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“Radiowave Propagation”
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"Experimental analysis of wireless propagation models with mobile computing applications"

This paper presents an experimental analysis of five wireless propagation models with mobile computing applications that were realized in Colima, Mexico, a typical urban setting located in a highly seismic area, where mean building height averages less than 6 meters. The analysis compares signal behaviour measurements between two computers connected in ad-hoc mode in the following propagation scenarios: free space model, IEEE 802.11, indoor, pedestrian and vehicular. Finally, the measurements are compared with the analytical results of wireless propagation models developed in OPNET. [C1277]

"Nominal direction and direction spread estimation for slightly distributed scatterers using the SAGE algorithm"

In this paper, the SAGE (subspace-alternating generalized expectation-maximization) algorithm is derived using the generalized array manifold (GAM) model proposed in Asztely et al. (1997) (GAM-SAGE) to estimate the nominal directions, i.e. azimuths and elevations of slightly distributed scatterers (SDS). As byproducts estimates of the azimuth spreads (AS), elevation spreads (ES), and the azimuth-elevation correlation coefficients (AECC) of the SDS can be computed from the estimates of the GAM parameters. These parameters determine with close accuracy the direction spreads of SDS. Simulation studies show that in a single-SDS scenario, the GAM-SAGE algorithm outperforms the Spread-ESPRIT technique, and both of them outperform the SAGE algorithm derived with the conventional specular-scatterer (SS) model (SS-SAGE) when the output signal-to-noise ratio (SNR) is beyond a certain threshold which depends on the AS and ES of the SDS. In a two-SDS scenario with strong power imbalance between the SDS, provided the direction spacing between the SDS equals twice the intrinsic azimuth or elevation resolution of the array, the GAM-SAGE algorithm can estimate the nominal direction of the SDS with weakest power with tolerably small errors. The SS-SAGE algorithm returns high root mean squared estimation error (RMSEE) regardless of the direction separation. We also found that the AECC estimator needs to operate in high SNR in order for its bias and RMSEE to be tolerably small. The performance of the AECC estimator, as well as the AS and ES estimators can be improved by applying an array-size selection technique proposed in Yin et al. (2005). [C1278]

"2005 IEEE 61st Vehicular Technology Conference. VTC2005- Spring (IEEE Cat. No. 05CH37631)"

{no data available} [C1279]

"The probe spectrum access method"

This paper describes the probe spectrum access method. This dynamic spectrum access method can be used in the TV band to enable a system to transmit at high power levels (>1 W) without causing harmful interference. Each "Frequency Agile Radio" (FAR) transceiver measures the background spectrum to identify potential available channels. The system uses a high-processing gain probe waveform that enables propagation measurements to be made with minimal interference to the non-cooperative users. The system uses a modulation method to identify the FAR signal to all non-cooperative users via on/off amplitude modulation, allowing easy resolution of interference claims. Other TV band spectrum access methods do not enable high transmit power levels (>1 W) without causing interference to the existing users [C1280]

"Cooperative MIMO gateways: a promising technique for fast handoff"

The multi-input multi-output (MIMO) technique has been portrayed as the next revolution for wireless technologies. The MIMO technique is an effective mechanism to increase capacity and reliability of wireless communications by taking advantage of its spatial multiplexing gain or diversity gain. However, conventional MIMO is expensive: the form factor of the radio is large, multiple RF front ends are required, multiple antennas

can be difficult to place on a mobile platform, and the parallel propagation channels may be correlated. The paper investigates an alternative way of implementing MIMO: cooperative MIMO, where multiple nodes coordinate their transmissions so that cooperative parallel transmissions can be established between multiple source nodes and a destination node, and space/time coding is applied on the transmissions. We not only investigate the capacity gain from using cooperative MIMO, we also use cooperative MIMO to perform fast handoff for wireless networks. The performance of the proposed fast handoff approach is evaluated using modeling and simulation (M&S). [C1281]

"An experimental study on the installation effect the EM wave absorber to wireless LAN communication environment"

Indoor propagation by dipole antenna and throughput measurement by using commercial wireless LAN equipment are conducted for the experimental room, in order to investigate the effectiveness of setting EM-wave absorber for better wireless LAN communication environment. Comparison of well reflected environment, replacing of one side wall to the three layered absorber using common building material makes average delay profile half, and makes average throughput 40% faster. So, desired results of the better wireless LAN communication environment are confirmed by the installation of EM-wave absorber by this work. Simulation by ray tracing method is performed and the relationship of throughput to delay spread for the experimental room is also discussed in this paper. [C1282]

"Effectiveness of electromagnetic wave absorbers to improve 5.8 GHz DSRC EM environment inside tunnel"

Electromagnetic (EM) wave absorbers have been used to improve the EM environment of an electronic toll collection (ETC) system on an express highway or a wireless local area network (LAN) system in an indoor environment. In this paper, an efficient multi-ray propagation model, which uses a combination of image technique and grid approach to trace multiple signal rays from transmitter to receiver, is employed to analyze the EM environment of a dedicated short-range communication (DSRC) system inside tunnel. The validity of the model employed is discussed by the comparison with the results obtained by an experiment inside tunnel. [C1283]

"Modeling and simulation strategies in wireless propagation and coverage planning"

This paper presents two-dimensional (2D) user-friendly, tailored with attractive and useful graphical user interfaces (GUI), Matlab propagation packages based on the classical knife-edge model and the parabolic equation method that can handle realistic propagation scenarios with non-flat, arbitrarily-designed and user-selected terrain profiles. Any 2D propagation scenario may be built by the user, and field vs. range and/or height profiles can be simulated. [C1284]

"VI International Symposium on Electromagnetic Compatibility and Electromagnetic Ecology (IEEE Cat. No. 05EX1162)"

{no data available} [C1285]

"Design and analysis of radio links for radiocommunication systems"

The paper presents method of a design and analysis of digital radio links of small and medium capacity. Proper project of radio links is major problem for EMC issues. The most important aspects of radio waves propagation that must be taken into account by designer are discussed. The problem of antenna placing and heights are discussed in particular. Propagation loss and multipath attenuation are taken into consideration as another important EMC factors. [C1286]

"Advanced mobility models for ad hoc network simulations"

It is well known that mobility modeling plays an important role when assessing the performance of MANET protocols during a simulation test. This paper presents a tool to generate realistic mobility traces for MANET simulations. A new mobility model called AMADEOS was developed as an extension for the CANUMobisim framework. To model mobility for simulation environments, a new mobility model was created that takes into account obstacles. AMADEOS makes it easy and fast to automatically generate realistic mobility. It allows to edit spatial environments with polygonal obstacles to he used within simulations. It also allows to visualize an animation of the generated mobility traces. A new propagation model based on ray tracing was also implemented as part of AMADEOS. [C1287]

"Assessing the impact of rainfall on system bandwidth for broadband fixed wireless applications"

Due to the presence of location dependent channel errors on wireless links, many wireless scheduling algorithms have been proposed which aim to provide efficient distribution of resources and fair allocation of available bandwidth to flows. Traditionally, these algorithms have adopted a two state model to represent the bandwidth of individual wireless channels, i.e., channels can be in a 'good' state or in a 'bad' state. In actual fact, the bandwidth of each channel depends on the adaptive techniques employed by the wireless system (e.g., coding and modulation). The paper considers different levels of rainfall and examines the impact of these levels in conjunction with suitable adaptive mechanisms on the available system bandwidth. A wireless link bandwidth model is presented which shows an accurate depiction of bandwidth variations to be used for design, optimization and benchmarking of wireless network schedulers. Knowledge of the link bandwidth is crucial for an intelligent scheduling algorithm since the scheduler must know how much bandwidth is available in order to perform fair reallocation. [C1288]

"Optimising wireless LAN for longwall coal mine automation"

A significant development in underground longwall coal mining automation has been achieved with the successful implementation of WLAN technology for communication on a longwall shearer. Wi-Fi was selected to meet the bandwidth requirements of the underground data network, and several configurations were installed on operating longwalls to evaluate their performance. Although these efforts demonstrated the feasibility of using WLAN technology in a longwall operation, it was clear that new research and development was required in order to establish optimal, full face coverage. By undertaking an accurate characterisation of the target environment it has been possible to achieve great improvements in WLAN performance over a nominal Wi-Fi installation. The paper discusses the impact of Fresnel zone obstructions and multipath effects on RF propagation, as well as reporting on an optimal antenna and system configuration. Many of the lessons learnt in the longwall case are immediately applicable to other underground mining operations, particularly wherever there is a high degree of obstruction from mining equipment. [C1289]

"Indoor prediction of propagation using dominant path: Study and calibration"

In this paper, we are interested in predicting signal level inside buildings. A new model is presented and described. The free space model and the two-ray model predict the received power as a deterministic function of distance. Recently, dominant path algorithm has introduced as an alternative thanks to its low computational time. It relies on the determination of the least attenuation path, the wave guiding effects and the loss interactions. In this paper, we extend the dominant path model to take into consideration the multi-floor case and the antenna pattern radiations. Our contribution consists in a specific method to solve these problems. Moreover, a method for the indoor dominant path calibration is introduced. [C1290]

"Understanding and analyzing the performance of MIMO systems from the microwave perspective"

Multiple input multiple output (MIMO) wireless systems use multiple element antennas at the transmitter and receiver to offer improved capacity over conventional single antenna systems in a rich scattering environment. In this paper, the microwave perspective of operation of MIMO system is given. Following the new interpretation of operation, an electromagnetic model is introduced to assess the MIMO system transmission capacity. The proposed model is shown to provide good agreement with reported results in the literature. [C1291]

"Maximum a posteriori detection of the primary synchronization channel of the UMTS/FDD mode"

We propose a maximum a posteriori metric for the optimum detection of the primary synchronization channel of the UMTS/FDD mode. This metric is derived assuming a perfect knowledge of the small-scale propagation channel statistics at the mobile station. It is then extended to take into account time-switched transmit diversity at the base station. The performance of this optimum metric in terms of false detection rate is compared to that of the non-coherent averaging metric used in the evaluation process carried out by 3 GPP. The simulation results show a performance gain of up to 3 dB for critical indoor, outdoor-to-indoor and pedestrian propagation environments which are characterized by small time and multipath diversity. [C1292]

"Empirical comparison of MIMO antenna configurations"

By now, it is well known that multiple-input multiple-output (MIMO) communications systems are able to bring considerable performance gains for wireless communications. It is also evident that both the propagation channel and the antenna characteristics influence the MIMO capacity. In this paper, we consider the problem of comparing MIMO antenna configurations using measured radio channels. We introduce a new figure of merit called mean effective link gain (MELG), which characterizes the signal power transfer properties of a MIMO

antenna system. We emphasize the importance of proper normalization of the results when comparing different MIMO antenna candidates. Evaluation examples with synthetic and measured channels illustrate the usability of the proposed methods. [C1293]

"A modified S-V clustering channel model for the UWB indoor residential environment"

In this paper, a new modified Saleh-Valenzuela (S-V) clustering channel model is proposed based on the measurement data collected in various types of high-rise apartments under different propagation scenarios in the ultra-wideband (UWB) frequency band of 3-10 GHz. A new distribution, namely, mixtures of two Poisson processes is proposed to model the ray arrival times. This new distribution fits the empirical data much better than the single Poisson process proposed in the conventional S-V model. The measurement procedure allows the small-scale amplitude fading statistics to be studied. Analysis results show that they can be well modeled by either lognormal, Nakagami or Weibull distributions whose parameters i.e. standard deviation, m-parameter and b-shape parameter, respectively, are lognormal distributed random variables. These parameters are found to be invariant across the excess delay. Additionally, the temporal correlation between adjacent path amplitudes is also investigated. The amplitude temporal correlation coefficients are found to be relatively small and thus, can be assumed to be negligible in reality. The proposed model can provide a more realistic simulation platform for the UWB communication systems. [C1294]

"A simple efficient method for generating independent Nakagami-m fading samples"

The Nakagami-m distribution is an important fading model in wireless communications. However, no simple and efficient method for simulating Nakagami-m fading channels is available in the literature. This letter proposes a simple efficient method for generating independent Nakagami-m fading envelope samples for arbitrary values of m. [C1295]

"Assessment of a new indoor propagation prediction method based on a multi-resolution algorithm"

The multi-resolution Fourier domain parflow (MR-FDPF) is a new indoor propagation prediction model based on a finite difference computation of the electrical field. The predictions made in two dimensions are fast: simulation lasts 6s for an 80Ч30 meters building floor at the resolution of 10 centimeters. At a coarser resolution, processing time can be reduced up to 0.6s. Prediction performance of our method is presented in this paper. A least-square calibration process based on signal power measurements is used to determine the propagation indices and attenuation factors of the constitutive materials of the building. The coverage predictions made with the calibrated MR-FDPF are challenged to real measurements and a mean squared error about 5dB is obtained. [C1296]

"A generic narrowband model for radiowave propagation through vegetation"

This paper aims to describe the results of a 15 months consortium project to study the effects of microwave and millimetre wave propagation radio signals through vegetation. The aim of the project was to provide a generic model for the determination of propagation loss through vegetation, and was to be achieved by a combination of an extensive campaign of measurements and deterministic modelling. The proposed model is ideally suited to micro- and picocellular radio service planning, and with the aid of a forest database giving dimensions, locations and tree types, the model may be used for macrocellular radio system planning. [C1297]

"Spatial and polarization characterization of MIMO channels in rural environment"

An extensive campaign to characterize the multi-antenna radio propagation channel between two ground based platforms was conducted in a rural area of Lakehurst, NJ. Dozens of links with ground level transmitter and receiver arrays were characterized in mixed wooded/open terrain over ranges of up to 4 km. MIMO capacity was computed for an 8Ч10 MIMO system using the measured H-matrices. It was found that median 8Ч10 MIMO capacity supported by the channel was about 8 times the corresponding 1Ч1 capacity, and 3.2 times the corresponding 1Ч10 capacity. It was found that using arrays containing antennas of both horizontal and vertical polarizations improves capacity for short range LOS channels by almost fifty percent. [C1298]

"MIMO channel measurements for personal area networks"

This paper analyzes MIMO propagation channels for personal area networks. Such channels show important differences to propagation channels in wide-area networks, due to the different environments in which the systems are operated, as well as due to different mobility models, ranges, and presence of humans in the environment, and the impact of the antenna arrangement. We present results from a recent measurement campaign for this type of channel. We first analyze the requirements for measurement setups, especially in

terms of different positions and orientations of the antenna arrays, to obtain meaningful results. We then analyze the measured data and present results for path loss, power delay profiles, spatial correlation and temporal correlation. [C1299]

"Modelling of propagation environments inside a scattered field chamber"

Measurements on communication devices for evaluation of diversity and/or MIMO concepts must be made in the real environment or in a model of the real propagation environment. As a first step towards a complex, physical environment model the plane wave angular distribution, incident on the device under test (DUT), is altered in order to model plane wave angular distributions of real environments. Here a specialized reverberation chamber called the scattered field chamber (SFC) is used to create a source of Rayleigh faded plane waves and a shielded anechoic box with apertures is used to alter the angular distribution of the plane waves incident on the DUT. According to the measurements made, the model seems to be able to produce data that show agreement with measurements made on real propagation environments. [C1300]

"Distribution of the amplitude of a sum of singly and doubly scattered fading radio signal"

The concept of multiple scattering radio propagation channels-in contrast to the conventional single (Rayleigh) scattering-has been recently proposed. Except for some special cases, expressions for the amplitude distribution of such channels are unknown. In this paper we focus on the double scattering radio channel. Let H1, H2, H3be identically distributed, independent zero-mean circularly symmetric complex Gaussian random variables with unit complex variance. We derive the distribution functions (pdf and cdf) of the random variable R = |w1H1+w2H2H3|, where w1and w2are real-valued positive weights. The distribution functions are given in integral and series forms. We also derive a computationally simple moment-based estimator for the "power" mixture weights w12and w22. In addition to the study of multiple scattering propagation channels, our results may also be applied in assessing the performance of communication schemes over such media. [C1301]

"Propagation characteristics of IEEE 802.15.4 radio signal and their application for location estimation"

IEEE standard 802.15.4 defines the physical (PHY) and medium access control (MAC) layers for low-cost and very low-power short-range wireless communications. One of the promising applications offered by the standard is wireless sensor networks. To begin with, this paper shows the propagation characteristics of the IEEE 802.15.4 radio signal in indoor environments such as "power decay factor" due to near/far effect and "fading distribution." Then, the paper presents a wireless sensor network system for location estimation which utilizes only received signal strength indicator (RSSI) and discusses the location estimation performance. [C1302]

"A location algorithm based on radio propagation modeling for indoor wireless local area networks"

This paper presents a location algorithm for indoor wireless local area networks (LANs) that is based on the signal-to-noise ratio (SNR) and a radio propagation model. The proposed radio propagation modeling approach reduces the number of training data points with no significant degradation in the location accuracy, as compared to the conventional empirical method. Experimental results obtained from an indoor wireless LAN are given to demonstrate its effectiveness. [C1303]

"The forward scattering surface interaction region"

This paper presents measured data from a low grazing, rough sea forward scattering measurement which shows that, while the forward scattering is generally restricted to the first few Fresnel zones for crosswind waves, measurable scattering frequently occurs many zones out for downwind waves. [C1304]

"Grating lobes in RF propagation through brick and metal reinforced walls"

This paper presents correlation of full wave RF predictions with measurements of transmission through standard brick walls. Transmission as a function of frequency and polarization is computed using both time and frequency domain solvers. Results are compared to measurements for three-dimensional brick geometries that include multiple arbitrarily shaped air holes with rounded edges and corners. Although there have been many experimental studies of RF propagation through walls, few references are available that specifically examine the grating lobe issues, Honcharenko et al. (1994) presented an analytical study for 1D periodicity that demonstrated the potential for grating lobe propagation in brick walls; however, very limited experimental validation was provided. Both brick and metal reinforced walls can support grating lobes if the frequency is high enough. For the bricks investigated, grating lobes occur at L-band frequencies for normal incidence, and at lower frequencies for other angles of incidence. At frequencies where grating lobes propagate significant power, transmission

measurements using stationary transmit and receive antennas do not account for all of the power transmitted through periodic walls. Very significant amounts of power can be propagated in directions that are not, in general, recorded by a stationary receive antenna over a wide bandwidth. This is because the angular locations of the peaks of the multiple grating lobe beams are a function of frequency. When significant power is directed into the grating lobes the power in the main lobe drops, which is an important effect that is not included in simple slab models. RF prediction tools used to predict total fields inside of buildings most often represent walls as multi-layer dielectric slabs. Because dielectric slabs support only the fundamental mode, they are unable to include grating lobe effects. [C1305]

"Exploration of Lloyd mirror rotation effect and radar look down angle"

A model designed to propagate electromagnetic fields in complicated terrestrial environments was used to make forward scatter predictions. The propagation model is capable of generating various rough sea surfaces with Donelan-Pierson-Banner wind-wave spectra. The rough sea surface feature of the propagation model was parameterized to simulate the surfaces generated during a forward scatter measurement. The Lloyd mirror rotation effect was observed during the measurement and in the predictions; this phenomenon is explored below. The Lloyd mirror rotation effect in a rough sea environment is explored by increasing the radar look down angle and observing its effect on the forward scatter interference pattern. Comparisons between forward scatter data and predictions from a parabolic wave equation (PWE) model are included. The measurement was performed in the Maneuvering and Sea-Keeping (MASK) basin at the Naval Surface Warfare Center in West Bethesda, MD. The variable terrain radio wave parabolic equation (VTRPE) is a range-dependent propagation model that solves the full wave equations for the complex radiation fields. The VTRPE code was used to simulate the sea surfaces generated during the measurement and make predictions of the forward scatter interference pattern. [C1306]

"Floquet-modes enhanced ray-tracing procedure for field prediction in a railway reinforced concrete tunnel"

The analysis of high-frequency propagation of radio signals inside a railroad tunnel is of great importance for broadband channel characterization and for the design of suitable devices allowing wireless communication to be maintained when a train is in the tunnel. Reinforced concrete walls often present periodic distributions of steel bars, which can be efficiently analyzed by means of Floquet theory. This theory is used in conjunction with a ray-tracing algorithm to realize an accurate numerical field prediction tool. Some preliminary results for the enhancement of beam-tracing software by exploiting an accurate FEM-based reflection coefficient are presented. [C1307]

"Enhancing radio coverage inside buildings"

In radio networks, cell sizes are determined by the power needed to provide an acceptable signal-to-noise ratio to a certain percentage of a given coverage zone. Propagation within buildings introduces losses to the system. If the losses can be minimised, it is possible to use lower power levels, while still covering the same region, and increase the overall spectrum efficiency of the network. Theoretical and experimental work has been performed to show that propagation within buildings can be greatly improved by using techniques based on frequency selective surfaces (FSS). A novel structure is proposed that has the potential to enhance the propagation in corridors and stairwells. The structure, mode conversion FSS (MC-FSS), is highly efficient and converts and re-radiates the specular energy in a predefined direction away from the specular direction. The structure can easily be retrofitted into existing buildings, with minimal structural impact, and can be fabricated using very low cost materials. The technology has been demonstrated at 870 MHz but could be very useful for much higher frequency applications, for example future MM-wave wireless LAN systems. [C1308]

"Dynamic signal strength estimates for indoor wireless communications"

Signal strength estimation for indoor wireless communications has attracted much attention lately due to its many applications in mobile networking including coverage analysis, localization, fast hand-off, and security audits. However, it is challenging due to the complexities of the indoor radio propagation characteristics exacerbated by users' mobility. Therefore, a common practice of the indoor wireless research is to manually construct a radio signal strength table mapping signal strength with known locations inside a building. Obviously, this is a tedious and time consuming task; also, the resulting signal strength table does not describe the dynamic property of the indoor radio propagation. The table is static. Thus the credibility of any further application is heavily affected. This paper proposes a novel and automated signal strength estimation method for the indoor wireless research. The method requires only a single signal strength measurement as reference, and the estimated signal strength table is comparable to the actual measurements in real time. With 6 days of continuous measurements and simulations, the results show that the proposed method dynamically estimates the signal strength for the

deployed building, and the results achieve average estimation accuracy to within 3% of maximum signal strength. With the dynamic method, the paper shows how the signal strength could be gracefully applied to special tasks such as coverage analysis, and localization. [C1309]

"Simulation of indoor ultra wideband propagation channel modeling"

UWB (ultra wideband) propagation channel modeling is very important for UWB communication system designing and its performance optimization. The split-field PML (perfectly matched layer) and unsplit-field PML were combined respectively with PSTD (pseudospectral time-domain) method to model 2-D (two dimensional) and 3-D indoor UWB propagation. The attenuation factor algorithm was applied to simulate realistic UWB propagation under 2-D environment. Channel characteristics were studied and the accuracy and efficiency of their modeling were also analyzed. Numerical simulations have indicated that the split-field and unsplit-field PML combined PSTD methods have the same accuracy while the consumed computer memory by unsplit method has been reduced to nearly one half of that by split method. Some resultant channel characteristics can be observable from the measurement results. [C1310]

"Realistic radio range irregularity model and its impact on localization for wireless sensor networks"

In the research of wireless communications, prototypes and measurements on real test-beds provide insights and fundamental information for a realistic tuning of simulation models. Recently there has been an increasing interest in exploring one of the critical fundamentals: the realistic radio range irregularity (RRI) model. This research builds on the IEEE 802.11, and investigates such a practical RRI model according to the measurements made under various settings. Using the RRI model, a set of representative localization algorithms are evaluated and compared. Through detailed analysis and extensive simulations, the paper points out how the localization performance is affected by the use of simplistic models. Moreover, some algorithms performing well under simplistic models do not work in real world settings. The RRI model reflects and highlights the weaknesses of those algorithms and allow the design of countermeasures. This paper introduces a constrained-greedy forwarding radio propagation method to remedy the negative effects encountered under actual operating environments. [C1311]

"A new solution expressed in terms of UTD coefficients for multiple diffractions by buildings considering spherical-wave incidence"

A new solution expressed in terms of uniform theory of diffraction (UTD) coefficients for the prediction of the multiple diffraction produced by an array of perfectly conducting buildings considering spherical-wave incidence is presented. Buildings are supposed to have rectangular cross sections and the mentioned solution, validated with numerical results from technical literature, is obtained by a recursion relation so that a successive use of UTD, diffraction in the transition zone is avoided, achieving an easier final formulation which significantly reduces the computing time over existing solutions. The result could find application in the planning of microcellular mobile radio systems to predict a more realistic path loss. [C1312]

"Models and methodologies for simulating mobile ad-hoc networks"

It is a truism that simulations of mobile ad hoc networks (MANETs) are not realistic. Today, simulations typically model propagation with either the free-space model or a "two-ray" model. Such models are valid only in open space where there are no hills and buildings. Since wireless signal at the frequencies used for MANETs is partly reflected off of buildings and is partly transmitted into the building, the presence of buildings greatly influences propagation. Consequently, these open-space propagation models are not accurate in outdoor urban areas. When propagation for Indoors is considered, the open-space models are not even applicable. There has been little effort in developing realistic mobility models. In urban areas, the mobility of vehicles and pedestrians is greatly influenced by node interaction. Furthermore, the location of streets, sidewalks, hallways, etc. restricts the position of nodes. Traffic lights also have a direct impact on the flow of nodes. We discuss the models and methodologies for realistically modeling the propagation and mobility of MANETs in urban environment. The techniques of simulation, models, model parameters and accuracy are all examined. The techniques for propagation are validated against propagation measurements. [C1313]

"Impact of clutters on quality of service in mobile communication using Walfisch-Ikegami propagation model"

The management of quality of service in communication network systems, particularly to support multimedia applications, includes service requirements, hardware implementation, propagation path loss and system requirements. The signal attenuation between multiple mobile stations and base stations affected by various free

space path loss, zones of poor coverage, dropouts, effects of multi-path reception, fading due to parameters like vegetation, rain, and snowfall deteriorates the strength of signals. An attempt has been made to modify the Walfisch-Ikegami model of propagation path loss model by adding the effect of vegetation, sea, rain and snowfall. A simulation has been carried out. The impact of these parameters on the quality of service is presented. [C1314]

"Interference-aware QoS OLSR for mobile ad-hoc network routing"

Ad-hoc wireless networks are made up of mobile devices that use wireless transmission for communication. They can be set up anywhere and at any time because they neither require infrastructure nor central administration. Hence they have enormous commercial and military potential. However, the bandwidth offered to users is strongly affected by radio interferences. This paper proposes a solution taking into account radio interferences at the routing level in mobile ad-hoc networks. This solution is based on an admission control and a modified version of OLSR routing protocol that considers bandwidth reservation and interferences. A comparative performance evaluation done by NS simulations shows that this solution outperforms classical OLSR in terms of maximum number of acceptable flows, bandwidth amount granted to a flow and route stability. [C1315]

"A hidden environment model for constructing indoor radio maps"

Constructing indoor radio maps plays an important role in many services and applications, such as wireless base station planning. We propose a hybrid approach to constructing indoor radio maps by developing a novel indoor signal propagation model, called the hidden environment model (HEM). The model is hybrid because it combines on-site measurements with a number of different types of calculations. As part of this model, we introduce the idea of an environment factor matrix (EFM). The EFM represents a model of the environmental features that affect radio attenuation. We also develop a lazy sampling algorithm to help generate the EFM. The goal of the lazy sampling algorithm is to balance the number of measurements that need to be taken with our model's accuracy. The goal is to minimize the measurement workload while maintaining satisfactory accuracy. We evaluate our model by comparing the radio maps calculated from the model to a radio map obtained by exhaustive measurements. The results show that our hidden environment model achieves good accuracy. [C1316]

"Analysis of mobile communication data"

Radiowave propagation models are very useful for assessing the quality of service (QOS) of mobile communications compared to the direct measurements. In this paper, signal data are acquired under different environmental conditions and for various cases depending on whether transmitter and receiver are in motion or stationary. The radio transmissions vary from VHF to S-band frequencies. Field strength, PDF and CDF of these cases are presented. The results indicate interesting features of both environment and mobility of transmitter and receiver at various frequencies. In this paper practical aspects of data acquisition, processing and analysis are dealt with. [C1317]

"Simulation of synthetic aperture radar (SAR) returns from complex scenes"

First Page of the Article [C1318]

"Experimental studies of the 2.4-GHz ISM wireless indoor channel"

Experimental results from indoor measurements of the 2.4-GHz wireless channel are presented. These measurements include both quasi-static and time-varying channel conditions in a number of indoor environments. Four channel propagation characteristics of interest are evaluated. For the time-varying environment, the Doppler spread of the wireless channel is measured. For the quasi-static environment, mean excess delay, rms delay spread, and coherence bandwidth of the channel are determined. The effect each of these propagation characteristics has on multiple antenna wireless systems and their suitability for indoor use is discussed. [C1319]

"Broadband wireless information connectivity using CDMA-a comparative analysis"

The rapid development of technology and the wave of globalisation and liberalisation has opened new dimensions in the telecommunication sector and consequently, its provision. Due to entirely wireless operation and resulting ease of provision, the cellular mobile telephone service became the choice of many administrations for quick expansion of service. Today's world is constantly on the move. Several users found the mobile telephone as a prayer answered, that enabled them to remain connected all the time. Thus it became the favoured choice of the users as well. The technology evolution made the cellular telephone lighter, smaller and

full of features and low-priced; competition made tariffs be lowered and growth led to further growth. making the service get a big market share. It seems headed towards eventually surpassing the fixed telephone service. This present paper deals with comparative parametric analysis for path loss using different models for CDMA based wireless communication. [C1320]

"Deterministic channel modeling and performance of monopolarized and multipolarized MIMO wireless channels"

A novel approach of the deterministic channel models for multiple-input multiple-output (MIMO) is presented in this paper. Monopolarized and multipolarized antennas are examined on a geometrical distribution of scatterers simplified for the diffusing waves. Thee geometrical models employed are defined in COST259. The proposed model takes into account the transmit antenna and receive antenna patterns, Doppler spectrum, dyadic coefficients and the polarization of antennas for the narrowband case in macrocells. Each scattering process is represented by a dyadic matrix corresponding to the depolarization and the distortion of the electromagnetic wave. Through simulations, the ergodic capacities and the outage capacities of monopolarization and multipolarization of 2 Ч 2 MIMO channels are presented on the richness of scattering. The results of simulations show that the largest spread angle at the receiver is proved for the best capacity. [C1321]

"Evaluation of propagation characteristics in indoor environment for MIMO system"

This paper presented that receiver correlation was lowered by using dual polarized antenna array in both the LOS and NLOS environments. In the LOS environment, the difference of the angle of polarization made no difference for both of the single and the dual polarization case, and the advantage of eigenvalues for dual polarization worked effectively. On the other hand, in the NLOS environment, although the advantage of eigenvalue for the dual polarized case was observed, it didn't overwhelm the power loss deriving from dual polarization. This is because the V component became dominant comparing the H component with the existence of partition, which gave high SNR and capacity to the single V polarized case in the calculated model. Finally, it is necessary to reexamine these results in more realistic simulation model and in experimental method. [C1322]

"Full wave analysis of RF signal attenuation in a lossy cave using a high order time domain vector finite element method"

We present a computational study of signal propagation and attenuation of a 200 MHz dipole antenna in a cave environment. The cave is modeled as a straight and lossy random rough wall. To simulate a broad frequency band, the full wave Maxwell equations are solved directly in the time domain via a high order vector finite element discretization using the massively parallel CEM code EMSolve. The simulation is performed for a series of random meshes in order to generate statistical data for the propagation and attenuation properties of the cave environment. Results for the power spectral density and phase of the electric field vector components are presented and discussed. [C1323]

"A RF map-based localization algorithm for indoor environments"

The paper presents a localization algorithm for wireless sensor network (WSN) units which estimates the spatial position of a probe unit by exploiting received signal strength information. The algorithm is particularly suitable for indoor applications where the presence of furniture, objects, walls and the induced reflection effects create a strongly non linear attenuation field map which makes ineffective the use of traditional 1/rktheoretical signal attenuation models. The field map is learned from samples acquired during a preliminary environment exploration campaign. The performances of the developed algorithm stay at the top of its class; we experimentally verified that it is able to locate nodes with an accuracy of 1.2 m and a confidence of 50% in a MICA2 WSN. [C1324]

"Multi-class adaptive radio resource management policy for multimedia cellular networks"

In this paper, we propose a combined fair packet scheduling policy and an adaptive connection admission control algorithm, to meet the rapidly increasing demand for providing multimedia services with diversified quality requirements. The new scheduling policy is based on an enhanced weighted fair queuing algorithm, while taking into account the spatial variation of the system characterizing both the user mobility and the signal propagation impairments due to the surrounding effects. The new adaptive QoS oriented CAC function, based on service class differentiation, decides whether the connection request is to be admitted into the system, on the basis of the generated interference level and the waiting time before access. The results indicate that significantly increased traffic performance can be achieved in comparison with other conventional investigated radio resource allocation policies. [C1325]

"Antennas for on-body communication systems"

The optimum choice of antenna for on-body communications is discussed in this paper. Several different antennas, including the monopole, the loop and patch and patch arrays have been fabricated and tested in the on-body environment. In particular, path gain measurements of two on-body paths has been performed for a range of body postures. It is clear that the monopole antenna performs best in most of the measurement cases. A first order analysis of the path loss, consisting of antenna gain deduced from link geometry and a free space loss appropriate to the path distance, give results that are within 10 dB of measurements for most body postures. [C1326]

"Digital measurement of human proximity to electrical power circuit by a novel amplitude-shift-keying radio-frequency receiver"

An electrical injury protection system is being developed to protect electrical workers from electrical injury and electrocution by human proximity and electrical contact sensing. Proximity is monitored by the insertion loss of a radiofrequency (RF) transmission between the power circuit and the human body. The system continuously transmits low power amplitude-shift-keying (ASK) RF waves from the power circuit to the surrounding area. An RF receiver attached to the human body measures the magnitude of incoming ASK RF waves which is inversely related to the proximity of the human body to the power circuit. A novel digital ASK demodulation method is used to conduct digital measurements of the incoming ASK RF wave magnitude efficiently. The RF receiver converts the incoming ASK signals to sawtooth-like enveloped ASK RF signals. A digital ASK demodulator demodulates the converted RF signal and digitizes the sawtooth-like envelopes into a square wave with the pulse width directly related to the magnitude of the incoming ASK RF signal. Human proximity and electrical contact are digitally detected by counting the width of the demodulated pulses. The current consumption of the prototype receiver is only 9 μA, which is 1600 times less than that for a conventional ASK magnitude detector. [C1327]

"Simulating an indoor ultra wideband channel based on a niching particle swarm optimizer"

A new approach to the modeling of indoor ultra wideband radio channel is presented. We first characterize the scattering by local clutter using a set of canonical structures. Subsequently, the channel can be regarded as a continuous multimodal cost function of the scatterer locations. Each local maximum and its surrounding area are the result of closely associated objects that are part of a very similar group of paths to the receiver. Next, an evolutionary ray tracing technique based on the niching particle swarm optimization, which is a newly invented population-based optimizer, is developed. By comparing model results with measurements, we conclude that a reasonably accurate description of the propagation process can be obtained with a relatively simple model [C1328]

"Providing location services within a radio cellular network using ellipse propagation model"

Mobile positioning is becoming an important service on radio cellular network. Among different kind of location estimation technologies, the one, which estimates the location of mobile stations using signal strength is able to be applied to different kinds of cellular network, and therefore, is more general. We have designed a directional propagation model-the ellipse propagation model (EPM), which makes use of a wave propagation model to perform location estimation. The EPM enhanced the traditional propagation model by resembling the contour line of signal strength as an ellipse rather than a circle and hence becoming more realistic. We have tested the EPM with real data taken in Hong Kong and it is proven that the EPM out performing other existing location estimation algorithms in different kinds of terrains. [C1329]

"Energy and latency control in low duty cycle MAC protocols"

Recently, several MAC protocols, such as S-MAC and T-MAC, have exploited scheduled sleep/wakeup cycles to conserve energy in sensor networks. Until now, most protocols have assumed all nodes in the network were configured to follow the same schedule, or have assumed border nodes would follow multiple schedules, but those cases have not been evaluated. The paper develops two new algorithms to control and exploit the presence of multiple schedules to reduce energy consumption and latency. The first one is the global schedule algorithm (GSA). Through experiments, we demonstrate that, because of radio propagation vagaries, large sensor networks have very ragged, overlapping borders where many nodes listen to two or more schedules. GSA is a fully distributed algorithm that allows a large network to converge on a single global schedule to conserve energy. Secondly, we demonstrate that strict schedules incur a latency penalty in a multi-hop network when packets must wait for the next schedule for transmission. To reduce latency in multi-hop paths, we develop the fast path algorithm (FPA). FPA provides fast data forwarding paths by adding additional wake-up periods on the nodes along paths from sources to sinks. We evaluate both algorithms through experiments on

Berkeley motes and demonstrate that the protocols accomplish their goals of reducing energy consumption and latency in large sensor networks. [C1330]

"Spectral-efficiency analysis in noncooperative interference environments"

The current focus on innovative spectrum policies and efficient wireless bandwidth utilization has motivated research on methods for dynamic spectrum access. By letting systems share the spectrum, trunking gains and better utilization of the bandwidth is predicted. From a technical point of view, the paradigm shift to open frequency bands implies a need to investigate and verify resulting capacity gains. In this paper, we give a general method for evaluating system capacity subject to outage probability constraints over fading channels, in an unlicensed environment with uncoordinated systems. The channel fading effects include attenuation, shadowing and multipath propagation and we end up with expressions, solved by numerical integration. The spectrum sharing is here performed by means of autonomous dynamic channel allocation (DCA), and we compare several DCA methods, e.g., maximum SIR and random DCA. [C1331]

"Relationships between radar ambiguity and coding theory"

We investigate the theory of the finite discrete Heisenberg-Weyl group in relation to the development of adaptive radar. We contend that this group can form the basis for the representation of the radar environment in terms of operators on the space of waveforms. We also demonstrate, following recent developments in the theory of error correcting codes, that the finite discrete Heisenberg-Weyl group provides a unified basis for the construction of useful waveforms/sequences for radar, communications and the theory of error correcting codes. [C1332]

"Wireless link SNR mapping onto an indoor testbed"

To facilitate a broad range of experimental research on novel protocols and application concepts, we consider an indoor wireless testbed to emulate the performance of real-world networks. A fundamental issue for emulation is the replication of communication links of specified quality. In particular, we need to replicate on the testbed, for every link in the real world, a communication link whose received signal-to-interference-and-noise-ratio (SINR) matches the corresponding link signal-to-noise-ratio (SNR). In this paper, we focus on the downlink SNR mapping associated with a network with a single access point (AP). Four indoor wireless propagation models (commercial buildings with/without line-of-sight path and residential buildings with/without line-of-sight path) and two types of spatial distributions (uniform distribution inside a circular cell and uniform distribution along a line) have been investigated. Based on the characteristics of the indoor testbed, we propose a mapping method with one AP and one interferer, which separates the task into two phases: in the first phase, the best location and transmission power for the interferer node are determined; in the second phase, the topology of receiver nodes is configured by a minimum weight matching algorithm. Through analysis and simulations, we find that when the interferer node is located on the corner across from the AP, we can achieve a mapping range on the order of 57 dB and an average root-mean-square (RMS) mapping error less than 1 dB. [C1333]

"Spatial limits to mutual information scaling in multi-antenna systems"

Previous results have shown significant capacity gains by employing multiple antennas at both transmitter and receiver, however, due to physical size restraints (particularly at the receiver) these may not be obtained. In this paper, we consider the capacity behaviour of multi-antenna systems when the receiver sampling is constrained to a finite region of space. By characterizing the wavefield generated at the receiver due to transmitted signals and the scattering environment, a theoretically derived sampling threshold is shown to exist, at which the capacity growth is reduced from linear to logarithmic with increasing number of sampling outputs. Furthermore, this threshold is shown to be linearly dependent on the receiver region radius within which the sampling is constrained, and is independent of the sampling characteristics such as the antenna properties, array geometry, and/or array signal processing. [C1334]

"Propagation parameter estimation in MIMO systems using mixture of angular distributions model"

For the development of future wireless systems, it is crucial to create accurate channel models. Channel sounding using antenna arrays and consequently propagation parameter estimation are key tasks in creating such models. In this paper we present an estimator for the angular distribution of the diffuse scattering component that is observed in channel sounding measurements. The angular distribution is modeled as a mixture of Von Mises distributions, which correspond to scatterer clusters. The parameters of the individual distributions as well as the mixture proportions are estimated. The large sample performance of the estimator is studied by deriving the Cramer-Rao lower bound and comparing the variance of the estimates to it. The simulations show that the the proposed estimator has asymptotically optimal performance since it attains the Cramer-Rao lower bound for relatively small sample sizes. [C1335]

"Received signal strength based location estimation of a wireless LAN client"

We consider the problem of identifying the location of a mobile client in an IEEE 802.11b wireless LAN. We propose an estimation algorithm that utilizes received signal strength (RSS) measurements provided by most 802.11b physical layer implementations. In contrast to traditional radio map-based methods that require a burdensome map building phase, the proposed algorithm requires no prior training by employing a probabilistic RSS model that is derived from indoor signal propagation models and the blueprint of the building in which the location estimation system is being deployed. Experimental studies demonstrate the accuracy of the proposed method. [C1336]

"Aerouter™-a graphical simulation tool for routing in aeronautical systems"

The enormous growth and demand for in-flight Internet access has driven the need for producing effective simulation tools in order to identify effectively the best resources, such as satellites and gateways, for routing in these large-scale systems. We introduce a simple simulation tool called Aerouter, which can assist in identifying the best satellites and gateways for routing in aeronautical applications. The proposed simulation tool includes new routing techniques and also takes Doppler and atmospheric attenuations into account in its automatic calculations. Preliminary results illustrate the effectiveness and usefulness of Aerouter for future in-flight Internet access networks. [C1337]

"An enhanced received signal level cellular location determination method via maximum likelihood and Kalman filtering"

The paper presents a new two-step cellular location determination (CLD) method based on signal strength and wave scattering models. The received signal level (RSL) method is first used in combination with maximum likelihood estimation (MLE) and triangulation to obtain an estimate of the location of the mobile. Due to non line of sight (NLOS) conditions and multipath propagation, this estimate lacks acceptable accuracy and consistency for demanding services, as numerical simulations reveal. Thus, the wave scattering 3D multipath channel model of Aulin is employed together with extended Kalman filtering (EKF) to obtain improved location estimates with high accuracy. The EKF is initialized at the MLE obtained from the RSL method, which is proved to be highly appropriate. Numerical simulations under urban, suburban and rural environments were utilized to evaluate the accuracy and consistency of the proposed two-step enhanced RSL method; the results of the worst-case rural environment are presented. [C1338]

"A comparative performance evaluation of RSS-based positioning algorithms used in WLAN networks"

The wireless local area network (WLAN) has been an emerging technology in the residential and enterprise market by providing high data rates at low cost. Future trends in the WLAN industry are targeted towards new applications with higher data rates, wider coverage, and increased QoS requirements. A user tracking system based on the WLAN infrastructure is a new service that helps network operators to monitor different aspects of their networks in addition to providing location aware services to their customers. We provide an overview of traditional location sensing algorithms and compare their performance with the new distance variance (DV) algorithm. These algorithms use the existing IEEE 802.11 infrastructure to locate a terminal. The newly introduced DV algorithm uses indoor radio propagation models to reduce the complexity of the calibration process used in conventional algorithms. The performances of the existing and new algorithm are compared using Monte Carlo simulations based on IEEE 802.11 channel models. [C1339]

"Optimum and sub-optimum detection of physics-based ultra-wideband signals in presence of inter-symbol interference"

The paper represents a major step toward receiver structures under the framework of the per-path pulse distortion using more realistic channel models. We extend our previous framework to include the important phenomenon of inter-symbol interference (ISI). ISI ultimately limits the maximum achievable data rate. We find that the per-path pulse distortion has impact on this maximum achievable data rate in the presence of ISI. As examples of this discovery, we investigate the optimum receiver structure and two sub-optimum receivers with zero-forcing and minimum mean square error (MMSE) equalizers. We use the high-rise building channel model as the underlying pulse propagation model. This model captures many properties that are not available in the IEEE 802.15.4a model. [C1340]

"Modelling and performance prediction for multiple antenna systems using enhanced ray tracing"

Multiple antenna systems can enhance wireless communication links by improving their capacity and/or reliability. Multiple input multiple output (MIMO) communications are the most common exploitation of this property. When applied to deterministic ray modelling, the computational cost of MIMO predication is a major drawback. Two MIMO modelling approaches are investigated. Both methods make use of an enhanced deterministic ray-tracing propagation model. The first method relies on point-to-point prediction for each of the multiple element-to-element links. The second approach estimates the MIMO link matrix from a single point-to-point ray tracing study. A comparison of normalized capacity and path loss is performed for the two methods in an outdoor city centre environment. For a single input multiple output (SIMO) case, the two modelling approaches are presented and compared with measured array data. Result show that the single point-to-point approximation works well and can significantly reduce run-time when compared with full element-to-element ray tracing. [C1341]

"A 3D correlation model for MIMO non-isotropic scattering with arbitrary antenna arrays"

We introduce a multiple-input multiple-output (MIMO) space-time-frequency wireless channel model for the wave propagation in three-dimensional (3D) space. The cross-correlation function (CCF) between two subchannels of the MIMO communication system is decomposed into some non-negative functions. These functions are expressed in terms of a selection of channel parameters, such as the carrier frequencies, the delay profile, the path-loss exponent, the softness factor, θ, the non-uniform distribution of directions of arrival and departure, array geometries, and the mobile speed. We introduce a class of distributions for the elevation angle (EA) spreads as a basis such that any arbitrary (isotropic or non-isotropic) EA distribution can be represented by a convex linear combination of this class. The corresponding term of the CCF of the 3D-MIMO model for any EA distribution equals to the same linear combination of the basic CCF terms associated to the class. This 3D-MIMO model formulates the CCF as a function the spacial separation of antennas, time, and carrier frequencies in terms of physical channel parameters such as mobile speed, delay profile and distribution of scavengers around mobile and base stations. [C1342]

