to 13 types of appliances, and their equivalent magnetic dipole moments and harmonic components were determined. The results revealed that the proposed method is applicable to many electric appliances. The conditions required for the adoption of the method were also clarified [J529]

"Graphics applications over the wireless Web: Japan sets the pace"

In Japan, the wireless cell phone has displaced the desktop PC as the preferred Internet access tool. The rest of the world is expected to follow Japan's lead in embracing the wireless Internet. By 2003, nearly all wireless devices will be Web enabled, and i-Mode is setting the pace. i-Mode phones, with screens the size of business cards, may seem less than ideal for Internet access, but it is important to realize that the wireless Web represents a new medium that will change the way people work and play. Consumers and professionals will use mobile devices for audio-visual communications, sending and receiving email with rich media, and consulting databases with technical drawings. The cell phone is transforming into a multifunctional tool with increasingly sophisticated graphics capabilities [J530]

"A matched-filter-based reverse-time migration algorithm for ground-penetrating radar data"

Ground-penetrating radar (GPR) is a remote sensing technique used to obtain information on subsurface features from data collected over the surface. The process of collecting data may be viewed as mapping from the object space to an image space. Since most GPRs use broad beam width antennas, the energy reflected from a buried structure is recorded over a large lateral aperture in the image spare, migration algorithms are used to reconstruct an accurate scattering map by refocusing the recorded scattering events to their true spatial locations through a backpropagation process. The goal of this paper is to present a pair of finite-difference time-domain (FDTD) reverse-time migration algorithms for GPR data processing. Linear inverse scattering theory is used to develop a matched-filter response for the GPR problem. The reverse-time migration algorithms, developed for both bistatic and monostatic antenna configurations, are implemented via FDTD in the object space. Several examples are presented [J531]

"Simulations of ground-penetrating radars over lossy and heterogeneous grounds"

The versatility of the three-dimensional (3D) finite-difference time-domain (FDTD) method to model arbitrarily inhomogeneous geometries is exploited to simulate realistic ground-penetrating radar (GPR) scenarios for the purpose of assisting the subsequent designs of high-performance GPR hardware and software. The buried targets are modeled by conducting and dielectric prisms and disks. The ground model is implemented as lossy with surface roughness, and containing numerous inhomogeneities of arbitrary permittivities, conductivities, sizes, and locations. The impact of such an inhomogeneous ground model on the GPR signal is demonstrated. A simple detection algorithm is introduced and used to process these GPR signals. In addition to the transmitting and receiving antennas, the GPR unit is modeled with conducting and absorbing shield walls, which are employed to reduce the direct coupling to the receiver. Perfectly matched layer absorbing boundary condition is used for both simulating the physical absorbers inside the FDTD computational domain and terminating the lossy and layered background medium at the borders [J532]

"Response of realistic soil for GPR applications with 2-D FDTD"

The three-dimensional (3D), wideband, bistatic ground penetrating radar (GPR) scatter response of rough,

realistic ground is efficiently and accurately simulated using a hybrid high resolution 3D and large area two-dimensional (2D) finite difference time domain (FDTD) model. The 3D computation carefully models the transmitting and receiving antennas, while the 2D FDTD models wave propagation between the antennas and the scattering by the soil below them. The FDTD soil model considers realistic frequency dependent (dispersive) soil with Gaussian height variations. The modeling results are compared to experiments performed with the Geo-Centers, Inc., Newton, MA, commercially available GPR system used for mine detection. Despite the simplicity of the 2D model, the results of the simulation and the experiment agree quite well [J533]

"Three-dimensional subsurface analysis of electromagnetic scattering from penetrable/PEC objects buried under rough surfaces: use of the steepest descent fast multipole method"

The electromagnetic scattering from a three-dimensional (3D) shallow object buried under a two-dimensional (2D) random rough dielectric surface is analyzed. The buried object can be a perfect electric conductor (PEC) or can be a penetrable dielectric with size and burial depth comparable to the free-space wavelength. The random rough ground surface is characterized with Gaussian statistics for surface height and for surface autocorrelation function. The Poggio, Miller, Chang, Harrington, and Wu (PMCHW) integral equations are implemented and extended. The integral equation-based steepest descent fast multipole method (SDFMM), that was originally developed at UIUC, has been used and the computer code based on this algorithm has been successfully modified to handle the current application. The significant potential of the SDFMM code is that it calculates the unknown moment method surface electric and magnetic currents on the scatterer in a dramatically fast, efficient, and accurate manner. Interactions between the rough surface interface and the buried object are fully taken into account with this new formulation. Ten incident Gaussian beams with the same elevation angle and different azimuth angles are generated for excitation as one possible way of having multiple views of a given target. The scattered electric fields due to these ten incident beams are calculated in the near zone and their complex vector average over the multiple views is computed. The target signature is obtained by subtracting the electric fields scattered from the rough ground only from those scattered from the ground with the hurled anti-personnel mine [J534]

"Complex natural resonances of conducting planar objects buried in a dielectric half-space"

A scheme is presented to incorporate a mixed potential integral equation (MPIE) using Michalski's “formulation C” with the method of moments (MoM) for analyzing the scattering of a plane wave from conducting planar objects buried in a dielectric half-space. The robust complex image method with a two-level approximation is used for the calculation of the Green's functions for the half-space. To further speed up the computation, an interpolation technique for filling the matrix is employed. While the induced current distributions on the object's surface are obtained in the frequency domain, the corresponding time domain responses are calculated via the inverse fast Fourier transform (FFT). The complex natural resonances of targets are then extracted from the late time response using the generalized pencil-of-function (GPOF) method. The authors investigate the pole trajectories as they vary the distance between strips and the depth and orientation of single, buried strips. The variation from the pole position of a single strip in a homogeneous dielectric medium was only a few percent for most of these parameter variations [J535]

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