"A cross-correlation model for non-isotropic scattering with non-omnidirectional antennas in MIMO propagation channels"

We present a cross-correlation model for multiple-input multiple-output (MIMO) Rayleigh fading channels in a two-dimensional (2D) multipath random media when energy is non-uniformly received/transmitted to/from the receiver/transmitter along propagation directions. We investigate the impact of non-omnidirectional propagation pattern of antennas along with the impact of non-uniform distribution of the scatterers in the propagation environment which introduces non-isotropic wave propagation, at both transmitter and receiver ends. The non-isotropic propagation is described by non-uniform probability density functions (pdf) for the direction-of-departure (DOD) and the direction-of-arrival (DOA) of the outgoing/incoming propagating waves from/to stations. The propagation patterns of antenna elements (and the effect of mutual coupling between them) are also described by the Fourier series expansion of antenna propagation patterns. The expression of the cross-correlation function (CCF) turns out to be a linear expansion of a number of Bessel functions of the first kind. The coefficients of this expansion are given by linear convolution of the Fourier series coefficients (FSC) of the corresponding antenna patterns and the FSCs of the corresponding pdf of the non-isotropic propagation directions. The Fourier analysis on the CCF shows impacts of non-isotropic environment and non-omnidirectional antennas on the spectrum of the received channel process while the maximum Doppler frequency shift remains invariant with variations of beam-patterns and the pdf of propagating waves. [C1343]

"Synthetic aperture analysis of multipath propagation in the ultra-wideband communications channel"

We discuss synthetic aperture techniques for radio imaging and direction-of-arrival (DoA) analysis in an indoor ultra-wideband (UWB) environment. A wavefront reconstruction technique is used for visual representation of time-evolutionary wave traversal, and optical diffraction theory is used to transform complex channel data from a rectilinear synthetic aperture into its angular spectrum. Using this analysis with measured channel data, the DoA properties of UWB propagation are investigated. It is demonstrated that the channel experiences strong angular clustering in general. Initial evidence of frequency selective scattering is also reported. The significance of these results for beam-forming, diversity and MIMO systems is highlighted. [C1344]

"Statistical performance of subspace matching mobile localization using experimental data"

In this paper, we present some statistical results on localization performance of subspace matching localization (SML), a technique for localizing non-cooperative transmitters in a microcellular environment Nezafat, M et al. (2004) using one (multiple) base-station(s) that is (are) equipped with an (multiple) antenna array(s). We use extensive experimental measurements obtained in Yokosuka, Japan. SML exploits the dissimilarities in spatial

multipath propagation characteristics of distinct locations, as reflected in the received respective signal subspaces to localize a transmitter. The location detector utilizes a match of the received signal subspace with those in a database. The database can be constructed by measurement campaigns, or ray tracing based simulations. In this paper, we report the localization accuracy of SML using a database that is constructed using a measurement campaign and up to two base stations. Issues regarding the variations of signal subspace due to non-stationarities in the environment and tracking of mobile transmitters are also addressed briefly. [C1345]

"Characterizing performance of multiband UWB systems using Poisson cluster arriving fading paths"

This paper provides a novel performance formulation for UWB systems that successfully captures the unique multipath-rich property and random-clustering phenomenon of UWB channels. Using the Saleh-Valenzuela model, we are able to characterize the pairwise error probability (PEP) performance for UWB systems employing multiband OFDM based on cluster arrival rate, ray arrival rate within a cluster, and cluster and ray decay factors. In addition, a PEP approximation technique is established, which allows us to obtain a closed-form PEP formulation that provides insightful understanding of the effect of channel characteristics on the performances of UWB systems. Finally, simulation results are provided to support the theoretical analysis. [C1346]

"Site-Specific formulations for determining Channel effects on a propagating Signal"

This paper proposes a versatile and user friendly method to determine the channel effects on a propagating signal, which exists within a space-time, coordinate in a built-up-area where there is clutter along a signal path length. In this approach, the reflected and/or diffracted rays as well as the order of the resultant coefficients are determined by the number of obtrusive surfaces where total reflectors and geometrical diffracting edges are assumed. Computed results of varying channel propagation path parameters using ray tracing techniques incorporating uniform theory of diffraction (UTD) are compared to physical measurements carried out in street canyons formed by vertical buildings of known electrical characteristics [C1347]

"Study of Prediction Models Compared with the Measurement Results of Rainfall Rate and Ku-band Rain Attenuation at Indonesian Tropical Cities"

In this paper, we present our contribution of rainfall rate and Ku-band rain attenuation measurements at Bandung. This measured data is an important complement to several of previous recorded data from other tropical cities in Indonesia for characterizing the Ku-band satellite propagation in tropical area. The two years of our experiment results indicate that the measured R0.01rainfall rate at Bandung is 120 mm/h and the measured A0.01rain attenuation is 17 dB. Therefore, the P region of ITU-R model is over estimated for Bandung, and we suggest that Q-region of ITU-R model is more suitable for Bandung. Another previous measurements which had performed in Indonesia confirmed with our conclusions that some cities in Indonesia have not only P-region of ITU-R model (such as Padang, Bengkulu an Makassar), but also N (Jayapura) and Q-region (Surabaya). Based on 10 samples rainfall rate in Indonesian archipelago, we have developed new prediction model of R0.01value for Indonesian cities. Concerning to the rain attenuation statistics, we have found out, that the DAH model is valid for Indonesia. We also have found out that if Bandung is modelled by Q-region of ITU-R, we should include the wetting antenna effects as the correction factor to the the ITU-R model for confirming with the measured A0.01rain attenuation [C1348]

"Parameters computation of the extended mobile fading channel of type II"

In mobile wireless communication systems, the multipath propagation in addition to the movement of the receiver and/or the transmitter leads to drastic and random fluctuations of the received signal. For flat fading channels, the extended Suzuki process of type II has been proposed as a stochastic model of such received signal fluctuations. In this paper we discuss this stochastic model and an appropriate deterministic model, and subsequently present and analyze simulation results based on these models. [C1349]

"A hybrid reconstruction algorithm for computerized ionospheric tomography"

Computerized Ionospheric Tomography (CIT) is a method to reconstruct ionospheric electron density images by using the Global Positioning System data collected by the earth based receivers. In this study, Total Electron Content values obtained from a model based ionosphere and tomographic reconstruction techniques are used together to obtain ionospheric electron density distribution. Algebraic Reconstruction Technique (ART) is one of the most commonly used reconstruction method in medical tomography due to its simplicity in implementation. The performance of ART is independent of basis functions and very sensitive to the initial state. Total Least Squares (TLS) algorithm assumes no regularization and produces the lowest error for Haar basis for a given

latitude interval. The performance of TLS is improved with the number of receivers. If only one receiver is used, TLS algorithm together with Haar basis functions produces a low computational complexity and has a lower reconstruction error compared to Regularized Least Squares Algorithm. When the estimation by TLS is input as the initial state of ART, the overall reconstruction error reduces significantly compared to the reconstruction error of ART only or TLS with Haar basis only. [C1350]

"Comparison of neural network models for path loss prediction"

This work presents the results of the studies concerning the applications of the feedforward neural networks to the prediction of propagation path loss in urban and suburban environment. First, neural network models are designed in order to predict the path loss. Further investigations are made on an error correction model, based on the combination between a theoretical model and a neural network. The performances of the neural models are compared to the measured path loss values from the measurements conducted in the city of Kavala and in Oia village on Santorini Island, Greece, based on the absolute mean square error, standard deviation and root mean square error between predicted and measured values. Also, the neural networks models are compared to each other and to the COST 231-Walfisch-Ikegami. [C1351]

"MCAS: a macrocell channel allocation scheme for broadband wireless access networks"

The radio spectrum of the IEEE 802.16 medium access control (MAC) protocol ranges from 2 to 66 GHz, which is one of the potential solutions for broadband wireless access (BWA) or beyond third generation (B3G)/4G networks. However, with the characteristic of radio propagation, the maximum transmission distance is proportioned inversely to the frequency which the subscriber station (SS) carries. According to this property, the base station (BS) can easily allocate appropriate channels for SSs according to the received signals which SSs transmit. Therefore, in this paper, we investigate the relationship between the signal propagation and the distance, and then we proposed a novel macrocell channel allocation scheme (MCAS) for dynamic channel allocation (DCA) in radio access networks (RAN). The MCAS enables the BS to allocate appropriate channels to SSs according to the received signal-to-noise ratio (SNR) value from the SSs. The MCAS not only increases the capacity of the system but also saves the overall power consumption of the system well. Simulation results show that the proposed MCAS increases the power saving up to 47.83% over the original IEEE 802.16 standard specifications. [C1352]

"The use of subionospheric VLF/LF propagation as the means to study ionospheric perturbations associated with earthquakes"

NASDA (National Space Development Agency of Japan) has just finished the Earthquake Remote Sensing Frontier Project (for which the author was the principal scientist) conducted since 1996 within the framework of the Earthquake Frontier Projects by the former S.T.A. (Science and Technology Agency). Main emphasis of NASDA's Frontier Project was the complete understanding of lithosphere-atmosphere-ionosphere (LAI) coupling by making full use of different kinds of observational items and finally we would like to contribute to the short-term earthquake prediction. The most exciting finding from our Frontier project was the discovery of convincing evidence of the presence of seismo-ionospheric perturbations, which has been extensively investigated by using the subionospheric VLF/LF propagation, and several important findings have been presented, including the initial result for the Kobe earthquake and a few case studies from many data. [C1353]

"Accurate detection of the number of arrival signals using pre-estimated signal subspace"

This paper presents an accurate detector of the number of incident waves arriving at smart antenna. The array antenna and MIMO techniques are developing toward 4th generation mobile communication systems, and the accurate estimation of propagation environment becomes more important. This paper attracts attention to the accurate detection of the number of incident waves which is one of important characteristics in multidirectional communication. There are some recent papers on the accurate detection, but they still have problems of computational cost or estimation accuracy in severe environment like low SNR, small number of snapshots or adjacent waves. Thus AIC and MDL methods based on information theory are still often used. In this paper, we propose an accurate estimation method of the number of arrival signals using the orthogonality of sub-spaces derived from preliminary estimation of signal sub-space. The proposed method accurately estimates the number of signals especially in severe environments where AIC and MDL methods can hardly estimate. [C1354]

"Determination of GPS positioning errors due to multi-path in civil aviation"

Fully automated landing systems based on GPS still suffer from errors, mainly due to multipath propagation. This paper presents a simulation tool to quantify positioning errors by combining a ray-tracing based three-dimensional multipath propagation model with a standard GPS receiver model. The propagation model accounts

for the reflecting environment geometry, transmitting and receiving antenna patterns, reflections and depolarization. For each ray the time delay, carrier phase delay and multipath-to-direct amplitude ratio is computed and fed into the receiver model to determine the pseudorange errors. The performance of the method is illustrated with numerical examples. [C1355]

"Modification of electron density profile about the earthquake epicenter by GPS data"

For testing the hypothesis about the modification of an ionosphere F2-layer in the epicenter area several days before the earthquake which occurred on August 17, 1999 in Turkey, the data from the stations removed from seismic zone were processed. IGS station coordinates: ZECK-43.79N, 41.57 W; ZWEN 55.7 N, 36.76 W. The ionosphere state analysis was carried out during on August 13-18. The electronic concentration profile and its maximal meaning in a F2-layer were considered. The variations of an electronic plasma maximum were received by radio translucence method on the GPS satellite, observable simultaneously with stations ANKR, ZECK and ZWEN. For definition of high-altitude structures of an ionosphere the standard RINEX-files of observations introduced on a site http://garner.ucsd.edu/pub were used. [C1356]

"Propagation Path Loss Models for Parking Buildings"

This paper proposes a method to predict path loss in parking buildings. We performed measurements in two different of parking buildings at a frequency of 1.8 GHz and proposed new upper- and lower-bound models. The actual breakpoint distance was shorter than theoretical one because of the effective floor height due to cars. These models also include time-variant effect, cars in parking area. This time-variant effect influence on the wave propagation very high. The results have shown that the upper- and lower-bound models will be useful for the system and cell design of indoor wireless communication systems [C1357]

"802.11ab propagation prediction inside a B777"

Electromagnetic propagation models for signal strength prediction within aircraft cabins are essential for evaluating and designing a wireless communication system to be implemented onboard aircraft. A prediction model was developed for a B777 using commercial grade software intended for predictions within offices and buildings. The performance of the model was evaluated through a comparison with test data measurements taken on the aircraft. It was concluded that the model can accurately predict power propagation throughout the cabin. This model can enhance researchers' understanding of power propagation within aircraft cabins and will aid in future research. [C1358]

"Indoors Radio Channel Simulator"

In this work we develop a program, to obtain the impulse response, by simulation, of the wide band radio channel in indoors. This program generates a sequence, in successive runs, of channel impulse responses, over different transmitter-receiver separation distances. Generating: amplitudes, delays and phases; of the paths arriving to the receptor, based on a statistical model, the model parameters are introduced by the user, matching, in this way, the simulation with the desired environment. Having too, as user entries, the transmitter and receiver antenna gains, the operation wavelength and the receiver sensitivity. The program was implemented in MATLab™ 6.5 and, it counts with a friendship interface, operating by means of menus, easy to use, from where, the user introduces the parameters and data. As result, of one simulator run, obtains, a impulse response graphic, amplitudes vs. arrival times, and a file that contains, for every simulated path, amplitude, arrival time and phase; in a results table. And, with successive runs, obtain in other results table, the radio channel parameter, such that: total multipath gain, path loss, rms delay spread and excess delay. [C1359]

"A new spatial-temporal channel simulator for multi-antenna system in urban"

A spatial-temporal channel simulator is necessary for properly designing, analyzing and implementing multi-antenna systems. A new geometry-based spatial-temporal channel simulator is proposed; it assumes that double bounce scattering components are the dominant multipaths received by base station and mobile as well as single bounce scattering components. Considering that scatterers from different distances to a mobile influence signal propagation dissimilarly, two different scatterer distribution densities within the coverage area are applied. Comparison of an example of urban channel simulation with measurement results shows that the simulator is capable of characterizing most of the properties of an urban channel. The simulator can also be configured to meet different requirement of angle spread and delay spread for estimating the robustness of a multi-antenna system. [C1360]

"Electromagnetic propagation of wireless networks in aircraft cabins"

A commercial software package, Wireless Insite®, was used to predict power levels inside aircraft cabins and the data was compared with previously collected experimental data. Two methods of propagation were examined and through basic statistical analysis, it was concluded that the software could qualitatively predict electromagnetic propagation inside the aircraft cabin environment. [C1361]

"An efficient wave propagation model for simulation and analysis of multipath effects of mobile users in indoor and urban environment"

In this paper, we present an efficient wave propagation model that supports both urban canyon and urban canyon situated indoor propagation based on a hybrid of the ray tracing and finite volume/finite difference time domain methods. The model is provided in a high-performance compact terrain database (CTDB) format with multi-elevation structure for use in high-resolution dynamic simulators. The effect of multipath propagation on the multiple access methods and the comparison of the WCDMA receiver against that of the UFO receiver in the urban setting is discussed. Simulation includes the bit-error-rate for a given satellite power, and the power needed at the satellite for a given bit-error-rate subject to the maximum beam power, which determines the relative fraction of the total time the signal is acquired for the two models. the simulation results of access control or power control based on urban multipath environment are also presented. [C1362]

"A SBR algorithm for simple indoor propagation estimation"

In this paper, indoor electromagnetic wave propagation is analyzed by using ray tracing method, which is based on high frequency ray launching or SBR technique. Here, three fundamental GO components of direct, reflected and transmitted rays are considered in the analysis. Taking into account three components only, the improved execution performance on most of indoor propagation models may be expected. Additionally, the physical indoor propagation model for a shooting angle may be considered as the corresponding non-physical tree construction model with the source as root. Providing the appropriate node number to every node of the tree, one may be able to refer the propagation history (total reflection/transmission number of times and its sequence) for the wave received at arbitrary observation point. The indexing described above may also lead us the required memory size reduction effect in the numerical procedure. Numerical calculations have been carried out for some simple indoor models, and by comparing the results of our method with those of the FDTD method, the validity of ours has been confirmed. It has also been found that computational time and required memory size reductions are both realized. [C1363]

"Propagation prediction software for wireless communication system optimization"

Propagation prediction software for wireless communications is developed based on efficient ray-tracing simulation. The software has a friendly graphical user interface (GUI) and provides calculations for propagation parameters including path loss, delay spread, and angles of arrival/departure. Users can upload AutoCAD files of indoor or outdoor environments and assign wall geometries and electrical parameters easily. User defined radiation patterns can also be incorporated in the simulation. The software provides colored graphs for the simulated results. [C1364]

"The Effects of Sumatra-Andaman Earthquake on Total Ionospheric Electron Content (TEC) and Ionospheric Scintillation of GPS Signal in Thailand"

This paper presents the effects of Sumatra-Andaman earthquake (26 December 2004) on the total ionospheric electron content (TEC) by using the TEC meter (JAVAD) installed at KMITL. From the results, we found that the total ionospheric electron content enhancement at the time of this earthquake is higher than other days about 7 TEC units. Furthermore, the study includes the effect of this phenomenon on GPS signal (1575.45 MHz) by employing S4index and sigmaphi(60sec)to identify the severity of amplitude scintillation and phase scintillation, respectively. From the observation, we can conclude that TEC variation is the cause of ionospheric scintillation leading to the position error on GPS about 8 meters [C1365]

"Transequatorial Radio Propagation Monitoring"

According to error of satellite signals traveling through the ionosphere, it can be impractical and receiver performance can be severely degraded. At times of high sunspot number, transequatorial propagation on ionospheric scintillations is most likely to occur during solar maximum, particularly affecting equatorial and auroral regions. Although isolated efforts have been reported, systematic analyses of the effects on positioning systems have not been performed. Auroral disturbances affecting north-south gradients can lead to effects at mid-latitudes. This paper presents initial monitoring results of a study on transequatorial radio propagation. A state-of-the-art SAO explorer, which extracts scintillation parameters from radio frequencies measurements, is

being used [C1366]

"MiNT: a miniaturized network testbed for mobile wireless research"

Most mobile wireless networking research today relies on simulations. However, fidelity of simulation results has always been a concern, especially when the protocols being studied are affected by the propagation and interference characteristics of the radio channels. Inherent difficulty in faithfully modeling the wireless channel characteristics has encouraged several researchers to build wireless network testbeds. A full-fledged wireless testbed is spread over a large physical space because of the wide coverage area of radio signals. This makes a large-scale testbed difficult and expensive to set up, configure, and manage. This paper describes a miniaturized 802.11b-based, multi-hop wireless network testbed called MiNT. MiNT occupies a significantly small space, and dramatically reduces the efforts required in setting up a multi-hop wireless network used for wireless application/protocol testing and evaluation. MiNT is also a hybrid simulation platform that can execute ns-2 simulation scripts with the link, MAC and physical layer in the simulator replaced by real hardware. We demonstrate the fidelity of MiNT by comparing experimental results on it with similar experiments conducted on a non-miniaturized testbed. We also compare the results of experiments conducted using hybrid simulation on MiNT with those obtained using pure simulation. Finally, using a case study we show the usefulness of MiNT in wireless application testing and evaluation. [C1367]

"Observation of Ionospheric Height Changes at Chumphon near the Magnetic Equator"

This paper presents the ionospheric height variation for station near the magnetic equator at Chumphon campus, King Mongkut's Institute of Technology Ladkrabang which located at longitude 99.3 degE latitude 10.7 degN. Ionogram was obtained every 15 minutes during equinox period. All data was used to determine apparent height (h'F) and critical frequency (fof2), respectively, by using data analysis of ionogram. This paper remains in predicting spread F onset base on the ionospheric height changes only. Although we have observations during a month, the height variation anomaly and we found that the spread F occurrences seem to be related to time of appearance [C1368]

"An adaptive maximally decimated channelized UWB receiver with cyclic prefix"

The frequency channelized receiver based on hybrid filter bank is a promising receiver structure for ultra-wideband (UWB) radio because of its relaxed circuit requirements and robustness to narrowband interference. Maximally decimated channelizer requires the fewest number of ADCs, but it suffers from poor convergence speed, making it ill-suited for UWB systems. By applying cyclic prefix (CP) to the transmitted data, the channelizer and the propagation channel can be decomposed as a cascade of three fixed DFT related matrices and two diagonal matrices. This decomposition allows the rapidly varying propagation channel and the slowly varying channelizer to be updated at vastly different rates. An adaptive algorithm bused on minimizing the data block mean squared error (MSE) of the cascaded equalizers is also proposed. The performance is comparable to an ideal full band receiver alter initial convergence. [C1369]

"Frequency offset acquisition based on subcarrier differential detection for OFDM communications on doubly-selective fading channels"

An effective frequency offset acquisition technique based on differential detection for wireless orthogonal frequency-division multiplexing (OFDM) communication is investigated in this paper. By taking advantage of differentially coherent detection, data-aided frequency acquisition assisted by frequency-domain pseudo-noise (PN) matched filters (MF's) can achieve lower probabilities of false alarm and miss over a propagation channel with a wide enough coherence bandwidth than its noncoherent counterpart can. Furthermore, the proposed technique can also function very well over a severely frequency-selective fading channel while the subcarrier-level differential detection is exploited. Extensive computer simulations verified the superiority of the proposed technique. [C1370]

"Ultra wide-band body area channel model"

Using wireless sensors placed on a person to continuously monitor health information is a promising new application. However, there are currently no models describing the radio channel around the human body making it difficult to design a suitable communication system. To address this problem, we have simulated electromagnetic wave propagation around the body and incorporated these results into a simple model. We then compared this model with measurements taken around the human torso and with previous studies in the literature. This paper proposes a simple statistical channel model useful for evaluating both UWB and (after resampling) narrow-band body area communication systems. [C1371]

"Integration of propagation modeling in simulation of CDMA communication systems"

The development of a propagation software package for characterizing both indoor and outdoor realistic wireless communication environments is described. The developed software is based on a ray-tracing method that provides channel parameters including path loss, delay spread, and angle of arrival/departure. Through a graphical user interface (GUI), propagation environments downloaded directly from .dxf files can be processed automatically. The obtained propagation results are then incorporated in Matlab (Simulink block) to simulate the performance of CDMA systems in realistic communications environments. The developed block is used to evaluate the interference suppression and SNR maximization of a maximum ratio combining scheme in RAKE receivers. [C1372]

"Unitary cyclic ESPRIT-like direction finding"

Two unitary formulations of cyclic direction-of-arrival (DOA) algorithms, which are appropriate for both cyclic ESPRIT algorithm and conjugate cyclic ESPRIT algorithm, are proposed. Firstly, two approaches achieve a substantial reduction of the computational complexity via real-valued decomposition. Secondly, unitary method I cannot separate highly correlated or coherent signals, but unitary method II can separate them. Finally, these unitary methods allow to select desired signals and to ignore interferences for uncorrelated source scenarios, but only unitary method II has signal selective property in multipath propagation. Compared with cyclic ESPRIT algorithm, simulation results show the effectiveness of the proposed methods. [C1373]

"Upper- and lower-bound path-loss modeling for indoor line-of-sight environments"

This paper proposes a method to predict line-of-sight (LOS) path loss in buildings. We performed measurements in two different types of buildings at a frequency of 1.8 GHz and propose upper-and-lower bounds path loss models which depend on max and min values of sample path loss data. This makes our models limit path loss within the boundary lines. The models include time-variant effects such as people moving and cars in parking areas with their influence on wave propagation that is very high. The results have shown that the proposed models will be useful for the system and cell design of indoor wireless communication systems. [C1374]

"Physical-statistical propagation model for the land mobile communications"

A physical-statistical propagation model is proposed by combination the statistical method with Macial-Bertoni-Xia radio model. It is assumed that the building height is not deterministic variable like those in theory propagation models, but a statistical variable. The performance of the model is studied by simulating probability density functions (PDFs), cumulative distribution functions (CDFs). Finally, we emphasize the research of the second order characteristics for the proposed model. Level cross rates (LCRs) and average duration of fades (ADFs) are given by assuming that the vehicle moves at the rate of 36 kilometers per hour in building-up areas. [C1375]

"Propagation modelling in troposphere using paraxial form of Helmholtz equation"

A new beam propagation method is developed based on direct approximations of Helmholtz equation. In this work, the Helmholtz equation applied on radiowave tropospheric propagation, properly manipulated, and resulting in a one dimensional form, is solved using finite element method. By using this method, horizontal and vertical tropospheric characteristics are assigned to every element, and different refractivity profiles can be entered at different stages. We also implement some abnormal environmental conditions to assess our method, and investigate ducting phenomena in troposphere. [C1376]

"Analysis of transmit-receive characterization of UWB impulse signals"

In the paper, the time domain electric field integral equation (TD-EFIE) in conjunction with the reciprocity principle is applied to synthesize the transmitting impulse signals on condition that the receiving signals have already been known. In addition, the effects of light-of-sight (LOS) and non-light-of-sight (NLOS) propagation paths on the transmitting and receiving impulse signals are also discussed. Furthermore, an averaged scheme has been proposed in the paper to keep the balance between eliminating oscillation phenomena and keeping the accuracy of computational results. In the analysis, impulse waveform and the shape of the antenna are arbitrarily given. The bowtie antennas excited by Gaussian monocycle pulses and ultra-wide band (UWB) slot antennas excited by prolate spheroidal wave functions (PSWF)-type UWB pulses are taken as examples and the computed results are compared with the originally known receiving impulse signals. The good agreement between them shows the correctness and effectiveness of the method proposed. The method also possesses the merits of clarity in conception and simplicity in computation. [C1377]

"Field strength prediction behind a lossy dielectric block by using the 3D parabolic equation model"

In this paper, a 3D parabolic equation wave propagation model based on split-step Fourier (SSF) transform for field strength prediction behind a lossy dielectric block, which just like an actual building in urban mobile communication system is presented. Field decomposed odd part and even part used to dealing with ground boundary condition is proposed here. And Fourier transform adding forward difference (FT-TD) approach, which used to dealing with the block vertical surface boundary condition is also brought forward. Comparing the result with the published literature, the validity of these methods is testified. [C1378]

"Characterize the indoor multipath propagation for MIMO communications"

In this paper, the statistic relationship between the characteristics of multipaths and the performance of multiple-input multiple-output (MIMO) systems in indoor environments is explored using channel measurements. Our investigations demonstrate the terminology of richness, which is generally used to characterize the multipath propagation, highly relates to the number of effective multipaths, their carried power and their angular features. A novel dimensionless parameter, angular spread factor, is proposed in this work. [C1379]

"Secret key generation exploiting antenna beam steering and wave propagation reciprocity"

This paper presents a novel physical-layer approach to information security. Unlike conventional mathematical-based encryptors, a secret key is generated from a natural phenomenon, i.e., the multi-path fading of a radio wave. The reciprocity in wave propagation is exploited to share the key with a party on the air. An array of electronically steered parasitic radiators provides time variation in the faded amplitude. This variation exhibits strong spatio-randomness which can never be practically solved by any other party. We show proof-of-concept experiments carried out in an actual indoor environment. [C1380]

"Statistical Evaluations of Packet Transmission Routes in Wireless Multi-Route and Multi-Hop Networks"

In this study, we evaluate the statistical characteristics of packet transmission routes and the hops in wireless multi-route and multi-hop network. Although the wireless network is based on cellar system, we consider the use of forwarding nodes for relaying the packets transmitted by user nodes. The network includes use of multiple routes from a user to base stations. Few researches have been done for statistical evaluations on the network, so far. In our route building method, nodes determine the connectivity based on SNR (signal-to-noise power ratio) of received signals. Our model employs free space propagation power loss model to derive SNR. We observe that the number of routes increases with the number of forwarding nodes and their transmit power. On the other hand, the number of hops per route is saturated with increases of those parameters. We conclude that an adequate selection of the parameters enables to suppress the number of hops [C1381]

"Reflection coefficient modification for mobile path loss calculation"

In this paper we modify the reflection coefficient of electromagnetic wave incident on the wall of the buildings and obstacles that occurs in mobile communication path by solving the nonlinear Riccati equation. For this propose, the building walls are assumed to be inhomogeneous layers of bricks and limestone where their permittivity change as a function of the wall thickness. After modifying the reflection coefficient, a new propagation model based on UTD and GTD (uniform geometrical theory of diffraction and geometrical theory of diffraction) for multiple diffraction paths in cellular mobile radio communication is proposed and the diffraction loss as well as the path loss for a row of buildings with two inhomogeneous faces are calculated. Measured reflection coefficient and diffraction loss are compared to the theoretical results obtained in this paper for reflection coefficient and diffraction loss. Comparison of theoretical results and measured cases reveal that the modified reflection coefficient can adequately predict the reflective properties of the brick and limestone wall surface. Also the proposed UTD model results are in a good agreement with measured data. Therefore the modified reflection coefficient as well as the new UTD model can directly be applied to the estimation of multipath signal strength, diffraction loss and also path delay calculation in ray tracing algorithms used in mobile communication, radar and radio links [C1382]

"Statistics of lower atmosphere refractivity in Czechia"

Atmospheric refractivity influences significantly the propagation of electromagnetic waves in atmosphere. ITU-R recommends using statistics of a refractivity vertical gradient in the lowest 65 meters above the ground for estimation of multipath fading incidence on the terrestrial fixed wireless links. In this paper, results of the measurement of atmospheric refractivity in a lower 80 m layer of atmosphere are presented. Daily and monthly variability of refractivity and of its vertical gradient is shown. Refractivity statistics are compared with the

quantiles obtained from the ITU-R world map. [C1383]

"Analysis of rain cell size distribution from meteorological radar data for rain attenuation studies"

The ability of radar to scan a wide area around the radar site and not just a particular path made it a very attractive for many types of investigations. Radar can be used to measure the rainfall rate indirectly. This is achieved by knowing the radar reflectivity and then converting them into rainfall rate. The S-band frequency of the meteorological radar ensures that propagation effects such as attenuation are negligible. Radar provides valuable information that is relevant in modelling rain-induced propagation effects. Radar also provides spatially and temporally continuous measurements that are immediately available at one location. Rain cell size distribution is obtained from radar data. 'Virtual' microwave links of 20-km path lengths were constructed in the scanning area of the radar. However, rain cell size distribution from radar data is limited to 1-km integration size. This is due to the fact that the radar uses a range bin size of 1 km. The radar data is obtained from the Kluang Radar Station of the Meteorological Department of Malaysia. This paper present an analysis of rain cell size distribution obtained from the meteorological radar data. Rain cell size is an important parameter in the study of attenuation of radio propagation through rain. This parameter is used for attenuation predictions, link budget estimation, microwave system planning, slant path rain attenuation modeling and remote sensing of the Earth's surface, and have important applications in attenuation mitigation techniques such as space diversity. Analysis was done to find the rain cell size distribution. [C1384]

"First ionospheric experimental campaign and observation at Fraser's Hill, Malaysia: total electron content (TEC) and scintillation measurements"

The ionosphere over Malaysia is unique because of her location near the equator where the existence of the equatorial anomaly, electrojet, and fountain effect have made it good for studies. As part of a rejuvenation process in investigating the equatorial ionosphere in Malaysia, a short duration ionospheric experimental campaign was carried out at Fraser's Hill (lat. 3° 42.9' N, long. 101° 44.2' E, at an altitude of 1298 m) from GPS Week 1334 to 1335 (Jul 31, 2005-Aug 13, 2005. This paper presents the results of the TEC and scintillation measurements obtained from the GPS receiver. TEC is a measure of the number of electrons along the path from the satellite and is reported as TEC units (1 TECU = 1 Ч 1016electrons). The number is proportional to the ionospheric delay between the L1 and L2 signals. However, amplitude scintillation monitoring is traditionally accomplished by monitoring index S4 derived from signal intensity of signals received from satellites. [C1385]

"An empirical model for propagation loss prediction in indoor mobile communications using Pade approximant"

This paper presents a model for path loss prediction in indoor mobile communications. It uses the free-space loss model added to an empiric function (based on Pade approximant), and a term that describes the sign randomness. In order to validate this model, a measurement campaign was accomplished at a typical 5 floors building of a university. The loss predicted by this model had a mean error of 4.78 dB and standard deviation of 6.05 dB in relation to the measured data. The proposed model doesn't need accuracy information of the environment in study, besides being adaptable to any indoor environment. [C1386]

"Three-dimensional simulations of an urban outdoor wireless channel by the block-FDTD method"

Full three-dimensional simulations of electromagnetic wave propagation in outdoor environments with the FDTD method the giga-hertz frequencies (or even mega-hertz) are not viable with the ordinary computational resources available nowadays. In order to reduce the required computational resources, especially memory, and make such simulations possible to perform in an eight-nodes-Beowulf-cluster, an alternative implementation technique is proposed: block-FDTD method, called here B-FDTD. The paper contains details about the method and results obtained by software developed based on B-FDTD, showing effects caused by ground and by diffractions generated at the edges of the buildings that compose the outdoor environment (time and frequency domains). The analyzed environment is 30Ч30Ч8 meters and received fields are registered at different points. [C1387]

"Characteristics of UWB antenna and wave propagation"

This paper proposes an omni-directional UWB antenna pattern in azimuth cut, low voltage standing wave ratio (VSWR), and easy to construct antenna for ultra wideband (UWB) systems. The designed antenna uses the multi circular blade configuration with a radiating element and on two different ground planes (square and circular ground shape). The multi-circular blades UWB antenna suitable for IEEE 802.15.3a and IEEE 802.16 UWB communication applications at 3.1-10.6 GHz and 2-11 GHz bands is presented and in specification. This paper discusses the phenomenon of dispersal in UWB antennas and presents a simple design to evaluate the radiated

fields from antennas structures. About the characteristics of UWB antenna of antenna bandwidth, antenna efficiency, co-polarization, cross-polarization and pattern integrity are discussed and measured and compared. New multi-blades circular metal for orthographical monopole UWB antenna design and enhanced which measured results exhibit extend return loss bandwidth and lower omni-directional pattern deviation in azimuth cut and lower pattern ripple. The antenna design allows a quick assessment of dispersion in design. The proposed multi-circular blades UWB structures is capable of achieving broadband and omni-direction at azimuth cut characteristics within 2-1 IGHz for UWB wireless communication applications and experiment. [C1388]

"Improving the treatment of mixed-terrain paths of the recommendation ITU-R P.1546 for the path-loss prediction of short UHF links"

The recommendation ITU-R P.1546 provides a "method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3000 MHz" an has been proposed to mitigate known limitations associated to distance and frequency ranges, combining several existent methods in one. In the present work, we suggest an improvement in the recommendation for the treatment of mixed-terrain paths, based on the intersection of the Fresnel's ellipsoid with the terrain profile. [C1389]

"Efficient ray-tracing method for indoor propagation prediction"

This work presents an efficient implementation of the 2.5D ray-tracing method for modeling indoor propagation. The implementation is made by means of graphic software tools using the shooting and bouncing rays (SBR) technique, in combination with the uniform theory of diffraction (UTD). A database is built to record geometrical characteristics and environment materials that allow flexibility and robustness to model news scenarios. Some comparisons between computed predictions and measurements show good agreement. The theory is also verified by comparison with previously published data. [C1390]

"Motley-Keenan model adjusted to the thickness of the wall"

This work proposes an adjustment in the Motley-Keenan model, considering the thickness of the wall. To validate the proposal, measures were made in environments indoor, as it will be presented. The results demonstrate the reliability of the adjustment, being obtained smaller errors in the predicted values in comparison with the measured values, indicating a better accuracy in the prediction of the propagation with the use of this model. [C1391]

"Sensor nodes localization based on inequalities of electric field intensity"

Using simultaneous inequalities of electric field intensity observed between sensor nodes during radio communication, the nodes positions are estimated. The multidimensional scaling (MDS) method which is often used in sensitivity measurement is improved to solve sensor nodes localization problem. In the improved MDS, sensor nodes and base nodes those positions are known are dealt separately, and the initial arrangement is set by a method which is suitable for this method. We use two simple radio propagation model which describe the characteristics of electric field intensity approximately. Using these models, computer simulations are executed, and these results reveal that it is possible to estimate sensor nodes positions with high accuracy when reflection and blocking of radio waves are not occurred [C1392]

"Higher-order effects of radiated interference-challenging research domains within EMC in future military dynamic wireless communication networks"

The EMC area was once born in the 1920's due to radio interference issues. In the near future, it is highly likely that radio interference issues once again will lead to several challenging new research domains within EMC. Examples of such domains are described and discussed in this paper. These domains require new analysis methods since the interference effects appear as higher-order effects on system-of-system level. One domain is the ongoing development of dynamic flexible wireless networks based on software defined radios (SDR) and cognitive radios (CR). Another one is a hybrid domain between the EMC area and the area of human factors, One vital combination is the use of commercial off the shelf (COTS) equipment in military wireless networks. COTS is allowed to radiate considerably higher levels of electromagnetic interference than military specified electronics. Examples of research results are given where analysis methods from wave propagation, intersystem interference and network management have been combined and further developed to analyze these new complex problems. [C1393]

"On the effect of radio channel propagation models to the ad hoc network performance"

In this paper, we study the behavior of ad hoc network performance under different propagation models. Ad hoc

networks are often studied with unrealistic cut propagation models, where the propagating signal is completely cut to some predefined distance. The worst drawback in this kind modeling is that it fails to include the effect of multiple access interference (MAI). Since cut propagation model is taken as a point of comparison, free space propagation model will provide the simplest enhancement to enable realistic MAI calculation. In addition, we also use a forest propagation loss model, which provides a more realistic environment for military scenarios. We study the performance in two cases: nodes equipped with our BCCA (bi-code channel access) and BC-MAC (bi-code MAC), and nodes with IEEE 802.11. The study shows that there are significant differences in the absolute performance between scenarios with different propagation models. This clearly shows the importance of lower layer modeling, although the focus would be on the upper layer performance (e.g., on the application layer quality of service (QoS)). The study also shows that BC-MAC outperforms IEEE 802.11 regardless of the propagation modeling. Despite the fact that the ranking of the performance between BC-MAC and 802.11 was unchanged in this study, the great differences in the absolute performance questions the generality of the results obtained with simplified lower layer models. This should be taken into consideration especially in military related studies, where the focus often is in the absolute performance of a certain scenario and not only in the relative difference between some methods [C1394]

"Research on mobile communication radio propagation characteristic based on 3DPE"

In this paper, a macrocell radio propagation model for mobile communication is established based on three-dimensional parabolic equation (3DPE). The loss characteristics of radio propagation around buildings are calculated by using this 3DPE model when buildings distributing differently on flat ground or irregular terrain. The results are compared with the physical optics (PO) method and three-dimensional Ray tracing method. The compare shows the 3DPE model is accurate and valid. So it provides an excellent propagation prediction model for mobile communication. [C1395]

"5.3 GHz MIMO radio channel sounder"

A radiowave propagation measurement system for wideband multichannel multiple-input multiple-output (MIMO) measurements at 5.3 GHz is presented. The MIMO channel matrix of 32 times 32 can be measured using microwave switches at the transmitter (TX) and the receiver (RX). The system is capable of measuring direction-of-departure (DoD) and direction-of-arrival (DoA) with dual polarization in both TX and RX. The antenna configuration can be selected to use planar array or semispherical groups at each end of the link. A high power switch is used at TX to enable large measurement distances. Results from calibration in an anechoic chamber and from measurement campaigns are shown [C1396]

"On the capacity of volume limited current distributions"

The capacity of MIMO channel is related to the channel statistics and this in turn related to the choice of antennas and the channel propagation environment. Recently, there has been some work on the evaluation of antenna independent spatial capacity. This analysis considers a multiple-antenna system in which unlimited number of antenna array elements are available, but there is a restriction on the volume they can occupy. The problem is viewed in electro-magnetic (EM) theory setting where a spatially continuous current distribution radiates into free space, with a receiver in the surrounding space measuring the radiated EM field. The advantage the aforementioned approach is that it provides an antenna independent analysis and this forms and upper bound on the achievable capacity with finite number of antennas. However, in computing the capacity, simplifying assumptions that reduce the vectorial EM problem to a scalar wave problem is made and heuristic arguments are used to extrapolate the results to the vectorial case. The impact of this on the results is not readily apparent. In this work, we consider the complete vector EM problem for a system comprising of a transmitter restricted to spherical volume and a receiver, which is a concentric spherical surface in the far-field, and derive some bounds on capacity. We first develop some tools essential for calculation the capacity of the system and then we compute the singular values of this channel in closed form. The main results of this paper are as follows: 1) the capacity scaling law in the high signal-to-noise ratio (SNR) regime is given by (c2+ c1log SNR) log SNR + 0(log SNR), where c1is linear and c2quadratic in the radius of the transmitting volume; and 2) the received power scales as a cubic function of the radius of the transmitting spherical volume [C1397]

"The effect of terminal movement to the physical layer performance of the IEEE 802.11b wireless LAN systems in simulated UMTS vehicular channel"

Wireless local area network (WLAN) systems are typically designed to provide fixed or nomadic access. Using WLAN systems for military purposes raises the question of how WLAN terminals can be utilized in a fully mobile outdoor environment. In these environments, there typically exists multipath propagation with a large delay spread in the radio channel. This paper investigates the effect of terminal movement on the physical layer

performance and capacity of IEEE 802.11b WLAN systems in a realistic outdoor mobile environment. Several wireless network interface cards are measured in laboratory conditions using a simulated radio channel. The measurement results indicate that WLAN systems can operate in mobile outdoor environment up to a certain mobile speed, and there are significant differences between equipment from product vendors [C1398]

"Neural network prediction of radio propagation"

Preliminary work for predicting signal distributions in a local area, using a feature-based neural network is presented. The neural network is trained by radio signal measurements at known positions. After appropriately setting the parameters of nodes of the neural network, a corresponding virtual propagation environment is built, which reasonably represents the actual environment. Radio signal strength distribution is predicted by the virtual environment. A new method for radio signal measurement is introduced which mitigates the effect of small scale fading when determining the fingerprint of a position [C1399]

"Coverage and Capacity Calculations for a CDMA cell in Different Radio Environments"

Coverage and capacity are important issues in the planning process for mobile cellular networks. In this article, we focus on calculations for capacity and coverage for a code division multiple access (CDMA) cell for Universal Mobile Telecommunication System (UMTS) network in different radio propagation environments, based on propagation prediction models [C1400]

"Dependence of Electric Field Strength Prediction Model Accuracy on Database Resolution"

A macrocell electric field strength prediction model directly depends on accuracy of used terrain and clutter databases, which, on the other hand, directly depend on their resolution. It is difficult to find exact mathematical model of this dependence because many factors influence on it, like particularity of a specific environment and irregularities of terrain. In order to find a proper dependence, an experimental analysis was carried out in the region of Belgrade. The conclusions are based on extensive electric field strength measurements that were carried out in the 900 MHz frequency band [C1401]

"A novel LAS-MIMO CDMA system with SISO multiuser detection"

The large area synchronized (LAS) smart spreading codes having an interference free window (IFW), makes high-dimension modulation patterns be feasible in CDMA system. Combining MIMO with LAS codes can effectively take advantage of multipath delay spread and the random fading characteristic of the mobile propagation channel. In this paper, we show that by using the turbo product codes (TPC) to utilize soft-in-soft-out (SISO) iterative multi-user detection algorithm in such a system, significant performance improvement, and high spectrum efficiency could be achieved. [C1402]

"Frequency selection for the wireless communication in coal mine underground based on the hybrid waveguide theory"

Based on the theory of hybrid waveguide, the paper analyses and simulates the loss of radio propagating in rectangular tunnel of the coalmine underground. The values of the simulation are agreed with what measured practically in other papers. At last, it deduces the most advisable frequency point for the wireless communication system in the coalmine underground so as to build the strong basement for the new generation wireless information system for the coalmine. [C1403]

"The six-state Markov model for land mobile satellite channels"

A new channel model with a six-state Markov chain for the land mobile satellite channel is presented. The received amplitude series were classified into two different states according to the degree of shadowing experienced, and both states have three sub-states. The two-state model, the Lutz distribution (Rice+Rayleigh+Log-normal), is extended to the new six-state model in this paper under the different time-share of shadowing. Comparison of the first- and the second-order statistics of the proposed model with the measured data demonstrate the flexibility of the model in characterizing a variety of channel conditions and propagation mechanisms over satellite links. [C1404]

"Empirical UWB path loss models for typical office environments"

This paper investigates the path loss characteristics of an UWB signal (0.1-2 GHz) in a typical office building. Three statistical path loss models are presented, i.e. the nthpower model and two attenuation factor dependent models. Attenuation factor for brick and gypsum wall, the two main obstructive walls in this experiment were

investigated assuming free space path loss. Attenuation factor of 10.37 dB and 3.86 dB were obtained per gypsum and brick wall respectively. A new distance-dependent attenuation model for gypsum and brick wall is also presented. Comparison of the three proposed path loss models is included. [C1405]

"Deterministic Propagation Model for the Planning of Hybrid Urban and Indoor Scenarios"

With the growing interest for broadband mobile services in mobile communication networks, the investigation of radio transmission in and into buildings is getting more important. Popular empirical and deterministic models for the propagation inside buildings compute the Field strength based on the inner structure of the buildings (walls, furniture). But for current and future wireless networks (3G, B3G, W-LAN, WiMax,..), the neighboring buildings must also be considered to avoid interference problems in these buildings. Additionally the indoor coverage of outdoor transmitters must be analyzed to guarantee a high QoS even inside buildings. A new concept for the prediction of the field strength in such hybrid scenarios (urban and indoor) is presented in this paper. This new concept does not rely only on the direct ray (like empirical models) and it does not consider hundreds of rays for a single radio link (like ray tracing). The new model focuses on the most dominant path(s) between transmitter and receiver. The parameters of these paths are determined (e.g. path length, number and type of interactions, material properties of objects, ...) and are used for the prediction of the path loss. This model allows also the computation of the transition from an urban to an indoor scenario and vice versa, thus allowing an accurate computation of the received power inside and around buildings. For the validation of the new model, measurements were made [C1406]

"Wideband radio propagation characteristics at 5.3 GHz in suburban environments"

Wideband radio channel measurements have been performed in suburban macrocellular environment at 5.3 GHz carrier frequency and 100 MHz chip rate. This paper summarizes the radio channel properties, such as tap number, rms delay spread and K-factor characteristics for the power delay profiles. As for the system level channel characteristics, path loss and shadow fading autocorrelation models are presented [C1407]

"Analysis of propagation models for UMTS ultra high sites in urban areas"

Analysis results of commonly used propagation models applied to UMTS ultra high sites (UHSs) in urban environment are presented. Differences between predicted values and measurements for two specific locations are presented as functions of the distance between the base and mobile station as well as of the elevation angle at the BS. An assessment of the validity range of the different propagation models is done and a proposal for the extension of the models is made [C1408]

"From Alaska to the South Pacific in one-hop"

This paper discusses research conducted by The Very Low Frequency (VLF) Group at Stanford University introducing them and a project called the High Frequency Active Auroral Research Program (HAARP). This project utilizes the latest oceanographic and ocean-engineering technologies for exciting applications to space physics and radio science research. Sponsors consist of the Air Force Research Laboratory (AFRL), the Naval Research Laboratory (NRL), and the Defense Advanced Research Projects Agency (DARPA). The program's facility is a high power transmitter located in Alaska, capable of broadcasting powerful VLF radio waves into the Earth's ionosphere. These waves propagate along the Earth's magnetic field lines to the system's geomagnetic conjugate point situated nominally 600 miles south of New Zealand in the southern Pacific Ocean. By studying the radio signals at this point, the VLF Group seeks to discover how energetic particles in the planet's radiation belts interact with very low frequency electromagnetic waves. This ambitious challenge of operating an autonomous, stationary, floating observation platform is known as the HAARP One-Hop Experiment-South Pacific Buoy. [C1409]

"Further Steps Towards the Development of a Hardware Simulator for MIMO Radio Channels"

The aim of the regional project SIMPAA2, which continues the research activities of the former national research SIMPAA project, is the realization of a hardware simulator of MIMO propagation channels for UMTS and WLAN applications. The simulator must reproduce the behavior of the radio propagation channel, thus making it possible to test "on table" the mobile radio equipments. The advantages are: low cost, short test duration, possibility to ensure the same test conditions in order to compare the performance of various equipments [C1410]

"Stochastic Maximum Likelihood Estimation of Angle- and Delay-Domain Propagation Parameters"

In this paper we derive an estimator for both time-delay and angular channel propagation parameters of the

diffuse scattering component that is frequently observed in channel sounding measurements. The joint angular-delay model leads to correlation matrix with high dimensionality, which prevents direct implementation of a maximum-likelihood (ML) estimator using finite precision arithmetics and finite memory resources. We derive low complexity methods for computing the ML estimates that exploit the structure of the covariance matrices. The estimator is based on a two step procedure: first, the parameters of the power delay profile are estimated, as well as measurement noise power. Then, using the estimated time-delay parameters, the parameters of the angular distributions are estimated. We present simulation results and compare the estimated time-delay and angular distributions to the actual distributions, showing that high precision estimates are obtained [C1411]

"Influence of an accurate environment description for the indoor propagation channel modelling"

The current wireless systems evolve towards multimedia applications demanding more and more high bit rate. Consequently, we observe an important rise in frequency. Then, it becomes necessary to study the influence of particular details of environment such as rough surfaces or small and complex scattering structures. Nowadays, ray tracing techniques, based on the geometrical optic (OG) and the uniform theory of diffraction (UTD), are the dominant techniques to predict the channel behaviour over a large bandwidth. Our study aims to improve the ray tracing power for the indoor propagation channel modelling by taking into account particular details of the environment [C1412]

"Signature-interleaved DS CDMA: controlling odd correlation peaks"

Users' asynchronism and multipath propagation are among the most problematic issues in designing direct sequence code division multiple access (DS CDMA) systems. In this paper a system employing interleaved multiple signatures per user to mitigate the damaging effects of these factors is described and studied. It is demonstrated that interleaving along with an appropriate selection of users' signature multitudes drastically lowers the level of data-modulation-related peaks of multiple access interference [C1413]

"Bandwidth, efficiency and directivity enhancement of printed antenna performance using planar circularly symmetric EBGs"

Planar circularly symmetric (PCS) electromagnetic band-gap (EBG) substrates have been recently proposed to suppress the surface waves in printed technology. The major advantage of the PCS-EBGs with respect to structures based on vertical pins is the fabrication simplicity since the dielectric slabs do not need to be perforated. With respect to other planar type of EBG, an advantage is that the surface waves launched by a central source are reduced equally in all radial directions. The motivation of this contribution is to design and measure a prototype which demonstrates the suppression of surface waves by a PCS-EBG of a single antenna printed on a dielectric substrate. Thanks to the presence of the PCS-EBG around the antenna, we obtain an enhancement of the bandwidth, efficiency and directivity performances. The study presents some design considerations for the PCS-EBG itself, and then proceed with the manufactured and measured antennas. The results explicitly show the advantages in terms of bandwidth and radiation pattern of the proposed EBG substrate. A bandwidth of 20% is achieved without significant surface wave losses [C1414]

"Investigations into MIMO Systems from an Electromagnetic Perspective"

The paper presents investigations into multiple input multiple output wireless communication systems, which are carried out from an electromagnetic perspective. The first part of the paper focuses on signal propagation models, which can be used for determining the MIMO system capacity or its performance when various space-time coding schemes are applied. Two types of models are considered. In the first model, array antennas are treated in an exact electromagnetic manner but interactions with scattering objects are incorporated using an approximate single bounce scattering approach. The other model is a simple but exact electromagnetic (EM) model, which takes into account EM interactions between antennas and scatterers. In this model, parallel wire dipoles represent antennas as well as scatterers. The second part of the paper reports on investigations into two types of MIMO testbeds. The first one is a simple transmit/receive diversity tested while the other one is a full MIMO testbed. The paper briefly describes the results obtained during the undertaken investigations [C1415]

"Investigating Long-Range Ionospheric Radiolines by Analyzing Maximum Observed Frequencies Daily Variances"

This work presents the method of dividing maximum observed frequencies (MOF) daily variances (DV) into regular and remaining components. The MOF DV remaining component (or the remaining component) is found to have random characteristics. Analyzing the standard deviation (delta) daily variance of remaining component (the delta-daily variance) in relationship with geomagnetic activity level simultaneously in different long-range

ionospheric radiolines points out a new method to determine the influence of geomagnetic storms and ionospheric disturbances on diverse geographical regions. The "sunrise-sunset effect" in the frequency domain of remaining component is introduced [C1416]

"The modelling of high-rise buildings' influences for application in a semi-deterministic propagation model"

In this paper a newly applied approach to model the effects of high-rise blocking buildings near a base station (BS) in cellular communications networks is presented. Although recently accurate deterministic propagation prediction methods have become popular to account for these propagation effects, many mobile operators still employ rather simple and quick semi-deterministic propagation models, which use averaged geo-location information instead of actual building shapes in their calculations. In this work important insights from purely deterministic propagation theories are adopted and employed in a popular semi-deterministic model. After performing measurements, the difference in the prediction error for shadow and no-shadow areas is used to quantify the effect of the blocking object. It is found that statistical geo-location information can be used to predict the amount of blocking in a deterministic way, after application of a simple transformation algorithm. Subsequently, correction factors are proposed in order to adapt the single knife-edge diffraction model to improve the attenuation predictions and prevent the overestimation. The derived factors are based on the degree of urbanity of the environment. Multiplying the predictions of the diffraction model with the environment-based correction factors indeed significantly improves the predictions for the sectors that were studied [C1417]

"Recent trend in technologies developments for wireless communications IEEE 2005 International Symposium on, Microwave, Antenna, Propagation and EMC Technologies for Wireless Communications (MAPE 2005)"

This paper describes on trend of the recent technology developments for wireless communications and consists of four parts. The first and most important development is the worldwide Internet traffic growth. The important trends in, the "worldwide Internet traffic" growth are summarized in terms of the global geographic areas and their Internet penetrations. The second item is the developments of the hardware supporting technologies for the backbone networks that are essential for the realization of wireless communications. The third item is the central issue for wireless communication, especially for local individual users. The fourth and last item is concluding remarks [C1418]

"Analysis of wave propagation in circular tunnel using BOR-FDTD method"

In this paper, a body of revolution finite-difference time-domain method is introduced that is applicable to lossy structures with axial symmetry like circular tunnels. This method allows us to reduce a computationally intractable, three-dimensional problem to a numerically solvable two-dimensional one. And the wave attenuation in circular tunnel is calculated for the TE01and TM01modes, also for both values of conductivity and permittivity of tunnel walls. [C1419]

"Propagation characterization of wideband indoor radio channels at 60 GHz"

This paper presents the results of indoor propagation measurements performed in a corridor (LOS) and a hall with both LOS and NLOS measurement routes at 60 GHz. The channel dispersion and fading effects are analyzed by examining the rms delay spread, path loss and shadowing. Moreover, the correlation properties between dispersion and fading effects are investigated, and negative cross-correlation is found between rms delay spread and shadowing fading. An upper-bound exponential model of rms delay spread and path loss is developed for estimating the worst case of rms delay spread at given path loss [C1420]

"Some simulation results of 3D imaging based on chirp stepped-frequency signal"

In this paper, some simulation results of 3D imaging of ground moving target are presented. Chirp stepped-frequency signal is transmitted in the interferometric inverse synthetic aperture radar system. Before the processing of 3D imaging, the strong ground clutter has been removed by using a new chirp stepped-frequency signal format. Then the 3D images of the ground moving targets can be achieved according to the principle of the interferometric 3D imaging. [C1421]

"A modified UTD model for indoor propagation prediction"

In this paper, a modified UTD model to predict the propagation channel parameters in indoor scenarios is presented. The model is based on the blueprint of the rooms for a transmitter and receiver located at the same room. It employs two plane views reference to the transmitter and the receiver, respectively and a new criteria

adopting vector's dot product to construct the visibility graph. To verify the model, comparisons between the simulation results and measurements available in literature are given. The numerical results show that the modified ray tracing model will be applied in complex indoor propagation environment and find all propagation paths from a transmitter to a receiver in a high degree of accuracy without redundant computation time [C1422]

"A new UTD formulation for multiple cylindrical diffraction"

This paper describes a new formulation of the uniform theory of diffraction (UTD) with application to multiple cylindrical structures. The new formulas present some modified UTD diffraction coefficients in cooperation with a slope diffraction term for higher accuracy in the electromagnetic modeling. The above are then combined with a simple ray tracing algorithm that takes into account multipath propagation between cylindrical structures. Comparisons with existing analytical models that employ other electromagnetic theories have shown that the new UTD solution can give very accurate results while it seems to be superior in terms of computation time and complexity. The solution can be applicable to radiowave paths which are characterized by convex structures and multipath propagation such as mountainous areas or urban areas with special rounded objects [C1423]

"A solution for improving medium wave night broadcasting, using sky waves propagation"

The aim of this research is to provide a solution for better night propagation of medium wave (MW) broadcast transmitters through pattern change, type of applied propagation and without creating essential changes in transmitters. Important propagation problems of MW especially at the night are: (a) Co-channel interference of far transmitters at the night that (b) Decreases local coverage (LC) at night in comparison with day. (c) To cause problems for those transmitters being far coverage (FC) area and (d) Heavy traffic of MW band. Execution of proposed solution at this article causes economical savings and decreases number of transmitters as well as energy consumption. It also decreases field strength (FS) at the far area and the areas being out of LC and finally decreases undesirable interference [C1424]

"FPGA implementation of MMSE adaptive array antenna using RLS algorithm"

A fixed-point RLS processor was simulated and integrated on a FPGA system. The proposed system including synchronization process and performance was confirmed from experiments in radio anechoic chamber and indoor propagation. This paper demonstrates the RLS processor integration system using modulated signals of pi/4-DQPSK (pi/4-differential quadrature phase shift keying). The performance of the RLS processor is verified by simulations and experiments. [C1425]

"High-voltage and high current measurement techniques for a very low frequency (VLF) composite bushing"

High voltage and high current testing methods for a very low frequency (VLF) composite bushing is presented. These measurements are performed at the Edgar Beauchamp High Voltage Test Facility (EBHVTF) in Dixon, California. [C1426]

"3-D FDTD modeling of ULF/ELF propagation within the global Earth-ionosphere cavity using an optimized geodesic grid"

We discuss an emerging application of finite-difference time-domain (FDTD) computational electrodynamics: modeling transient ultra-low frequency (ULF) and extremely low frequency (ELF) propagation within the global Earth-ionosphere cavity. This permits for the first time a direct, three-dimensional, time-domain calculation of round-the-world ULV/ELF propagation accounting for arbitrary horizontal as well as vertical geometrical and electrical inhomogeneities and anisotropies of the excitation, ionosphere, lithosphere, and oceans. [C1427]

"Analysis of planar antennas using unconditionally stable three-dimensional ADI-FDTD method"

In this article, two kinds of absorbing boundary conditions (ABCs) are jointly employed for the ADI-FDTD algorithm: The Gedney's uniaxial PML (UPML) scheme is applied in propagation direction and Mur's first order ABC is set on the other outer surfaces. The manner to apply the source excitation in ADI-FDTD algorithm is described. The numerical simulation of a planar antenna demonstrates the validity of this ADI-FDTD scheme. The results show that the number of iterations with this algorithm can be four times less than that with the conventional FDTD without the large loss of accuracy [C1428]

"Performance analysis for indoor wireless systems employing directional antennas in the presence of external interference"

External interference can cause significant performance degradation in indoor wireless systems such as third/fourth-generation mobile systems and WLANs. Strategic deployment of simple antennas (e.g., the directional patch) at base stations is an attractive low-cost solution that can mitigate, to some extent, the effect of external interference by modifying the propagation of signals in the environment. An experimental investigation of the influence of external interference on the performance of an indoor wireless system is presented. Although appropriate deployment of directional antennas can reduce the impact of external interference, the effectiveness and the optimal antenna arrangement of this deployment strategy are dependent on the relative power level of the external interference. [C1429]

"Near field propagation law & a novel fundamental limit to antenna gain versus size"

The paper presents a theoretical analysis of the near field channel in free space. The theoretical model is then validated by comparison to data measured in an open field. The results are important for low frequency RF systems, such as those operating at short range in the AM broadcast band (525-1715 kHz). Finally, the paper establishes a novel fundamental limit for antenna gain versus size. [C1430]

"Exact and approximate underground wavefront shape determination from an above ground GPR source"

Waves radiated from a ground penetrating radar in air above soil refract at the planar ground surface, and change from a circular to a flattened shape resembling a hyperbola. It is useful to predict analytically the shape of this wavefront in the underground half space. The exact wavefront shape is derived, along with a hyperbolic approximation with specific parameters depending on the dielectric constant of the half space, ε' (= n2), the height of the source, h, and p, the propagation time from source to wavefront multiplied by the wave velocity in the half space. [C1431]

"Impact of supergain in multi-antenna systems"

Wireless systems using multiple antennas can theoretically use array supergain (Uzsoky, M. and Solymar, L., Acta Phys., vol.6, p.185-204, 1956) to exploit the propagation channel optimally. However, this effect has not been observed in traditional multiple-input multiple-output (MIMO) system analysis due to simplifications invoked during the problem formulation. The paper formulates MIMO system capacity when these simplifications are removed, and demonstrates how array supergain impacts the performance under this more complete representation. The framework also allows computation of the capacity when the supergain is constrained to lie below a desired level. Application of the framework to representative examples has quantified the impact of supergain on the achievable MIMO performance. [C1432]

"Array interaction with complex platforms"

The paper proposes an efficient and accurate approach for the high frequency analysis of the radiation from large irregularly contoured planar tapered phased arrays installed on complex platforms. The arrays are seen as the superimposition of parallel linear arrays. The radiation from each constitutive linear array is collectively described in terms of rays associated to conical Floquet waves, and spherical diffracted waves arising from the tips. The interaction of these relatively few rays with the complex environment can then be easily modelled by means of the geometrical theory of diffraction or physical optics. Numerical results are shown in order to demonstrate the effectiveness of the proposed approach. [C1433]

"Application of ray tracing accelerating techniques for the analysis of antennas on complex platforms modelled by NURBS"

A new 3D ray-tracing technique, based on the angular Z-buffer algorithm (McNamara, D.A.. et al., "Introduction to the Uniform Geometric Theory of Diffraction", Artech House, 1990) to speedup reflection calculations, is presented. The technique can be applied, amongst others, to the analysis of propagation in urban or indoor environments, or the radiation of antennas on complex board structures. The technique is used in combination with the uniform theory of diffraction (UTD) and shows a spectacular reduction in CPU-time. [C1434]

"A procedure for calculating the mutual impedance of antennas in a disturbed refracting medium"

Disturbances in the propagation medium can have a severe impact on the performance of a radio channel, and it is desirable to have techniques for calculating the magnitude of their effect. The paper develops a procedure for estimating the impact of disturbances upon the mutual impedance between the antennas of the channel. For the undisturbed medium, it is assumed that the length scales are large enough for a geometric optics approach to be valid. Disturbances, however, are allowed to have scales that are small enough for diffraction effects to be

important. [C1435]

"Dispersion in the enclosed-space radio channel: measurements and model"

Sensor and instrumentation networks operating inside aircraft wings, unmanned air vehicle (UAV) fuselage, small submarine craft and/or automobile engine compartments could be significantly enhanced or enabled by implementing radio communications within these spaces. However, these enclosures are highly reverberant, and radio channel dispersion has been shown to be considerable in an empty-enclosure configuration. In this work, further dispersion measurements incorporating environmentally realistic objects are presented. Results are introduced that allow the channel dispersion parameters to be represented by a single measured channel parameter, making. an important advance towards complete enclosed space channel dispersion predictions. [C1436]

"Wideband and MIMO measurements in wooded and open areas"

To demonstrate a real-time, mobile, peer to peer, ad-hoc networked MIMO system in a realistic tactical environment, the Defense Advanced Research Projects Agency has instituted a program called mobile network MIMO. The first stage of this program is to demonstrate such a system in a rural foliated environment using MIMO equipped nodes in an ad-hoc network. For any particular link, both nodes are naturally at ground level. Such node placement necessitates a channel measurement and modeling effort to determined parameters such as spatial correlation, delay spread and propagation loss. [C1437]

"Model-based investigation on MIMO channel capacity in main street of urban microcells"

We have studied the influence of environmental parameters and of antenna array height and inter-element spacing on MIMO channel capacity. Vertical polarization (VP) and horizontal polarization (HP) have been considered. In general, VP results in more MIMO channel capacity. The results could be useful in designing systems to provide high data. rate services. [C1438]

"Modeling and numerical analysis of the Earth-ionosphere waveguide using finite difference method"

The ionosphere, the region of the upper atmosphere, varies strongly with frequency; this provides some properties in the ionosphere region which make radiowave propagation more complicated. We propose a new method, based on phasors of the voltage, V, and on the solution of the Laplace equation, to compute the effective B in arbitrary points of space. This method is implemented easily and solved in different conditions. [C1439]

"Generalized curved Earth radar propagation"

An approach for calculating the propagation factor due to radar returns emanating from targets over a curved Earth is proposed. The multipath propagation factors due to interference and curved Earth diffraction are combined into a single response by recognizing the transition point for the infinite series applicable to each phenomenon. [C1440]

"Efficient calculation of field distribution with high-resolution using ray-tracing method"

A new method is proposed to calculate the field or power distribution in a rectangular region in wireless communication environments using the efficient ray-tracing algorithm developed by the authors. The region is divided into small cells according to the resolution requirement. Instead of checking all the cells for possible reception of the rays, we first check the interception of the ray with the rectangle. Then the cells hit by the ray can be determined and serve as the starting cells for a cell-scanning procedure that finds out all the cells illuminated by the ray tube. It is shown that the new method is very efficient [C1441]

"A physical scattering model for the ultra-wideband (UWB) propagation channel"

This paper presents a discrete scattering model for the ultra-wideband (UWB) propagation channel in dense multipath environments. A method is introduced whereby the complex and highly cluttered UWB propagation channel is replaced with a finite impulse response (FIR) filter. Subtractive deconvolution method is applied to obtain the filter parameters from channel transfer function measurement data. Channel transfer characteristics obtained from the discrete scattering model are then compared to the experimental data based on the UWB channel measurements [C1442]

"On-body propagation channel characterisation for UWB wireless body-centric networks"

The paper presents an experimental investigation of ultra-wideband (UWB) on-body propagation channels. Effects of different antennas on path loss and propagation delay parameters are also demonstrated. Results highlight the consequences of changes in body postures and positions on path loss and delay profile variations. The study also shows the important relation between on-body channels and antenna characteristics [C1443]

"Synoptic, mesoscale, and microscale influences on near surface radio frequency clear air propagation in the coastal atmosphere"

Near surface clear air radio frequency (RF) propagation in the coastal area is the result of air/sea/land interactions influenced primarily by the characteristics of the surface of the land and sea. Synoptic influences by large scale (approximately 300 km) meteorological features, such as cold fronts and high-pressure ridges, control wind direction and sources of water vapor. Mesoscale meteorological influences (approximately 50 km), such as sea breeze and convective precipitation, may rapidly change the propagation environment. Microscale meteorological structures (approximately 1 km), such as the atmospheric boundary layer, react to the larger synoptic and mesoscale features to create spatiotemporal refractivity fields. The paper presents the results of a three-year research effort that identifies the larger scale meteorological processes that impose non-standard propagation structures in the coastal marine atmospheric boundary layer. Highly resolved propagation and thermodynamic data from Wallops Island, Virginia, the California coast, and the Persian Gulf are combined with archived meteorological data in order to relate anomalous clear air propagation to universal weather map features. [C1444]

"Effect of line of sight propagation on capacity of an indoor MIMO system"

In this paper the performance of a multiple input multiple output (MIMO) wireless communication system operating in an indoor environment, featuring both line of sight (LOS) and non-line of sight (NLOS) signal propagation, is assessed. In the model the scattering objects are assumed to be uniformly distributed in an area surrounding the transmitting and receiving array antennas. Mutual coupling effects in the arrays are treated in an exact manner. However interactions with scattering objects are taken into account via a single bounce approach. Computer simulations are carried out for the system capacity for varying inter-element spacing in the receiving array for assumed values of LOS/NLOS power fraction and signal to noise ratio (SNR). [C1445]

"A SBR estimation for indoor wave propagation through dielectric walls"

For indoor multihop- or relaying-based wireless systems, it it is important to comprehend the complex propagation mechanisms, and, hence, a high speed propagation estimation method is required. Indoor electromagnetic wave propagation through dielectric walls is analyzed using a ray tracing method, which is based on a high frequency ray launching or SBR (shooting and bouncing ray) technique. In the previous SBR analysis for indoor environment with many walls (Sato, R. et al., 2005), three fundamental GO components, direct, reflected and transmitted rays, have been considered. However, the contribution of multiple reflections inside the walls has not been included in the study. To derive the multiple reflections representation analytically, the Green's function problem for a line source in the presence of a dielectric slab is considered, and the asymptotic Green's function representation for each ray is obtained using the collective ray approximation. Taking into account the derived complementary terms for the multiple reflections inside the slab, an accurate numerical result for a simple indoor model is obtained. In comparison with the FDTD result, the validity of the present SBR solution with multiple reflections is confirmed. [C1446]

"Modelling of directional spectra in vegetation media using RET theory"

This paper aims to model the directional spectra in vegetation media using the radiative energy transfer (RET) theory. A generic propagation model (N. C. Rogers, et al., May 2002), developed for the United Kingdom Radiocommunications Agency (formerly RA, now a subsidiary of OFCOM), concentrated on the results of previous work (R. Johnson, and F. Schwering, 1985) which suggested that there are several possible mechanisms of propagation associated with vegetation. Each component is modelled using simple methods, such that the final model can be easily implemented. The scattered component is modelled using the radiative energy transfer theory (RET), as this is a fully deterministic model which may be used by fitting the model input parameters to the specific measurement geometries and then expanded to provide results for more generic cases. This paper concentrates on improving the method of extracting the RET input parameters for the scattered component of the generic propagation model. An improved method to extract these input parameters is presented. The results obtained from measurements performed in a Southern European forest formed by Populus trees are used to assess the performance of the model [C1447]

"Spatial correlation for unmanned surface vehicles"

The paper considers multi-sensor communications between low profile boats, such as unmanned surface vehicles (USVs), in a rough sea environment. We derive the expression of spatial correlation coefficients between two antennas, which is important in designing the configuration of multi-sensor systems. It is assumed that the line-of-sight (LOS) is obstructed by high waves, and the channel distortions by diffraction as well as local scattering are take into account. [C1448]

"Low-angle reflectivity modeling of sea clutter using LS method"

Radar sea clutter (SC) reflectivity is important for predicting the performance of radar engaged against a low-angle target at sea. Existing techniques to resolve the reflectivity estimate are mainly based on radar clutter theory and the LS approximation method. A more practical reflectivity model for SC is presented through data (Nathanson, F.E. et al., "Radar design principles: signal processing and the environment", McGraw-Hill, 1991). Throughout the reflectivity modeling, the idea of inductive reasoning is used. By using it, the functional relations between radar parameters and radar surface clutter backscattering are analyzed. In calculating the unknown parameters in the presented models, simplification of limit conditions are used so properly that the LS method can be employed. From the comparisons analysis, we can obtain that, generally, the presented SC model approximates that of Nathanson et al. better than others. Considering the accuracy and complexity for a more complex prediction of radar performance, the presented SC reflectivity model is preferable. [C1449]

"Antenna/structure interaction computation by using fast multipole techniques"

The paper deals with a new approach to compute the interactions between an antenna and a surrounding structure. This method is divided into 2 steps: (1) the computation of the incident field from the antenna; (2) the computation of the scattered field. In the first step, the antenna is described by its radiation pattern (from measurement, for example) and its location point. We use a new method to perform a far field to near field transformation in order to compute the incident field on each point of the structure. In the second step, the current on the structure is computed by solving the electric field integral equation (EFIE) using a multilevel fast multipole method (FMM). [C1450]

"FDTD modeling of helicopter antenna pattern rotor modulation"

Rotor modulation is the periodic disruption of electromagnetic communication signals caused by the rotation of lift or thrust generating propellers on aircraft. Rotor modulation is predominantly associated with helicopters because their very large main rotor can cause intense modulation effects, and their comparatively small fuselages provide few antenna mounting locations at which rotor modulation can be avoided. Rotor modulation modeling, because of its complexity, has not received very much attention. We use the finite-difference time-domain (FDTD) method to model the radiation patterns of antennas mounted on helicopters, including the modulating effects due to the motion of the rotor blades. [C1451]

"Modeling of radiopaths for mobile communication systems in the presence of shading produced by forest"

The design procedure for of electromagnetic field strength behind the forest canopy layer for dual mechanism of wave propagation in case of radio transmitter installed at a big height is presented. A comparative analysis of contribution of diffraction and refraction electric field components forming the resultant field at a point of reception for vertical and horizontal polarizations is realized. Comparison of experimental and calculated results at 200 MHz frequency is executed [C1452]

"The electrodynamic analysis of modified pyramidal type radio absorber"

Presented in this paper are the results of numerical research of electromagnetic properties of pyramidal type radio-absorbers. Influence of modification of constructive and material absorber's parameters on their electromagnetic properties is investigated [C1453]

"Experimental evaluation scheme of UWB propagation channel with human body"

This paper presents the evaluation scheme to investigate the pulse distortion, propagation loss due to human body shadowing. The matched filter is employed at the UWB receiver to maximize the SNR. The propagation loss and matched filter gain of the passband rectangular pulse are simulated for comparing with the experiment results. The experimental channels are taken for several T-R separation distances in an indoor environment. The frequency responses of the radio channels are acquired by using a vector network analyzer (VNA) over the

frequency bandwidth of 3 GHz to 11 GHz. From the results, the distortion and the propagation loss of the UWB pulse increase as the T-R separation distance increases, especially when the fully shadowing is occurred. [C1454]

"Automatic cell site selection system of radio network"

A automatic cell site selection system of radio network is designed and performed to solve the problem of the limited serviced area of the base station. The design of control set for the base station allowed the base station set up at any area. Each station operates the same frequency of radio wave which can be propagated to overlap with in six stations. But they don't work with in the same time and the master control interfacing pass frequency through the transmission network. The control set automatically selects the clearest one of the sites by using the same frequency. One control expansion can be achieved by increasing the number of the control set for the base station. [C1455]

"Some features of the land mobile CDMA networks ecological safety"

This paper discusses the influence of system characteristics (traffic intensity, power adjustment, site size) networks of the radio communication using technology CDMA, on network ecological characteristics. [C1456]

"RF propagation characteristics of in-cabin CDMA mobile phone networks"

Towards the goal of evaluating compatibility between passenger transmitting portable electronic devices (T-PEDs) and potential interference victims, such as avionics receivers and terrestrial mobile phone networks, we conducted an investigation onboard a Boeing MD-90 aircraft using CDMA handsets. The objectives of these tests were: 1) to determine a multiple equipment factor (MEF) to create a simulated signal source with RF energy equivalent to multiple T-PEDs inside the cabin; 2) to verify the hypothesis that MEF can be determined analytically using an accurate path loss model and the spatial distribution of T-PEDs within the cabin; 3) to evaluate external RF signal leakage from in-cabin mobile networks to assess potential interference to terrestrial mobile phone networks; 4) to evaluate passenger effects on RF propagation within the aircraft cabin. The aircraft cabin was equipped with picocell equipment capable of supporting 100 simultaneous CDMA mobile phone calls. 100 commercial-grade CDMA handsets were distributed evenly throughout the cabin. All handsets were configured for one of two scenarios: 1) manual full-power operation (representing the worst case); or 2) power-controlled communication with the picocell, where the phone is dynamically commanded to transmit the minimum power necessary to maintain the digital link. In each of these configurations, received power was measured mid-aisle along the length of the cabin, as well as external to the aircraft to a range of 1 km. Major findings were: 1) At mid-aisle, typical MEF for 100 phones was 9 dB; 2) MEF was accurately predicted from a empirically-derived path loss model and the known distribution of devices within the cabin; 3) Compared to full-power operation, cumulative power from 100 phones was reduced by approximately 60 dB when in communication with an onboard picocell; 4) Under picocell control, cumulative signal power from 100 phones was not observable beyond approximately 200 meters from the aircraft; 5) A handset outside the aircraft was unable to acquire the picocell signal beyond approximately 500 meters; 6) Each passenger standing in the aisle produced 0.5 to 1.0 dB of additional path loss along the length of the cabin- . [C1457]

"System configuration for multiband MC-CDM systems"

{no data available} [C1458]

"The reculiarities of propagation of EMF-waves in alive biological objects"

The new sight at the mechanism of distant propagation of EMF-waves in alive biological objects has been developed. This mechanism is determined by arising of dynamics negative conduction of membrane of cell in the presence of transportation through it positive and negative ions K*, Na*, Cl-, NO3-, and brighten up of membrane at high frequency, and re-radiation the waves by the acoustic-electrical oscillations of membrane. [C1459]

"Modeling of EM waves for simplified cases of urban and terrain areas by method of auxiliary sources"

This article concerns some realistic scenarios for evaluation of the EM field and for better comprehension of its behavior indoors, outdoors and terrain areas having a place nearby of base stations [H. Lehmann et al., 2003]. Based on the method of auxiliary sources the new approaches are presented in case of problems with the electrically large objects using reasonable computational resources and keeping acceptable accuracy [R. Zaridze et al., January 2002]. Three general scenarios are marked. First, the finding of field distribution indoor, without

influence of outside objects. Second considers the field distribution near the wall with finite sizes when effect of ground is taken into account. Third is the finding of the field distribution near mountains or hills. These scenarios are an integral part of all cities and consequently are taken for consideration. Corresponding results are presented below. [C1460]

"Generalized Doppler power spectrum for 3D non-isotropic scattering environments"

This paper presents a novel generalized Doppler power spectrum. The expression is useful especially when the scattering propagation is three-dimensional and non-isotropically distributed, which is almost always the case in urban macrocell environments. The generalized Doppler power spectrum includes the well-known U-shaped power spectrum as a special case. This generalized expression helps further investigations on the characteristics of wireless channels. It also assists the research on mobility management for next generation networks. [C1461]

"Impact of multipath propagation on impulse radio UWB autocorrelation receivers"

The autocorrelation function of the channel's response to an ultra wideband (UWB) pulse determines the interframe-interference (IFI) in transmitted reference UWB systems employing autocorrelation receiver (AcR) front-ends. The statistical properties of this autocorrelation function were previously derived by the authors, i.e., expressions have been given for the mean and covariance of the correlator outputs in terms of channel parameters. In this paper, these previous results are validated by means of channel measurement data, which allows conclusions on the importance of the various components of a UWB channel model for an AcR in presence of inter-symbol-interference or multiple-access-interference. It is demonstrated that a model representing the received prototype pulse-shape, an exponentially decaying power delay profile plus a line-of-sight component, and a homogeneous ray arrival process can largely represent the impact of multipath propagation on the AcR. [C1462]

"A comparison between theoretical propagation models and measurement data to distinguish urban, suburban and open areas in Jodo Pessoa, Brazil"

The theoretical propagation models founded in literature are compared with measured data with the goal of characterizing areas in Joao Pessoa, Brazil. The complex behavior of the fading and multipath phenomena in mobile communication systems are generally simplified by mathematical models. The restrictions and simplifications over the probabilistic behavior of the signal impose limitations to the prediction models. In order to increase their analysis limitations, an accurate measurement procedure is done to detail the environment characteristics. This paper presents the accomplishment of measurement data using Agilent Technologies' E7474A Drive Test System in three specific areas of Joao Pessoa city (Brazil) and vicinity. The measured results compared with theoretical ones obtained from prediction models show us the best way to classify the above regions as urban, suburban or open areas. [C1463]

"Convergence analysis of integral equations for characterization of RF channels"

The main concern of the present work is to investigate the convergence of the electric and magnetic field integral equations (EFIE and MFIE) adopted in the characterization of radio wave propagation over irregular terrains. The terrain irregularities are smooth, such that back-scattering is neglected and a recursive technique is used to determine the equivalent currents. Due to the near-grazing incidence and the vertical polarization of the incident field, the terrain can be considered an open surface made of a perfect magnetic conductor. This approach leads toward an equivalent problem that, in principle, can not be solved by the EFIE, a fact apparently overlooked in the literature. This may explain why the MFIE provides accurate results with a smaller number of basis functions than the EFIE. [C1464]

"UWB measurements and propagation models for snowy environments"

In this paper, we present the results of the first ultra wideband (UWB) measurement campaign performed in the time domain in a snowy environment. For the purpose of addressing radiolocation and communication issues, measurements were realized with aerial RX and buried TX antennas. At first, the complete measurement set-up and the explored environments are described. Then, crude but realistic propagation models, relying on geometrical optics and further narrow-band approximations, are extended to the UWB context. This work principally concerns modelling the biases affecting the time-of-flight (TOF), and the attenuation suffered by UWB signals while propagating through the snow layer. The model parameters that were extracted from measurements prove to be in accordance with expected physical trends. These preliminary results could be advantageously taken into account in the design of future UWB systems capable of fusing communication and localization functionalities. The main application we identify is the rescue and monitoring of snow avalanche victims, based on low-cost, low data rate (LDR) UWB localizers operating below 1 GHz. [C1465]

"Mobile user localization in wireless sensor network using grey prediction method"

Knowing the position of mobile user is an important role for location services in the building. The characteristics of wireless sensor network are low power, low cost and low complexity. With these functions, wireless sensor network have great potential to develop indoor position system. However, radio signal propagation is easily affected by diffraction, reflections, and scattering of radio in the building, the received signal strength need good calibration method to improve the accuracy of position estimation system. In this paper we use grey prediction method in wireless sensor network and employ wireless LAN medium (Zigbee/802.15.4). The grey prediction is used to predict the tendency of RSSI (received signal strength indicator), and we also designed dynamic triangular (DTN) location method. We have done some experiments and compare with other classical location finding methods. The mean distant error of RSSI on mobile user can be within 2.3 m at offline stage. As a result, grey predication with DTN provides more accurate predicted position and carries out mean distance error within 1.3 m at run-time stage. [C1466]

"The effect of laptop computer shadowing on UWB propagation in an indoor environment"

This paper presented the effect of laptop computer shadowing on UWB propagation in an indoor environment. The frequency responses of the radio channel are acquired by using a vector network analyzer (VNA) over the frequency bandwidth of 3.1 GHz to 10.6 GHz. Consequently, the characteristics of the UWB channel including the transmitter/receiver antennas, the environment, and the laptop computer shadowing are investigated. As the results, the mean excess delay and the RMS delay spread increase, respectively, in the case of laptop computer. Moreover, the angular power loss is occurred when fully shadowing by the laptop computer. [C1467]

"Characterization of the ultra wideband body area propagation channel"

Using wireless sensors placed on a person to continuously monitor health information is a promising new application. In developing these sensors, detailed knowledge of the communication channel is essential. However, there are currently very few measurements describing propagation around the body. To address this problem, we have measured electromagnetic waves traveling near the torso to derive a simple pathless law. The pathless law is then extended to include the influence of arm movements and a surrounding office environment. This paper describes our measurement campaign and the basic characteristics of the body area radio channel. [C1468]

"Propagation effects in UWB body area networks"

Due to the ongoing miniaturization of electronic devices and due to a multitude of applications, wireless body area networks (WBANs) have gained much interest recently. Ultra wideband (UWB) communication is one promising transmission technology for WBANs due to reduced hardware complexity. To optimize receiver structures and antennas for UWB WBANs it is necessary to know the propagation mechanisms at the human body. In this paper, we focus on transmission at the head and consider direct transmission, surface waves, reflections, and diffraction as possible propagation mechanisms in the frequency range between 1.5-8 GHz. We show theoretically and by measurement results that the direct path is attenuated such that direct transmission through the head is negligible. Based on measurements we conclude by process of elimination that diffraction is the main propagation mechanism around the human body and that surface waves and reflections are negligible. Finally, we discuss the impact of the propagation mechanisms on the UWB WBAN communication system. [C1469]

"Ray simulations for evaluating different methods used to locate mobiles in cities"

Mobile location techniques for cellular environments are of current interest due to the great number of new value-added services that can be provided using location technology, as well as the Federal Communications Commission's (FCC) requirement that all cellular service providers must be able to determine the location of a 911 caller with a radius of 100 m, 67% of the time (Federal Communications Commission CC Docket No. 94102, July 1996). Current mobile location technologies, such as the Global Positioning System (GPS), angle of arrival (AOA), uplink-time difference of arrival (UTDOA), and enhanced observation timed difference (EOTD) have difficulties in urban environments. The signature method uses a predetermined reference table of path gains between each of many possible mobile locations and several surrounding base stations. The path gain signatures contain information of the shadowing of the signals by the buildings surrounding the mobile. To the extent that this shadowing is unique to each mobile location, the shadowing information can serve to locate the mobile. This paper compares the time difference of arrival (TDOA) method and the path gain signature method to locate mobiles in a large urban environment. [C1470]

"Electromagnetic propagation in urban areas"

Propagation in the urban environment is in principle a well-posed problem: the electromagnetic field radiated by prescribed sources, in the simplest case a single antenna, must fulfil Maxwell equations in the open space and boundary conditions over the built-up buildings walls. But any attempt to provide a solution to this apparently simple problem must face the complication of the scattering scenario. A general frame to locate above mentioned problem is certainly desirable, if not necessary. This point is examined in the paper. [C1471]

"A new three-dimensional vector parabolic equation approach for modeling radio wave propagation in tunnels"

A new three-dimensional (3D) vector parabolic equation method (PEM) is proposed to study the propagation of electromagnetic waves in tunnels, which is particularly useful for modeling wave propagation in tunnels with traffic obstructions. It allows full wave treatment of the 3D problem which is not possible by its scalar version. Vector fields are presented in terms of three unknown scalar functions which are coupled through boundary conditions on the tunnel walls and divergence-free condition of electromagnetic fields. Numerical results for empty and obstructed tunnels are presented. [C1472]

"On the constrained MMSE decision feedback equalization for MIMO wireless systems"

Constraints imposed on designing the decision feedback equalizers (DFE) are used effectively to mitigate propagation errors. In this paper, we introduce a novel design of the constrained minimum mean squared error (MMSE) DFE for a multi-input multi-output (MIMO) system under intersymbol interference (ISI) environment. The proposed design results in a significantly improved performance compared to the conventional MIMO MMSE-DFE, especially under the practical situation where the channel is not perfectly estimated and the channel coding is employed [C1473]

"Simulation of communications through a weakly ionized plasma for a re-entry vehicle at Mach 23.9"

A linear dispersive model has been added to a high-order CEM solver in order to simulate radiation through the shock layer plasma over a generic re-entry vehicle at high Mach number flight. The methodology adds a differential equation for the electron current to Maxwell's Equations. The simulation utilizes a 4th-order Runge-Kutta scheme for time and 6th-order compact-differences in space in order to minimize the number of grid points needed to solve the problem. The base electron distribution is determined by the simulation of non-equilibrium hypersonic viscous flow and is in turn used to model the plasma for the wave propagation problem. [C1474]

"Far field radiation from an arbitrarily oriented Hertzian dipole in an unbounded electrically gyrotropic medium"

The general solution to the problem of far field radiation from an arbitrarily oriented Hertzian dipole in an electrically gyrotropic medium such as magnetically biased cold plasma, is found using the dyadic Green's function for the gyrotropic medium which is expressed as a sum of two single dyads. The numerical results are given in different frequency bands using Clemmow-Mually-Allis (CMA) diagram. The analytical results and the numerical results are compared with the existing results. Good agreement is observed on all of them. [C1475]

"Circulant wired MIMO structures"

MIMO has developed increased spectral efficiency in wireless systems where there is rich multipath in the propagation channel. MIMO has also been applied to multi-conductor channels where the cross-talk between the individual conductors limits cable capacity. Here, the theoretical capacity of two structures is compared: completely random complex Gaussian (i.i.d.) and circulant (feasible for cables). The comparison is extended to a practicable capacity using QAM modulations. It is shown that for large SNRs, where there is enough power to use all the eigenchannels, circulant structures show higher capacity. For small SNRs, the water-filling eigenchannel cut-off feature means that the completely random channel case has the higher capacity. The more similar pdfs of the eigenvalues of the circulant is the mechanism for higher capacity for large SNRs. This is confirmed by the theorem of maximum capacity for the parallel channels [C1476]

"Diffraction of electromagnetic radiowaves on the cylinder of the limited size"

This work examines an algorithm of the approached intensity calculation of diffraction field from the cylinder of the limited size and the results of mathematical modelling on this algorithm. [C1477]

"Experimental study of meteorological parameters variation using HF-signal during solar proton events"

This paper presents the statistical studies of the signal level variation processes which give some information about meteorological processes in the troposphere. Refractive index, which plays a significant role in radiowave propagation relates to the main meteorological parameters such as temperature, pressure and vapor pressure. To solve this problem, an experimental radio link from the telecommunication satellite was constructed, where more than 20 flare events are analyzed. After three days the received signal return to the normal, nonflare state. This fading can be connected to the phenomena of the interference between few signals originating at different sources like tropospheric inhomogeneouses and the satellite. These inhomogeneouses are linked to small scale fluctuation of refractive index. When analyzing time delays between beginnings of the solar flare and the flare distribution is possible to assume that solar flare products influencing on tropospheric parameters may be ultraviolet or X-rays or high energy solar photons. The first two appear in the Earth's atmosphere in 8-9 minutes after the flare begins, whereas the latter appears near Earth's space in 1-2 hours after the solar flare beginning. So, the tropospheric inhomogeneouses linked to tropospheric inhomogeneities can play a significant role in UHF (ultra-high frequency) radiowaves propagation. Thus the experimental result concludes that tropospheric inhomogeneouses disappear from 48 to 72 hours after the beginning of the solar flare where the high energy solar proton density comes back to the previous level. [C1478]

"On the reconstruction of the refractive index structural characteristic profile"

The statistical propagation inverse problem or problem of the reconstruction of refractive structural characteristic profile of stochastically inhomogeneous troposphere have vital importance for diagnosing transgorizon radio-wave propagation conditions. This problem may be solved by means of transversal spatial correlation function of amplitude fluctuations. The present work contains description reconstruction algorithm of the refractive index structural characteristics profile by transversal spatial correlation function of amplitude fluctuations to a case of spherical wave propagation and weak smooth fluctuations. The main result of the work is the creation of the program of the numerical solution of a propagation inverse problem for the spherical radio-wave in the stochastically inhomogeneous troposphere. [C1479]

"Iterative DCT algorithm for digital elevation model reconstruction from isogram maps"

The problems of digital elevation model (DEM) reconstruction from isogram maps and the arising problems are considered. An iterative algorithm based on discrete cosine transform with taking into account several nonlinear constraints is proposed. The algorithm efficiency and accuracy analysis for test and real data are performed and compared to Delaunay triangulation based method. The advantages of the proposed technique are shown. [C1480]

"Impact of multipath angular distribution on performance of MIMO systems"

The objective of this paper is to analyze the impact of multipath angular distribution on the channel correlation and performance of MIMO systems. A full breadth of AOA models is used in this study, and they cover most scattering scenarios of the physical propagation channel. Closed-form expressions for parameters and corresponding correlation of these AOA models are derived. A simulation model was developed and extensive Monte Carlo simulations were performed to obtain the MIMO channel capacity, correlation, and diversity gain for various scenarios. Two major results are (i) the distribution shape has minor impact on the correlation, capacity and diversity gain; the major impact is due to the angular spread; (ii) the continuous and impulsive distribution have dramatically different impacts on the correlation, capacity and diversity gain. [C1481]

"A graphical method for the estimation of radiation hazards from a crowded multiple antenna site"

The major objective of the design of safe crowded transmitting antenna sites is not only to determine a safe zone around each individual antenna, but also to establish safety areas, both at the antenna site itself and at neighboring areas. The requirement is to ascertain the safety regions by considering the following parameters at each test point (TP) (or area segment): the contribution of N colocated radiating antennas to the total radiation incident at the TP; the radiation pattern of each antenna; the near/far field region of each antenna; most importantly, the different permissible exposure limits (PELs) associated with each operating frequency at the antenna site. Implementation of all the above-mentioned aspects in a suitable computer requires resources that only expert knowledgeable organizations possess. The graphically aided tool presented facilitates the calculation of a "safety zone" for RADHAZ around a crowded antenna site from the knowledge of the "safety ranges" which correspond to the individual transmitting antennas comprising it. [C1482]

"Global geolocation of intense lightning strokes associated with TLEs based on ELF measurements from single-station"

A new, improved algorithm has been developed to geolocate intense lightning strokes around the globe. In the ELF (extremely low frequency) range, radio waves from lightning propagate in the Earth-ionosphere cavity and quasi-TEM is effectively the only radiated mode. The spectra depend on the distance between the source (lightning) and the observer. Based on theoretically predicted spectra, a numerical data base was established to compare with our experimental data. The algorithm allowed us to determine SOD (source-observer distance) with high resolution (50 km) while the source bearing was determined through a Lissajous figure for the magnetic field and Poynting vector components using a least-squares fitting method. The algorithm and ELF electromagnetic data from other groups allowed us to geolocate lightning strokes associated with TLEs (transient luminous events) which were observed from the Columbia space shuttle during MEIDEX with the first Israeli astronaut, Ilan Ramon, aboard. [C1483]

"The estimation of error in selection of orthogonal basis used for elliptical coefficient measurement"

The analysis of sensitivity coefficients to the errors in the measurement of ellipticity coefficients in the devices which decompose electromagnetic wave in linear as well as in circular polarization basis is provided in the present article. The original ratios, which characterize sensitivity coefficient to changing of Δr, Δm, Δy, $\Delta \psi$ in the linear basis and Δr in the circular polarisation basis, have been obtained. [C1484]

"Capacity scaling in wireless ad-hoc networks with Pe"

This paper describes the capacity scaling in wireless ad-hoc networks with probability error. A Rayleigh fading environment with rich scattering with a standard model of wave propagation in space is presented. The performance achieved with a decentralized implementation at the receiver clusters by using repetition coding in joint detection, thus forms a distributed MIMO architecture. [C1485]

"A Jakes' channel simulation based on 2-dimensional channel model"

A Gaussian random process with a given power spectral density (PSD) function can be modeled as a sum of sinusoids (SOS), and has been widely used to simulate Rayleigh-fading communication channels. In practice, a finite number of sinusoids can be used to approximate a Gaussian process, which reduces complexity. For this reason, the method of sum of sinusoids (SOS) to simulate fading channels has been extensively investigated. M. Patzцld et al. (see IEEE Trans. Veh. Technol., vol.45, p.318-31, 1996) studied the method of SOS in more detail and developed several approaches to determining the sinusoidal frequencies. The very popular Jakes' channel simulation model calculates the frequencies of the sinusoids based on a physical channel model with uniformly distributed scatterers around a circle. The conventional one-dimensional (1D) channel model cannot capture the spatial correlation of shadowing processes. We develop a two-dimensional (2D) SOS-based channel model to simulate the shadowing process. [C1486]

"Interferometric method for image formation: investigation of potentialities by means of computer simulation"

Shortening of the wavelength in radioastronomy eventually should result in application of image formation methods characteristic for optics. It is justified and even it is desirable already in mm and the more so in submm a range. Thus, as always, one of the main tasks is the increase of resolution of astronomical instruments. As it is known, the key resolution limit of an astronomical instrument is determined by diffraction of the incoming wave on the instrument aperture. However, at observation from the Earth surface in a short-wave side of a wave band, it is seldom possible to achieve this limit because of the phase contortions arising at propagation of a wave in the Earth atmosphere from the fluctuations of the refraction index. There is a series of ideas how to form an astronomical image decreasing or excluding influence of phase distortions during observation One of such methods is the interferometric imaging method. The point of this method is that an image is not formed directly in the telescope focal plane, as it is done at the traditional method. Instead of this the interferometer entrance aperture is divided into sub-apertures. Image reconstruction from an interferogram obtained requires removing unknown phase distortions from several independent measurements of the coherence function by different pairs of sub-apertures and find true values of the Fourier-components of the object brightness. Thereto it is necessary to solve the algebraic system of equations connecting the results of measurements of the coherence function phases with their true values and phase distortions in the atmosphere. This idea is verified well using a computer model of the optical system, when the brightness distribution over the object is known exactly and may be compared with the image reconstructed. [C1487]

"Channel estimation for OFDM system with fast fading channels"

An adaptive pilot insertion based frequency-domain channel estimation and equalization technique is proposed for OFDM systems with fast fading channels. The proposed method, in addition to the conventional method which averages and updates the estimated propagation characteristics on each channel, detects subchannels that are momentarily distorted by noise and intercarrier interference (ICI) over fast fading frequency-selective channels, or by the sudden intercept owing to shadowing effects. The information of the detected subchannels is used to decide whether or not to insert new pilots in the corresponding subchannels. Then we obtain the LS equalizer, and get the MMSE solution. Through simulation, we optimize the coefficients λ, α and β. The simulation results demonstrate that the method is effective for OFDM systems with fast fading channels. [C1488]

"The influence of HEMT nonlinear distributed modeling on transient performance of microwave circuits"

This paper presents the impact of electromagnetic wave propagation on HEMT device electrodes in transient response. The proposed model is used in analysis and simulation of a MMIC compatible, Ka band power amplifier. Final results are the comparison between the simulation results in semi-distributed and lumped models, respectively. [C1489]

"Discrete propagation model for mobile communications in urban environment"

The need for wireless communication data has increased considerably in past decades. In this paper we have introduced new propagation model for the streets and avenues in urban areas that can be thought as a waveguide for EM-waves. Using our developed model it is possible to calculate the contributions of each direct and scattered wave separately. We don't assume the sidewalls as perfect conducting materials in our developed model unlike the previous studies. Our simulations revealed that developed model is applicable for broadband of frequencies. If the shape of the wave-guide is entered to simulation program in great detail, the output can be very close to results that are obtained by measurements. Even the shape is not entered very accurately; an approximate result can be obtained if the fast result is needed. [C1490]

"Use of wire-grid method to evaluate the effect of finite metallic plane of OATS on NSA in LF (30-100 MHz) region"

A wire grid model is proposed to discuss the normalized site attenuation (NSA) associated with an open area test site (OATS) with finite metallic ground plane. The NSA values for three different OATS sites around Taiwan, based on the wire grid model and measurement, are carefully examined. The agreement between the calculated and measured results supports the usefulness of the proposed wire grid model. The wire grid model is then adopted to analyze the deviation in NSA values for the LF (30-100 MHz) region. [C1491]

"Blind Hammerstein decision feedback equalizer (BHDFE) as a new blind equalizer"

Intersymbol interference (ISI) of the radio propagation through multipath fading channels is a major factor that limits the performance of mobile communication systems. Blind decision feedback equalization (DFE) is one of major methods for channel equalization. We propose a new method, based on a Hammerstein filter instead of DFE filters, for enhancing the performance of DFE, hence, blind HDFE. In this paper, we show the bit error rate (BER) performance of blind DFE and blind HDFE, in order to prove the superiority of BHDFE. [C1492]

"Implementation and field test of a new channel estimation technique for DVB-T system"

The European standard for digital terrestrial transmission, DVB-T, has been designed for fixed, portable and mobile reception. This versatility is due in part to coded orthogonal frequency division multiplexing (COFDM). OFDM can provide large data rates with sufficient robustness to radio channel impairments. During the deployment of terrestrial DTV broadcasting systems, very often the channel characteristics have to be captured for DTV coverage studies, reception problem diagnosis and service planning. The software implementation of a new channel characterization technique using a frequency domain pilot time domain correlation (FPTC) method for DVB-T systems is presented. This technique exploits the pilot sequence embedded in the DVB-T signal, which is derived from the frequency domain pilots and known to the receiver. The major advantages of this proposal, compared to other DTV channel characterization techniques, are its wide amplitude dynamic range, robustness to frequency synchronization errors, and avoidance of interruptions to the broadcasting service. [C1493]

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{no data available} [C1494]

"Nonlinear prediction of mobile-radio fading channel using recurrent least squares support vector machines and embedding phase space"

Prediction of the rapidly fading mobile-radio channel enables a number of capacity improving techniques, such as fast resource allocation or fast adaptive modulation. We construct an embedding phase space which includes more system information than the scalar time series; then we use a new nonlinear regression method, recurrent least squares support vector machines (RLS-SVM), to resolve the prediction problem. A performance evaluation of the prediction algorithm is carried out with various SNR values on Rayleigh fading channels. The simulation results show that the proposed algorithm is a good method for long range prediction of the fading channel. [C1495]

"Statistical modeling of fading channel statistics based on SIRP and H-functions"

For wireless communication, fading is the dominant factor that reduces the performance of the system. Under various outdoor/indoor fading scenarios, statistical modeling of envelope distributions, such as Rayleigh, Rician, exponential, Nakagami-m, Weibull, lognormal, etc., have been proposed. We show that spherically-invariant random processes (SIRP), Mellin transform, and Fox H-functions, can be used to model these fading statistics. This approach can be used to obtain various explicit performances of fading communication systems. [C1496]

"New angle-of-arrival measurement technique for over ocean propagation studies"

Radio propagation experiments are a useful tool when verifying propagation models and identifying anomalies in a practical link. This paper describes a new method to measure the angle-of-arrival (AoA) of a radio signal for terrestrial propagation studies. The new technique allows the phase of radio signals received by incoherent detectors arranged in an array formation to be obtained. This measurement, along with the amplitude readings at each element of the array can then be processed to find the AoA of signals on the array. The proposed technique is novel in that frequency drift and offsets, arising because the different receivers are incoherent, are compensated for by way of a common reference signal injected into the front of the array. The phase of the incoming signals are obtained by processing the down-converted and digitized waveforms. A novel approach based on an adaptive, discrete-time quadrature delay estimator (QDE) algorithm is used for this purpose. This algorithm is insensitive to variations in the amplitudes of the input signals, and does not require an accurate prior estimate of the frequency of the input sinusoids. This approach is shown to be an accurate, low cost alternative to conventional vector measurement techniques when used with large antenna arrays and is therefore well suited to fixed link, angle-of-arrival measurements [C1497]

"Propagation in a ferrite cylindrical waveguide magnetized by a two four-pole magnetic fields"

The normal modes of a transversely magnetized ferrite cylindrical waveguide are found using a coupled mode approach. The bias yoke generates an electrically rotatable four-pole transverse magnetic field in the ferrite producing birefringence phase shift. The changes of polarization state of the electromagnetic wave at the output of the guide sections of different lengths are investigated and applied to develop a rotatable half-plate section useful for phase shifter design. [C1498]

"Wave propagation in random urban areas based on percolation paradigm"

A computer model of wave propagation in random two-dimensional urban areas using the high-frequency ray-tracing method is presented. The randomness of the approach is realised by introducing a percolation model of the environment and model of ray arrivals based on the nonuniform Poisson distribution function. Computer simulation enables us to assign an approximate formula for magnitude of electric-field strength, which can be treated as an envelope of radio channel pulse response. [C1499]

"Modeling of indoor positioning systems based on location fingerprinting"

In previous years, positioning systems for indoor areas using the existing wireless local area network infrastructure have been suggested. Such systems make use of location fingerprinting rather than time or direction of arrival techniques for determining the location of mobile stations. While experimental results related to such positioning systems have been presented, there is a lack of analytical models that can be used as a framework for designing and deploying the positioning systems. In this paper, we present an analytical model for analyzing such positioning systems. We develop the framework for analyzing a simple positioning system that employs the Euclidean distance between a sample signal vector and the location fingerprints of an area stored in a database. We analyze the effect of the number of access points that are visible and radio propagation

parameters on the performance of the positioning system and provide some preliminary guidelines on its design. [C1500]

"Experimental and analytical investigation of MIMO channel capacity in an indoor line-of-sight (LOS) environment"

The paper present the results of a multiple-input multiple-output (MIMO) channel capacity measurement experiment conducted in an indoor line-of-sight (LOS) office environment. Channel responses were taken systematically with varying distance in a static indoor environment. Results showed measurements with high received signal-to-noise ratio (SNR) and a high level of correlation among the antenna elements. Further analysis of the results showed that MIMO systems can be efficient in the indoor LOS office environment, despite the high antenna correlation. Theoretical analysis reveals that when the SNR is sufficiently high, the loss in channel capacity due to high correlation is relatively low. Therefore, it is shown that in the indoor LOS environment, MIMO systems can be achieve sufficiently high channel capacity because the MIMO channel is more robust to correlation when the SNR is high. [C1501]

"Ultra wideband radio propagation in body area network scenarios"

This work presents novel, very-short range UWB radio channel investigations performed in typical body area network (BAN) scenarios using small size, low profile terminal antennas. A novel RF fiber optic connection has been employed for the small antenna set-up in order to maximize the accuracy of the measurements. Several test users have been investigated and significant changes of the UWB antenna radiation characteristics when close to the human body were disclosed using numerical simulations. The measurements with different UWB device positions on the human body showed drastic changes in the calculated radio channel parameters (frequency and time-delay domain) not only due to the body area but also due to the total propagation environment. [C1502]

"Performance of three, six, nine and twelve sector sites in CDMA-based on measurements"

We investigate the performance improvement achieved by increasing the number of sectors on a W-CDMA or cdma2000 site by increasing the number of sectors from today's typical three to six, nine or twelve. The radio propagation environment determines if the narrow beams can be created and kept separated or if they blur together, which in turn determines the sector-to-sector isolation and the soft-handoff populations. The rate of change in signal strength of the beams also determines whether the handover mechanisms are sufficiently fast to allocate the correct beam. We analyze these issues based on simultaneous measurements of two antenna panels placed on the top of a building overlooking a typical European urban environment of mostly six to eight storeys-high buildings. Based on these measurements and simulations we find that a nine-sector site has more than double the capacity of a conventional three-sector site. [C1503]

"Simulation and measurement of 24 GHz Short Range Radar (SRR) Interference"

The automotive industry is currently considering the introduction of Short Range Radars operating near 24 GHz for improving road traffic safety. Short Range Radars are intended to observe the full azimuthal space cover around a vehicle using up to eight sensors. The sensors would operate in an ultra wideband (UWB) mode, occupying 3 to 5 GHz of bandwidth. Interference from SRR transmitters with passive microwave remote sensing satellites could occur as the result of several coupling mechanisms, including direct coupling via the transmit antenna beam and scattering and diffraction of the transmitted signals from leading vehicles, buildings, and other nearby objects. In this study, we estimate the amount of coupling anticipated to occur from SRRs, including the direct and scattered contributions. The calculations are based on bistatic scattering measurements at of a typical automobile and ray optical simulations of reflection and propagation in an urban environment. [C1504]

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{no data available} [C1505]

"Modeling and analysis of a cellular MC-CDMA downlink system"

The concept of a multi-cell environment for an MC-CDMA downlink scenario is presented; it is based on a propagation model taking into account path loss and shadowing. The interference of adjacent cells is studied and the Gaussian approximation (GA) is investigated for simplifying the interference simulation. The major influence of the interfering cells is restricted to the peripheral area of the desired cell. In particular, it is shown, by simulations, that the GA for the impinged interference signals is an appropriate assumption. This drastically

decreases the simulation complexity for a high number of interfering cells, e.g., one or two tiers around the desired cell. [C1506]

"Path-loss exponents of ultra wideband signals in line-of-sight environments"

The paper proposes a new ultra wideband (UWB) line-of-sight path loss formula based on the narrowband two-path (direct and ground reflected waves) model, taking into account the bandwidth of signals. The following results were derived from numerical calculations: (1) UWB signals suffer less interference fading than narrowband signals; (2) UWB path loss exponents change approximately to 2 to 4 around the breakpoint; (3) the breakpoint distance depends on the transmitting and receiving antenna heights, the lowest frequency, and the bandwidth of the signal. Indoor experimental results verified the validity of this new formula. [C1507]

"The effect of mobile station rotation on a correlation model for microcellular environments"

This paper studies the effect of rotation of a mobile station (MS) on the cross-correlation function (CCF) derived for a microcellular isotropic wave propagation environment with enough number of scatterers. The statistical model characterizes the propagation media when the MS rotates with a constant angular velocity around an axis perpendicular to the azimuthal plane, and moves with a constant velocity on the azimuthal plane in an arbitrary direction. The moving MS, with a constant speed, produces the conventional linear Doppler while the rotating MS introduces angular Doppler. The research shows that the rotation of the MS results in a non-stationary random process as the CCF. The only exception in which the result follows a stationary function is a narrow-band communication system, when either the MS angular velocity or the MS speed is zero. [C1508]

"Empirical eigenanalysis of indoor UWB propagation channels"

The paper aims at characterizing the second order statistics of indoor ultra-wideband (UWB) channels using channel sounding techniques. We present measurement results for different scenarios conducted in a laboratory setting at Institut Eurecom. These are based on a eigendecomposition of the channel autocovariance matrix, which allows for determining the growth in the number of significant degrees of freedom of the channel process as a function of the signaling bandwidth as well as the statistical correlation between different propagation paths. We show empirical eigenvalue distributions as a function of the signal bandwidth for both line-of-sight and non line-of-sight situations. Furthermore, we give examples where paths from different propagation clusters (possibly arising from reflection or diffraction) show strong statistical dependence. [C1509]

"Estimating signal strength coverage for a wireless access point"

Estimating the signal strength coverage of a wireless access point (AP), given its desired location at a site, is essential in many instances, e.g., to determine optimal AP placement. In this paper, we present a new non-parametric modeling solution, based on sampling, for this problem. We use sample measurements from several fixed APs in a novel way to compute a signal coverage model for an AP at a random location. Our technique automatically takes into account the signal strength propagation characteristics of the site and also allows for an efficient deployment methodology. We present an experimental study that validates the practical usability of the proposed technique. [C1510]

"EM algorithm-based estimation of amplitude, carrier phase and noise variance in multiuser turbo receivers"

The current paper addresses the issue of estimating the users received carrier phase offsets and received amplitudes as well as the noise variance in an asynchronous DS-CDMA environment with frequency nonselective propagation channels. The user propagation delays are assumed to be known or estimated beforehand. The proposed synchronizer is based on the expectation-maximization (EM) algorithm and takes benefit from the soft information delivered by the receiver which is of turbo type. Besides, this paper explains which training symbols should be preferably chosen to initialize this synchronizer. It also compares two methods for combining the training-based estimate and the EM estimate. Performance of the resulting synchronizer is illustrated by simulation results. [C1511]

"A modelling approach for multiuser MIMO systems including spatially-colored interference [Ccellular example]"

This paper deals with the investigation of MIMO (multiple input multiple output) systems on a system level, including interference. The interference affects the capacity of each user and depends on the spatial characteristics of the propagation channel. It is spatially-colored. A necessary step towards a realistic performance evaluation is to include interference into the channel modelling process. A new multiuser double-

directional channel model (MDDCM), that enables a correct interference description, is presented in this paper. It is based on a distributed scatterer approach and includes line-of-sight areas, far clusters and new models for street guided and over-rooftop propagation. Simulation results of a cellular multiuser MIMO system for the downlink case, based on the MDDCM, are presented. With this tool, it becomes possible to evaluate the performance of multiuser MIMO systems under realistic propagation and interference conditions. [C1512]

"Throughput analysis of an extended service set in IEEE 802.11"

We present a method to determine the throughput of an extended service set in an IEEE 802.11 network. The method combines two tools. The first tool takes the location of access points and a floor plan and uses an RF propagation model to predict the spatial distribution of SNR and interference that mobile stations will experience. The second tool takes the SNR of mobile stations and predicts system throughput, based on an analytical Markov chain model. The method can help to intelligently plan WLAN deployment. [C1513]

"Angular and frequency correlation for sea-ice thickness retrieval"

A combined spatial and frequency domain interferometer or angular and frequency correlation (ACF/FCF) between two radar beams in the VHF-band is applied for the direct measurement of sea-ice thickness. This measurement is critical because the thickness of sea ice within the polar region indicates the state of ocean circulation and the associated air-sea heat exchange, which profoundly affects the global heat balance and ocean thermohaline circulation. This new instrument technology-cryospheric advanced sensor (CAS)-can measure sea-ice thickness, tilling a critical gap in measuring the polar region. In this paper, we present the algorithm development and demonstration by simulations of estimating the height of the sea-ice that led to the robust design of CAS interferometric system. Sea-ice thickness is derived from the interferometric phase of the ACF/FCF function of two VHF-band-scattered returns of two radar waves that have different frequencies, incident angles, and observation angles. The inversion calculation to estimate the ice thickness is based on several methods, gradient-descent (GD). least-square (LSQ) method, and genetic algorithm (GA). Compared with a GD method, and LSQ method, GA does not require the knowledge of the derivative of the ACF/FCF function. Good agreement is shown with GD and LSQ results, when a single unknown variable-sea-ice thickness-is to be determined. To support the inversion calculations and analysis, we developed an analytical model. The analytical model used to formulate the ACF/FCF function depends on the age of the ice being measured. The analytical model for first-year ice is based on the small perturbation method (presented here) and, for multiyear ice, the Kirchhoff approximation (presented in accompanying paper by the authors). [C1514]

"Multienvironment radio predictions involving an in-building WLAN network and outdoor UMTS base stations"

Siradel takes part in a French research project (RNRT) named Rhodes that has been initialised in 2003 to experiment a joint deployment of a UMTS/TDD and WLAN network. Siradel coordinates the workpackage dealing with the multisystem (WLAN, UMTS) radio planning. Thus radio propagation prediction tools have been designed in the frame of that project to deal with complex multienvironments (indoor, outdoor, mountainous). The presented propagation modelling is used to simulate the coverage of the hybrid network and determine the cell boundaries. The paper presents the distinct solutions to predict the propagation either from outdoor UMTS base stations or from in-building WLAN transmitters. The focus is set on the terrain representation of both environments. The outdoor map data and the 3D building model have to be perfectly adjusted in a common coordinate system. This is indeed a key feature to achieve a full analysis of the hybrid network. A measurement campaign has been realised to calibrate and validate the propagation prediction tools. The synthesised results are presented here. [C1515]

"A discrete model for radiowave scattering in vegetation screens at millimetric wave frequencies"

A method based on the radiative energy transfer theory (RET) to estimate the scattered signals from isolated groups of trees is presented. The proposed method consists of measuring the reradiation function of each tree in the group and subsequently uses these in a discrete algorithm to estimate the overall reradiation at any location within a forest scenario. The estimated scattering is compared with measurements performed inside an anechoic chamber on two tree species at 20 and 62.4 GHz. [C1516]

"The impact of highly reflective ceilings on wireless systems in occupied open plan offices"

Improving the reliability and coverage of indoor wireless systems is an important design goal. A highly reflective ceiling creates an elevated image of the access point, which delivers a strong and reliable multipath component to the mobile terminal. Measurement results show that a small area of metallic ceiling above the transmitter can provide significant enhancement to the received signal power across a large room. Experiments with human

bodies obstructing the line-of-sight path were performed to further examine the effectiveness of such an architectural modification. The improvement can be as high as 6.5 dB in cases where the line-of-sight path is obstructed by a human body. Moreover, the effectiveness of the metallic ceiling does not diminish with the distance from the transmitter. A comparison of measured and simulated results shows that ray tracing simulation can adequately approximate the results observed by measurement at 5.8 GHz. [C1517]

"Passive radiolocation of the meteor trails"

In This work a brief description of the practical and scientific problems connected to research of meteoric phenomena is given. The capabilities of a passive radiolocation method, which make use of television and broadcast station signals, are considered. To provide maximum spatial coverage the antenna beam of broadcast station is directed horizontally. For research purposes this beam configuration is also the most effective, because some part of the energy, passing close to horizon, is getting reflected from meteor trails. [C1518]

"The impact of wireless radio fluctuations on ad hoc network performance"

The degree of dynamics with respect to changes of the network's topology strongly affect the performance of a wireless mobile ad hoc network. Main reasons for topological changes are (i) node mobility and (ii) wireless radio fluctuations, e.g., due to fading effects. The impact of node mobility on ad hoc network performance has already been studied intensively. However these studies usually do not consider temporal fluctuations of the wireless channel. We quantitatively study the impact of radio fluctuations on the performance of wireless ad hoc networks. Based on field trial measurements of IEEE 802.11b wireless LAN communication in a static line-of-sight scenario, we derive a basic model for non-deterministic, but temporally dependent, received signal power variations. According to the derived model, we quantify the impact of radio fluctuations on topological change rate (TCR) and link stability as relevant ad hoc network performance metrics via simulation. The effects of pure node mobility and the effects of signal strength fluctuations, as well as the combination of node mobility and fluctuations, are studied. We demonstrate that signal strength fluctuations have a significant impact on ad hoc network performance metrics sometimes 'outperforming' the impact of node mobility. Thus, non-deterministic radio fluctuations cannot be ignored when designing robust ad hoc network protocols based on ad hoc network simulation and analysis. [C1519]

"Modeling the radio frequency environment of Mars for future wireless, networked rovers and sensor Webs"

NASA's long-term goals for the exploration of Mars include the use of rovers and sensors, which intercommunicate through proximity wireless networks. The performance of any such wireless network depends fundamentally on the radio frequency (RF) environment. This paper presents our initial results concerning modeling the RF environment on Mars in support of determining the characteristics of potential in-situ networks. In this work, we have utilized commercial RF propagation modeling software, designed for cellular telephone system planning, together with recent topographic data for Mars to deterministically construct propagation path loss models. The software takes into account antenna heights and types, radiated power, topographic information, image data, and surface features and clutter. As we show, the resulting models provide a powerful tool for determining potential coverage patterns and data rates for mission planners. [C1520]

"System-level benefit of combined power control and multiuser detection for CDMA uplink over a frequency selective channel"

This paper analyzes the benefit of power control and multiuser linear detection for CDMA uplink transmissions. Several papers have recently shown a benefit for such an approach in the case of synchronous uplink transmissions without multipath propagation. We study the impact of a multipath channel on the system level performance. ZF and MMSE multiuser block linear receivers are considered for various scenarios to compare them and to analyze the influence of multipath propagation and of out-cell interference. The results are compared to the performance obtained with a RAKE receiver. [C1521]

"On the generation of correlated Rayleigh envelopes for representing the variant behavior of the indoor radio propagation channel"

A simple method for generating correlated Rayleigh-fading envelopes with any desired correlation factor is proposed. In addition, based on this method, an impulse response model of the indoor radio channel with a process of apparition and vanishing of correlated rays for representing the variable nature of the channel is developed. This channel model can be employed to analyze the performance of wideband wireless communications systems, such as current and next generation wireless local area networks (WLANs), and the

procedure for the generation of correlated Rayleigh envelopes can be used to analyze frequency, space and time diversity systems with any given correlation factor. [C1522]

"Numerical analysis method for wireless channel of MIMO system"

A numerical analysis method for the wireless channel of the multiple-input multiple-output (MIMO) system is proposed. This method is a hybrid of the finite difference time domain (FDTD) method and the method of moment (MoM), and is capable of analyzing the MIMO system including the propagation channels consisting of scatterers with arbitrary location and structure, and the transmitting and receiving antennas with arbitrary geometry. Bit error rate (BER) and channel capacities of the MIMO systems are calculated and shown by changing the received SNR, the number of antenna elements, the array spacing and the scatterers located in the propagation channel. [C1523]

"Stochastic modeling of time series radar interferometry"

Quality description and evaluation of InSAR results is hampered by the fact that the model to derive parameters from the observations is usually underdetermined. Only using strong, often rather qualitative, assumptions it is possible to reach unique solutions. One of the most prominent assumptions is that phase ambiguity resolution can be treated as a deterministic problem. In this study, a model formulation is presented that captures the majority of the assumptions in a mathematical sense, allowing for adjustment, testing procedures and formal error propagation. The influence of stochastic ambiguity resolution to the probability distribution of the estimated parameters is shown. [C1524]

"W-CDMA uplink capacity and interference statistics of a long tunnel cigar-shaped microcells (underground train case)"

The capacity and the interference statistics of the sectors of the cigar-shaped W-CDMA microcell are studied. A model of multimicrocells is used to analyze the uplink when the users are within an under-ground train. The microcells are assumed to exist in a long under-ground tunnel. The capacity and the interference statistics of the microcells are studied for different propagation exponent, different antenna side lobe levels and different bends loss. The capacity for the best case and worst case are given. [C1525]

"End to end performances of a short baseline interferometric radar altimeter for ocean mesoscale topography"

The swath radar altimeter concept has been revisited-in the framework of an ESA study-with the objective of defining an optimal functioning point with respect to mission performance while keeping the instrument complexity as low as possible. We show that a swath altimeter concept, with a shorter interferometric baseline than WSOA and moderate power can meet the requirements of mesoscale topography mapping. The paper presents a complete sea surface height (SSH) error budget for the mission [C1526]

"Capacity estimation of polarization-diversity MIMO systems in urban microcellular environments"

MIMO systems based on dual-polarized antennas at transmitter and receiver constitute an interesting alternative to conventional MIMO configurations. This paper analyzes the ergodic capacity of such systems in urban micro- and pico-cellular environments. The MIMO channel is modeled by using a site-specific ray-tracing propagation tool. This technique permits to analyze the impact of environmental parameters, like antennas location and orientation, on the system performance. Ergodic capacity estimations in a specific urban environment are presented. [C1527]

"Long distance path-loss estimation for wave propagation through a forested environment"

Accurate modeling of wave propagation behavior through forested environments is of great interest for civilian and military communication applications. Existing foliage propagation models treat the forest as an effective lossy dielectric medium and predict an exponential increase of path-loss with respect to the propagation distance within the forest. Such a model captures only the coherent power of the signal and neglects the incoherent power from the field fluctuation due to the random distribution of scatterers, such as brranches and leaves, within th forest. For long distance communication, such incoherent power tends to dominate the overall received power after a certain distance. Experimental results show that the simple models grossly overestimate the path-loss. A new Statistical WAve Propagation (SWAP) model, based on coherent wave theory and a renormalization approach, is presented and is shown to provide a reasonably accurate and computationally efficient solution for the estimation of path-loss in a forested environment over long distances. [C1528]

"A new 2-cluster model for indoor UWB channel measurements"

The paper describes a new model for the indoor non-line-of-sight (NLOS) UWB channel based on measurements. To date, the Saleh-Valenzuela model (Saleh, A.A. and Valenzuela, R.A., IEEE J. Selected Areas in Commun., vol.SAC-5, no.2, p.128-37, 1987) has been the standard model for indoor NLOS wireless propagation. However, we show that for our set of indoor NLOS UWB channel measurements, better results are obtained using a model which has a fixed number of clusters of multipath arrivals. Our goal is to generate channel models which closely match the statistics of the RMS delay spread, mean excess delay spread, the number of significant multipaths and the RAKE finger energy capture observed in the UWB channel. [C1529]

"IEEE Antennas and Propagation Society Symposium (IEEE Cat. No.04CH37529)"

{no data available} [C1530]

"Evaluation of the received signal level in relation to the size and carrier frequencies of the wearable device using human body as a transmission channel"

Studies of wearable computers have attracted public attention these days. One of the area of interest is the communication system adopted in those wearable computers. As an example, wearable devices which use the human body as a transmission channel have been developed. When a user wearing the transmitter touches the electrode of the receiver, a transmission channel is formed within the human body. In this paper, investigations of the received signal level in relation with the carrier frequency and the size of the transmitter using human body as a transmission channel have been presented. The results show that the received signal voltage is slightly influenced by using higher frequency from 10 MHz to 100 MHz in the ISM frequency bands. However, it strongly depends on the size of the transmitter. In addition, it is necessary that the direction of the electrode of the transmitter is transverse for higher received signal level, compared with the longitudinal direction. [C1531]

"Influence of the ground plane geometry on the normalized site attenuation of an OATS"

The existence of differences between different open area test sites (OATS) in antenna calibration and electromagnetic compatibility (EMC) compliance measurements is still a real issue. To minimize the differences, it is necessary to analyze the influencing factors. To examine the influence of the ground plane geometry on the site attenuation, a comparison of different open area test site geometries and sizes has been carried out. The investigation has been performed numerically with the method of moments in the frequency range 30-130 MHz for test distances of 3 m and 10 m. The deviation of the site attenuation (with receiving antenna height) in relation to the ideal test site has been calculated. The minimal plane, for example, which is suggested in the standards, shows a high deviation. Furthermore, the significant influence of on and off axis measurements is shown and the reasons are explained. [C1532]

"Effect of lag correlations on the statistical modeling of wave propagation in a complex cavity [Caircraft fuselage applications]"

We have extended our earlier 2D multiple scattering formalism for plane GHz waves propagating down a loaded aircraft fuselage. The periodic array of seats/windows is modeled by longitudinal phase screens in the Z-direction, while scattering variations within a row are modeled by the random medium having various transverse lag-correlations. The effects of different lag-correlations and the strength of the scattering parameter γ on the existence of possible hot spots are readily seen, indicating that the computationally trivial approach of the multiscattering method could play a role a useful role in the determining of hot spots within an aircraft cavity due to electromagnetic sources (e.g., PEDs) within the cavity. The method is readily extended to examining polarization effects as well as 2D transverse structures. [C1533]

"Progress in modeling challenging propagation environments"

This paper reviews the recent progress in propagation modeling for complex and challenging wireless communications environments. As more advanced wireless communication systems are being developed, detailed propagation and channel prediction research is needed for systems designs and for evaluating their performance. Complex propagation environments such as complex walls, windows and metal framed structures, and tree canopies are examples of environments that still need more detailed and accurate propagation modeling. New parameters, such as coverage, MIMO capacity, and bit error rate are needed to better evaluate and understand the performance of these systems under realistic communication environments. The paper discusses some of the models and shows some of the recent results in this area. [C1534]

"A spatial channel model for multiple-antenna systems"

Conventional multi-input multi-output (MIMO) models are not efficient in assessing the benefits of multiple-antenna systems with area limitation on antenna arrays in realistic propagation environments. Physical models, though capturing these factors, are too complex for tractable analysis. The paper presents a spatial channel model that takes into account these factors without sacrificing analytical tractability. In the model, Green's function for radiation is adapted to account for the array area limitation, and the clustering of propagation paths observed in recent spatial channel measurements is exploited to obtain a concise description of channel scattering. [C1535]

"Stochastic modeling and simulation of multiple-input multiple-output channels: a unified approach"

We present a unified framework for the characterization and simulation of random multiple-input multiple-output (MIMO) fading channels. Depending on the presence of local scatterers around the base station and mobile station, we consider several geometrical configurations, which result in parametric expressions for key channel features, such as space-time-frequency correlations, average stay duration, etc. This approach allows one to describe and simulate the complicated random MIMO channel via several parameters, which in turn facilitates the analysis and design of multi-antenna systems. [C1536]

"Simulation of radar scattering from electrically large objects under tree canopies"

A model is developed to investigate the scattering behavior of hard targets embedded inside a forest canopy, at high frequencies. Wave penetration through, and scattering from, a forest canopy is calculated, using a coherent scattering model which makes use of realistic tree structures (Yi-Cheng Lin and Sarabandi, K., IEEE Trans. Geosci. Remote Sensing, vol.37, p.440-51, 1999). A physical optics (PO) approximation is used to estimate the equivalent current on an electrically large, perfectly electrically conducting (PEC) object, located above a ground plane and under a tree canopy. In this model, the reciprocity theorem is used effectively in order to derive the backscattering from the target above the ground plane, and also to calculate the interaction of the target scattered field with the foliage. [C1537]

"Experimental verification of a 3D propagation model based on Fresnel-Kirchhoff integral"

Experimental results obtained from measurements inside an anechoic chamber on scaled 3D building models are compared with the theoretical predictions based on the application of the Fresnel-Kirchhoff integral. The model is applied to predict field strength in outdoor urban environments. Buildings are represented by wooden scaled models coated with copper sheets. One of the biggest challenges of the 3D experiments is to remove the directivity of antennas as much as possible, because the theory developed so far assumes that antennas are isotropic. Different configurations involving one and two buildings are considered, and the good agreement between the theoretical results and measurements for both vertical and horizontal polarizations proves that Fresnel-Kirchhoff integral is an accurate 3D deterministic method. The results provide a benchmark for other researchers to compare their methods with experimental results. [C1538]

"Indoor directional channel modelling for future wireless communications"

The space-time multiple-input multiple-output (MIMO) technique is being developed as the potential solution for future high data rate wireless mobile communications. Channel modeling is very important for the design and analysis of the MIMO space-time systems it. The paper develops a stochastic double directional indoor MIMO channel model, and validates it with measurement data. The model addresses the issue of signal clustering encountered in an indoor channel. Directions of departure and of arrival of signal clusters are both considered. The model is verified by comparison with published measurement data. The model describes an indoor MIMO channel directly using a reference SISO cluster channel model. The model also provides a simple yet tractable framework for further investigation on MIMO techniques in a clustering indoor environment. [C1539]

"Prediction model for the characteristics of non-specular wave scattered from building surface"

Wave propagation prediction models are crucial in determining propagation characteristics for any arbitrary installation on the implementation of a mobile radio communication system. The paper presents the development of simulation techniques for the estimation of wave propagation characteristics. It is based on a propagation prediction model of non-specular wave scattering from building surfaces. The method used to calculate the total field of the receiver antenna consists of four parts: calculate the far field pattern of the transmitter antenna; determine the equivalent current on the building surface; calculate the total field on the receiver antenna; obtain the multipath signal by applying ESPRIT. Numerical results show that the signal parameter profile is in good agreement with experimental results. However, a small difference is observed between the numerical and

experimental results. The difference is attributed to the accuracy with which elements are discretized in the building surface roughness. [C1540]

"Mobile and wireless communications networks"

The purpose of this tutorial is to highlight several aspects of mobile and wireless communications networks. A first part presents a brief overview of the market and technology evolution. The second part is devoted to the radio propagation channel characteristics. In the third section, we present an overview of the transmission techniques related to the definition of new mobile communications systems. The design of these systems is based on a realistic modeling of the transmission channel. Thus, several measurement campaigns are realized in order to characterize the mobile radio propagation channel in various environments (urban, rural, and indoor). Finally, the research topics in progress are presented. [C1541]

"Power delay profile in a cluttered environment"

A stochastic-ray model of wave propagation based on the theory of random walks that accounts for only two parameters: the amount of clutter and the amount of absorption in the environment is considered. This model applies to indoor and outdoor environments, characterized by a large number of (small) scattering objects. Examples are microcells for personal communication and networks of multihop wireless sensors or laptop computers. We extend our previous results on narrowband signals to impulse waveforms, deriving a closed form solution for the power delay profile of the received signal. [C1542]

"UWB propagation measurements by PN-sequence channel sounding"

An extensive measurement campaign is carried out in a modern office building. The channel is sounded by a carrier at 4.78 GHz modulated by a train of pulses, each having a duration of 0.4 ns, shaped by a pseudo noise (PN) sequence, covering the band 3.6-6 GHz. The transmitter is moved in six different positions on the floor, while the receiver is moved within each room by a digitally controlled positioner in 625 different locations arranged in a square grid of 25 Ч 25 points with 2 cm spacing. A total of 625 Ч 16 profiles in nonline-of-sight (NLOS) and 625 in line-of-sight (LOS) conditions are recorded within the rooms. LOS measurements are made in the corridor in 11 locations at incremental spacing of 1 m. We describe the measurement technique as well as the procedure by which we process the experimental data to extract the amplitude, phase and delay associated to each path of the channel impulse responses. Finally, we derive LOS and NLOS path-loss models. [C1543]

"Autonomous navigation and positioning for indoor wireless measurements using mobile robots"

Personal wireless communications have experienced a tremendous growth in the last decade. In indoor scenarios, such as underground stations or buildings, the signal received at the mobile propagates in a different way than in outdoor environments. Therefore, measurement techniques used in outdoor cells cannot be used indoors, especially when determining the position of the mobile test equipment. Alternative methods of navigation and positioning are required for specific indoor measurement campaigns. Three mobile robot platforms have been developed to improve the accuracy of characterisation of the indoor propagation channel. The aim of each system is to provide an accurate mechanism for determining relative position within acceptable error bounds, depending on the specific characteristics of the measurement campaign and especially where other methods of positioning are not available. This paper describes each of the robots developed, emphasising the penetration that robotics has had in the wireless mobile communication industry, as a useful and affordable tool to improve propagation measurement techniques. [C1544]

"Locating mobile stations with statistical directional propagation model"

Recently, mobile location estimation is drawing considerable attention in the field of wireless communications. Among different mobile location estimation methods, the one which estimates the location of mobile stations with reference to the wave propagation model is drawing much attention. This approach, in principle, makes use of the most primitive property of wave propagation-signal strength, to perform location estimation. Hence this approach should be able to apply to different kinds of cellular network. We found out that in estimating mobile location with reference to signal strength, the azimuth gain of directional antenna and environmental factors can help to improve the accuracy. In this paper, we report our study of a directional propagation model (DPM) which enhanced the traditional propagation model with these factors. We experimented our model with 3,703 sets of real life data collected from a major mobile phone operator of Hong Kong. Results show that the DPM models have significant improvement over other existing location methods in terms of accuracy and stability. [C1545]

"Optimum operating frequencies for inter-node communications"

This article presents the optimum operating radio frequencies (RF) required for inter-node communications. The work was motivated by the need of many applications requiring energy-efficient communications over a wide range of terrain conditions. Although many factors influence energy-efficient communications, one of the most important factors is use of the most energy-efficient radio frequency for the target application. The results derived indicate that the optimum operating frequency for inter-node communications highly depends on the antenna configurations and terrain conditions. In this article, the background and derivations of the frequency optimization problem are outlined, examples illustrated, key results discussed, and future work identified. [C1546]

"Performance of coherent and noncoherent receivers for UWB communications"

In this paper we present a comparison between coherent and noncoherent UWB receivers, under a realistic propagation environment, that takes into account also the effect of path-dependent pulse distortion. As far as coherent receivers are concerned, both maximal ratio combining (MRC) and equal gain combining (EGC) techniques are analyzed, considering a limited number of estimated paths. Furthermore, two noncoherent schemes are presented: a simple differential detector and its adaptive version. While the first receiver shows a significative performance loss, if compared to coherent detectors, the second one is able to guarantee probability of error similar to the one obtained employing a Rake receiver, equipped with up to 20 fingers, without requiring channel estimation. [C1547]

"A novel powerloss model for short range UWB transmissions"

Narrowband pathloss models are not applicable to the link budget calculation of ultra wideband (UWB) systems. In this paper, a rigorous analysis reveals the powerloss behavior of short-range UWB systems when operating in a cluttered environment. The contribution of this paper is the derivation of a power law model that exhibits a novel breakpoint within the vicinity of the transmitter, which is shown to influence the UWB link budget by up to 5 dB. [C1548]

"Multiuser interference and inter-frame interference in UWB transmitted reference systems"

In transmitted reference ultra-wideband (TR-UWB) systems and differential transmitted reference (DTR-UWB) systems, the performance is, besides noise, determined by interference among pulses due to the dispersive multipath radio channel (interframe interference). The multiple access interference is also heavily influenced by multipath propagation. As a first step towards the analysis and optimization of such systems, this paper analyzes statistically the response of the pulse-pair correlators, including integrate and dump circuits which are the basic building blocks of TR-UWB receivers, to desired and un-desired pulse-pairs. Results are given in terms of basic channel parameters like RMS delay spread and Ricean K-factor. As an example for the application of our analysis, we present a novel multiuser DTR-UWB system. [C1549]

"Free space link budget evaluation of UWB-IR systems"

Ultra wideband impulse radio (UWB-IR) technology is an ideal candidate for wireless networks that can be utilized for short-range, high-speed, low power, and low cost indoor applications. The link budget of the free space propagation loss is usually estimated by using Friis' transmission formula. However, it is not directly applicable to ultra wideband impulse radio transmission systems, in particular the single band impulse radio, as the formula is expressed as a function of the frequency. Moreover, the waveform may be distorted due to the frequency characteristics of the antenna, and the comparison between Tx and Rx waveforms is not straightforward. The paper discusses the free space link budget evaluation of UWB-IR systems based on the extended Friis' transmission formula. The matched filter is considered at the receiver side to maximize the SNR for evaluation. An experimental evaluation of the antenna transfer function needs the three-antenna method for the calibration of the reference antenna. The technique gives very accurate results and is very useful for design and evaluation of UWB impulse radio transmission systems, especially for the evaluation of waveform distortion effects. [C1550]

"Co-axial 2D Bragg structures for a high-power free electron maser"

A coaxial 2D Bragg structure can be obtained by machining the corrugation on the surfaces of either inner or outer conductors of a coaxial waveguide which can be presented as $r(z,\varphi) = R_{in,out}+a_1\cos(kzz)\cos(m\varphi)$, where $R_{in,out}$ are the radii of inner ("in") and outer ("out") conductors, a_1 is the amplitude of the corrugation, $kz=2\pi/dz$ and dz is the period of the corrugation along the longitudinal coordinate z and m is the corrugation variation number along the azimuthal coordinate φ. Taking into account the small perturbations of the waveguide surfaces, the RF field inside the 2D Bragg structure can be considered as a superposition of four partial waves. Using the code MAGIC, the RF field scattering on the corrugation has been studied and indirect coupling between incident and reflected waves has been demonstrated. In recent experiments, an annular electron beam

of diameter 7 cm with electron energy of up to 450 keV and beam current up to 1.6 kA has been measured. An efficiency of 15% has been predicted for the FEM with a 2D Bragg cavity. The immediate goal of the experiment is to generate 100 MW of power at an operating frequency of 37.5 GHz. [C1551]

"A site-specific tool for UWB channel modeling"

UWB communication systems design and performance through link budget simulations need an accurate knowledge of radio channel propagation. The paper presents a site-specific tool for ultra wideband (UWB) channel modeling. A description of the tool is given. Channel impulse responses (CIR), simulated with the tool, are shown. Then, extracted temporal and frequential channel parameters are presented and discussed. [C1552]

"Experimental evaluation of a SAGE algorithm for ultra wideband channel sounding in an anechoic chamber"

The paper presents the results of experiments in an anechoic chamber that assessed the reliability of a UWB channel sounding system based on a deterministic approach with a SAGE algorithm. The system could resolve and detect waves separated by 10° in the angle domain, which was near the resolution limit. In the delay domain, waves separated by 0.67 ns could be resolved where the relation between the bandwidth of the subband and spectrum estimation was discovered. The behavior of the algorithm for the detection of incident waves which are within the resolution limit was examined. The spherical incident wave model was applied for estimating the parameters of incident waves. This model could drastically reduce the number of spurious paths compared to the plane wave model. [C1553]

"A deterministic tool for multipath propagation modelling"

Mobile communications are influenced by multipath effects. Radio wave propagation over urban and natural terrain depends on topography and morphography. A simulation tool, URBES (urban ray beam electromagnetic simulator), is presented. It is based on astigmatic beam tracing (ABT), a deterministic method which combines ray and beam tracing. ABT can handle multiple reflections and diffractions in 3D using GO and UTD. The tool has been applied to models of different scenarios, including urban and natural terrain scenarios. Some preliminary results of a validation activity are presented, showing a fair agreement with published measurements and results of other methods. [C1554]

"Wave propagation modeling for airborne communication systems"

The wave propagation between an airplane and a ground station is investigated by using ray tracing techniques. Signal strength, and especially the effects of multipath phenomena, caused by structures near the runway, are regarded and discussed. [C1555]

"Probability density function for waves propagating in a straight rough wall tunnel"

The radio channel places fundamental limitations on the performance of wireless communication systems in tunnels and caves. The field propagating in caves or tunnels is a complex-valued Gaussian random process, by the central limit theorem. We assume that the phase probability density function is uniformly distributed over a range of extent 2pi. Under this assumption, the phase and amplitude of the field joint probability density function are independent and uncorrelated. We show that the probability density function for the amplitude of a random field propagating in a straight rough wall tunnel or cave is Rician. This tells us that there is a dominant signal component, such as a line-of-sight propagation path. In such a situation, random components arriving at different angles are superimposed on a stationary signal. At the output of an envelope detector, this has the effect of adding a DC component to the random multipath signal (Gibson, J.D., "The Mobile Communications Handbook", CRC Press, 1996). Since both expected value and standard deviation depend only on radial position, the probability density function for the amplitude of a random field propagating in a straight rough wall tunnel or cave is a radially dependent function. [C1556]

"Propagation prediction in a vegetated residential area using the combined method of ray tracing and diffraction"

A theoretical method-the combined method of ray tracing and diffraction (CM-RTD), based on geometric optics and Kirchhoff diffraction theory, is used to compute the intensity behind one row of trees/buildings. In this work, the two-dimensional cases in which a cylindrical wave or plane wave is normally incident upon a row of trees/buildings are discussed. [C1557]

"Rate and extent of signal strength change at street corners in urban environments"

Analysis of measurement data from intersections that exhibit the corner effect in the San Francisco financial district yields their empirical properties. For low rates of change of the average signal strength, i.e., less than 0.3 dB/ft, the rate and extent appear to be related. For higher rates of change, the extent of the change is around 9 ± 4 dB. [C1558]

"Electromagnetic propagation prediction inside aircraft cabins"

Electromagnetic propagation models for signal strength prediction within aircraft cabins are essential for evaluating and designing a wireless communication system to be implemented onboard aircraft. A model was developed using Wireless Valley's SitePlanner; which is commercial grade software intended for predictions within office buildings. The performance of the model was evaluated through a comparison with test data measurements taken on several aircraft. The comparison concluded that the model can accurately predict power propagation within the cabin. This model can enhance researchers' understanding of power propagation within aircraft cabins and will aid in future research. [C1559]

"Fields in a rough-walled circular tunnel excited by a ring source: surface-impedance formulation"

The subject of electromagnetic wave propagation in regions such as caves and tunnels, for application to wireless communications in these environments, is of interest from both theoretical and practical points of view. We present an approach for determining the electromagnetic field in a circular tunnel with a rough wall when the field is excited by an electric or magnetic ring source. An equivalent surface-impedance boundary condition has been used to represent the actual rough interface between the tunnel and the surrounding medium. The field is found to comprise a deterministic or coherent component, identical to that which would be found in a tunnel with a smooth wall, and a random or incoherent component whose expected value is zero and whose covariance functions can be expressed in terms of integrals over the power spectral density of the surface roughness. Representations of the field in the tunnel can now be developed in terms of modal or ray expansions; these can be obtained from different methods for evaluating the integral representations in certain integral equations. [C1560]

"Through wall imaging at microwave frequencies using space-time focusing"

Imaging inside of buildings to detect a human signature has become a problem of great importance to law enforcement agencies. A physics based wave propagation simulation tool is employed to investigate the phenomenology of wave propagation inside complex building structures such as statistics of path loss, angle of arrival, spatial and spectral field coherence, etc. In addition the application of a space-time focusing method for detecting objects inside a building is examined. The focus of this investigation is mainly on the forward problem to better understand the physics of the problem which can be utilized to simplify the inverse problem. The result of this study will be used in the development of novel radar-based detection algorithms as well as detection methods based on multi-modality. [C1561]

"Laboratory investigation of the propagation and ducting of whistler-waves"

Summary form only given. There have been a number of interesting in situ and laboratory observations of whistler wave propagation and stimulated emissions over the past few decades. For example, Stenzel [1975] reported on the self-ducting of large amplitude whistler waves in a laboratory plasma. Those experiments showed that with increasing amplitude, the radiation pattern from a small dipole antenna becomes increasingly narrow, and ultimately forms a duct with diameter of the order of the parallel wavelength. The ducted waves were observed to propagate virtually undamped along the length of the plasma column. In the space environment, observations of artificially stimulated VLF emissions triggered in the magnetosphere by whistler modes from VLF transmitters have been reported by Stiles and Helliwell [1975]. Emission radiation is assumed to come from the transverse currents formed by counter-streaming electrons that have been temporarily phase bunched by the constant frequency triggering signal. These observations have prompted a new NRL Space Physics Simulation Chamber investigation of whistler wave dynamics in a simulated radiation belt environment. The ultimate goals of these experiments are to understand and quantify ducting, self-focusing, and amplification of whistler waves, to investigate nonlinear whistler-plasma interactions, and to study the secondary emission of whistler waves. The initial experiments concentrates on the ducting of whistler waves in pre-existing density depletions and enhancements. Density structures with controllable scale size and depth is created using methods previously developed for a Space Chamber investigation of the dynamics of magnetospheric boundary layers. [C1562]

"Effect of oversimplifying the simulated indoor propagation on the deterministic MIMO capacity"

MIMO systems have shown promising information capacity gain in a multipath-rich environment. Evaluation of the MIMO achievable capacity requires knowledge of the RF channel matrix. A common approach is to assume a Rayleigh fading channel and, accordingly, evaluate the statistical average of the capacity. This simple approach neglects the dependence of the capacity on the specific propagation environment. Alternatively, in this work, we use a deterministic approach based on the simulation of the RF propagation channel matrix for specific scenarios, which includes the propagation characteristics. Consequently, the RF channel matrix can be found, yielding the deterministic MIMO capacity. The objective of this work is to show how an oversimplification of the RF simulation characteristics (number of rays, planar/non-planar reflection tracing and wall thickness) affects the evaluated deterministic MIMO capacity. [C1563]

"Propagation in circular tunnels: ring source excitation"

We present a model for propagation in lossy circular tunnels. Our study has potential application to wireless communication in highway and railroad tunnels where the cross-sectional geometry is often circular except for the roadbed. In addition, the circular tunnel model has relevance to wireless communication in underground nuclear waste storage facilities, such as that planned for Yucca Mountain, Nevada, USA. Our principal goals are: (1) to provide insight into strategies for the placing of transmitting antennas and receiving sensors at various positions in a tunnel; and, (2) to provide criteria for antenna design. [C1564]

"Experimental mode content analysis technique for complex overmoded waveguide systems"

In this paper, short time Fourier transform techniques are used to analyze the mode content of overmoded waveguides. The analysis is applied to transmission through straight sections, bends, and T-junctions. In addition to determining the modes with the dominant contributions to the response, the presence of mode conversion in bends and T-junctions is observed. The direct application of this technique is channel characterization of an HVAC duct system, which behaves as a multimode waveguide network at RF frequencies when used for indoor wireless communications. [C1565]

"Characteristics of radio propagation channels in tunnel environments: a statistical analysis"

The propagation characteristic in tunnel environments is very different from that in free space. Measurements for both strong and weak fading phenomena regions have been performed to characterize the channels in a tunnel. The direct and reflected waves of the received power have been separated, and the ratio of the reflected wave to the direct wave is used to estimate a parameter, K. The tunnel propagation channels have been analyzed for variation of the K parameter with distance. The signal was received in the form of a Rician channel with the reflected and the direct waves. With the channel characterized using the K parameter, in a short section, where the receive antenna is near the transmit antenna, the received signal distribution fitted a Gaussian channel, while it fitted the Rayleigh channel in long sections. [C1566]

"Experimental study of meteorological parameters variation using HF-signal during solar proton events"

There are many experimental facts showing the influence of solar activity on weather and climate. Nevertheless, we still do not have a model explaining all the problems of solar-terrestrial links. This is due to the lack of experimental data about variations in meteorological conditions before, during and after a solar flare. This type of data could be obtained by use of, for example, weather balloon, rocket or aircraft sounding. However, achieving large arrays of continuous data by these methods is not possible due to their high cost. Refractive index, which plays a significant role in radiowave propagation, relates to the main meteorological parameters such as temperature, pressure and vapor pressure. Statistical studies of the signal level variation processes can therefore give some information about meteorological processes in the troposphere. An experimental radio link from the Asiasat-3S telecommunication satellite (elevation angle in Kharkov, Ukraine is 4.5°) was constructed. The experiment was carried out from May 2002 to November 2003 at the frequency 3.6 GHz. More than 20 solar flare events were analyzed. The paper describes the scheme of the experiment and the results. [C1567]

"MIMO capacity for realistic wireless communications environments"

With the growing interest in implementing wireless communication systems based on MIMO, it is important that the capacity of such a system be evaluated in typical and realistic propagation environments. The paper describes an FDTD simulation procedure for calculating MIMO capacity in some typical propagation environments, including transmission through windows and metal-framed structures, communications through tree canopies, and accounting for the walls of complex structures. Scattering and diffraction effects from metal frames, complex walls, and leaves of trees result in complex field distributions which are expected to cause

varying fading characteristics and hence affect the estimation of the MIMO capacity. It is shown that scattering and diffraction effects may increase the MIMO capacity when compared with those cases based on uniform solid walls. [C1568]

"Comparison of different numerical modelling techniques for reverberation chamber: initial 2D study"

Traditionally, reverberation chambers have been used for measuring electromagnetic compatibility (EMC) of electrical devices. More recently, they have also been used for measuring small antennas and even MIMO antenna systems. The reverberation chamber is basically a rectangular metal cavity with many resonant modes and with several different types of stirrers used to stir the modes in order for the device under test (DUT) to see a statistically uniform field environment. As we want to make the stirring as effective as possible, it is important to be able to evaluate the effectiveness of the stirring methods in a controlled manner. The paper considers some numerical models that can be used to study the stirring effectiveness of a reverberation chamber. The methods are applied to two-dimensional (2D) cavities, i.e., a chamber with almost zero height in which the only excited polarization is vertical. With this simple case, computation times are acceptable and the mode stirring is easier to understand without the additional complexity of polarization effects. The study is still realistic, because the depth and width of the chamber are made so large that the mode density is the same as in a full-height chamber. We have validated several codes for calculating the field solution inside a 2D cavity and identified the most promising method. The implementation is readily available for 3D. [C1569]

"A super-resolution method for extraction of modal responses in wideband data"

The paper presents a spectral estimation method to process coherently the wideband frequency domain field data of any object, and extract specific modal responses associated with wave propagation along the object. The problem is formulated in terms of well-known range processing used in radar waveform analysis. Thus, the data is modeled in terms of complex sinusoids, whose phase yields the decay/growth constants and the range associated with discrete scattering centers. Unlike previous approaches, the resulting amplitude and decay/growth constants are made frequency-dependent to capture the dynamic wideband behavior of the scattering mechanism. The method is illustrated by application to mode extraction for a cylindrically stratified scatterer. [C1570]

"Optimal pulse penetration in Rocard-Powles-Debye model dielectrics using the Brillouin precursor"

When an ultrawideband electromagnetic pulse penetrates into a causally dispersive dielectric, the interrelated effects of phase dispersion and frequency dependent attenuation alter the pulse in a fundamental way that results in the appearance of precursor fields. For a dielectric described by the Rocard-Powles extension of the Debye model, the dynamical field evolution is dominated by the Brillouin precursor as the propagation depth typically exceeds a single penetration depth evaluated at the carrier frequency of the input pulse. This is because the peak amplitude in the Brillouin precursor decays only as the square root of the inverse of the propagation distance. Because of its unique nonexponential peak decay, the Brillouin precursor has direct application to foliage and ground penetrating radar, remote sensing and wireless communications in adverse environments. Of equal importance is the frequency structure of the Brillouin precursor which exhibits a complicated dependence on both the material dispersion and the input pulse characteristics. A Brillouin pulse is then defined and shown to possess near optimal (if not indeed optimal) material penetration. [C1571]

"Demonstration of time reversal methods in a multi-path environment"

Time reversal methods (TRM) offer a unique opportunity for solving the problem of electromagnetic (EM) wave propagation and focusing in a spatially varying (inhomogeneous) medium. While the concept of time reversal is new to the field of EM wave propagation, it has been applied in the area of acoustics and ultrasonics for several years (Fink, M. and Prada, C., Inverse Problems, vol.17, p.R1-38, 2001). In any finite size array that occupies a limited spatial area, the system is diffraction limited; however in acoustics, it has been shown that, in an inhomogeneous medium, a time reversal array is not always diffraction limited and can achieve super-resolution. Basically, scatterers near the transmitting array and/or focal point act as an extension of the array in the focusing process. The paper shows that the same phenomenon exists for EM waves. While the feasibility of applying TRM to EM problems has been demonstrated, many issues must be investigated and resolved before TRM can be implemented practically in a communications or radar imaging system. [C1572]

"Application of moving window FDTD to predicting path loss over forest covered irregular terrain"

A new wave oriented approach to modeling radiowave propagation based on an extended finite difference time domain (FDTD) method has been developed. The new approach takes advantage of the fact that when a pulsed

radio wave propagates over a long distance, the significant pulse energy exists only over a small part of the propagation path at any instant of time. This allows the use of a relatively small FDTD computational mesh that exists only over a portion of the propagation path and moves along with the pulse. At the leading edge of the FDTD mesh, inside the moving window, the appropriate terrain and foliage parameters are added to the mesh. At the trailing edge, the terrain and foliage that have been left behind by the pulse are removed. The moving window FDTD (MWFDTD) method has previously been applied to propagation over different types of irregular terrain. This paper extends this approach to forest covered terrain by treating the foliage as a lossy dielectric layer. Comparisons with path loss measurements show good accuracy and illustrate the advantages of a full wave method. [C1573]

"Measured results of quasi-zenith satellite visibility and its time delayed diversity (TDD) system characteristics"

The paper deals with the time delayed diversity (TDD) system characteristics for a quasi-zenith satellite system measured using GPS (Global Positioning System) satellites. To design a digital mobile broadcast satellite system with the TDD system, it must estimate the characteristics of attenuation by urban buildings, electrical light poles, trees, etc. Signal data from southern orbital arc GPS satellites with elevation angles from 40° to 80° are used for propagation characteristics measurements, rather than from actual geostationary satellite orbit (GSO) satellites. To overcome urban signal attenuation, the TDD system is applied for GSO satellites and quasi-zenith satellite systems and TDD characteristics are examined by processing measured GPS data. [C1574]

"Studying the communications potential of the enclosed-space radio channel"

Wireless communications inside enclosed-space environments (e.g. aircraft wings and fuselage, automobile engine compartments, etc.) provides a unique opportunity for instrumentation systems native to these spaces to operate with improved reliability, flexibility and capabilities. However, since these enclosed environments are typically surrounded by reflective boundaries, the enclosed-space radio channel is extremely dispersive and offers a significant challenge to enclosed-space radio communications. Coherence bandwidth and RMS delay spread data is thus obtained and presented as a first step to understanding the communications potential of the enclosed-space radio channel. Despite the extremely dispersive nature of this channel, communications seem possible, and measurements begin to suggest a potentially successful scheme of communications in the enclosed-space channel. [C1575]

"Impact of antenna geometry on MIMO communication in indoor clustered channels"

In this paper, we study the impact of different array configurations in indoor propagation environments. We measure the capacity/diversity gain attainable by different array geometries with seven elements and fixed interelement spacing. To make the discussion more concrete, we base our simulations on the IEEE 802.11n Technical Group (TC) clustered channel model. Our results show that averaged with respect to cluster location, uniform linear arrays often yield the highest capacity/diversity gains. However, in poor scatterer environments, and for compact arrays, the "Star" configuration provides the best system performance. [C1576]

"Database simplification for field prediction in urban environment [Cradiowave propagation]"

The performance and the usability of deterministic field prediction tools for the urban environment is heavily limited by the high computing time, which depends exponentially on the size of the input urban database. A simple technique for urban database simplification, aimed at speeding up deterministic field prediction is presented in the paper. Such a technique, based on a sort of heuristic preprocessing of the city map, identifies the buildings which are 'likely' to have an impact on the multipath propagation mechanism taking place between the radio terminals, and discards the rest of the map. Using this pre-processing technique, the CPU time can be decreased by orders of magnitude in typical ray tracing prediction cases, while the accuracy of the results only marginally degrades, as shown in the results section of the paper. [C1577]

"3D wave propagation simulation in complex indoor structures"

Modern wireless radio systems, such as public mobile cellular services (GSM or CDMA), PCN, DECT, wireless LANs, etc., are established in different operating frequency bands according to their specific applications. For new service deployments and expansion or improvement of existing systems, accurate path loss and power delay profile prediction in different environments is important for specifying system parameters. Recently, wave propagation prediction algorithms based on site-specific deterministic models, quasi-optical ray tracing and higher order electromagnetic wave propagation models have been developed. The paper discusses the results from a simulator consisting of two discrete computer codes, an environment modeler and a ray tracing engine. It

is found that, for closed indoor areas with many scatterers, modeling the environment with more details is beneficial because it improves the accuracy of the simulated results while simulation time is not significantly increased. However, considering diffraction may not be useful, as it is very time consuming and does not have a major impact on the total predicted result because of extreme multipath effects. [C1578]

"Propagation modeling of wireless networks for interceptibility assessment"

Summary form only given. Many organizations are choosing wireless local area networks (WLANs) and point-to-point (PTP) systems over hardwired networks because of their convenience and flexibility. One concern in deploying such systems is the possibility of the signal being intercepted by unauthorized users. Predicting, and subsequently controlling, the electromagnetic radiation can be an effective means of securing the network. The paper examines the propagation of WLAN and PTP systems and their vulnerability to interception. Some simple steps that can be taken to improve security are provided. The findings indicate that there are numerous vulnerabilities associated with wireless systems that may not be apparent through examination of the physical layout of buildings. The simulation results show that sporadic hotspots may appear due "corner reflectors" comprised of a building's corners and the floor. Some precautions are suggested to reduce the chances of interception, including adjustment of antenna locations, tinting windows, and exercising physical security measures at hotspots. [C1579]

"Radio channel models for MIMO antenna systems based on ellipsoidal scattering"

For multiple-input, multiple-output (MIMO) antenna systems, it is necessary to evaluate performance under realistic propagation channels that include spatial correlation and dispersion. Models developed for this purpose must have enough flexibility to handle different antenna configurations and propagation scenarios. In this paper, the recently proposed 3GPP spatial channel model is extended to three-dimensional scattering using ellipsoidal sub-regions to model time dispersion. We further develop an analytical formulation of the space-time correlation function, allowing traditional methods to generate correlated fading realizations. We show that the 3D model reduces correlation compared to 2D propagation, and evaluate correlation properties for different antenna orientations, showing that averaging over random receive antenna orientations both reduces correlation and its dependence on the base to mobile distance. [C1580]

"Mobile propagation path loss models for suburban areas using type-2 fuzzy logic approximation"

This paper presents a type-2 fuzzy logic system to predict path loss in cellular mobile communication system. The propagation mediums are classified into two environment of terrain defined as suburban house density and tree density. The environment terrain is classified into flat area terrain, light tree terrain, heavy tree terrain and village terrain respectively. These data from the environment terrain transfer to the type-2 fuzzy logic system. Once the rules have been established, the type-2 fuzzy logic system can be viewed as a mapping from environment terrain inputs to path loss outputs. From the prediction, the results obtained have shown that the ability of type-2 fuzzy logic system to predict more accurate prediction of strength loss than that of conventional Hata's model. [C1581]

"On the anti-multipath performance of UWB signals in indoor environments"

By simulating the transmitting and receiving of UWB pulse trains with different pulse durations in indoor environment, the anti-multipath performance of UWB signals in indoor environments is evaluated by statistical energy of the signal quality at various locations in a room such as in the corner. The effect of several typical materials used to construct a room on the anti-multipath performance of the UWB indoor wireless is also studied. For comparison, the anti-multipath performance of narrow-band digital signals is simulated in the same wireless environment. [C1582]

"Investigating dominant scatterers in urban mobile propagation channel"

The data obtained from a series of wideband directional measurements performed in an urban area in a microcell scenario is analyzed. We try to estimate the dominant scatterer objects in the propagation channel comparing the data obtained from experiment and accurate map of the area which includes all present objects. Results show that all metallic objects in the transmitter and receiver vicinity have a significant impact on the propagation channel. [C1583]

"Site-specific indoor propagation prediction using adtive neuro-fuzzy inference systems [Cadtive read as adaptive]"

This paper presents a new model for the propagation prediction for mobile communication network inside

building. The model is based on the determination of the dominant paths between the transmitter and the receiver, diffraction at the corner and wave-guiding effect. The field strength is predicted with adaptive neuro-fuzzy inference systems (ANFIS), trained with measurements. The advantage of the ANFIS with hybrid least squares and gradient descent algorithms is fast convergence compared with original neural network. The K-means algorithm for selection of training patterns is also used. Comparison of our predicted results to measurements indicate that improvements in accuracy over conventional empirical model are achieved. [C1584]

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{no data available} [C1585]

"Investigation of ultra wideband short-range radio wave propagation characteristics based on PSTD method"

The pseudospectral time domain (PSTD) method and PML medium is applied to investigate the characteristics of ultra wideband (UWB) short-range radio wave propagation. A two-dimensional UWB source setup method is proposed to initialize the propagation of UWB Gaussian monocycle in a short-range environment such as some indoor environments. Numerical simulations confirm the suitability and efficiency of the PSTD method and some interesting results have been obtained. [C1586]

"A new predictive algorithm for radio propagation model in WCDMA networks"

In this paper, we present a novel algorithm to predict the coverage area of pilot channel, which can aid the RF optimization of WCDMA wireless networks. This algorithm exploits a radio propagation model without 3D digital map and inversion technique to reconstruct the median strength distribution of pilot signals in a cell with few measured data. Based on this distribution, we can determine the main coverage area of pilot channel. We show that our algorithm is accurate and fast enough to predict efficiently the coverage area which is one of the key tasks in the optimization process of WCDMA networks. [C1587]

"Some new experimental research of HF backscatter propagation in CRIRP"

This paper describes some new experimental research of HF backscatter propagation in CRIRP. This new experimental research includes the detecting of a target with two different polarization arrays using the Faraday rotation effects, the detecting of the HF Doppler spectrum of sea and land by an HF backscatter propagation experimental system (HF BPES) in CRIRP. Airplanes as far away as 2000 km are frequently successfully detected by the HF BPES with two different polarization arrays. The track points of the airplane were compared with that detected by VHF radar, and the difference of the two tracks is very small so that the square root difference is σ=13 km. The illuminated range by HF BPES is from land, by land, the sea boundary, and the sea over a long distance. The HF Doppler spectrum of ground, the sea echo Doppler spectrum and the HF Doppler spectrum of sea boundary and land are probed. It indicates the identification of both sea and ground. [C1588]

"The low frequency radio interference are a means of diagnostic of environment"

It is accepted to consider low frequency noise as radio interference. Actually it is a very useful means for diagnosis of the medium in which it is excited and propagated. The results of research of low frequency emissions (0.1-20.0 kHz) obtained from the "Intercosmos" satellite data have shown that the low frequency emissions bear information on parameters of the environment: about variations of energy particle fluxes in the area where the noise is excited, about parameters (density and temperature) of plasma in which it is propagated, about level of disturbance and turbulence of plasma, and about geomagnetic and solar activity level. [C1589]

"Characterization of discontinuities and propagation in waveguides using simplified finite element schemes"

Two simple finite element algorithms with a 2D first-order rectangular node and edge elements are applied to the analysis of rectangular waveguide structures. Our results agree very well with those obtained using other numerical techniques, validating our simple finite element algorithms. Compared with other finite element schemes, our finite element algorithms are much simpler and can lead to a satisfying accuracy. [C1590]

"The hybrid-neural empirical model for the electromagnetic field level prediction in urban environments"

The application of multilayer perceptron networks to calculating the electromagnetic wave path loss in an urban

environment for propagation through an area with low or high buildings is presented. A hybrid neural-empirical model, created in two phases, is proposed. The first phase implies the realization of an approximate (coarse) propagation model based on measured values. This model determines the propagation loss from the beginning of the area, based on the distance from the area beginning, the average building density, the partial loss of a single building, the distance from the transmitter and the exponential loss index of the area. In the second phase, a neural network and the approximate model are integrated in the hybrid (fine) model of the propagation area. The input parameters for the neural network are the distance from the area beginning and the average height of buildings in that area, while the output parameter is the partial loss of a single building. This value is used in the approximate model, in order to obtain the propagation area model with higher accuracy. [C1591]

"Complex permittivity determination of material for indoor propagation in ultra-wideband communication frequency"

This paper describes a theoretical study of the material complex permittivity in the ultra-wideband (UWB) communication frequency range. To characterize the transmission and reflection mechanism over the UWB frequency range, the frequency dependent permittivity must be taken into account. Therefore, an effective formulation is derived for the calculation of the material permittivity for the indoor environment. The dielectric constant and dielectric loss are studied at UWB communication frequency with different materials and thicknesses. This new formulation shows that the complex dielectric constant can be accurately determined with less computation time. The values of dielectric constant and dielectric loss are found to be reasonable. [C1592]

"BER performance evaluation of LMDS with OFDM in different measured channel models"

Accurate characterization of communication channel is required to design a reliable and spectrally efficient wireless communication. Channel characteristics of Local Multipoint Distribution System (LMDS) shows that it has multipath propagation. For optimum system design, intersymbol interference (ISI) due to multipaths must be removed. OFDM is an efficient multicarrier modulation scheme used to avoid ISI due to multipath propagation in radio communications. In this paper, we propose and analyze the performance of OFDM for LMDS over different measured channels. Simulation results show that the bit error rate (BER) performance of LMDS with OFDM is better than without OFDM along with forward error correction coding (FEC). [C1593]

"Mobile propagation path loss models for suburban areas using fuzzy logic approximation"

This paper proposes method to predict path loss in cellular mobile communication systems using fuzzy logic. The propagation medium is classified into two propagation environment density defined as an input fuzzy set, X1 = suburban house density and X2 = tree density. These crisp inputs are classified by fuzzifier to fuzzy sets and then inferenced using fuzzy linguistic rule base into path loss prediction output via de-fuzzifier. For this study, we classified the terrains into free space, flat area terrain, light tree terrain, heavy tree terrain, and village terrain and used the simple linguistic rules for prediction the path loss slope. The results have shown that fuzzy logic approach provides more accurate prediction of strength loss than that of conventional Hata's model. [C1594]

"Spectral properties of signal fading and Doppler spectra distribution in urban mobile communication links"

In this work we continue the analysis of a probabilistic approach and the corresponding stochastic multi-parametric model of wave propagation in built-up areas with randomly distributed buildings. Here we concentrate on the spectral properties of signal strength spatial variations and on Doppler spread spectrum distribution of signal power. The analysis is based on a unified stochastic approach of radio wave propagation above the built-up terrain with applications to mobile communications. We analyze the signal power spectrum of spatial frequencies and the signal power distribution in the Doppler domain for moving vehicles, taking into account Doppler shift proportional to the vehicle antenna speed with respect to the base station. The comparison between the theoretical prediction and experimental data was motivated by the proposed stochastic model and by other existing statistical models to verify the signal power distribution in the Doppler domain for various urban environments and terminal heights with respect to building rooftops. New effects of terrain features on signal power spectrum distribution are obtained and examined through the comparison with existing models and experimental data. [C1595]

"A long baseline kinematic GPS solution of ionosphere-free combination constrained by widelane combination"

Why can't the dual frequency long baseline kinematic positioning be solved accurately? In kinematic positioning, the coordinates changes epoch by epoch, and the number of the observation equations per unknown does not

increase. Hence, the averaging effect of the least square solution can't work well in contrast to the static positioning. So, when the baseline length is long and the error increases, the least square solution can't give the accurate solution. Supplementary information for the correct solution would be required. In case of static positioning, a constraint that the coordinates of the receivers are constant is imposed. If a similar constraint is found in kinematic positioning it may be a strong help to obtain the accurate solution. The initial phase ambiguities of the wide-lane combinations can be obtained correctly irrespective of the baseline length by using HMW (Hatch-Melbourne-Wubbena) combinations. The ionospheric delays may be estimated with rather nice accuracy by using the external source such as IONEX and the geometry free combinations. So, the use of the information may be useful. Specifically, a nice approximation of the coordinates is obtained by solving the wide-lane combinations where the above-mentioned wide-lane ambiguities and the ionospheric delays are used. The ionosphere free combinations are solved under the constraint of these coordinates [C1596]

"Predicting the long-term average of the effective earth radius factor for South Africa using ground-based observations"

The work reported in This work further extends work presented in a companion paper and uses ground based meteorological observations to predict the long-term annual average value of the k-factor. These results are compared with those obtained from the radiosonde data used in the companion paper. The results are in broad agreement with those obtained from radiosonde observations. However, it is found that there are discrepancies in the comparison for Alexander Bay data. This may be due to the influence of the cold Benguela current. [C1597]

"Subspace matching localization: a practical approach to mobile user localization in microcellular environments"

In this paper, we present "subspace matching localization" as a technique for localizing non-cooperative transmitters in a microcellular environment dominated by non-line-of-sight (NLOS) propagation. using one base station that is equipped with one antenna array. The proposed method takes advantage of the dissimilarities in the multipath propagation characteristics of distinct locations in such an environment and site-specific ray tracing models to localize a transmitter. Issues regarding the coherency or non-coherency of multipath signals and effects of spatial smoothing on subspace matching localization are also addressed. [C1598]

"Hybrid algorithm for indoor positioning using wireless LAN"

Locating an indoor mobile station based on a wireless communication infrastructure, has practical applications. The most widely employed methods today use an RF propagation loss (PL) model or location fingerprinting (LF). The PL method is known to perform poorly compared to LF. But LF requires an extensive training dataset and cannot adapt well to configuration changes or receiver breakdown. In this paper, we develop a hybrid method that combines the strength of these two methods. It first formulates the RF PL in a nonlinear, censored regression model and adjusts the regression function to the observed signal strength in the fingerprint dataset. In the absence of a training dataset, the hybrid method coincides with the PL method, and, as the spatial granularity of the training dataset increases, the result of the algorithm approaches the result of the LF method. It balances the flexibility and accuracy of the two traditional methods, makes intelligent use of missing values, produces error bounds, and can be made dynamic. We evaluate the performance of the algorithm by applying it to a real site and observe satisfactory positioning accuracy. [C1599]

"Database correlation for positioning of mobile terminals in cellular networks using wave propagation models"

Many new services for mobile radio networks rely on a precise location of the mobile terminal. Especially in urban environments, multipath propagation leads to very complex scenarios without line-of-sight between the mobile and the different base stations. In these situations, a location technique based on simple delay evaluations and/or GPS is not accurate enough or not applicable. In this paper, a database correlation method for the positioning of mobile terminals is presented which yields precise results in urban environments. The approach is based on propagation models utilized for the planning of mobile radio networks. The results of the propagation models during the planning process define a look-up-table. By evaluating the measured path losses and available propagation times between the mobile terminal and several base stations, the positions of mobile terminals in urban environments can reliably be predicted. [C1600]

"An improved heuristic algorithm for frequency assignment in nonhomogeneous cellular mobile networks"

We present an improved heuristic sequential algorithm for fixed frequency assignment in mobile radio systems with nonequal cells. This algorithm models the problem using nonbinary constraints and accounts for the interference level and the number of channel requirements to define a degree of difficulty for each cell in order to establish the sequence for the assignment process. Improvements with respect to an existing algorithm are done by accounting for transmitting power and adjacent channel interference, and by introducing a more accurate urban propagation model. [C1601]

"Study of antenna array based multipath propagation phenomenon in LAS-CDMA standard"

Throughout the history of wireless communications, spatially diverse antenna array systems have being important in improving the radio link between wireless users. Moreover, this system is proposed to reduce the multipath fading through its narrowly directive radiation beam. The introduction of an interference free window in the delay domain from the new LAS-CDMA standard has received much attention for furthering research on multipath delay spread. In this paper, we studied the effect of angular spread on maximum excess delay in multipath propagation environments. Then, we examined the application of antenna arrays in the LAS-CDMA standard to overcome this multipath phenomenon. First of all, the multipath propagation literature is reviewed, followed by the explanation of maximum angular spread in a simple discrete ring of scatterers model. Comparison analyses are made between the conventional omnidirectional antenna and narrow beam antenna array. Finally, the analytical performances in term of power delay profile are presented. [C1602]

"Mitigation of the effect of ionospheric scintillation on differential GPS rangefinding"

The phenomenon of the scintillation of radiowave propagation producing irregularities in the equatorial ionosphere is discussed in this paper. Based on a dual frequency data for fluctuations along the path of GPS signals through the equatorial station, sampled at a rate of 1 Hz, are used to investigate the phase scintillation phenomenon. Statistical parameters of the signal such as the scintillation index, autocorrelation function, cross-correlation function, power spectrum density, spectral index, etc., are investigated. Experimental results concerning phase scintillation in the ionosphere structure are presented and has been demonstrated by using the MATLAB® program. Theoretical results are compared to observational data taken from the equatorial region. Both correlation function and power spectral density analyses are considered. Finally, some future effects in ionospheric scintillation studies in the areas of transionospheric communication are recommended. [C1603]

"Evaluation of ultra wideband (UWB) signal transmission, propagation and reception with low cost UWB RF front end"

We present ultra wideband signal measurements in an indoor environment using a simple UWB transmitter and receiver at some defined ranges. At the transmitter side, the UWB source is generated using a low cost sub-nanosecond impulse generator, triggered by a rectangular pulse, and transmitted with SkyCross's UWB antenna. At the receiver side, the UWB signal is received by SkyCross's UWB antenna and subsequently amplified by an ultra wideband low noise amplifier (LNA). The frequency spectrum and time domain waveform of the UWB signal, transmitted and received over defined ranges, is presented. The primary study in this paper is to demonstrate short-range low power UWB signal transmission, propagation and reception and its simplicity of implementation. [C1604]

"2004 RF and Microwave Conference (IEEE Cat. No.04EX924)"

{no data available} [C1605]

"Predicting the monthly cumulative distribution of the effective earth radius factor for South Africa"

In previous work a model was developed to predict the annual average cumulative distribution of the effective earth radius factor, the k-factor, for telecommunications applications in South Africa. Long term meteorological radiosonde data from eight stations were used for this purpose. In this paper, the model is used to predict the cumulative effective earth radius, or k-factor, distribution for different months as a function of height. Comparisons between observed and predicted results are presented. [C1606]

"An advanced multi-element microcellular ray tracing model"

In this paper an advanced site specific image-based ray-tracing model is developed that enables multi-element outdoor propagation analysis to be performed in a microcellular environment. Sophisticated optimization techniques such as pre-processing the environment database using object partitioning, visibility determination, diffraction image tree pre-calculation techniques, and parallel processing are used to improve run time efficiency. A comparison of path loss prediction with multi-element site specific measurements shows strong agreement,

with a mean error of 3.6 dB and a standard deviation of 3.2 dB. The model is also shown to be capable of performing detailed MIMO analysis. [C1607]

"Ultra-wide bandwidth communication channel analysis using 3-D ray tracing"

A true 3-D ray tracing model has been developed for UWB propagation in a typical modern office. A time domain approach is used to determine all dominant paths by which radiation radiates from a transmitter to a receiving site. The number of rays that have to be considered can then be dramatically reduced for subsequent analyses. The properties of received power and delay spread as well as angle of arrival are presented. Each dominant path could then be represented by a function with these properties. Predictions of received waveform are produced by convolving a typical input UWB pulse with these functions. Hence, different input pulse characteristics can be applied to the transmit antenna and the receiver characteristics rapidly evaluated. The model also gives the transmission direction for each successful ray, which is difficult to measure in reality but essential to build the smart antenna. [C1608]

"Anomalous signal detection using multi-layer neural network for electromagnetic wave radiation"

It is well known that the electromagnetic waves that radiate from the Earth's crust are useful for predicting earthquakes. We observe electromagnetic waves in the extremely low frequency (ELF) band of 223 Hz. These observed signals contain several undesired signals due to fluctuations in the magnetosphere or the ionized layer, lightning radiation from the tropics, and so on. This paper proposes a multi-layer neural network using compression data for precursor signal detection. Input data are reduced by the wavelet transform. Moreover, we discuss an implementation of the hidden layer. It is shown that the proposed neural network is useful for precursor signal detection. [C1609]

"Reduction of intersymbolic interference using the eigenanalysis method and linear antenna array"

This work presents results of a study concerning joint use of antenna arrays and eigenanalysis method for inter symbolic interference reduction without using a training sequence. The cancellement capacity of the eigenanalysis method is applied to reduce the multipath propagation effect, beamforming the path of the desired signal and attenuating undesirable paths. This equalization is analyzed in frequency and time domain and results show that the method can be used to combat intersymbolic interference. Besides, the curve of the estimated bit error rate (BER) shows that antenna arrays and eigenanalysis method can be utilized to improve the equalization efficiency. [C1610]

"Capture properties of the generalized CMA in alpha-stable noise environment"

In cellular radio system, both multipath propagation and additive interference can disrupt the constant envelope property of the received signal, but the constant modulus algorithm (CMA) has the ability to remove received envelope variations and reject the various interference components from the desired signal. The capture properties of CMA in Gaussian noise environment have been fully developed (J.R. Treichler and M.G. Larimore, 1985). This paper proposes a GCMA (generalized CMA) which generalizes the CMA by introducing the α-stable distribution as the noise model. Here, the original CMA is only a special case of the GCMA. An analytical model is proposed to analyze the capture properties of the GCMA. [C1611]

"Analysis of propagation path for location of base-station in the microcell CDMA mobile communications"

In microcell mobile communication, we analyze the propagation path which can accurately and rapidly interpret mobile communication propagation in an urban environment, when the subscriber service is based on the urban main road. To find the appropriate BS location in an urban street, we suggest a simplified algorithm to interpret the propagation path and a propagation prediction model which can predict the field strength at the receiving MS, located in a LOS or NLOS position within the service area. The algorithm was tested by simulation. As a result, we present a location condition for the BS of microcell CDMA mobile communication systems. [C1612]

"Position location scheme for low coverage areas"

A network-based hybrid location scheme is proposed for the localization of mobile users at outskirts of coverage areas. Since in the case of low subscriber density areas, the number of base stations is reduced, difference time of arrival (DTOA) and angle of arrival (AOA) measurements are combined to allow acquisition of mobile location using only one BS and one LMU as fixed land references. The feasibility of the proposed methodology, based on maximum likelihood estimation, is examined analytically and via simulation for a variety of propagation scenarios. Results show that the proposed methodology can be applied for a wide range of cell sizes and noise

environments. [C1613]

"Indoor radio WLAN performance in multimedia communications"

This paper deals with multimedia communications over WLAN. An experimental study is described with the main focus on optimisation of indoor radio propagation models and its application to broadband multimedia streaming performance. The results show that improved accuracy of existing indoor radio models is achieved through parameter optimisation based on experimental on-site measurements. A minimum threshold for the received power of the radio signal is found as a limit for achieving acceptable QoS. [C1614]

"Proceedings of 2004 International Symposium on Intelligent Signal Processing And Communication Systems ISPACS 2004 (IEEE Cat. No.04EX910)"

{no data available} [C1615]

"Small-scale delay-domain statistics of the frequency-selective indoor wireless channel"

In this paper, electromagnetic signal propagation in the frequency-selective indoor wireless channel is investigated with the help of ultra-wideband channel measurements. Delay-domain statistics used to characterise the multipath delay spread are evaluated numerically. The spatial variation of these parameters over a short range is studied, and their statistical behaviour is analysed. It is demonstrated that the mean and rms delay spread exhibit spatially distributed alternating zones of high and low spread over a short range corresponding to electromagnetic interference fringes. Furthermore, they are approximated with Gaussian random variables. A theoretical explanation is provided for this small-scale behaviour. [C1616]

"Application of large-scale electromagnetic numerical methods to model ultra wideband radio wave propagation"

The pseudo-spectral time domain (PSTD) method and the local spectral time domain (LSTD) method, two large-scale electromagnetic numerical methods, were applied to investigate ultra wideband (UWB) radio wave propagation. A one-dimensional (1D) initial condition technique was applied and extended in order to use these large-scale methods. Some numerical simulations were used to study the feasibility and efficiency of these two methods. Compared with the UWB measurement methodology, the theoretical simulations may be more convenient, practical and helpful in link-budget analysis of UWB wireless communication. [C1617]

"Scattering of EM waves from a wall with random distribution of gaps"

A semi-deterministic model of electromagnetic scattering from the exterior urban building wall is developed. This model is capable of modeling scattering from ledges, windows and other large scale structures present on the walls. The results of this analytical model are compared with Monte-Carlo simulation of scattering from a wall and they are in good agreement. [C1618]

"Accurate high-speed propagation prediction method based on measurement [Curban microcellular radio]"

A new propagation prediction method, aimed at urban microcellular radio systems, is presented. Using the proposed method, the prediction area is divided into some sub-zones to distinguish the changes of propagation environment in it at first. Then, an adaptive coefficient algorithm, based on measurement data, is employed to derive the propagation characteristics of each sub-zone. Finally, we can obtain the field strength distribution of each sub-zone and the 2D coverage of the entire prediction area. Results indicate that the proposed method combines the speed of classic statistical models and the accuracy of classic deterministic models and has good propagation prediction performance for microcellular radio communication systems. [C1619]

"Wideband space-time communication: from propagation-based models to information-theoretic design prescriptions"

First Page of the Article [C1620]

"A parabolic wave equation approach for modeling propagation through windows"

The work presents a novel method for studying wave propagation through windows based on the parabolic wave equation. A 2D wide-angle parabolic equation is applied for modeling of propagation through a set of windows. It is shown that the proposed method can be accurate and efficient in comparison with applying FDTD to the whole

of the domain. Computer simulation results are presented for both normal and oblique incidence and compared with some reported results. [C1621]

"Full wave analysis and design of a photonic crystal substrate patch antenna"

Planar microstrip patch antennas can achieve a wide range of radiation patterns. However, due to surface-wave losses, they have low bandwidth, low gain, and a potential decrease in radiation efficiency. In order to minimize the surface-wave effects, a photonic-band gap (PBG) substrate is proposed. The PBG structure significantly diminishes the surface wave modes and thus improves the gain and farfield radiation pattern and efficiency. In this paper, using FDTD, an accurate full wave analysis of surface wave propagation in a rectangular microstrip patch antenna with and without PBG is presented. [C1622]

"High resolution scatterometer based on vector network analyzer"

For a scatterometer, based on the Hp8520c vector network analyzer, used for high resolution radar clutter measurements, the system parameters must be redesigned to fulfill the request. A relationship exists among the range resolution, minimum ambiguous range and sample point number, and the scope of parameters is limited, so a tradeoff must be considered. At the same time, as the range resolution increases, the illuminated area reduces and the return echo power falls, so the equipment sensitivity or the maximum range must be consider too. The design procedure is introduced. A sea clutter measurement has been done by this project. It is found that the scattering coefficient at 1 GHz bandwidth is greater than that at 0.2 GHz bandwidth when the grazing angle is less than 10°. The preliminary results show that the project for high resolution is viable. [C1623]

"Establishing atmospheric cross section with modified ITU-R model [Cradiowave refraction]"

The key to increasing the modified radiowave refraction precision is to acquire an accurate atmospheric profile. In this paper, we present a modified atmospheric model algorithm referring to the atmospheric reference model given by ITU-R. Based on this, and incorporating it with the set of recent five years profiles in a given area of China, we give statistics of the meteorologic parameters which most fit the atmospheric environment of China. [C1624]

"Low statistical data processing for applications in Earth-space paths rain attenuation prediction by an artificial neural network"

The paper discusses low statistical data processing tools used to select appropriate input-output pairs to train an artificial neural network. The input-output pairs are constituted by a satellite link's operating parameters, such as the rain rate for a specific time percentage, latitude, elevation angle, polarization angle, station height, frequency as input, and attenuation as output. After several experiments, we observed that the existence of low statistical input-output data contributed to failures in the neural network learning process. In this way, we developed an instrument to identify poor statistical data among experimental data. So, after implementation of this method, no more failures were detected during the learning process and the neural network performed well in the prediction of rain attenuation in Earth-space paths. [C1625]

"A new fast prediction of the coverage area in WCDMA networks"

The paper provides a forward channel pilot strength coverage prediction method to aid in the RF optimization of WCDMA wireless networks. A novel prediction algorithm for wave propagation environments without using a 3D digital map is proposed; it is computed using an inversion technique from measured data. This algorithm is accurate and fast enough to predict efficiently the coverage area which is one of the key tasks in the process of optimizing WCDMA networks. [C1626]

"Radiation characteristic of eight-shaped slot leaky coaxial cable and the restraint of high-order mode"

In finite spaces such as tunnels and mines, mobile communication is mostly implemented by using leak coaxial cable. Starting from the basic electromagnetic theory, the radiation characteristics of eight-slot leaky coaxial cable is studied, the existing condition of radiation mode is given, and the frequency bandwidth of the single-mode radiation is discussed. In this paper, the authors point out that the cable does not have radiation waves of even mode but only has waves of odd mode such as -1, -3, -5 and so on. A series of new slots can be opened at the outer conductor of the cable where the distance between the new slot and old ones is P/2n where n must be an odd number and it should be equal to or less than -3. Consequently, the corresponding high-order mode is restrained and the frequency bandwidth of the single-mode radiation is extended. The conclusions have all important meaning to the design and use of eight-slot leaky coaxial cable. [C1627]

"Characterization of indoor radiowave propagation at university buildings"

Indoor radiowave propagation is studied by mathematical models of 5 and 7 ray multipath. Frequency response and impulse response are calculated. Measurement of spatial variation of receiver power were performed at 5 sites in university buildings. The power-distance gradients were found. The penetration loss of walls was calculated from measured data. Calculated cumulative distribution function (CDF) showed that spatial distribution of power resembles the log-normal distribution. [C1628]

"The effect of background noise on WCDMA property"

Based on the Okumura-Hata propagation model, we analyzed theoretically the effect of background noise on WCDMA properties, and educed the relation between background noise and coverage capacity. The simulation about noise indicates that, when background noise increases by about 1 dB, WCDMA coverage area is reduced by 12%, and the increase of background noise also reduces capacity. In a word, an increase of background noise debases WCDMA properties, and these effects are different if the height of NodeB antennas, NodeB transmitted signal power or cell coverage radius is varied. [C1629]

"Generation mechanism of VLF chorus emissions and relativistic electrons in the magnetosphere"

Summary form only given. We first study the generation mechanism of whistler mode chorus emissions. The essential mechanism of the frequency change is due to the inhomogeneity of the geomagnetic field in the equatorial region. A whistler mode wave can trap electrons near the cyclotron resonant velocity. The trapping is only possible near the equator where the Lorentz force due to the magnetic field component of the whistler mode wave is larger than the magnetic mirror force due to the inhomogeneity of the geomagnetic field. The electrons approaching the equator get into resonance with the wave when the parallel velocity increases to the resonance velocity of the wave due to the adiabatic motion. Most of the resonant electrons, however, do not enter the trapping region, because the separatrix of the trapping region is closed. Only a fraction of the resonant electrons near the separatrix get into the trapping region because of the enlargement of the separatrix as the particles approaches to the equator. Consequently, there arises a deficit of trapped particles in the velocity phase space, giving rise to a resonant current causing wave growth and frequency increase. Since the resonant current changes its polarization to cause wave damping on the other side of the equator, the rising tone emissions with increasing amplitudes are only possible when the coherent wave propagates away from the equator interacting with counter-streaming resonant electrons. The relativistic electrons with relatively high pitch angles can readily get into resonance with such a coherent whistler wave, if their parallel velocities satisfy the relativistic cyclotron resonance condition. We performed test particle simulations where we solved relativistic equations of motion for high energy electrons under the electromagnetic fields of a coherent whistler mode wave and the dipole geomagnetic field. We find that resonant trapping of relativistic electrons by a whistler mode wave with a rising tone results in efficient acceleration of resonant particles to relativistic energy. [C1630]

"Study of VLF band electromagnetic waves in the Antarctica observed by polar patrol balloons"

The two large scientific balloons (PPB: polar patrol balloons) were launched on January 13th, 2003 at Syowa Station in Antarctica. The balloons reached the altitude of 33 km, and observed various data for about two weeks. We developed the wideband electromagnetic wave receiver onboard PPB and observed ELF/VLF waves in Antarctica. VLF band waves observed in Antarctica are frequently modulated in frequency. Among these frequency modulations, the modulations of about 20 sec are considered to have relations with the compressional Alfven waves. By taking cross correlations between data observed by two balloons, we can identify the direction from which VLF waves propagate as well as the source region where these waves are excited. We compared one event observed by both balloons on January 17th, and found the time when the strong VLF wave observed by the 8th PPB was 3 seconds earlier than that observed by the 10th PPB. This result indicates that this VLF wave propagates with the velocity of about 67 km/s. The projection of this velocity on the equator plane is about 1800 km/s, which is almost the same order as the estimated velocity of the compressional Alfven waves in this region. [C1631]

"Measurement of characteristics of MF radio wave propagation in the ionosphere by the S-310-33 rocket experiment"

The electron density in the lower ionosphere is very interesting because it affects the MF radio wave propagation. In order to investigate the electron density profile in the lower ionosphere, we load the S-310-33 rocket with the medium frequency receiver (MFR), and the S-310-33 rocket experiment was carried out. The MFR observed the radio wave intensities at 238 kHz and 873 kHz in the lower ionosphere. The electron density in the lower ionosphere is estimated by the MF absorption method. The MF absorption method is developed to

estimate the electron density by comparing the observed wave intensity with that calculated with the full wave method. In the profile of the radio wave intensities observed by the MFR the radio wave is suddenly absorbed at an altitude of from 88.5 km to 89.5 km. The electron density is estimated to increase suddenly at this altitude. [C1632]

"Ionospheric propagation of ELF/VLF waves radiated from earthquake"

Anomalous phenomena associated with earthquakes have been reported using satellite observations. Before earthquake generation, electromagnetic wave emissions are frequently observed as high noise levels in wide bands. We compute rigorous wave intensities on the ground surface and in the ionosphere caused by earthquakes, using full-wave analysis. We assume the seismic source is an electric dipole located underground as the combination of much smaller dipole polarizations created around the epicenter. The inhomogeneity of the ground and the inhomogeneity and anisotropy of the ionosphere are taken into consideration. Especially, the effects of the geomagnetic field on the wave propagation are considered. The computed results in the frequency range from 10 Hz to 10 kHz show the difference in spatial distributions of the wave intensities due to the whistler-mode propagation in the ionosphere. By using these results, the wave intensities which would be observed on the Earth's surface and in the ionosphere are determined as a function of seismic source strength. [C1633]

"Second-order statistics of electromagnetic pulse propagation through the turbulent ionosphere"

The characteristics of the signal fluctuations and the channel model are described by several important coherence parameters, which are determined by a two-position, two-frequency and two-time mutual coherence function of the received signals after propagating through random media. The paper discusses these second-order statistical quantities by using an analytic solution to the mutual coherence function for a plane wave recently obtained by iteration of an integral equation. Afterwards, the power impulse response, spectra and delay-Doppler scattering function are also derived and discussed. [C1634]

"The variation of foF2 in the equatorial ionosphere"

The ionospheric variation plays an important role in high frequency (HF) propagation. HF radio waves emitted by a transmitter at a given elevation angle may travel and reach the designated receiver via reflection off the ionosphere in a given circuit. Thus, the understanding of the variation of the ionosphere is very important for the design of the communication circuit. In the study of the ionosphere, foF2 is taken as the main parameter that reflects the ionospheric variations because the densest ionization occurs in this layer. One of the most important quantities in HF communications is the maximum usable frequency (MUF), which is the maximum frequency reflected by the ionosphere for a given circuit, and is closely related to foF2. Thus, the study of the variation of foF2 is very helpful for the HF circuit design. We investigate the behavior of foF2 values which can characterize well the F-region morphology over the equatorial region and of the relation to solar activity. Thus, we can get a better understanding of the equatorial ionosphere and provide suggestions and help on the improvement of the prediction of the equatorial ionosphere and HF circuit design. [C1635]

"The conceptual design of multi-channel millimeter wave receiver for VLBI"

The most important thing in millimeter and sub-millimeter wave VLBI is how to calibrate the variations in the phase of an electromagnetic wave propagating through the troposphere. Many techniques for calibrating the phase fluctuations due to the troposphere have been well proposed and demonstrated (Alef, W. et al., 2003; Asaki, Y. et al., 1998; Sasao, T., 2002). A millimeter wave multi-channel receiver system which can be used for phase calibration in millimeter and sub-millimeter wave VLBI observation is proposed. A conceptual multi-channel receiver system and quasi-optical filters which could be used in this receiver are described. [C1636]

"Signal level interpolation for coverage area prediction"

Predicting the received signal level is important in the design of cellular communication systems. In this paper, signal level interpolation around measured signal levels is introduced as a means to predict coverage areas. For signal level interpolation, surface fitting methods are required and three methods have, been evaluated: moving least squares (MLS), Delaunay triangulation and averaging for interpolation (AFI). The first two methods interpolate signal level values over a wide area with samples from only a few measurement points, while AFI requires closely spaced, evenly scattered points. MLS and Delaunay triangulation are described in the literature while AFI is a novel method developed by the author. The interpolated signal levels have been compared with measurements. The mean of the standard deviation of the error for seven test cases is 6.1 dB with the MLS method and 5.1 dB with triangulation. A comparison between all three methods revealed that in cases of closely spaced, evenly scattered points AFI gives the smallest mean value of the standard deviation (3.0 dB) for four

cases. [C1637]

"Macrocell radio wave propagation prediction using an artificial neural network"

This paper presents and evaluates an artificial neural network model used for macrocell radio wave propagation prediction. Measurement data obtained by utilising the IS-95 pilot signal of a commercial CDMA mobile network in rural Australia is used to train the model. Simple models requiring only small amounts of training data have been used for the propagation predictions. The neural network inputs are chosen to be distance to base station and parameters easily obtained from terrain path profiles. It is concluded that a path loss predictor based on a simple neuron model generalises relatively well and requires only a few iterations in batch mode, using the Levenberg-Marquardt algorithm and early stopping, to converge to its optimum. The path loss prediction results using the neural models are favourably compared to the new semi-terrain based propagation model recommendation ITU-R P.1546, and traditional models, such as the Hata model. The statistical analysis shows that the simplistic artificial neural network approach is an alternative to traditional propagation models regarding accuracy, complexity and prediction time. [C1638]

"The characteristics of UWB signal transmitting through a lossy dielectric slab"

The electromagnetic transmission phenomenon is one of the most important parts of propagation modeling of UWB signals in the indoor environment. However, in previous work there has not been an efficient solution for the transmission of UWB signals. In this paper, we develop an analytical time-domain solution of a transmitted electric field through a lossy dielectric slab excited by an oblique incident plane wave. This solution is derived from the inverse Laplace transform of refraction coefficients at both surfaces of the slab and propagation losses in the slab. Based on the solution, a detailed investigation is presented on the transmitted field waveform for UWB signals passing through lossy dielectric slabs in varied scenarios of an indoor environment. Finally, we discuss the transmission loss of different slabs in the indoor environment and how to efficiently apply our solution efficiently in modeling the UWB propagation. [C1639]

"Capacity of MIMO OFDM systems in spatially correlated indoor fading channels"

Multiple-input multiple-output (MIMO) wireless systems provide significantly higher capacity compared to the conventional single antenna systems in rich scattering environments. However, the real capacity advantage in a specific channel environment strongly depends on its propagation characteristics. In this paper, we analyze the capacity of an OFDM based spatial multiplexing system for indoor fading channels. We model the channel between the transmitter and receiver arrays by considering two indoor propagation models, the extended Saleh-Valenzuela (ESV) model and the geometrically based single bounce elliptical model (GBSBEM). Spatial correlation matrices for the realizations of the ESV and GBSBEM are obtained for the wideband MIMO fading channels, which are then used for evaluation of the mutual information and outage capacity using Monte Carlo simulations. The behavior of capacity versus outage is investigated for different physical parameters and antenna geometries. Capacity results are discussed here with similar power delay profiles, antenna spacing and angle spreads for uniform linear and circular arrays. [C1640]

"Spatial correlation measurements for broadband MIMO wireless channels"

In this paper, we propose a method to determine the transmit and receive side spatial correlations for an arbitrary antenna spacing in the arrays from a directional MIMO channel measurement. A broadband MIMO channel measurement platform has been developed, which is used to obtain the angles of arrival (AOA) and angles of departure (AOD) of resolvable multipath components (MPC). The AOAs and AODs are estimated from the measured MIMO channel data by using a sequential unitary ESPRIT algorithm. The measured AOAs, AODs and corresponding powers of the MPCs are used to compute the power angle spectrum for the transmitter and receiver sides of the MIMO propagation channel. The spatial correlation matrices and MIMO capacity can then be obtained from these directional measurements. Capacity results from the correlation measurements using a stochastic broadband MIMO channel model are observed to closely match the directly measured MIMO capacity for different propagation conditions and antenna spacings. [C1641]

"Modeling of the LF-MF radiowave propagation over inhomogeneous irregular radiopaths"

First Page of the Article [C1642]

"Communication and distance measurement in subway tunnels using natural propagation"

This paper first presents experimental results on the narrow band and wide band propagation characteristics in a typical subway tunnel, including the influence of narrowing, bends and masking effect. From this approach, the

possibility of having a system ensuring simultaneously a communication link and a distance measurement is investigated. Trials have then confirmed the predicted results. [C1643]

"Parametric MIMO model for ray tracing/launching simulations"

A parametric model (PM) that reconstructs the MIMO (multiple-input multiple-output) channel from a single SISO (single-input single-output) realization using a ray launching/tracing engine is presented in this work. This model uses spherical propagation and image theory. The novelty of this model is that it takes into account variations in the diffraction coefficient. It is shown that spherical propagation and variations in the diffraction coefficients must be taken into account in short-range distances. [C1644]

"2004 IEEE 60th Vehicular Technology Conference. VTC2004-Fall (IEEE Cat. No.04CH37575)"

{no data available} [C1645]

"Automatic optimization algorithms for the planning of wireless local area networks"

The planning of WLAN infrastructures that supply large buildings or areas requires the consideration of many aspects and therefore is a difficult task if done manually. In this paper, a method is presented that allows one to optimize such networks automatically. The approach is based on predictions of the received power to account for the propagation conditions that have a major impact on the performance of WLANs. The optimization is applied to a set of possible locations where access points can be installed. Out of this set, a minimum selection of locations is made to meet the given requirements. These consist of the determination of areas with different priorities and the definition of further parameters. It not only takes into account the required coverage and capacity but also the interference situation. The arising co-channel interference is minimized by an appropriate assignment of the available carrier frequencies. The discussed approach may not find the global optimum in all cases, but it yields a suggestive result based on the locations defined by the network planner. Due to the very short computation time, different configurations can be analyzed very quickly. [C1646]

"Influence of people shadowing on optimal deployment of WLAN access points"

With their low cost and high-speed data rate capabilities, installations of IEEE 802.11-based wireless local area networks (WLANs) are growing exponentially. Although many organizations have started using WLANs, there are still very few tools available that can help the design of WLAN networks. As a result, the current deployment remains ad-hoc in nature. The objective of this work is to develop modeling tools for performance optimization of WLAN networks and WLAN access points. In particular, propagation models are available that can predict the signal strength and interference in a WLAN system by taking into account environment specific parameters such as the structure of the building, presence or absence of stationary obstacles etc. This paper investigates the influence of moving obstacles, such as people, on radio wave propagation inside a building and the effect on received signal quality in a WLAN. Our findings suggest that the presence of moving obstacles seriously affects the performance of the system by introducing heavy variations in the received signal strength. [C1647]

"Modeling and optimization of heterogeneous wireless LAN"

A sophisticated approach to automated prediction for the optimal layout and quantity of WLAN access points to achieve the desired network parameters is introduced. The algorithms were implemented in Web-based software for RF planning of a complete wireless local area system with multiple radio frequency technologies (IEEE 802.11a, 802.11b/g, and Bluetooth) based on a mesh topology. The implemented optimization method based on evolution strategies offers easy specification of various network aspects and QoS requirements (hotspots of various technologies, proffered areas near Ethernet ports and power outlets, throughput, number of concurrent users, etc.). The first few months of operation and usage in many real-world scenarios have shown good performance and appropriate accuracy. The application is also able to model site-specific coverage and the capacity of the wireless network using semi-empirical propagation models. [C1648]

"Propagation characteristics for coastal region of South Korea and their impact on communication systems"

Refractive index structure of the atmosphere may play a dominant role in influencing signal levels associated with terrestrial communication systems. It is therefore desirable to have a-priori knowledge of the statistics of refractivity structures for the design of a communication system for a particular region of the earth. Statistics of refractivity profiles were derived from a database of radiosondes corresponding to two spring-summertime periods (2002 and 2003) for Cheju, South Korea, which is in the vicinity of the Korea Strait. Modified refractive index profiles, which give characteristic features defining propagation conditions, were constructed from

temperature, pressure and humidity versus altitude measurements by radiosondes launched at Cheju. Ducting and non-ducting cases were culled from an analysis of the radiosonde measurements. Equivalent bi-linear and tri-linear ducting profiles were modeled for the ducting cases. Statistics associated with K-factor, a characteristic propagation feature for non-ducting cases, were determined. Typical refractivity profiles with correlated features were characterized for both the ducting and non-ducting cases. Unique aspects of this effort are that: (a) refractivity statistics were determined for a part of the world hitherto not considered, (b) most-probable or typical refractivity profiles with correlated features were determined, and (c) the impact of typical refractivity profiles on signal levels for a notional communication system in this region was addressed. [C1649]

"RF propagation in tunnel environments"

A review of radio propagation in subterranean tunnels is presented. Such environments are of interest for homeland security as subways are a vulnerable target, and in a military context. A theoretical analysis of the waveguide nature of tunnels is presented along with the loss mechanisms due to surrounding walls. Propagation losses associated with corners, bends and antenna coupling are also presented. Modeling techniques such as finite difference, time domain, parabolic approximations and ray tracing approximations are discussed and some numerical results for straight, curved and cornered tunnels are presented. [C1650]

"A novel approach for indoor geometric OFDM quality-of-service analyses"

This paper introduces a novel method for the indoor orthogonal frequency division multiplexing (OFDM) quality of service (QoS) analyses. We focus on an automatic geometry-driven approach to quantify the indoor OFDM performance through off-site computer-aided procedures. Essential OFDM quality-of-service measures, such as signal-to-interference ratios (SIR) and bit error rates (BER) can be generated by this new analysis tool. The resulting QoS measure contours can be used by service providers and OFDM communication system designers to quantify the system performance and determine the optimal accessing locations for an indoor geometry. [C1651]

"Satellite propagation path model along a railway track for GNSS applications"

The applications of GNSS (Global Navigation Satellite System) services are continuously growing in the field of transport. However, the choice of the system for a given application is directly guided by its availability and the availability of most satellite-based localization processes of terrestrial mobiles is considerably degraded in transport environments because of significant masking effects. In these environments, the availability of positioning information is not always guaranteed. We present the results of a railway study using both experimental measurements and the PREDISSAT simulation tool that we have developed. We follow a Markovian approach with three states corresponding to the three states of reception of the signal (direct, multipath and blocked). The probability of occurrence of each state characterizes the GNSS propagation channel in a railway environment. [C1652]

"Behavior of ad hoc routing protocols in metropolitan environments"

The current implementation of propagation models for the network simulator ns-2 only allows simulations within flat environments. Nodes are always within line of sight and the distance between one and another determines their connectivity. Our extensions permit simulations within urban and non-flat environments. This gives new insights into the behavior of routing algorithms. The simulation environment has great impact on the performance of ad hoc routing algorithms. Results show that packet loss and routing overhead are dramatically increased. Further, they advise the assumption that AODV always outperforms DSR. However, both have great shortcomings concerning networks with fast moving or numerous nodes. Results suggest the necessity for new routing algorithms or imply a paradigm shift for the application of ad hoc networks. [C1653]

"Modeling effects of mutual coupling considered at both ends of a MIMO channel using computational electromagnetics"

We describe a technique that uses the method of moments (MoM) to consider the effects of mutual coupling, and electromagnetic ray tracing (ERT) to model far-field propagation. Our technique allows for the comparison of the capacity of a communications channel when mutual coupling is and is not considered at one or both ends of the link. We apply this technique to several representative and actual urban environments. We find that pattern diversity, which results from the inclusion of mutual coupling, should be considered in cases when there is large angle spread at the receiver. Further, with this technique, we are able to simulate a vehicular mobile ad-hoc network and compare spatial multiplexing to beamforming capacity. [C1654]

"Modeling MIMO-OFDM ad-hoc communication systems with computational electromagnetics"

The paper proposes an efficient way to simulate MIMO-OFDM systems with computational electromagnetics. The key idea is to extrapolate channel responses at various frequencies based on the simulated electric field values at a certain frequency. Then it is shown how to fit the simulated and extrapolated channel responses into a statistical channel model. The system capacity under a MIMO-OFDM ad-hoc system scenario is analyzed and it can be seen that both spatial and frequency diversity have been achieved. [C1655]

"Calibration of dipole array with reflector using method of images"

Recently, implementation of super-resolution technique for high-resolution direction-of-arrival (DOA) estimation has been expected in application of smart antenna and wireless propagation research fields. However, to realize high-resolution performance of the techniques, array calibration is indispensable. Generally, array calibration becomes difficult when there exist conductive object close to the array elements. A dipole array with reflector plate is one of the popular arrays. The calibration becomes difficult for the array with finite size of the reflector In this report, we propose a new calibration technique by using method of images, and show that the technique is available for arrays with reflector by computer simulations and experiments. [C1656]

"An effective solution of wireless channel sounder and its channel modeling application"

A real time wideband wireless channel sounder based on WCDMA system is introduced in this paper. After installing a baseband data acquisition device to the base station and some modifications on test UE, a real time wideband wireless channel sounder is established with fairly high performance and low cost comparing to commercial channel sounders. The time resolution of this sounder is limited by the WCDMA system bandwidth and chip rate; however it can provide an extremely high data storing rate up to 100 Mbyte/s which guarantees a high sampling speed up to 15000 Hz of the time variant wireless channel and multichannel measurement simultaneously. The high sampling rate make it available to have a close sight of the time variant characteristics of the wireless channel such as small scale fading and Doppler effect. The performance of sounder is analyzed and summarized in detail; also the post-processing method of the measurement data is described briefly. Some measurement results corresponding to different wireless environments are presented as examples; wireless channel propagation characteristics analysis and a wireless channel modeling application are introduced finally. [C1657]

"Wide-band characterization of building materials for propagation modeling: analysis of dispersion phenomena"

In this paper, original developments based on high resolution (HR) algorithms (MUSIC, matrix pencil) are proposed for the spectral analysis of reflection and transmission interactions experienced by a short electromagnetic pulse with construction materials. Such algorithms, whose specificity lies in frequency-dependent multipath phenomena, have been used to reconstruct the impulse responses of a sample from data obtained in a wide but limited bandwidth. The influence of parameters associated with the sample structures has been studied in order to evaluate the performance of HR algorithms in material characterization. Such a study leads to a useful tool for the analysis of free-space measurements. Analysis of experimental data obtained from usual materials are presented. [C1658]

"Absorbing and scattering of a short pulses radiation by the radioabsorbing materials"

Here are the results of experimental researches by pulse signal of the absorbing-and diffusing material "Contrast". The material is effective for wideband signals and may be used for camouflaging in the radio-location. [C1659]

"A study of geometric channel modeling methods in wideband directional mobile radio channels"

Conventional geometric channel models (GCMs) were applied to narrowband nondirectional modeling. The main purpose of this paper is to provide a unified analysis on the spatial pattern of scatterer distributions in the E-space for wideband directional channels (WDCs). One advantage of this approach is the availability of analytical expressions relating signal properties in the respective domains to channel properties. A further virtue of this method is to exploit the geometric distribution of scatterers from a physical wave-propagation viewpoint. The analysis is based on the recently proposed semi-geometrically based statistical (SGBS) model and four heuristic rules, which are so formulated as to provide the underlying relationship between the canonical model and the physical channel it represents. Finally, a layered multiple-input-multiple-output channel model is proposed by applying the generic methodology. [C1660]

"The use of HVAC ducts for WCDMA indoor solutions"

In this paper the use of in-building solutions in WCDMA/FDD is studied. In particular HVAC (heating, ventilation, and air conditioning) ducts for signal distribution is studied. Measurement results from a real installation are used as input to a simulation study. In this specific installation the HVAC solution performs almost as good as a DAS (distributed antenna system), but the cost is only a fraction. [C1661]

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{no data available} [C1662]

"Spatial-temporal characteristics of a half-spheroid model and its corresponding simulation model"

For specific probability density functions (PDFs) of the spatial angle of arrival (AOA), the spatial-temporal characteristics of a three dimensional (3D) theoretical channel model, in terms of the temporal autocorrelation function (ACF), Doppler power spectral density (PSD), and spatial cross-correlation function (CCF), are investigated. The mobile station (MS) is assumed to be surrounded by scatterers which form a half-spheroid with a given axial length ratio. Based on the theoretical model, a deterministic simulation model is further proposed, and its spatial-temporal properties are also investigated by providing closed-form solutions. It is shown that both the temporal and spatial characteristics of the simulation model fit those of the reference model very well when the parameters of the simulation model are determined by using the Lp-norm method. Moreover, the influence of the axial length ratio on the spatial-temporal characteristics for both the reference model and the simulation model is also studied. The resulting simulation model is very useful for designers to evaluate the performance of modern wireless communication systems in macro-cellular environments. [C1663]

"Influence of arrival wave with amplitude variation on autocorrelation and frequency correlation coefficients in wideband mobile propagation"

We had investigated autocorrelation and frequency correlation coefficients of an instantaneous received signal level with bandwidth, one of the basic wideband propagation characteristics in mobile communications, by using a delay profile model with invariable arrival wave amplitude. However, the arriving wave amplitude in an actual field was known to vary with the movement of the receiving point. We clarify the dependence of the correlation coefficients on the amplitude variation of the arriving waves by using computer simulations. Our results show that the autocorrelation coefficient is independent of the amplitude variation in the arriving wave. Furthermore, the frequency correlation coefficient increases because of the median variation in the received level. [C1664]

"Phase distribution characteristics in mobile radio channels-phase difference between symbol intervals and adjacent channels"

We evaluate the phase difference distribution with and without diversity in multipath propagation by computer simulation, and find some parts theoretically. The distribution is discussed from two points of view in the time and frequency domains. In the time domain, (a) probability and cumulative density functions are derived, (b) the distribution depends on the product of fading frequency, fm, and symbol interval, Ts, (c) the cumulative value of beyond plus and minus pi/4 in phase difference, p(|x|>pi/4), is calculated. In the frequency domain, (a) the distribution depends on the product of subchannel bandwidth, f0, and excess delay time, τi, (b) the phase difference at a cumulative value of 50% is 0τi>, and is zero off, (c) the cumulative value of p(|x|>pi/4) is also calculated. Furthermore, the distribution with thermal noise is simulated. As an example of the application of the distribution, we estimate the BER of DQPSK by using the distribution, and this agrees well with the theoretical value. [C1665]

"MIMO: a disruptive technology enabling very high spectral efficiency beyond conventional limits"

To demonstrate a real-time, mobile, networked MIMO system in a realistic tactical environment, the DARPA has instituted a program called mobile network MIMO. The first stage of this program is to demonstrate such a system in a rural foliated environment using 20 MIMO equipped nodes using an ad hoc network in bandwidths of 1 MHz, 10 MHz, and 25 MHz, reaching a total network throughput of up to 1 Gbps. Each node is an SUV with 8 transmit and 10 receive antennas. For any particular link, both nodes are naturally at ground level. Such node placement necessitates a channel measurement and modeling effort to determine quantities such as spatial correlations, delay spread as well as propagation loss. Some of the key propagation questions are whether the channels offer enough scattering richness to benefit from MIMO systems. Also of importance is determining the delay spreads experienced in rural environments ranging from densely wooded to open field with large but sparse clutter within line of sight. In this work some of the initial results of spatial channel characterization are

shown for ground level nodes placed in a diverse rural environment. [C1666]

"Simulation of MM-radiowave scattering over statistically uneven surfaces"

The work presents the results of numerically simulating the problem of EM MM-wave scattering over statistically uneven surfaces of natural and anthropogenic origin with regard to directional pattern. Calculations have been made using the perturbation technique and the tangential planes technique. The influence of wavelength, elevation of radiation source above the Earth's surface, angle of sight, electrophysical and statistical surface properties on scattered fields has been studied. The available mathematical and software tools allow for the scattered field and the absolute cross-section to be calculated for varied geometrical and electrophysical parameters of the problem. These investigations have been carried out with the aim of simulating a MM-wave radar radio channel. We intend to develop the model to encompass compound pulse probing signals and actual directional patterns. [C1667]

"Moon-limb reflection of radio waves during solar eclipse on May 31, 2003"

During observations of a solar eclipse on May 31, 2003, a zone of brightness was discovered in the Moon limb in a polarization channel of a 13.5-mm wave. This was either due to the reflection of radio waves from its surface or to their refraction in the circumlunar plasma. [C1668]

"The impact of mobile speed on the performance of W-CDMA networks"

We investigate the impact of mobile speed on the performance of a W-CDMA network. The analysis has been carried out using a very complex simulation tool which takes into account propagation, users mobility, voice and data users and the main radio resource management strategies (RRM) in both the uplink and downlink. The results show that in the presence of peaks of offered traffic, the performance of the network is strongly dependent on the mobile speed. [C1669]

"Base station placement in asymmetric TDD mode systems in a Manhattan environment"

With time division duplexing (TDD), radio resources can be flexibly divided between uplinks and downlinks. This makes TDD suitable for handling the increasingly asymmetric traffic generated by data and multimedia services. When asymmetries are different in neighbouring cells, adverse interference conditions can arise, however. The paper investigates how base station (BS) placement affects the performance of a TDD mode system with asymmetric links in a Manhattan like environment. In particular, the influence of BS placement on inter-base station interference (IBI) and inter-mobile interference (IMI) is assessed. Results show that, similar to conventional systems with symmetric traffic, it is preferable to place BSs somewhere between intersections rather than in intersections. Though the interference mechanisms are different, the studied asymmetric systems seem to be no more vulnerable to an in-intersections placement than is a symmetric system. [C1670]

"Using mobile phones for therapeutic purposes"

The paper discusses the features of mobile phones that determine the nature of radiated EM fields, as well as generated sound and optical vibrations having various spectral characteristics. It is shown that, due to the wide spectrum of vibrations radiated by mobile phones, they may have both negative and positive influences on the human body. Ways and techniques for assessing these influences are suggested. Approaches to design improvements are formulated with the aim of applying the bio-information effects of mobile phones to human organisms, including stress relief. [C1671]

"A 60 GHz transceiver with multi-gigabit data rate capability"

A transceiver operating at 60 GHz capable of gigabit data rate has been built and demonstrated. On-off shift keying (OOK) was selected for modulation for the first-generation system due to the relative simplicity of implementation and the potential it offers for very high data rates. A combination of commercial and custom MMIC was used in the system. High-directivity horn antennas as well as omnidirectional antennas were used in various combinations during system testing. A BER of 1Ч10-12for data rates up to 3 Gbit/s at 10 meters was demonstrated. At a data rate of 3.5 Gbit/s, a BER of 1Ч10-8was measured at 3.0 meters. To the authors' knowledge, this is the highest data rate reported at a carrier frequency of 60 GHz. [C1672]

"Modeling radiowave scattering by an elliptical cylinder and its applications in communications and imaging"

The scattering of a normally incident plane wave from an infinitely long, elliptical cylinder is investigated using

the combined method of ray tracing and diffraction (CMRTD). Both horizontally and vertically polarized incident plane waves are considered. The analytical solution is given for the case when the size of the elliptical cylinder is large compared to the wavelength of the incident field, which is applied to simulate scattering from one row of elliptical trees in radiowave propagation. The numerical simulation results are presented and discussed. [C1673]

"An efficient multipath channel model for UWB home networking"

We extend our previous work, to investigate the time-domain transmitted field through a lossy dielectric slab, so that our time-domain UWB multipath propagation channel model can characterize the most important electromagnetic wave propagation mechanisms, such as reflection, diffraction, and transmission, in a home environment. In order to effectively determine the UWB transmitted field through the lossy material, a time-domain transmission coefficient is derived in a closed form. The analytical solution includes both perpendicular polarization and parallel polarization. Simulation results, which take into account all possible rays in a typical UWB home environment, are presented and some guidance for UWB home networking is presented. [C1674]

"Performance evaluation of 2D RAKE algorithms for WCDMA-DL applications at the handset"

Several 2D RAKE algorithms have been evaluated for performance improvement over a conventional single antenna RAKE receiver at the handset for WCDMA downlink air interface. The main focus of the research is to study the feasibility of smart antenna algorithms for handset application and to identify the best candidate algorithm in terms of performance improvement (BLER) and relative hardware complexity (power and area requirements on a chip). The candidate algorithms are based on the following performance metrics: maximum signal-to-noise ratio (MSNR), maximum signal-to-interference-plus-noise ratio (MSINR) and minimum mean squared error (MMSE). The algorithms have been investigated for hardware complexity based on TSMC 0.18 μm technology. 3GPP specified propagation channels and test conditions have been employed to evaluate coded BLER performance. The improvement in error rate performance combined with relative hardware complexity are used to assess the feasibility of an algorithm for handset applications. [C1675]

"Propagation modeling of VHF radio channel in forest environments"

In previous works, we have described a method, based on a parabolic equation (PE) algorithm, which allows computation of impulse response of stationary determinist channels. We have applied this method in various types of situations, including canonical problems and real radio links over irregular terrain in forest environments. In this previous approach, the radiowave was computed, in a first step, outside the vegetation using boundary conditions on top of the trees and, in a second step, values of path loss inside the forest were deduced using some restrictive hypothesis. In our present model, the electromagnetic field is now directly computed in the entire domain above ground, including the vegetation bulk, using the full-wave PE algorithm. The forest is treated like a lossy atmospheric layer characterized by its permittivity and conductivity. The method can also be used in the case of irregular ground and with sophisticated multi-layered and/or range-dependent forest models. We present results that illustrate the influence of the different parameters (frequency, antenna characteristics, electromagnetic constants, etc.). We also make some comparisons with the well-known Tamir theory. Unlike Tamir, we have experienced noticeable asymmetry in the treatment of upward and downward links when one antenna is inside the forest and the other outside: for instance, computation of the transmitted beam is relatively straightforward when the corresponding antenna is over bare ground and far more difficult when it is inside the vegetation layer. Neither the depolarization effects nor the random nature of propagation media are taken into account at this point in our model but it does not seem to be an issue to do it and we are currently working on this question. [C1676]

"Validation of intermediate level circuit models (ILCM) of a generic system through measurement"

A combined work programme is currently being undertaken to develop and validate suitable modelling and empirical tools to enable the prediction of interference upset to systems. This is a collaboration between the University of York (development of ILCM modelling techniques), and QinetiQ (model validation). The modelling effort and validation exercise centres on a system known as GENEC, a simplified modular representation of a generic missile system. The paper focuses on the RF measurement techniques that were undertaken as part of the collaborative programme to validate the York ILCM frequency domain models. The ILCM method treats the enclosure as a waveguide with forward and reverse propagating waves for each mode. As such, the technique has been applied to the computation of coupling between currents on short monopole antennas located within GENEC, and also to the coupling between internally located monopoles and incident plane waves via the apertures in the GENEC enclosure. The measurement techniques that were used to validate the monopole to monopole coupling scenario are the main topic of the paper. It is found that intermediate circuit level models of the dominant coupling modes within an enclosure can provide very rapid and accurate predictions when

compared to measurement. [C1677]

"Localization of wireless terminals using subspace matching with ray-tracing-based simulations"

This paper presents a method for localizing transmitters in a microcellular environment dominated by non-line-of-sight (NLOS) propagation, using one base station that is equipped with one antenna array. The proposed method takes advantage of the dissimilarities in multipath propagation characteristics of distinct locations in such an environment and site-specific ray tracing models to localize a transmitter. Studies of experimental data are provided to validate the proposed method. [C1678]

"Advances in direct position determination"

We examine the performance of the direct position determination (DPD) approach in the presence of model errors and multipath propagation. DPD is a method that was recently introduced A. J. Weiss (2004). We have demonstrated that DPD outperforms the conventional location methods (AOA/TOA) under line-of-sight (LoS) conditions. The conventional approaches are based on measuring specified parameters, such as angle or time of arrival (AOA/TOA) at each base station and these measurements are then used to estimate the transmitter's location. The conventional approaches are sub-optimal since the measurements at distinct base stations are independent and ignore the constraint that all measurements must correspond to the same location. Using exactly the same data, DPD provides an accurate and natural solution to the measurements-sources association problem that is encountered in AOA and TOA systems. Moreover, in the presence of multipath. DPD provides a better location estimate. [C1679]

"Reliable indoor geometric OFDM quality-of-service analysis using sparse channel estimation"

A novel method for indoor orthogonal frequency division multiplexing (OFDM) quality of service (QoS) analysis using the robust sparse channel estimator is proposed in this paper. Through the procedures of radiofrequency propagation modeling, sparse channel estimation and interference analysis, OFDM quality-of-service measures, such as signal-to-interference-and-noise ratios (SINR) and bit error rates (BER) can be generated using this computer simulation tool. The geometry-dependent QoS measure contours from the simulations can be used by service providers and OFDM communication system designers to quantify the system performance and determine the optimal access locations indoors. [C1680]

"Features for propagation of radiowaves at their interaction with the ionized traces of meteors"

Fast and intensive development of the researches connected to studying of plasma formations in an atmosphere and a space, entails statement of the numerous problems providing successful realization of these researches. To these plasma environments many concepts and the representations received in a course of laboratory researches which, thus, get a new field of application and use are applied. However, in some cases it is necessary to lay down special conditions at the joint decision of theoretical and experimental jobs in which solve the problems arising during realization of researches designated above. The purpose of the given job is experimental check of some results of theoretical calculations on dispersion of radio waves forward on the laboratory model simulating a plasma trace behind space object included in an atmosphere. Experiments were spent at the laboratory stand including vacuum installation, working in a range of pressure from one tenth up to thousand Pascal's, high-frequency installation for generation of air plasma at a current of the category from 0.1 up to 10 amperes, microwave measuring installation in a range of lengths of waves from 3 up to 12 centimeters and installations for electrical probes and other measurements of parameters of plasma. [C1681]

"Simulation of SAR for vehicle occupants"

Vehicle and radio-communications equipment manufacturers, as well as those with responsibility for deploying specialist communications systems for vehicle applications, have a duty of care to ensure that the vehicle occupants are not exposed to high field levels from on-board transmitters. Numerical simulation is well suited to the analysis of in-vehicle field exposure issues, offering numerous advantages over experimental methods of evaluation. The paper outlines the development of such a model, and provides illustrative results obtained for both an empty vehicle model excited by a vehicle-mounted antenna (electric field only), and the same model augmented with a numerical model of the driver (electric field and SAR). [C1682]

"Distributed space-time codes for cooperative wireless networks in the presence of different propagation delays and path losses"

The application of a distributed space-time coding scheme in a simulcast network is considered. A key challenge is addressed which is particularly crucial in the downlink: since the distances between the individual transmitting

nodes and the receiving node are typically different, the transmitted signals are subject to different propagation delays and to different path losses. The influence of these effects on the system performance is investigated for the example of a specific space-time coding scheme, based on simulative and analytical results. Specifically, the issue of equalization/detection at the receiver is addressed, and a joint equalizer/detector algorithm of practicable complexity is proposed for large relative propagation delays. [C1683]

"Optimization of building material properties for accurate indoor ray tracing models"

A 3D ray-tracing program was divided into a geometric engine and an electromagnetic engine so that the electromagnetic engine could be used in an optimization program. The optimization program computed the 92 dielectric permittivity values of a ray tracing building floor plan to minimize the error between ray tracing and measurement peak powers. The results showed that the optimization is well behaved and can reduce the mismatch on a single measurement to about 1 dB or less in most cases. When several measurements are used, it is seen that the overall error between ray tracing predictions and measurements decreases as more measurements are used in the optimization. They also show that the optimized floor plan produces better ray tracing predictions including at the locations not used in the optimization. The proposed optimization program eliminates the tedious task of the manual "tweaking" of building material properties and produces an optimized floor plan that can be used by conventional ray tracing programs. It can be also used to discover weaknesses in ray tracing electromagnetic models. [C1684]

"Stealth constrained routing optimization using directional antennas in mobile ad-hoc networks"

Low probability of detection (LPD) is an important requirement of mobile ad-hoc networks in battlefield applications. Although directional antennas are a suitable means to achieve LPD, related work on the use of directional antennas at the MAC and network layer has been mostly centered on improving network utilization and QoS, while LPD has been mostly addressed at the physical layer. The paper presents a novel scheme to optimize proactive link-state ad-hoc routing algorithms using directional antennas, taking into account LPD requirements. A power control algorithm is used to guarantee that the radiation footprint of a group of mobile nodes is never greater than a predefined maximum, even when directional transmission is allowed. This power control algorithm takes into account the radiation pattern of the antenna, network topology, mobile node positioning and a worst-case propagation model. Preliminary simulation results for the proposed scheme are presented and discussed. [C1685]

"A synchronizing scheme for an impulse network"

We define a synchronous impulse network (SIN) to be a network of distributed wireless nodes employing UWB impulse transceivers whose local oscillators are 'ticking' at the same time/phase. In this paper, a synchronizing scheme employing time-of-arrival (ToA) measurements to transfer time among nodes in order to build a SIN is proposed. Three major sources of impairments to the measurement of the ToA are considered. They are additive noise, multipath self-interference and non-line-of-sight (NLOS) measurements. The effect of multipath self-interference on a correlative timing detector, which is an important component of the proposed synchronization system, has been addressed (Chui et al. (2003)). This paper is devoted to the proposed master-slave time division multiple access (TDMA) synchronization scheme and analyzes the accumulated timing jitter as a result of additive noise, oscillator phase noise and multipath propagation, and places a bound on the number of synchronous nodes possible in the network. We conclude this paper by introducing the concept of a 'roving' master which transforms the master-slave TDMA scheme to a mutual synchronous network. The other objectives of the 'roving' master are to extend the geographical coverage of the synchronous network and overcome blockages of signal propagation paths. [C1686]

"Simplified simulation models for indoor MANET evaluation are not robust"

We evaluate the robustness of simplified mobility and radio propagation models for indoor MANET simulations. A robust simplification allows researchers to extrapolate simulation results and reach reliable conclusions about the expected performance of protocols in real life. We show that common simplified mobility and radio propagation models are not robust. Experiments with DSR and DSDV, two representative MANET routing protocols, show that the simplifications affect the two protocols in very different manners. Even for a single protocol, the effects on perceived performance can vary erratically as parameters change. These results cast doubt on the soundness of evaluations of MANET routing protocols based on simplified mobility and radio propagation models, and expose the urgent need for more research on realistic MANET simulation. [C1687]

"Application of moving window FDTD to modeling the effects of atmospheric variations and foliage on radio wave propagation over terrain"

A new approach to wave oriented radio propagation modeling based on extended finite difference time domain (FDTD) method has been developed. In order to model radio wave propagation using standard FDTD, the entire propagation path would need to be included in the FDTD grid. This would require prohibitive amount of computer memory and time. The new approach takes advantage of the fact that when a pulsed radio wave propagates over a long distance the significant pulse energy exists only over a small part of the propagation path at any instant of time. This allows the use of a relatively small FDTD computational mesh that exists only over a portion of the propagation path and move along with the pulse. At the leading edge of the FDTD mesh inside the moving window the appropriate terrain, foliage, and atmospheric parameters are added to the mesh. At the trailing edge the terrain and foliage that have been left behind by the pulse are removed. Since this method solves Maxwell's equation directly, all physics relevant to radio wave propagation is included in this model In addition, since it is based on the FDTD method, this model can take advantage of the extensive research that has been done on the FDTD algorithm, such as the higher-order finite differencing and multiresolution time domain (MRTD). The moving window FDTD (MWFDTD) method has previously been applied to propagation over different types of irregular terrain. This paper extends this approach to forest covered terrain by treating the foliage as a lossy dielectric layer. In addition, using MWFDTD, atmospheric refractive effects can also be included simultaneously with irregular terrain effects and foliage. We apply our method to radio wave propagation in atmospheric ducts. Comparisons with path loss measurements show good accuracy and illustrate the advantages of a full wave method. While this method is slower than other propagation models, it is potentially much more accurate. Therefore, MWFDTD can be used to validate other faster propagation models, and can provide predictions in cases where a high degree of accuracy is desired. [C1688]

"Military operations in urban terrain: indoor radio frequency propagation prediction methods"

This paper investigates the applicability of two current military tactical communications technologies to military operations in urban terrain (MOUT): Single channel ground and airborne radio system (SINCGARS) and squad radios. Various existing radio frequency (RF) propagation prediction (or path loss) methods for urban environments were surveyed. The primary criterion for the selection of methods of consideration was that they must be valid over the 30-88 MHz frequency range of primary interest. Predicted results from chosen analytical tools were compared to measurements taken using a hardware suite representative of SINCGARS on the campus of The Johns Hopkins University Applied Physics Laboratory (JHU/APL) for select indoor propagation scenarios. A new analytical indoor path loss model is derived from measurements by methods of polynomial and power curve fitting for a typical one-story office building. Also, modifications made to chosen analytical models yielded more accurate predictions. [C1689]

"Deterministic propagation models for radio transmission into buildings and enclosed spaces"

With the growing interest for broadband mobile services in 3rd generation mobile communication networks, the investigation of radio transmission into vehicles and buildings is getting more important. Models for the propagation into vehicles and buildings enable the calculation of the field strength or received power inside these objects. The inner structure of the vehicles (e.g. metal parts) and buildings (inner walls, furniture) as well as the surroundings (other vehicles, buildings) must be considered, and also different construction materials must be taken into account. A deterministic ray tracing approach has been developed, enabling the computation of the transition from an urban scenario to an indoor scenario and vice versa, thus allowing a very accurate computation of the field strength or received power inside vehicles or buildings. Due to the ray tracing technique, the approach can also be utilized to evaluate wideband properties of the mobile radio channel by computing its impulse response. In order to validate such propagation models, measurements inside and outside a building were made. [C1690]

"Link quality assessment in mobile satellite communication systems"

This paper presents a simulation tool aimed to assess the relation between the link quality and the overall capacity on a MSS (mobile satellite system). This tool is particularly appropriated to compare different radio interfaces and to estimate the applicability of the UTRA radio interface in future satellite systems. Moreover, it permits the analysis of innovative radio resource management techniques. All the models included in the simulator, namely spotbeam projection on the Earth, multibeam antennas and radio propagation models are also presented. [C1691]

"A hybrid indoor MIMO channel model using signal clusters for wireless communication"

Both ray tracing and practical measurements have confirmed existence of clustering of signal; during propagation in an indoor environment. In this paper we propose a hybrid MIMO channel model that allows incorporation of spatial correlation into modeling of indoor environments involving the use of multiple antenna elements. The

MIMO model is based on the clustering of rays during indoor propagation and combines statistical property of cluster with ray tracing algorithms. With this model a more realistic simulation can be made, which allows investigation of the actually achievable diversity gain using smart antenna array for a wide range of indoor scenarios. [C1692]

"A 2-d indoor radio propagation modeling by using MATLAB for classroom instruction"

The paper presents the development of a MATLAB simulator for the indoor radio propagation models, used as a teaching aids. The software application is designed to allow the user to select the propagation models, characteristics of the building, transmitter and receiver systems, etc. [C1693]

"Conventional radiopropagation models and no-wave equation approaches: an application of the percolation theory"

Predicting electromagnetic (EM) fields radiated in quite complex scenarios is an urgent demand in many classes of problems. Several modelling strategies are available such as the Okumura-based model (OK), the semi-deterministic Walfisch-Ikegami model (WI) and the fully deterministic approaches based on the Geometrical Optics (GO) or on the Uniform Theory of Diffraction such as that on the basis of the "Single Knife Edges" (SKE) model. Some models are especially devoted to manage with specific geographical or urban characteristics, some others are too CPU-time demanding, others deserve a strong tuning effort before ensuring reliable predictions. In such a context Percolation Theory (PT) may be quite a promising new technique; a new model can be set-up without involving the classical EM wave equation based on the assumption that EM urban propagation can be assimilated to a fluid flowing through a percolative lattice. In this paper, different numerical solutions, ranging from the more standard radio propagation model up to the novel PT approach, are implemented and tested in a real case: GSM sub-networks in Umbria region. A discussion on the different model performances is proposed as well. [C1694]

"Negative group velocity in left-handed materials"

In 1968, Veselago posed that media with simultaneous negative values of the permittivity and permeability would exhibit a negative index of refraction (Soviet Physics Uspekhi, vol. 10, pp. 509-514, 1968.). Due to the left-handed relationship between the electric field, magnetic field, and wave vector in these materials he termed them left-handed media (LHM). These LHM are expected to have many unusual properties such as inverted Snell's law, Doppler shift and Cherenkov radiation. However, until recently, such materials were unavailable and these predictions remained uncorroborated for nearly thirty years. As with any new field, the topic of the LHM suffers from some misconceptions and misunderstandings. One such misconception has to do with the notion of negative group velocity which has been closely linked with these media (R.A. Shelby et al, Appl. Phys. Lett., vol. 78, pp. 489-91, 2001) and in fact has been used as equivalent to the term LHM. In this paper, the existence and meaning of negative group velocity in LHM are discussed. It is shown that similar to normal right-handed media (RHM), LHM can also exhibit a negative group velocity and group delay within the region of anomalous dispersion ($\delta n/\delta \omega$ [C1695]

"Physics based ray-tracing propagation model for suburban areas"

In this paper a hybrid model has been developed based on a physics-based model for the forest and a ray-tracing algorithm. Using the physical model of the forest, effective dielectric constant is found and applied to the raytracing algorithm. This 3-D modeler can consider objects with different shape and position, and therefore the simulator can be used for any arbitrary scenario. [C1696]

"Radio wave propagation measurements for land-mobile satellite systems at 2.33 GHz"

The performance of a mobile satellite communications link is dominated by roadside attenuation due to vegetation or manmade structures. Previous measurement campaigns characterized land-mobile satellite channels at UHF and L bands. In 1997, the FCC allocated S-band spectrum to the Digital Audio Radio Satellite (DARS) service to provide nationwide radio services to the North American continent via satellite. This article describes a propagation measurement campaign at 2.33 GHz for DARS systems. Measurements were taken in various propagation environments and typical values of propagation constants for standard models are presented. [C1697]

"Measured results of time delayed diversity (TDD) system characteristics for mobile broadcast satellite system"

This paper deals with the time delayed diversity (TDD) system characteristics for mobile broadcast geostationary

satellite orbit (GSO) system measured by using the GPS (Global Positioning System) satellite. To design digital mobile broadcast satellite system with TDD concept, it must estimate attenuation characteristics by urban building, electrical light poles and trees etc. Southern orbital arc GPS satellite signals with elevation angle about 40 degrees data are used for propagation characteristics measurements, rather than actual GSO satellite. To overcome urban signal attenuation, the effect of TDD system characteristics are examined from processing measured GPS data. [C1698]

"The effect of building height variation on the multiple diffraction loss component of the Walnsch-Bertoni model"

The Walfische model predicts the average path loss from a conceptualised model of the propagation environment in which propagation is assumed to take place over rows of buildings of equal height and spacing. The propagation loss is then separated from the free space wave-front spreading, multiple forward-diffraction past the rows of buildings and diffraction over the final rooftop down to the receiver. In this paper we use numerical simulations to examine the effect of random building height variations on the multiple diffraction loss component of the model. In particular, our results show that the average multiple diffraction loss component is increased by any building height variations. A simple equation, which agrees within 1 dB of the simulation results, is presented that relates building height variations, wavelength and average building separation to the increase in average multiple diffraction loss. [C1699]

"Polarization estimation of individual propagation paths using the SAGE algorithm"

This contribution describes an extension of the ISI-SACR (initialization-and-search-improved space-alternating generalized expectation maximization) algorithm originally published in [B.H. Fleury, et al., 2001] and [2002] to include polarization estimation. The proposed scheme allows for joint estimation of the relative delay, the direction (i.e. azimuth and co-elevation) of departure, the direction of incidence, the Doppler frequency and the complex polarization matrix of propagation paths between the transmitter (Tx) site and the receiver (Rx) site in mobile radio environments. This contribution presents the initialization procedure of the extended ISI-SAGR algorithm and discusses necessary and sufficient conditions regarding the responses of multiple-element Tx and Rx arrays for the system consisting of these two arrays to be able to estimate all coefficients of the polarization matrix. Experimental investigations in a line-of-sight microcellular environment illustrate the application potential of the ISI-SACR algorithm for gaining insight into the polarization states of individual paths. This information is of paramount importance for the design of stochastic and prediction models ut the radio channel for communication systems equipped with multiple Tx and Rx dual-polarized antennae. [C1700]

"A spatial averaging technique for measuring the transmission of planar composites"

A transmission measurement technique for planar composite materials is presented. This technique involves the averaging of several measurements taken for different antenna separations. This effectively removes unwanted noise and scattering from panel edges. This technique is useful for the characterization of materials and for radome applications. [C1701]

"Study on power azimuth spectrum of wireless channel in microcell environments"

This paper discussed the spatial or angular spreading properties of wireless propagation in the urban microcell environment, which is of great interests of future mobile technology, especially in case of using smart antennas. Based on the elliptical scattering model, the power azimuth spectrum in microcell environments is derived and it is found that the result approximately followed a truncated Laplacian distribution. The parameter of the Laplacian function is determined by regression. The results can provide insight into the spatial spreading properties of the wireless channel and can be used easily for further research. [C1702]

"Electromagnetic analysis of the distributed structures applied to EMC and SAR estimation problems"

The electromagnetic compatibility (EMC) and estimation of specific absorption rate (SAR) problems are discussed in this paper together with interaction of the cellular telephone antenna field with the user's head considering the shape of the telephone housing and the model of the hand. The radiation characteristics of cellular handset antennas strongly depend on the objects in vicinity of the phone. When the wavelength of the radiated field is comparable with the dimensions of the objects located near the handset those objects disturb performance and change all electrodynamic properties of the antenna. The presented electromagnetic analysis is based on method of auxiliary sources (MAS) (R. Zaridze et al., IEEE Trans. Antennas and Propag., vol. 50, No. 1, pp. 50-58, 2002). [C1703]

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First Page of the Article [C1704]

"Wireless communications using integrated antennas"

The feasibility of integrating antennas and required circuits to form wireless interconnects in foundry digital CMOS technologies has been demonstrated. The key challenges including the effects of metal structures associated with integrated circuits, heat removal, packaging, and interaction between transmitted and received signals and nearby circuits appear to be manageable. This technology can potentially be applied for implementation of a true single chip radio, on-chip and inter-chip communication systems, RFID tags, and others. [C1705]

"A method for determination of RF exposure compliance for pico cell base stations by SAR measurements in a flat phantom"

With the increasing number of cellular base stations in both indoor and outdoor environments, there is a growing need for simple and accurate methods for RF exposure assessments and for the determination of exposure limit compliance distances for such equipment. For low output power devices, whose compliance distances can be assumed to be short, measurements of SAR in a phantom representing the human body can be feasible. Assessment of SAR by measurements requires technically advanced equipment and stable setups and procedures in order to reduce the uncertainty of the result. With the usage of a box-shaped phantom, the position of the antenna in front of the phantom is easily determined. The shape of such a flat phantom roughly resembles the trunk of a person and can be assumed to be more conservative (i.e. giving higher SAR) than an anatomically shaped homogeneous phantom due to the greater coupling with the antenna. The purpose of this study was to investigate whether flat phantom measurements can be used to accurately estimate the maximum averaged local SAR in a human body exposed to RF fields from small pico base station antennas and if such a measurement method can be used to determine RF exposure compliance distances. The validity of the method was verified by comparing measurements of SAR in a flat phantom with numerical calculations of SAR in an anatomically realistic human model. [C1706]

"A novel technique to increase the realized efficiency of a mobile phone antenna placed beside a head-phantom"

It is demonstrated how the realized efficiency of a mobile phone antenna, placed beside a head-phantom, can be increased approximately 1 dB by adding a parasitic radiator on the front side of the ground plane. The effect of the parasitic radiator is a cancellation of a part of the near field impinging on the head. This reduces the amount of power dissipated in the head and hence, the realized efficiency is increased. [C1707]

"SAR reduction for mobile phones based on analysis of EM absorbing material characteristics"

With the recent explosive increase of the use of mobile communication handsets, there has been a growing concern about possible hazard to a human body, especially head part, exposed to the EM fields radiated from handsets. The specific absorption rate (SAR) is normally used for one of the important criteria to evaluate the degree of the hazard. The SAR is influenced by various kinds of parameters such as kind and size of antenna, position of antenna, radiated power, handset structure, distance and angle from human body, area of absorbing material if used, and so on. Most of the studies on this area have been performed to evaluate SAR values based on these parameters. In a previous paper (Minscok Jung and Bomson Lee, IEEE APS, vol. 1, pp. 444-448, 2002), after defining SRF (SAR reduction factor) for a quantitative discussion of effective SAR reduction methods, we analyzed the effects of the ferrite sheet attached to the handset based on power conservation relation. In this paper, we analyze the SAR data for various shapes of the ferrite structure. After investigating the reflection and transmission characteristics of the absorbing material layer, we also present a method to estimate the complex permittivity and permeability having a maximum absorption. We then evaluate SAR and SRF data for handsets coated with those absorbing layers. [C1708]

"Radio wave propagation over a rectangular obstacle"

With the increased use of radio communications systems in cluttered urban environments, there is a growing need for techniques that can be used to estimate the strength of non line of sight propagation. An important model problem for such calculations, and that to which this paper is addressed, concerns the propagation of radio waves over a rectangular dielectric body. [C1709]

"Analysis of radio wave propagation characteristics in rectangular road tunnel at 800 MHz and 2.4 GHz"

We analyze radio wave propagation characteristics in tunnel using simulations by ray-tracing method and measurements for a newly constructed tunnel in Korea. As the simulation results using direct wave and 25 reflected waves and the measurement ones against the 14.7 meters wide, and 6.15 meters high, and 365 meters long tunnel is similar to each other, the radio wave propagation model for predicting received power in the tunnel can be applied to the other tunnels. [C1710]

"Different kinds of walls and their effect on the attenuation of radiowaves indoors"

This paper describes a study of how different walls and wall materials affect the attenuation of electromagnetic waves with frequencies 433MHz, 868MHz, 2.4GHz, and 5.0GHz. The attenuation of the transmitted signals has been studied by creating propagation models using an advanced computer tool. Concrete, wood, and plaster board are the studied wall materials. Furthermore, different wall thicknesses (0.15m, 0.20m, 0.25m, 0.30m, 0.40m) have been used. The long term goal of the research is to compile an easy-to-understand manual containing information on what kind of an effect do walls that differ by material and thickness have on the attenuation of electromagnetic waves. Thus, the simulation construction has been left fairly simple on purpose. Finally, an example of how the information can be used in practice is shown. [C1711]

"Adaptive beamforming dependencies on wideband and directional propagation characteristics in micro- and macro-cell UMTS scenarios"

It is important to study the fundamental wideband and directional factors in order to establish how the channel properties affect adaptive beamforming, regarding intra-cell interference reduction. With such aim, a comparative set of micro- and macro-cell propagation scenarios is generated, allowing for the systematic analysis of the involved factors. A non-blind adaptive beamforming algorithm is applied, the conjugate gradient at the base station in the up-link makes use of the mobile terminal identifying the UMTS codes. Performance is measured through the gain in SINR relative to that obtained with a single omnidirectional antenna. The scenarios involve the variation of the grouping and angular displacement of mobile terminals, their distances to the base station, their number, and the number of array elements. It is found that the angular and temporal densities of incoming signals are the fundamental roots behind the differences in performances between macro- and micro-cells. For macro-cells, involving much larger angular densities, the effect of having common angles-of-arrival among links is much more critical than for micro-cells; in the case that terminals are grouped, beamforming gains are close to 0 dB. In such case, for micro-cells, values range from 0.9 to 9.6 dB, for 16 users, with a monotonous dependency on distance and on the number of array elements. Micro-cell environments not only allow for the application of simpler beamforming adaptive implementations, but also render larger performance increases by improving such implementations. [C1712]

"Multipath characteristics of non-specular wave scattering from building surface roughness"

This paper presents multipath characteristics of non-specular scattering from building surface roughness. Superresolution method was applied as an approach to handle signal parameters (DOA, TOA) of the individual incoming waves reflected from building surface roughness. In order to comprehend in detail the microscopic mechanisms of scattering, signal parameters are to be incorporated into the geometrical ray tracing. The results show that the multiple paths can he detected from many scatterers, such as ground, window glass, window frame, bricks surface, as well as directly from the transmitter. Most of the scattered waves arrives closely from specular directions. [C1713]

"FPGA realization of adaptive coding rate trellis-coded 8PSK system"

An adaptive code-rate scheme for Ka-band satellite system which adapts the level of coding to overcome rain-induced signal fade is presented. It is based on a pragmatic code, and can decode the QPSK and TC-8PSK signals using a single Viterbi decoder. The optimal parameters for implementation through computer simulations are determined. The adaptive channel coding algorithms described in this paper may be used for high-speed satellite communications to compensate the rain-attenuation. [C1714]

"Modelling of wave propagation in rough mine tunnels"

A new technique is applied to the modelization of radio waves propagation in mine tunnel having lossy dielectric side walls of random roughness. The resultant model takes into account the spatial variability of the electromagnetic waves in non canonical rough mine tunnels and makes use of the cascade impedance method (CIM) to predict the propagation behavior. Two (2-D) and three dimensional (3-D) propagation models were

obtained and compared with experimental data. [C1715]

"Global three-dimensional FDTD modeling of impulsive ELF propagation about the Earth"

This paper has reported the initial application and validation of the FDTD method to model impulsive ELF propagation within the entire Earth-ionosphere cavity. This technique permits direct, 3-D, time-domain calculation of impulsive, round-the-world ELF propagation accounting for arbitrary horizontal as well as vertical geometrical and electrical inhomogeneities and anisotropies of the excitation, ionosphere, lithosphere, and oceans. We expect that this model will be useful in studies of ELF propagation phenomena which form the physics basis of important remote-sensing investigations of lightning and sprites, global temperature change, and subsurface structures. [C1716]

"Propagation of 2000 MHz radio signal into a multistoreyed building through outdoor-indoor interface"

Mobile communication systems are being developed operating both in outdoor and indoor environments. This calls for establishment of effective communications. IEEE-802.11b also provides wireless connectivity in both of these environments. We have made study in the scenario when a mobile user enters into an indoor environment from outside environment and establishes communication inside. This paper reports propagation measurements for two situations at 2000 MHz. In order to simulate, a source at 2000 MHz is used to illuminate the building from outside. Theoretical models have been used to calculate penetration loss, Rician factor 'K' and other channel parameters. It has been observed that when the transmitter illuminates the building from outside, the received signals inside the building attenuates severely. The received signal distribution follows d-mpower law. Measurements reveal that the received signals are attenuated by approximately 40-45 dB in the corridors of different floors. The movements of people greatly vary amplitudes of the transmitted signal and make the indoor channel nonstationary even when either both the transmitter and receiver are stationed at a particular position or transmitter is fixed and receiver moves. This aspect has also been reported in this paper. [C1717]

"Measurement of TOA using frequency domain characteristics for indoor geolocation"

Frequency domain techniques have been widely used for indoor radio propagation measurements and modeling for telecommunication applications. This paper addresses measurement of the time of arrival (TOA) of the first path for geolocation application using results of frequency domain channel measurements. First, we analyze the effect upon TOA measurement accuracy due to: sampling period of the radio channel in the frequency domain, sampling period in the time domain used for detection of the TOA and the windowing filter used before transformation to time domain. Then we provide some results of measurement in line of sight (LOS) and obstructed LOS (OLOS) indoor environments to compare the characteristics of the measured TOA in these two important scenarios for indoor geolocation applications. [C1718]

"Investigation of strong solar flares influence on high tropospheric structure"

Some experimental data from tropospheric communication lines are presented. It is shown that reflective layer, which was predicted by the theoretical model, is detected. This one influences radiowave propagation of different wavelengths (1.5 m, 10 cm, 3 cm). [C1719]

"A frequency domain geometric model for a wideband mobile radio channel"

A frequency domain geometric model aimed at clarifying the fundamental propagation characteristics for a wideband time-invariant channel is proposed. This modeling approach envisages a direct mapping from the frequency-domain transfer function T(f) in classic random linear systems to the geometric representation of a broadband channel. One of the main advantages of this approach is the availability of analytical expressions relating signal properties in frequency domain to channel output. A further virtue of this method is to exploit the geometric distribution of scatterers for different spectral components from a physical wave-propagation viewpoint. The workhorse is the semi-geometrically based statistical model and three heuristic rules proposed, which are an extension to the rules presented in the previous work. These rules are so proposed as to provide the missing link between any canonical model and the physical channel it represents. The power azimuthal spectrum and poster delay spectrum are calculated using this model. We further study the channel properties for a macrocell. [C1720]

"Clusterization of measured direction-of-arrival data in an urban macrocellular environment"

Measured wideband direction-of-arrival data from urban macrocellular environment were clusterized. The clusterization was done by manual inspection. To understand the physical propagation channel, the source

points of the extracted clusters were located to the local environment surrounding the mobile station. Some key parameters were calculated for each of the extracted clusters and for the residual power. By combining these parameters with the estimates of the cluster source points, assumptions on the propagation mechanisms of the clusters were drawn. According to the results the most significant sources are building structures above the average building height and corners of the buildings. This result is inline with previous studies in the urban propagation. Only a few significant clusters were found, in this study three clusters out of 14 extracted clusters contributed nearly 60% of the received power, while 19% of the power remained outside the clustering. Most of the clusters follow the Rician distribution with relatively high K-factor, while the residual power was Rayleigh distributed. There was only slight depolarization from the transmitted vertical polarization. One of the clusters was a clear exception with a negative XPR. [C1721]

"CPICH power settings in irregular WCDMA macro cellular networks"

In a WCDMA system, mobiles select cells based on received common pilot channel (CPICH) signal quality from the different base stations. The cell size therefore depends on radio propagation properties and transmitted CPICH power. For efficient resource utilization, it is important that the traffic is shared fairly evenly over the base stations. This is specifically challenging in irregular networks with inhomogeneous site locations and traffic distribution. This paper discusses methods for automated CPICH power planning, based on differently detailed traffic density information and predicted radio propagation. Simulations using data from a realistically planned network indicate that the tuning results in a more evenly utilized base station power. This in turn improves the overall capacity. It is furthermore fairly robust with respect to traffic density deviations from the true traffic density. [C1722]

"Advanced models for backscattering from rough surfaces"

In surface scattering model applications a large variety of roughness conditions are encountered: some surfaces may be described with one roughness scale and others with more than one roughness scales; some surfaces are correlated exponentially, Gaussian-like or anywhere between the two. In this study we want to show two backscattering models in algebraic form: (1) a scattering model whose correlation function behaves like a Gaussian or an exponential function, and (2) a scattering model whose correlation function behaves like a Gaussian near the origin and nearly an exponential function at large lag distances. It is believed that most surface backscattering problems can be explained with one of the two models. Applications of these models to data interpretation are demonstrated. [C1723]

"A study on the electromagnetic radiation from cellular base station at Curitiba-Brazil"

This work comprises a theoretical analysis, of the electromagnetic fields radiated by an ERB (cellular base station) in the city of Curitiba-Brazil. Computational simulations are made using the Friis transmission equation to calculate the radiated power density for every 3D point in the space. Simulated results are then compared to experimental measurements. Finally, these results are compared with the established limits of the ICNIRP standard. Values of power density obtained in this work (simulated and measured) are 50 dB below the limits presented by ICNIRP/ANATEL. [C1724]

"Ray tracing outdoor to indoor coverage prediction [Cradiowave propagation]"

In this paper, a ray tracing based software tool has been developed that provides accurate and site-specific radio signal predictions from outdoor to indoor locations. The tool provides results very quickly, and is adapted to find new results for changes in transmitter and/or receiver antenna locations and/or building geometry. The propagation prediction tool combines techniques from several different disciplines, including computer graphics and asymptotic electromagnetic theory, to reduce the calculation time without compromising accuracy. Using computer graphics techniques, the time necessary for shooting the rays through the urban geometry is greatly reduced. [C1725]

"Wideband channel propagation prediction in urban scenarios using TD-UTD"

This work deals with the application of the Time Domain Uniform Theory of Diffraction (TD-UTD) in wideband propagation predictions for urban scenarios. Results are presented and compared against those obtained by the application of an inverse Fourier transform upon the usual frequency-domain UTD and Method of Moments (MoM). In the frequency domain, multiple diffractions and lossy obstacles can be accounted for. However, in the adopted TD-UTD formulation only a single diffraction and perfect electric or magnetic conductors are considered. For the present TD-UTD analysis and for a typical urban radio channel where the antennas' heights are small compared to the buildings' heights, it is shown that the consideration of ground as a perfect magnetic conductor instead of an electric one provides a better approach for a vertical polarization over lossy ground. The buildings

are treated as perfect electric conductors. [C1726]

"A TD-MFIE for a vertically-polarized pulse propagation over irregular terrains"

A time domain magnetic field integral equation (TD-MFIE) is developed and applied in the study of the propagation mechanisms of a vertically polarized electromagnetic pulse over an irregular ground. The atmosphere is assumed homogeneous and the conductivity of ground sufficiently small so to consider such ground a perfect magnetic conductor (PMC) for a vertical polarization. Furthermore, the terrain profile is assumed electrically smooth, such that back scattering is neglected and a forward scheme applied to obtain the surface magnetic currents of the equivalent problem, together with a marching-on-in-time (MOIT) technique to account for the time-varying characteristics. [C1727]

"Electromagnetic scattering analysis in indoor and outdoor environments by applying FDTD method"

Economical and efficient means to obtain the characterization of radio channels have been investigated a lot since mobile communication devices became popular. So, this article presents solutions and results for two electromagnetic scattering problems: an outdoor environment simulation, solved by applying the two-dimensional FDTD formulation and an indoor environment radiation scattering simulation, whose solution was based on the three-dimensional FDTD formulation. In both cases, the numerical domains were truncated by using the UPML formulation and solved though code parallelization techniques. Power received at specific points and field distribution are analyzed. [C1728]

"On the transition from light to shadow"

The importance of the concept of penumbra width in radio propagation studies is stressed in this paper. The propagation over a smooth spherical earth is the mathematical model used for discussing the transition from light to shadow or, in other words, between interference and diffraction zones. The breakpoint between these two zones corresponds to the well-known criterion of a path clearance equal to 0.6 of the first Fresnel zone radius. It is shown here that this criterion can be related to the relative position of the penumbra width associated to each terminal. [C1729]

"Evaluation of MIMO capacity in regular chaflane street corners for microcellular communications"

In this paper, a ray launching model based on the application of the uniform theory of diffraction (UTD) and geometrical optics (GO) has been implemented for modelling the propagation in MIMO microcellular urban scenarios. This model has been used to analyse the behaviour of the capacity in two street corners environments: Regular and chaflane street corners. The study of the environment of the two corners shows that there exist important differences between both street scenarios: capacity is higher in chaflane street corners. Finally the impact of the orientation of the transmitter and receiver is studied in terms of capacity. [C1730]

"Conversion of rainrate statistics with various integration times to equivalent one-minute distributions"

Recent ITU-R recommendations indicate that rainrate distributions with integration time of one minute should be used for obtaining statistics to be applied in rain attenuation prediction methods. However, long-term rainrate statistics available for Brazil have integration times ranging from five minutes to one hour, making necessary to reliably convert these to equivalent one-minute distributions. Various procedures have previously been tested with rainfall data from Brazilian tropical and equatorial regions, with reasonable accuracy. A recently developed method is applied here to convert statistics with higher integration times, obtained from data measured at six locations of three different climatic regions in Brazil, to equivalent one-minute rainrate distributions. Comparison of these distributions with those obtained from measurements show excellent agreement. [C1731]

"The JANUS experiment on ISS"

In the frame of ASI supported programmes focused on the definition of utilization of the International Space Station (ISS), a university and industry consortium, lead by Space Engineering, proposed a mission, named JANUS (Joint Access to the Network for the Users of the Space Station) to define and realize an experimental technological payload to support the data transfer of other experiments on board the ISS to ground. Scope of the JANUS payload is the demonstration of the connection of the on-board ISS network, accessed by the ISS experiments, to an experiment ground facility, to create a direct link to ground in W band, directly controlled by the experimenters. JANUS has been conceived as a modular mission, in which the technological and scientific development can be stretched in flexible way and will realize two different experiments: 1) the data

communication experiment, aiming at the interactive data transfer between the ISS and an Earth terminal. 2) The propagation experiment, which has been conceived by adding the TX section at W band, thus allowing characterizing the V and W band transmission channel, today largely unknown. The paper describes the conceived system architecture and the architecture solutions implemented on-board and on-ground to take advantage of parallel industry development contracts undertaken or in progress by means of ASI founds. Other interesting aspects are: 1) use of an oscillator architecture based on a common reference source, 2) use of a solid state phase locked local oscillator at a frequency of 89.2 GHz, 3) utilization of a common high quality phase noise characteristics first local oscillator (PLDRO) operated at 6.3 GHz for two TX plus RX chains 4) use, as second local oscillators, of two different dielectric resonator oscillators (PLDRO) at 24.3 GHz for the 37.9 GHz transmitter chain and 36.4 GHz for the 50 GHz receiving chain and 4) realization of a solid state 83.9 GHz power amplifier based on the use of a metamorphic InP based MMIC modules. [C1732]

"Antenna alignment for radiometeoric synchronization systems"

We consider questions of the orientation and tuning of radiometeoric synchronization complex (RMSC) antennas, taking into account path extension and area relief. Design data are obtained under the following assumptions: the troposphere is normal; the mean height of a meteoric trace is 95 km; the carrier frequency is that of the "METKA" RMSC signal; the surface of a reflecting region is horizontal and smooth; the elementary antenna has horizontal polarization. [C1733]

"The influence of urban area factors on accuracy of error-condition modeling in cellular communications systems"

In this report, the analysis of SHF-band radiowave propagation principles is conducted for urban areas with a high density of building sites. The analysis is based on the statistical data collected in Novosibirsk City, one of the biggest cities of Russia. The adjusted model of interference in cellular communications is considered. As a result of experiments, the incorporation of the correction coefficients, dealing with the peculiarities of the surrounding urban area, into the known expressions is suggested. [C1734]

"Performance evaluation of Bluetooth system in the presence of WLAN IEEE802.11 system"

This paper uses the protocols of IEEE 802.15 (Bluetooth) and IEEE 802.11 wireless local area network (WLAN) to develop a Bluetooth radio system on an OPNET platform. Typically, this wireless model is an indoor model of the Bluetooth TM technology implemented in C programming language and assisted by a Matlab programming language. We evaluate the performance of voice in the presence of interference from a WLAN system. One major challenge for interference in an indoor area is the complexity of radio propagation. This article provides a fundamental understanding of issues related to indoor radio transmission that is needed for design and performance evaluation of emerging systems for different indoor configurations. [C1735]

"A correlated indoor MIMO channel model"

For assessing communication technology that uses multielement antenna system for a fading indoor environment it is necessary to have an accurate tractable description of indoor wireless channel. A general correlated representation based on indoor wave propagation is proposed here to model the flat Rayleigh fading indoor MIMO channel. The proposed two-ring model takes account into most key features of the scattering environment, such as configuration and characters of antenna array, angle of arrival (AOA) at receiver and angle of departure (AOD) at transmitter, root-mean-square (RMS) delay spread of specific environment. In addition, we include the nonisotropic scattering environment. In order to quantify effects of fading due to scattering, we investigate the information-theoretic channel capacity. The model combines the accuracy of full-wave propagation analysis with efficiency of a statistical description of multipath. It is represented in close form, which provides a powerful framework for analysis and simulation of multiple antennas coupled with space-time processing algorithms for indoor wireless applications. [C1736]

"Reconstruction algorithms and experiments with a prototype of holographic subsurface radar"

The paper presents the mathematical basis and numerical implementation of the wave front conversion method for the reconstruction of a scattering object. We also describe a prototype holographic microwave radar and first experimental results. [C1737]

"Influence of the antenna gain loss on capacity of tropospheric communication radiolines"

The paper analyzes the influence of antenna gain loss on the tropospheric communication radioline (TCRL) capacity defined by its energetic characteristics. The purpose of the paper is the development of a simplified flow

chart for an algorithm to estimate the TCRL energetic characteristics influencing its capacity and determining maximum and minimum speeds of information flow, with given probabilities. [C1738]

"Three-dimensional model of electromagnetic field distribution in the human head from mobile phones"

This work is a development of the ideas of A. Chaplin's and Y. Vasiliev's. We model the distribution of the electromagnetic field from a mobile phone in the human head phantom. The modeling is done by an integral equations method with unknown polarization currents induced by the mobile phone radiator. The currents and SAR distribution are defined in an inhomogeneous medium with complex permittivity. For simulation, the method of moments was used. [C1739]

"Performance of asynchronous multicarrier CDMA multiuser receiver over frequency selective fading channels"

An asynchronous multicarrier code division multiple access (MC-CDMA) scheme over frequency selective multipath Rayleigh fading channels for the reverse link of a mobile communication system is investigated when the delay spread is in excess of a symbol interval. An architecture of a centralized decision feedback equalizer (CDFE) based on the minimum mean-square-error (MMSE) criterion is suggested to reduce both inter-symbol-interference (ISI) and multiple access interference (MAI) due to the multi-path propagation, and the MAI due to the effect of the reverse asynchronous reception mode at the base station. The receiver architecture is for multi-user detection (MUD) consisting of a multiple-layer feed-forward filter (ML-FFF) and a centralized feed back filter (CFBF). Results indicate that an enhancement in capacity and good interference resistance are obtained by the proposed multi-user detection scheme over the structure without CFBF (NCDFE), which only uses ML-FFF and FBF. Additionally, it is demonstrated that the structure performs multi-path energy Rake combining. [C1740]

"Investigations of adaptation possibility of the over-horizon radar antenna"

The results of complex radio physical investigations of the possibility to adapt over-the-horizon radar antenna to radiowave propagation conditions are presented. For this purpose, shipborne navigation radars with different antennas were used. To define the adapted parameters, a great volume of statistical data concerning propagation path parameters, above water duct heights and shipborne navigation radar coverage range was used. For each area of investigation, the coverage range distribution functions are given. From the analysis of the obtained data, a conclusion about over-the-horizon radar antenna adaptation to radiowave propagation conditions is made. [C1741]

"Low-height radiation field of the coastal radar antenna taking into account troposphere inhomogeneities"

A procedure is considered for defining the presence of the tropospheric waveguide based on the shape of the phase-plane portrait, with which it is convenient to describe the behavior of all combinations of radio wave trajectories. A rough model of the spatial distribution of the troposphere refractive index n(x, z) near the sea coastline is given. The minimum information needed for model construction is from two separated vertical profiles of n(z) in the troposphere, which can be obtained by radio-acoustic sounding. [C1742]

"The mathematical model of antenna and antenna-radome system"

Methods, algorithms and programs for calculation by computer of the characteristics of the antenna and the antenna-radome system (ARS) are developed. The type of antenna considered is the phased antenna array (PAA) or the cophase antenna with a mechanical beam control (an antenna array-AA). Radome shape is spherical, quasi-conic or flattened ellipsoid. Radome shell is multilayer ($N \geq 1$), same-thickness, or special profile. Errors in the manufacture of the antenna are taken into account. Programs designed for optimization of radome shell are discussed. [C1743]

"Performance of UWB time-hopping spread-spectrum impulse radio in multipath environments"

This paper presents the theoretical analysis of BER performance for ultra wideband (UWB) impulse radio systems in multipath propagation channels. Both time-hopping pulse-position-modulation (TH-PPM) and the time-hopping pulse-amplitude-modulation (TH-PAM) are considered. The closed-form BER formulas are derived. The impact of system parameters on the BER performance is discussed. It is demonstrated that the impact of multipath propagation on TH-PAM UWB radio is different from that on TH-PPM UWB radio, which is analyzed in detail. For the TH-PPM scheme, the multipath propagation time-delay may lead to unbalanced BER over "0"-"1" in some particular multipath channels. For the TH-PAM scheme, however, there exists no such unbalance of

BER over "0"-"1". In typical deterministic multipath environment, to obtain the same BER performance of 10-4, the required SNR for TH-PPM scheme is about 7dB larger than that for TH-PAM. [C1744]

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First Page of the Article [C1745]

"A generic channel model in multi-cluster environments"

We present a new method of defining spatio-temporal clusters using geometric modeling approach, which simulate the phenomenon that has a geometric analog. Various clusters are given different shapes or forms to scatterer distributions based on their logical appeal to certain radio environments. This classification methodology is based on the semi-geometrically-based statistical model developed in this paper. We then derive the analytical expressions of power azimuthal spectrum, power delay spectrum and cluster power using the generic model. Armed with the model preliminaries, we further parameterize some important geometric clusters, which reproduce the significant effects of typical scattering environments. The modeling approach presented in this paper is useful for system-level simulation and performance evaluation. [C1746]

"Artificial neural networks as rain attenuation predictors in earth-space paths"

Satellite communication services have grown in recent years and the radiowave spectrum to support them is saturated. So, it is necessary to search for frequency bands higher than the presently used ones, to allocate new services. But the problem of radiowave degradation by rain is critical for communication links operating above 10 GHz, and a precise knowledge of rain attenuation is important to design reliable satellite communication links, considering that it must operate under all atmospheric conditions. Several phenomenological models have been developed to predict the rain attenuation in earth-space paths, but these models show poor accuracy for higher frequencies. In order to improve the prediction, this paper introduces a new method to evaluate the rain attenuation in satellite communication links using a specially designed neural network. The results show that this new model performs much better than the classical ones. [C1747]

"On signal strength and multipath richness in multi-input multi-output systems"

A common practice when analyzing systems using multiple antennas at both ends is to focus on the multipath properties and normalize the SNR out of the channel matrix. This paper studies the relationship between the signal strength and multipath richness using indoor measurements taken at the Brigham Young University campus. It is found that the SNR and multipath richness can be strongly corrected. Hence, some caution is needed when normalizing out the SNR in system performance studies. Furthermore, for unnormalized channel, the channel capacity usually rises when moving from NLOS into LOS since the loss in multipath is more than compensated for by an increase in SNR. A theoretical study also reveals that for moderate sized systems, the required SNR increase for a LOS channel to yield the same channel capacity as a NLOS channel is not very large. [C1748]

"Analytical derivation of the mean interference power in WLANs & ad-hoc networks"

Radio interference from adjacent systems or users is an important limiting quantity for the transmission rate in wireless communications. Interference studies, however, often have the drawback that they are obtained from measurements in a particular environment. A more generally valid characterization for the interference power is highly desirable. In this paper, such an expression is analytically derived for a single link. The derivation is based on a simple, well-accepted pathloss law; furthermore, on a geometrically motivated transformation of the properties of the environment into expressions that depend only on the volume and surface of the domain in which transmitter and receiver are randomly located. This strategy yields a highly flexible and accurate approximation of the mean interference power as an analytical function of the key characteristics of wave propagation and the surroundings. The paper sheds also some light on the question why the stochastic radio channel is geometrically very robust. To the best knowledge of the author, this contribution is the first rigorous, non-empirical derivation of radio interference. [C1749]

"An evaluation of the performance of IEEE 802.11a and 802.11g wireless local area networks in a corporate office environment"

In recent years there has been considerable interest in the development of standards for wireless local area networks. In particular, IEEE's 802.11a and 802.11g both employ coded orthogonal frequency division multiplexing (COFDM) but operate in different frequency bands. In this paper, the performance and relative merits of 802.11a and 802.11g are compared for the scenario of a corporate office wireless LAN application. It is

shown that for comparable scenarios 802.11g achieves superior range but that 802.11a achieves higher data rates. Thus the two standards are found to have complimentary strengths and weaknesses. [C1750]

"Characteristics of radio wave for the indoor wireless communication in Malaysian typical office environment"

It is well known that the propagation characteristics are changed for wireless communication. We have investigated the characteristics of radio wave for indoor wireless communication in a typical Malaysian office environment. It is not too far when a lot of Malaysian people will use their personal computer or lab top in the office for signal transmission through an indoor wireless link. The transmitted signal is attenuated by the different materials used in the office such as partitions, cabinets etc. The transmitted signal is also changed due to the difference of transmitting and receiving antenna heights. We conducted our investigation in a room of about 7 m Ч15 m size. We put different obstacles in between the transmitter and receiver. The experiment was conducted at the different levels of a 5-storey building. Our investigation shows that signal strength changes with different materials used in the office as well as the location of the transmitter and receiver. We have used different frequencies for the transmitted signals. [C1751]

"A new heuristic UTD diffraction coefficient for prediction of radio wave propagation"

In this paper, a new heuristic diffraction coefficient is proposed for dielectric wedges with losses. The suggested diffraction coefficient is based on the uniform theory of diffraction (UTD) and is compared to Luebbers', Holm's and the rigorous diffraction coefficient (RDC). Parallel and perpendicular field polarizations are tested. The new heuristic diffraction coefficient shows clear accuracy improvement over Luebbers' and Holm's coefficients when compared to the RDC. Moreover, the proposed diffraction coefficient is as simple to compute as Luebbers' and Holm's coefficients. [C1752]

"Improvement in a heuristic UTD diffraction coefficient for prediction of radio wave propagation"

Illumination of two sides of a wedge is quite common scenario for building corners in microcellular environment. Holm's heuristic solution for the diffraction coefficient, which is an extension to Luebbers' solution, is inaccurate in this region. This work avoids limitations of Holm's diffraction coefficient in the illumination region when the source illuminates both faces of a wedge. The improved diffraction coefficient gives a result that is very close to Maliuzhinets' rigorous diffraction coefficient. The improvement is valid for parallel and perpendicular polarizations. [C1753]

"The capacity of papaya trees to absorb radio frequency waves"

This paper presented the case study of the radio frequency (RF) waves absorptions by papaya trees. The experiment is focused on the frequency which is transmitted from free space (existing signal) and by a RF generator. The RF signal is detected by a simple a set-up consisting of a Yagi antenna and a spectrum analyzer. From this study, it was found out that the papaya trees absorbed RF, where the fruits absorb the maximum RF waves followed by the trunk and the leaves. [C1754]

"On the frequency dependence of wireless propagation channel's statistical characteristics"

In this paper a novel frequency dependent stochastic model for the mobile radio propagation channel is addressed. The wireless channel's statistics at different frequencies are studied and issues such as amplitude and arrival time distributions are investigated. Correlations of channel parameters at different frequencies are proposed. Using the models the rms delay spread as well as the statistics of path loss at different frequencies is obtained. Further, based on the correlation properties of rms delay spread with frequency, a frequency dependent simulator for the rms delay spread is devised. [C1755]

"The LR2 model for mobile satellite channels and its system performance analysis"

Based on analysis of propagation characteristics about mobile satellite communication channels, the Lognormal-Rice-Rayleigh (LR2) model includes as many classical narrowband models such as Loo's et al. The LR2model suits well with the features of frequency-bands used by MSS including UHF/L/Ka. The paper provides statistical description of envelope and phase about the LR2model, such as level cross rate (LCR), average fade duration (AFD), bit error rate (BER), block error rate. Finally, the paper describes the procedure to extract model parameters from experimental data. [C1756]

"On limits of wireless communications when using multiple dual-polarized antennas"

In this paper, capabilities of wireless communication systems using multiple dual-polarized antennas at receiver and transmitter side are examined in terms of channel capacity. Therefore an intrinsic channel description including polarization effects is been derived, which allows the modeling of transmission between array antennas which are composed of closely spaced and arbitrarily oriented antennas in a fading environment. Although only two orthogonal polarization can be accessed in antenna farfield, it is shown, that the use of orthogonal oriented antennas may provide high capacities even for closely spaced antennas. [C1757]

"Channel acquisition and tracking for the uplink of a code-division multiple-access system"

This paper investigates channel acquisition and tracking for the uplink of a DS-CDMA system. The transmission medium is characterized by multipath propagation and the goal is the estimate the time-varying channel impulse response (CIR) of a new user entering the system. Channel acquisition is pursued through maximum likelihood techniques while channel tracking is performed through weighted least squares methods. At each signaling interval the CIR estimate the inverse of the interference covariance matrix to mitigate the near-far problem. Performance is assessed by simulation in a scenario inspired by the UMTS system. [C1758]

"A multipath intensity profile model for residential environments"

We describe a statistical model for the multipath intensity profile (MIP) in residential environments. The work is based on over 300,000 frequency response measurements at 712 locations in 23 homes. We show that, for non-line-of-sight (NLS) path, the MIP is well-modeled as a decaying exponential vs. delay, multiplied by a lognormal process over delay; and that a similar model applies to line-of-sight (LOS) paths. Moreover, we present simple statistical descriptions for the parameters of these functions. [C1759]

"A non-line-of-sight equalization scheme for wireless cellular location"

Among the challenging issues that affect the performance of wireless location techniques is the temporal and spatial variations of the channel, and the distribution of the scatterers, which introduce non-line-of sight errors at the base station. This paper develops a technique for addressing this problem by exploiting the topology of the cellular network. [C1760]

"A piecewise parametric method based on polynomial phase model to compensate ionospheric phase contamination"

This paper addresses a parametric method based on high-order ambiguity function (HAF) to solve the problem of phase contamination of HF skywave radar signals corrupted by the ionosphere. When signal-to-noise ratio and data sequence available satisfy the predefined conditions, the ionospheric phase contamination may be modeled by the polynomial phase signal. As a new parametric tool for analyzing polynomial phase signal, HAF is applied to estimate polynomial phase model parameters and reconstruct the disturbance signal. Using the estimated reconstructed signal, compensation can be performed before coherent integration and the original radar return spectrum can be restored. A piecewise scheme is proposed to track rapid variation of the phase contamination in HAF method, and it can remove the Doppler spread effect caused by the ionosphere nonstationarity. Simulation is used to demonstrate the efficiency of the proposed method. [C1761]

"A novel estimator and performance bound for time propagation and Doppler based radio-location"

This paper presents the theoretical accuracy limits of the geolocation algorithms based on TOA measurements exploiting the fact that the mobile is moving in a known or unknown direction. The developed expressions show us the possible improvements in terms of accuracy and/or availability due to the diversity created with the movement. A simple algorithm based on the use of TOA drift estimation is also presented in order to compare its performance with the developed theoretical limits. The proposed estimator attains the theoretical limits under certain conditions. [C1762]

"Minimum probability of error and channel capacity in large dual antenna array systems"

Uncoded bit error probability with maximum-likelihood detection and channel capacity is derived analytically for binary signaling on the dual antenna array channel with correlated fading in the large system limit. The example of fading correlation due to poor scattering is analyzed in greater detail. In case of poor scattering (or high load), a waterfall behavior of the uncoded bit error probability is observed. [C1763]

"QoS of dynamic radio resource management policies in a GPRS network"

The paper introduces a GPRS-like cellular network simulator, where mobile terminals move, initiate and

terminate their communications. This tool aims at evaluating the major QoS parameters in realistic propagation conditions and for different resource allocation policies. Our objectives in developing such a simulator are to use it first to compare some existing channel management methods and second to validate a new optimal scheme of allocating the physical channels to mobile users supporting multimedia applications. Our discrete-event simulation tool takes into account both the time variation of the system and its spatial dimension relating to user movement and its effect on the signal propagation and the radio link. The system considered is a GPRS-like (i.e. TDMA) one, i.e. voice and data are integrated over a time division multiple access wireless cellular network. Our scenario considers three traffic classes: best-effort, medium and premium. [C1764]

"Generation and applications of bi-shaping shadowing in mobile systems modeling"

As a part of propagation characteristics of mobile communication channels, slow fading caused by shadowing not only obeys the lognormal probability density distribution (PDF), but also has an exponential autocorrelation function. Cross-correlation of shadowing process between uplink and downlink also should be included. Generally only the probability distribution of slow fading is considered in modeling of mobile communication channels, but not the power spectral density (PSD) or cross-power spectrum. An accurate correlation/probability model for shadow fading is of vital importance for both analytical and simulation based evaluation of any power control and handover scheme. The paper proposes a method to generate the slow fading random process with specified PDF/PSD for the first time. The applications of the method are introduced in brief. Theoretic analysis has been given to prove the validation of the method, and simulation steps are described. The simulation results show the method works well. [C1765]

"Channel modeling and simulation for mobile user objective system (MUOS)--Part II: selective scintillation and terrestrial multipath fading"

Performance of the mobile user objective system is dominated by the channel conditions characterized by ionospheric scintillation and multipath fading. Detail analytical modeling for flat channel is provided in part I of this paper, while the emphasis for part II of this paper is on wideband waveforms. Efficient computer simulation techniques for the selective scintillation and terrestrial multipath fading channel impairment have been presented. [C1766]

"The impact of traffic type on the propagation dependent performance of a CDMA system"

This paper examines the impact of a traffic stream's statistical properties on the propagation dependent performance of a CDMA system. Traffic in a CDMA system directly affects the amount of interference in the wireless channel and therefore the level of traffic corruption. We evaluate a typical outdoor 3G CDMA cellular deployment. System performance is compared using three diverse traffic types with a variety of propagation conditions and system configurations. It is shown that propagation dependent performance is generally insensitive to the statistical properties of the traffic stream. Only with non-hostile propagation conditions and low traffic loads is there a significant performance difference, in which case the more variable traffic results in inferior performance. This suggests that accurate traffic modeling is generally not necessary when dimensioning the propagation aspects of a CDMA system. A simplistic and convenient traffic model will usually be sufficient. [C1767]

"Characterization of non-WSSUS fading dispersive channels"

We present several novel tools for statistical characterization of fading dispersive channels that do not satisfy the usual WSSUS assumption. A local scattering function, describing the time- and frequency-dependent average scatterer power, is introduced. Furthermore, a novel channel correlation function, we introduce the practically important class of doubly underspread channels. Numerical results involving a simulated and a measured channel illustrate the usefulness of our framework. [C1768]

"Channel modeling and simulation for mobile user objective system (MUOS)--part 1: flat scintillation and fading"

Performance of the mobile user objective system is dominated by the channel conditions characterized by ionospheric scintillation and multipath fading. Detail analytical channel modeling is provided, with the emphasis on narrowband waveforms in part I of this paper. Efficient computer simulation techniques for these flat fading channel impairment have also been presented. [C1769]

"High resolution acquisition methods for wideband communication systems"

We consider the problem of low-complexity timing synchronization in digital receivers for DS-CDMA and UWB

systems operating over channels with single or multiple propagation paths. We extend some of our recent sampling results for certain classes of non-bandlimited signals and develop a method that takes advantage of transform techniques to perform propagation delay estimation from a low-dimensional subspace of a received signal, that is, by sampling below the traditional Nyquist rate. By lowering the sampling rate we reduce computational requirements compared to existing solutions, allow for slower A/D converters and significantly reduce the power consumption of digital receivers. [C1770]

"A virtual representation for time- and frequency-selective correlated MIMO channels"

A key to reliable communication is a fundamental understanding of the interaction between the signal space and the channel. In time- and frequency-selective MIMO (space-time) fading channels this interaction happens in time, frequency and space. In this paper we propose a four-dimensional Karhunen-Loeve-like virtual representation for space-time channels that captures the essence of such interaction and exposes the intrinsic degrees of freedom in the channel. The four dimensions are: time, frequency and the two spatial dimensions at the transmitter and receiver. The key signal space parameters are the signaling duration, bandwidth and the two array apertures. The corresponding channel parameters are the delay, Doppler and the two angular spreads associated with the scattering environment. The representation induces a virtual partitioning of propagation paths in time, frequency and space that reveals their contribution to channel capacity and diversity. It also exposes fundamental dependencies between time, frequency and space thereby revealing the essential degrees of freedom. [C1771]

"Towards a propagation model for wireless biomedical applications"

Propagation model plays a very important role in designing wireless communication systems. Current advances in semiconductor technology has made it possible to implant a network of bio-sensors inside the human body for health monitoring purposes [C. Furse, H.K. Lai, C. Estes, A. Mahadik, A. Duncan, 1999], [C. Furse, R. Mohan, A. Jakayar, S. Karidehal, B. McCleod, S. Going, 2001], [L. Schwiebert, S.K.S. Gupta, P.S.G. Auner, G. Abrams, R. Lezzi, P. McAlister, 2002]. For wireless communication inside the human body, the tissue medium acts as a channel through which the information is sent as electromagnetic (EM) radio frequency (RF) waves. A propagation model is necessary to determine the losses involved in the form of absorption of EM wave power by the tissue. Absorption of EM waves by the tissue body, which consists of mostly saline water, accounts for a major portion of the propagation loss. In this paper we present a propagation loss model (PMBA) for homogeneous tissue bodies. We have verified the model for the frequency range of our interest (900 MHz to 3 GHz) using a 3D EM simulation software, HFSS™, and experimental measurements using saturated salt water. [C1772]

"Random wave propagation in a two-dimensional complex medium [Cloaded aircraft cavity]"

2D multiple scattering modeling of GHz waves propagating from a source within a loaded aircraft cavity is considered, with trivial computational effort. The periodic array of seats within the aircraft cavity can be readily modeled by longitudinal phase screens in the z-direction, while physical variations within a row can be modeled by a random refractive index with appropriate statistics. The effects of the scattering parameter Γ on the field intensity has been exhibited with strong scattering, leading to sharp, numerous and strong δ-function spikes as opposed to the low scattering limit in which the field intensities remain diffuse, broad and not as strong. This can have implications to the occurrence of hot spots within an aircraft cavity due to an electromagnetic source (e.g., PED) within the cavity. [C1773]

"Radio propagation in urban environments using iterative Fourier split-step method"

In urban environments, the buildings are often modelled as knife-edges or more realistically, polygons. With abrupt changes of building profiles. diffraction and backscattering effects are important in this scenario. Several wide-angle parabolic equation (PE) methods have been used to calculate the diffraction or/and backscattering problem in built-up areas. However, no one has ever combined all the factors: diffraction, forward and backward reflections with angle-dependent impedance boundary conditions on the varying terrain or along the polygonal building. In this paper we formulate an iterative Fourier split-step PE method to achieve this. [C1774]

"A spectral wavenumber starter for parabolic wave equation models"

Radiowave propagation based upon the parabolic wave equation (PWE) has rapidly gained acceptance as a robust method for computing electromagnetic propagation in complicated environments. The PWE method is a numerical "marching" algorithm which recursively advances the. electromagnetic field along a propagation geodesic in a sequence of steps from preexisting field distributions. This paper describes a rigorous technique based upon Green's functions and the Sommerfeld integral equation for generating correct PWE starter fields

which account for finite conductivity and ground plane interactions. Examples are be shown at MF for broadcast type antenna over a variety of ground planes. [C1775]

"Propagation modelling of complex HVAC networks using transfer matrix method [Cindoor communication application]"

Use of heating, ventilation, and air conditioning (HVAC) ducts for indoor communications is a topic of recent interest. Real HVAC networks are complex systems, which contain multiple bends, tapers, etc. In this paper, we present a propagation model for such cascaded networks. based on the transfer matrix method. As an example, we theoretically analyze and experimentally characterize a system composed of straight sections, bend and taper. Measured data are in agreement with our theoretical predictions. [C1776]

"Composite antenna pattern for realistic ray tracing simulations"

The widespread adoption of wireless local area networks (WLAN) and the emerging wireless personal area networks (WPAN) has required a deeper understanding of the indoor propagation channel. As a consequence, ray analysis techniques based on geometrical optics have emerged as the tools of choice for modeling indoor and outdoor environments. In realistic scenarios, antennas will be installed within proximity to wall structures or embedded in complex environments such as vehicle interiors for telematics applications. Hence. we no longer have free space antenna patterns but composite antenna patterns. We consider here the application of the finite-difference time-domain (FDTD) technique for obtaining 3D antenna patterns in complex structures with different material properties. Simulation results are submitted and discussed. [C1777]

"Modelling of a non-isotropic indoor MIMO channel"

A promising way of achieving very high data rates is to use multiple antennas at both the transmitter and the receiver (MIMO). In this paper, we aim to develop a new indoor MIMO model that combines the accuracy of wave propagation analysis with the efficiency of a statistical description of the multipath. We propose here a two-ring indoor MIMO channel representation, based on single bounce scattering that provides a tractable channel characterization. This model takes into account most characteristics of the indoor scattering environment, and offers a transparent interpretation of the effects of indoor scattering and array characteristics on channel capacity and diversity. [C1778]

"Window effect on wall penetration loss in mobile communications"

In mobile communication scenarios, a window opening on a wall enhances the field strength inside the room, as compared to a whole wall. Scarce models in the literature address this topic, or objectively quantify this effect relating it to window dimensions-this is the objective of the present paper. Wall and window are treated as an antenna aperture with the appropriate field distribution, which re-radiates its near field into the room. Measurements on a scaled model of a wall with different window sizes show good agreement with simulations. Based on simulation results, a statistical model is constructed to enable fast quantification of the window effect through a "window gain" parameter. [C1779]

"Design of a probe excited circular ring above the reflector for bridging outdoor wireless LAN applications"

Point to point communications have received attention for several decades. An antenna that can be useful for point to point communication is the antenna radiating a unidirectional beam pattern. This paper proposes to accomplish a unidirectional beam by using a probe excited circular ring above the reflector. The structure is simple and easy to fabricate. In addition, since there is no dielectric component, it has low loss. The antenna can be made using low cost material that is easy to find in the market. This structure is expected to be cost effective (S. Kusulvu et al, IEICE Trans Electron. vol. E84-C, no.4, pp. 443-450, 2001). The antenna design is straightforward. The ring radius is first specified to accomplish the condition of dominant mode propagation. The ring length is designed based on the suitable ring radius and desired directivity. Furthermore, the spacing between the probe excited circular ring and the reflector is selected to achieve compact antenna size. The antenna radiation patterns with and without the reflector are shown. The experimental results for the radiation pattern and impedance characteristic show that this antenna can be used for bridging outdoor wireless LAN systems. [C1780]

"A study of 2.3 GHz bands propagation characteristic measured in Korea"

The WLL (wireless local loop) service at the 2.3 GHz frequency band is being withdrawn and redistributed as a new service for efficient use of radio resources in South Korea. In this paper, analysis of 2.3 GHz band

propagation path loss characteristics by investigating the raw data gathered from practical measurements is presented. Also, we have performed field measurement in the frequency band over several types of building to obtain the penetration loss and diffraction loss. 2.3 GHz band propagation characteristics (path loss, diffraction loss, and penetration loss) and a corrected theoretical model for path loss prediction which was presented will be useful to applications such as prediction of path loss in the consideration of domestic environments, cell planning and optimization for new service systems. [C1781]

"Outdoor propagation analysis of ultra wide band signals"

An ultra wide band (UWB) signal is defined as any radiation in which the 3-dB bandwidth is greater than 25% of the center frequency. UWB signals are characterized by extreme low powers and large bandwidths, which can be used for data, voice and video communication. Since UWB waveforms have very short time duration, they possess unique properties. For example in radar applications, these same pulses can provide very fine range resolution and precision distance and/or positioning measurement capabilities. These short duration waveforms are relatively immune to multi-path cancellation effects. In this paper we test the performance of a simulation to model the propagation of an UWB signal in outdoor forested environment. The simulation uses a combination of finite difference time domain and ray tracing methods to simulate UWB wave propagation. The model takes into consideration the dielectric constants of the materials of the trees and measures the signal strength for vertical and horizontal polarizations of the UWB antennas placed at various heights and distances from each other. The results of the simulation are compared to measurements obtained from tests conducted at a wooded area in Seneca Creek State Park, Gaithersburg, Maryland. It was observed that up to 150 ft distance between the transmitter and receiver, the horizontally polarized antenna system gave better signal-to-noise ratio, but at greater distances the vertically polarized antenna system gave a better signal-to-noise ratio performance. Three dimensional plots of the signal strengths and the signal-to-noise ratio for various transmitter and receiver distances are plotted for the system. These are compared with experimental results and it was observed that the simulation closely matched the experimental data. The results of the simulation and measurements will be used for further developing a UWB location and tracking system in outdoor environments. [C1782]

"Gain enhancement of microstrip antenna using parasitic metallic patch bar"

The characteristics of a microstrip patch antenna with stacked parasitic elements, metallic strips, and superstrate have been investigated in terms of antenna gain. To enhance the antenna gain, it is important to suppress undesirable surface waves. In this paper, we propose a new parasitic metallic bar to reduce the propagation of a surface wave. Simple and analytic solutions of the surface wave scattering from a metallic bar on a grounded dielectric-slab are obtained using the mode-matching method. [C1783]

"A forward scattering UTD method for determining signals from GSM base stations in urban"

This paper presents a forward scattering UTD method to evaluate GSM signals along the vertical and transverse planes. Reflections and diffractions in forward directions from the base station to the mobile in those two planes are included to determine the power received by the mobile. To find the scattering objects, building exterior geometries are obtained from 1:1000 digital city maps. An efficient method to identify forward propagation paths of multiple reflections and diffractions is developed. Simulations and measurements of the signals from a GSM base station are compared. [C1784]

"Application of moving window FDTD to prediction of path loss over irregular terrain"

The full wave electromagnetic calculation method that is most efficiently applied to electrically large problems is the Finite Difference Time Domain (FDTD) method. FDTD offers several advantages over the commonly used ray and PE methods. It is full wave, so that the approximations and assumptions needed for application of PE and ray methods do not limit its accuracy. It call include all of the pertinent information available for the propagation path, including terrain profile, terrain permittivity and conductivity, vegetation features, and atmospheric conditions. The FDTD mesh, assuming a uniform atmosphere, need be only long enough (the dimension along the propagation path) to contain the dispersed pulse, and high enough to include the terrain profile and a few Fresnel zones above the highest elevation. [C1785]

"A global ray-tube tracing method to determine signal variations in urban areas for mobile communications"

The ray tracing method has been applied successfully to predict wave propagation for wireless communications but it is not computationally efficient. This paper presents a new method, called the global ray-tube tracing method, to trace the global wave tubes instead of many individual rays for simulating GSM signal propagation in urban areas. Therefore, simulation efficiency can be improved significantly so that site-specific signal

distributions in cities may be determined more easily and practically. Field measurements on streets in Taipei city were performed, and the results are compared with those obtained from the global ray-tube tracing program. To find the scattering objects, building exterior geometries were extracted from 1:1000 digital city maps. Good agreement between simulations and measurements are obtained. [C1786]

"A spatio-temporal equalization scheme for wireless Internet access in rural areas"

Wireless local loop (WLL) is primarily used for providing multimedia services to subscribers in rural areas, particularly for locations where no existing comprehensive telephone networks are available. It provides an economical means of serving these areas with moderate data capacity. The availability of a radio link for data transfer between the subscriber and its corresponding base station is affected by effects such as multipath and rain attenuation. We evaluate the effectiveness of a spatial and temporal equalization scheme to combat the impacts of signal degradation. [C1787]

"Effect of soft handoff parameters and traffic loads on soft handoff ratio in CDMA systems"

In this paper, the relations of soft handoff ratio to soft handoff thresholds setting and the pilot channel power fraction under different traffic loads in CDMA systems are analyzed. Sectorized cells are considered, and the propagation environment includes correlation of shadow fading signals arriving from multiple sectors of the same base station and different base stations. Simulations are made and the results can be referenced for CDMA networks planning and optimizing. [C1788]

"A new location algorithm for mitigating NLOS propagation errors in microcell environment"

An efficient algorithm used to detect and mitigate NLOS propagation error is proposed in this paper. The method reorganizes NLOS receivers by selecting weights matrix, and then refreshes their measurements to mitigate the effects of NLOS propagation. Comparing with CRLB and from the results of simulation, we can find that this algorithm is simple and has high estimation accuracy. [C1789]

"Frequency conversion using a moving plasma front generated optically in transmission lines-theoretical analyses"

A novel method for frequency conversion using a transmission line on a semiconductor substrate has been presented. Laser pulses move along the transmission line while generating an electron-hole plasma at the surface of the semiconductor substrate. The plasma in the transmission line acts as a moving short with a relativistic velocity, reflecting an incident microwave and up-shifting the frequency through the double Doppler effect. Power and energy conversion efficiencies have been theoretically analyzed for the frequency conversion. The results have shown that the converter can be used to produce short millimeter and submillimeter waves. [C1790]

"Maximum likelihood channel parameter estimation from multidimensional channel sounding measurements"

We describe a multidimensional maximum likelihood estimator for radio channel parameters. We also derive a data model to describe the complete data, which is virtually applicable to every antenna array geometry. The proposed iterative gradient based algorithm has been developed, since algorithms using component-wise updates of the likelihood function show a slow convergence, if at least two propagation paths with nearly the same parameters exist in the measured radio propagation paths with nearly the same parameters exist in the measured radio propagation scenario, that means if super-resolution is necessary. The algorithm provides furthermore a variance estimate of the estimated parameters, since the Fisher-information matrix is calculated throughout the algorithm. [C1791]

"Spatial temporal characterization of UTRA FDD channels at the user equipment"

A directional channel sounding trial from the mobile terminal was recently performed in the city of Bristol. The trial provided temporal and full azimuth view of both channels in the UMTS terrestrial radio access (UTRA) frequency division duplex (FDD) bands simultaneously via the use of a uniform circular patch array (UCPA). Extraction of the multipath components (MPCs) parameter was performed via a newly developed 2D hybrid-space space-alternating generalized expectation-maximization (HS-SAGE) algorithm. Typical propagation mechanisms observed are described as seen from the respective sample azimuth-delay power spectrum (ADPS). The similarities of both duplex channels are verified. In addition, second order statistics of delay and azimuth parameters are presented where large azimuth spreads independent of mobile terminal orientation were observed. [C1792]

"The dependency of turbo MIMO equalizer performance on the spatial and temporal multipath channel structure-a measurement based evaluation"

In this paper a performance analysis of the turbo MIMO equalizer concept for broadband MIMO channel is presented. The channel modeling in the link-level simulation is based on MIMO measurement in different scenarios. The results reveal the strong relationships between the propagation conditions in terms of the available spatial and temporal multipath diversity, the antenna configurations, and the achievable bit error rates. It is shown that the consideration of a simple transmit diversity concept and the application of antenna subset selection leads to remarkable performance improvements. [C1793]

"A blockage based channel model for high altitude platform communications"

Referring to the geometrically based single bounce (GBSB) model, a new geo-propagation model is proposed to predict the delay spread as well as the direction-of-arrival of multipath components in channels for high altitude platform station (HAPS) communications. Furthermore, an approach to calculate the probability of existence of single bounce paths caused by building blockages is given. By using the model, numerical simulation gives the power delay profile and the joint time-angle spread of the HAPS channels. [C1794]

"Ground-based polarimetric SAR systems for environment studies"

Polarimetric SAR interferometry is a compound technique that has shown an ability to extract geophysical parameters from SAR images and is useful in terrain classification and surface change detection. SAR is a well-known technique for airborne or spaceborne remote sensing. It can usefully be exploited in a ground-based radar imaging system as well. By using radar polarimetry, a ground-based SAR system can be used for monitoring seasonal vegetation changes. We have developed a ground-based polarimetric SAR system for environmental studies. It is based on a vector network analyzer, polarized antennas and a scanning control unit. We describe the ground-based polarimetric SAR system and present some experimental results of monitoring trees with seasonal variation. [C1795]

"Analysis and improvement of Liao ABC for FDTD"

The finite-difference time-domain (FDTD) method is widely used for solving Maxwell's equations in the time domain. FDTD is particularly good at dealing with small changes of the radio environment size in an inhomogeneous environment. One of the major issues in the usage of FDTD is the mesh truncation method. Liao's absorbing boundary condition (ABC) is a widely used mesh truncation algorithm as it is valid for all incident angles and is implemented easily even in an inhomogeneous environment. The higher the order of Liao's ABC, the higher its accuracy and its memory requirement. However, Liao's ABC experiences instability. The paper considers the reduction of data storage requirements and enhancement of the stability. [C1796]

"Differential equation model for a through hole via in multilayered microstrip circuits"

The analysis for a through hole via, which is used as a vertical interconnect line in multilayered microstrip circuits, is a challenge 3D problem. A simple distribution circuit is presented for modeling the non-TEM propagation characteristics of the through hole via for the first time. This model gives an excellent result, which is very close to the full-wave MoM simulation within a wide frequency bandwidth, while the speed of the differential equation is much faster than the MoM. [C1797]

"Starya Pustin', a historical radio-physical polygon of NIRFI and its potential for a 32 m radio telescope antenna for VLBI"

The paper describes in outline format some historical achievements as obtained with different radio telescope antennas built at Staraya Pustin, and describes some of the current developments. The Radio-physical Research Institute (RRI or NIRFI in Russian) at Nizhny Novgorod is responsible for the Staraya Pustin facility. The main subject of the paper is a description of the possibility of constructing at this facility a 32 m radio telescope antenna, suitable for very long baseline interferometry (VLBI) and stand-alone radio astronomy. Similar 32 m radio telescope antennas have been realised already at Svetloe (near St. Petersburg), Zelenchukskaya (North Caucasus) and Badary (near Irkutsk). [C1798]

"IEEE Antennas and Propagation Society International Symposium. Digest. Held in conjunction with: USNC/CNC/URSI North American Radio Sci. Meeting (Cat. No.03CH37450)"

First Page of the Article [C1799]

"Validation of a novel radio location technique by a deterministic propagation model"

A radio location system operates by measuring physical quantities related to radio signals traveling between a mobile terminal (MT) and a set of fixed base stations (BSs). In order to reduce the implementation complexity and the signalling overhead, the solution presented makes use of a single BS to locate unmodified MTs. The novel algorithm applies a triangulation technique supported by minimal information about the environment in the BS neighborhood. The proposed algorithm is compatible with the architecture of 3G cellular networks, as it relies on CDMA (code division multiple access) signalling and a BS array antenna for the estimation of the time delay and of the angle of arrival, respectively. Despite its modest implementation complexity, the proposed algorithm can predict the MT position with a fairly good accuracy, as demonstrated by numerical tests performed by resorting to a fully 3D deterministic propagation model developed at the University of Pisa. [C1800]

"Backward wave propagation in waveguide filled with negative permeability meta material"

The waveguide filled with a lossless dispersionless material with negative permeability is analyzed. It is shown that such a waveguide supports the propagation of backward waves below the cut-off frequency. There is no propagation above the cut-off-frequency and the waveguide behaves as a low-pass filter; thus, it is a dual of the conventional waveguide. The theoretical analysis was verified by measurements of the scattering coefficients of a rectangular waveguide loaded with split ring resonators in the 10 GHz frequency band. As expected, the propagation band occurred below the cut-off frequency. It was observed that an increase of the frequency caused an increase of electrical length of the waveguide. Therefore, Foster's theorem is satisfied for this waveguide. It was also shown that an increase of the physical length of the waveguide causes a decrease of the electrical length. This unusual behavior is a consequence of the fact that the phase of the backward wave leads along the waveguide. [C1801]

"Characterization of spatial channel model based on ray path analysis in high-rise urban environment"

The strongest ray analysis based on the computer simulation of wave propagation between a base station(BS) and mobile stations(MSs) is carried out to obtain the spatial-time wideband channel characteristics. The strongest rays are responsible for about 70% of the total received power for BS-MS pairs on the average and their arrival angles rarely deviate from the shortest path lines between a BS and MSs. However, this does not mean that the strongest ray is necessarily the first arrived ray for each BS-MS pair. The AOA statistics reveal that AOAs of the strongest and the second strongest rays are very close to each other for uplink channel, while those are quite apart for downlink channel. [C1802]

"EMF exposure in the vicinity of GSM-base stations"

According to the World Health Organization (WHO) there is no evidence of adverse health effects at levels below exposure guidelines. However, the final WHO health risk assessment would not be published before 2006. Consequently, the precautionary principle is discussed intensively. The following report analyses the EMF exposure in the vicinity of typical GSM antennas, as used in modern European cities today. Furthermore the different protection zones resulting from different EMF limits are visualized and finally, the question of technically and economically achievable EMF limits will be discussed. [C1803]

"MIMO-study propagation first!"

Despite many valuable contributions to the theory and practice of MIMO communication systems from various scientific fields, we want to emphasize the outstanding importance of propagation aspects when dealing with MIMO systems. Radio propagation forms the basis for any radio channel including MIMO systems. On one hand, popular mathematical models and the commonly applied statistical assumptions sometimes turn out to neglect the important properties of MIMO radio channels. On the other hand, the detailed knowledge and investigations of MIMO specific phenomena (e.g. pinholes) does not imply the practical relevance. By means of four specific examples, we argue that studying propagation is indispensable in order to stay in touch with the real MIMO channels. [C1804]

"5th European Personal Mobile Communications Conference 2003 (IEE Conf. Publ. 492)"

First Page of the Article [C1805]

"SAR approval requirements for mobile and portable transmitting equipment in Australia"

Regulations limiting human exposure to radio frequency radiation now exist in many countries. In order to legally market mobile and portable transmitting equipment (MPTE) in Australia, manufacturers must comply with the provisions of the Australian Communications Authority regulations on electromagnetic radiation (EMR) and specific absorption rate (SAR). This work explains the Australian EMR and SAR standards, and the test procedures and administrative requirements to achieve compliance. [C1806]

"Penetration of electric and magnetic field components of Schumann resonances into the ionosphere"

A penetration of electric and magnetic fields of global electromagnetic ELF resonances in the cavity Earth-ionosphere into the ionosphere is investigated numerically. It is shown that a penetration depth for magnetic components is 2-3 times greater than for electric ones and it depends essentially on the orientation of the geomagnetic field with respect to the normal to the Earth's surface. A penetration height for the electric field is about 50ч60 km, for magnetic field it is 100ч150 km. [C1807]

"Outdoor propagation models: applications and considerations for real life problems"

Implementation of propagation prediction models is discussed. It is shown that for real terrain and building data, the additional parameters and assumptions must be made. The determination of coverage percentages for digital communication is discussed. The results indicate that the field strength predictions depend on the implementation of the model. [C1808]

"Analysis of propagation characteristics of radio waves in tunnels"

This paper analyzes radio wave propagation characteristics in a tunnel with a rectangular cross section and multi-layer-structure walls. These walls consist of a surface moisture layer, concrete, reinforcing mesh, concrete, and bedrock. The wavelengths are assumed to be small compared with the tunnel's cross section. In the analysis, the geometrical optic approximation is used to determine the radio wave propagation routes in this tunnel. Also, the input impedance of the material that forms each layer of the multi-layer walls is given by an equivalent transmission matrix and applied to the calculation of the reflection loss for radio waves against tunnel walls. In addition, we give an example of the calculation of radio wave propagation characteristics in a tunnel using the tunnel cross-section dimensions, dielectric constant of rock, reinforced concrete, and other parameters. [C1809]

"Reduced complexity channel parameters estimation with multi-dimensional Unitary-SAGE algorithm"

Estimating channel parameters from measured data using maximum-likelihood methods can be very time-consuming due to the iterative nature of these algorithms. Although the SAGE algorithm has a faster convergence speed compared to the classical EM algorithm, it could still be computational-intensive. Since most of the computations of the SAGE algorithm are concentrated in the M-step, we propose a new implementation of the algorithm, namely the Unitary-SAGE algorithm, that is able to implement the entire M-step throughout the iterations in the real-valued domain. This helps to reduce the processing time and memory consumption of the original SAGE algorithm since all computations in the M-step are performed in the real-valued domain with efficient matrix manipulation. We present the general implementation of the Unitary-SAGE algorithm in the frequency domain when applied in both the element-space and the newly developed beamspace domains. [C1810]

"The effect of path loss variations on the capacity of MIMO systems"

Flat fading MIMO channels are often modelled by a transfer matrix with independent but identically distributed (i.i.d) complex random numbers. Measurements indicate that the assumption of an identical distribution of all matrix entries is not fulfilled, at least for some antenna configurations. We adapt the channel model to include this observation and study the influence on the capacity and performance of MIMO systems. The results are compared with measurements. [C1811]

"HF telecommunications, what happened between Poldhu and Telstar"

In the last two years two important anniversaries of radio communications have been celebrated. The first was in December 2001 commemorating the 100th. anniversary of Marconi's transatlantic transmission. The second in 2002 was the 40th.anniversary of transatlantic satellite communication via Telstar. With respect to HF telecommunications the first event was a beginning whereas the latter was considered to have sounded its death knell. Just as in 1901, when bridging the Atlantic ocean was seen as the goal for the fledgling technology this

expanse of water has remained a bench mark throughout the 20th.century for the development of long distance communication systems, whether by cable, by direct radio, or via satellite. As we took to the future of HF radio systems and techniques it is well to consider the technical achievements, in radio telecommunications, that were made during the almost forgotten 61 years of the last century. It should be noted that the development of international telecommunications, of which HF radio has played a major part during the period under consideration, has been driven by commerce and global politics. This paper, however, is concerned mainly with the technical aspects of HF radio telecommunications. [C1812]

"Optimising quality of service of a new digital radio broadcasting system"

Digital Radio Mondiale (DRM) is a new transmission standard designed for broadcasting in the traditional AM bands below 30 MHz. The system was officially launched at the World Radio Congress in June 2003, after which permanent digital broadcasting in the AM bands will begin. Quality of service in digitised AM bands (QoSAM) is a collaboration between QinetiQ, Thales Broadcast & Multimedia, VT Merlin Communications, Deutsche Welle and Radio Netherlands, and partly funded by the European Commission Information Society Technologies Fifth Framework. The key objectives of the QoSAM project are: to develop real-time tools for the measurement of quality of service (QoS); and to develop innovative solutions for the optimisation of the whole digital broadcasting chain, from the audio encoder through the transmission system to the receiver, in a near-real-time automatic feedback loop. This paper introduces the DRM and QoSAM systems, and describes some of the key elements required to relate propagation and system parameters measured by test receivers, to audio QoS. [C1813]

"Packet combining strategies for EGPRS"

Packet combining techniques are used to improve the performance of the hybrid ARQ mechanisms. This paper assesses the impact of several variations of packet combining, in its two basic forms (diversity combining and code combining), on a selective-repeat ARQ mechanism in an EGPRS wireless system. These variations range from the application of no packet combining at all, to the application of both diversity combining and code combining on all possible combinations of available packets. A link-level simulator for the EGPRS downlink in a typical urban mobile radio propagation environment is implemented. Mobile speeds of 5 km/h and 50 km/h are considered. It is shown that packet combining can significantly improve performance and has a greater impact at the higher speed. Furthermore, a packet combining strategy of moderate complexity is shown to be optimal in terms of the trade-off between performance, on the one hand, and the associated decoding-related processing load at the receiver, on the other. [C1814]

"An analysis of the first order PDF of small-scale fading in multipath radio channels"

The first order probability distribution of a signal received over small-scale multipath fading is analyzed and its convergence to a circularly symmetrical Gaussian distribution (Rayleigh fading) is discussed. A criterion for assuming this Gaussianity is proposed which is based on the relation between the symbol interval duration and a reference obtained from parameters closely related to the propagation environment. The analysis presented also permits quantifying the error implied in the Gaussian assumption. A numerical example of its application is presented using indoor propagation environment parameters. [C1815]

"A recommended Maliuzhinets diffraction coefficient for right angle lossy wedges"

Diffraction by right angle lossy wedges formed by building surfaces is of great importance for field strength predictions in ray-based and ray-tracing methods in urban and indoor microcellular mobile communications. Some important conclusions related to the efficiency of different diffraction coefficients are derived, by comparing the diffraction fields generated by 90° and 270° lossy wedges illuminated by TM and TE waves. For a right angle wedge, Holm's diffraction coefficient is more accurate than Luebbers' in a deep shadowing region. However, the prediction results are quite poor in some illumination regions for both of the heuristic diffraction coefficients. For a 270° wedge, the heuristic diffraction coefficients are invalid. The simplified Maliuzhinets diffraction coefficient is recommended for field strength prediction in microcellular mobile communications. [C1816]

"Field experiments on adaptive modulation and channel coding coupled with hybrid ARQ with packet combining based on HSDPA air interface"

This paper presents field experimental results on throughput performance employing adaptive modulation and channel coding (AMC) coupled with hybrid automatic repeat request (HARQ) with packet combining based on the high-speed downlink packet access (HSDPA) air interface in the forward link under multipath fading channel. In the implemented equipment, optimum modulation and coding scheme (MCS) is selected among four candidates such as MCSI (QPSK data modulation with the channel coding rate R=1/2, hereafter simply referred

to as QPSK with R=1/2), MCS2 (QPSK with R=3/4), MCS3 (16QAM with R=1/2), and MCS4 (16QAM with R=3/4) according to the measured signal-to-interference power ratio (SIR) over one transmission time interval (TTI) (=2 msec) in AMC and both Type-I HARQ with packet combining, (hereafter Chase combining) and Type-II HARQ (incremental redundancy) are implemented in the preliminary evaluation on AMC by the laboratory experiments employing multipath fading simulators, we elucidate that the average throughput above 5 Mbps was achieved at the average received signal energy per chip-to-background noise power spectrum density ratio (Ec/N0) of approximately 17 dB in a 1-path fading channel with the fading maximum Doppler frequency of fD=5 Hz and nevertheless that the achievable average peak throughput becomes approximate 2.6 Mbps due to the multipath interference in a 2-path fading channel when the average signal power of the second path was lower by 3 dB than that of the first path. We compare the superiority of incremental redundancy and Chase combining in a slow-to-fast multipath fading channel along with the use of the AMC. Furthermore, we present the achievable throughput performance employing AMC coupled with HARQ with packet combining in a real multipath fading channel by field experiments conducted near Tokyo, in order to clarify the potential of HSDPA for actual system application. [C1817]

"Wave propagation over a forest-edge parabolic equation modelling vs. GTD modelling"

This paper presents a comparison between a wave propagation model based on the parabolic wave equation (PE) technique and a model based on the geometric theory of diffraction (GTD) technique, for calculating the propagation attenuation in a forest environment. To compare the PE model and the GTD model, we have made the comparisons against measurements in a fir forest environment. [C1818]

"Ultrawideband promises and problems"

Summary form only given. Ultrawideband (UWB) radio, sometimes referred to as impulse radio or short pulse radio, has a considerable amount of bandwidth and a small amount of power available under the new FCC regulations that permit its use. This paper illustrates the typical indoor UWB channel with propagation measurements, and explores some of the promising characteristics and technical problems associated with UWB technology through experimental and theoretical work performed at USC's UltRa Laboratory. Specifically, issues related to interference mitigation, signal acquisition, energy capture, antenna matching, etc., are illustrated. [C1819]

"Antenna arrays and propagation models for advanced communications systems"

Summary form only given. It is understood that the realization of the next generation wireless technology will require an integrative approach and multidisciplinary research that may span across the entire communication (physical to the application) layers. Innovative antenna solutions and advanced propagation modeling techniques; however, have recently received considerable attention as an integral part of the realization of future and advanced systems. This presentation focuses on reviewing recent developments in the antenna and spatial channel modeling technologies. [C1820]

"Higher order electromagnetic modeling for wireless technology applications"

The paper presents the development of novel higher order electromagnetic (EM) modeling techniques for wireless technology applications. The techniques are based on the method of moments (MoM), finite element method (FEM), and physical optics (PO). Modern wireless systems involve electrically large EM structures (antennas, circuits, and components) that are very complex in both geometry and material composition. There is a clear need for advanced analysis and design tools for predicting the performance and optimizing the parameters of such structures prior to costly prototype development. In addition, EM tools are needed for indoor and outdoor propagation modeling, for assessing EM interactions with human bodies, etc. These tools have to be very accurate and reliable. Wireless designers also demand that the simulation techniques be fast and run on relatively small computing platforms, such as standard desktop PCs. Generally, MoM is very efficient at modeling of open-region (e.g., antenna/scattering) problems, while FEM is an excellent choice for modeling of closed-region (e.g., waveguide/cavity) problems. Finally, PO is extremely cost effective for structures that include electrically very large surfaces with slowly varying currents, especially when hybridized with MoM. [C1821]

"Doubly underspread non-WSSUS channels: analysis and estimation of channel statistics"

The local scattering function (LSF) and the generalized channel correlation function have recently been introduced as intuitive and useful statistical characterization of fading channels that do not satisfy the usual WSSUS assumption. In this paper, we present a generalized LSF and we demonstrate that for the subclass of practically relevant doubly underspread non-WSSUS channels, several useful approximations and interpretations for the LSF can be given. We further propose a computationally efficient, nonstationary multiwindow LSF

estimator that yields reliable estimates in the case of doubly underspread channels even for a single channel realization. [C1822]

"Global mapping of attenuation at RF frequencies; application to spaceborne communication and RF systems"

The propagation of radio waves for Earth-space slant path at C-band and higher frequencies are dominated by precipitation in the atmosphere. At a given frequency, attenuation depends on the length of the radio path, the size distribution and the phase state of the hydrometeor profile. Using the observations from the Tropical Rainfall Measuring Mission (TRMM) space-borne Ku-band (13.8GHz) radar at Low Earth Orbit of 350km above earth, global attenuation maps are produced at the Ku-band frequency. A simple microphysical model for precipitation developed using hydrometeor size distributions and thermodynamic phase state is used to estimate attenuation and reflectivity observations at Ka-band (35GHz) where numerous high bandwidth satellite applications are being planned including the next generation space-based radar for the Global Precipitation Mission (GPM). Differences in the microphysical structure in convective and stratiform precipitation are also incorporated in the model. The results show substantial attenuation variation in a 12-month period at both Ku- and Ka-bands over the various regions of the globe, including the contrast between land and ocean. The estimates of attenuation made at Ku- and Ka-band will be useful in the design and development of space-borne communications and RF systems. [C1823]

"Small satellites constellation for monitoring of natural and man-made disasters"

The possibility to create the new concept for usage of small satellites constellation arises today in connection with development of the circuit technology for manufacturing of real small space vehicles. Their low price allows the formation of a multi-purpose satellite constellation. Such a constellation is created in frames of the Russian Federal space program up to 2006. It is designed for monitoring of natural (typhoons, hurricanes, eruptions of volcanoes etc.) and man-made (radioactive contamination etc.) catastrophes. The space segment will be designed and manufactured by the Research Institute for Electromechanics of the Federal State Unitary Enterprise. The Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation (IZMIRAN) will design the set of scientific devices and programs. [C1824]

"State space method for reducing phase fluctuations for the radio waves travelling through the ionosphere at 26 MHz"

In this work one of the most important problems in the radio astronomy has been attacked. In radio astronomy antenna arrays are used with very long baselines in order to obtain good angular resolutions. For the baseline of 3000 km the two element array gives an effect of a parabolic antenna as if it has 3000 km radius. The antennas see different parts of the Ionosphere because of the large distance between the antennas. These different regions seen by the two antennas have different random dynamic structures with a small correlation of these dynamic time varying structures. These different changes in two different regions of the Ionosphere cause different random phase changes of received waves by the antennas. The effects are large for the frequencies at 26 MHz regions. The observations are important at this frequency region for different reasons. Because of the random phase fluctuations of the received waves, random phase drifts of the local oscillators and the limited observation time, the correlation between the signals obtained from the receivers is below the detection level. Therefore, detection becomes even impossible. In this work, the differential ionospheric phase error is modeled as quasi-sinusoidal exponential phase because of the periodic structure of ionospheric irregularity blobs. The differential oscillator drift is modeled as a linear change with a random slope. Finally, the total differential phase error is expressed as a matrix equation with approximate parameters. Applying the recursive Kalman Filter algorithm to the matrix equation the true phase is estimated. With the new phase, the correlation function is reconstructed. This process improved the S/N ratio in great extends. The method has been applied to the radio star 3C144 and very good results have been obtained. Because of improvements in the processing speeds of the computers lately, the method seems to be valuable. [C1825]

"Simplified analysis for indoor propagation of a WLAN channel"

As IEEE 802.11 wireless LAN (WLAN) systems have become widespread over the last few years, a significant research topics has been to investigate how radio waves propagate inside office environments, since local objects like pillars, walls, doors and windows may reduce the link performance of such low power systems (Kara, A. et al., 2001). Ray tracing/shooting techniques based on the geometrical theory of diffraction (GTD) have been widely applied to the analysis of wave propagation modeling for both urban complex and office indoor environments (Bertoni, H.L., 2000; Zhang Ji et al., 2001). However, by using such ray methods, it is not easy to model precisely fields transmitted through dielectric walls and glass. The finite difference time domain (FDTD)

method (Taflove, A. et al., 2000) may provide an easy evaluation procedure for the complex propagation behavior inside the dielectric materials. The paper attempts a simple and easy 2D-FDTD analysis of indoor propagation of a WLAN channel. The FDTD numerical experiment for a real indoor model and the simplified measurement of the signal strength at the 2.4 GHz band are both executed. [C1826]

"Signal processing aspects in propagation and scattering modeling"

First Page of the Article [C1827]

"Continuous and digital modulated radiofrequency fields propagation in planar biological models"

The aim of the study is a comparison between continuous and digital modulated radiofrequency fields absorption in planar biological models. Results obtained show that specific absorption rate attenuation with depth and its distribution, for continuous wave and for the modulated signals, depend on the signal parameters, on the dielectric characteristics of the layers and on the thickness of the layers. The method allows a theoretical prediction of the radiofrequency power distribution of different radiofrequency signals in biological targets. [C1828]

"Propagation and coverage analysis over terrain profiles comparing empirical approaches with numerically exact solutions"

Mobile radio planning requires the accurate prediction of electromagnetic field strengths over large areas and in a wide variety of environments. This present approaches to predicting field patterns present a similar behavior about the main trend in field attenuation. However, they do not give numerically or analytically exact results. The spectral acceleration forward-backward (FB/SA) is an integral equation based numerical method that obtains the exact scattering data over very undulating terrain profiles with a computational cost of O(N). In this paper, the propagation and coverage analysis problem over different terrain profiles is explored using the FB/SA. In addition, the exact solution is compared with some popular propagation models. [C1829]

"Indoor diffraction for metallic walls"

Recently, the continuous increased demand of wireless communication has created a need for the efficient use of the spectrum band. This demands accurate knowledge of the physical interaction that degrades the signal in the channel. The precise knowledge of multipath propagation, reflections, transmissions, diffraction, scattering, etc. allows implementing effective diverse techniques that reduce the degradation of the signal. We calculate the receiving power of an omnidirectional antenna with linear polarization into a rectangular room with metallic walls. Diffraction, and multipath propagation effects are considered in the model. In order to calculate the degradation of the signal for these kinds of interactions, we apply a rigorous solution of Maxwell's equations for the diffracted fields, and the fields from the multipath propagation. The diffracted wave is obtained using the Sommerfeld solution. [C1830]

"Dual polarization diversity reception modeling for indoor propagation channel"

In this paper, multipath propagation mechanisms including diffraction and reflection are studied by transmitting a 900 MHz (CW) vertically polarized signal from a fixed emitter to a mobile receiver. The receiver is equipped with a cross-dipole antenna (two crossed elements) which makes possible the application of polarization diversity in order to reduce the deep fades that affect the signal envelope. Measurements were also performed for empirical modeling and validation of the theoretical work carried out in this paper. [C1831]

"UHF radio propagation map using GPS and TV broadcasting wave"

A future service planned for Japan is called Information Services (IS). In order to provide it effectively with broadband, mobility, asymmetric, and multicast features, we have proposed a new type of information platform where digital mobile communication networks and digital TV broadcasting media are synergistically utilized (Nishi, M. et al., GLOBECOM2001, p.552-6, 2001; Proc. IEEE AP-S2002, vol.1, p.252-5, 2002). We apply the UHF band (470 to 770 MHz) TV broadcasting media to the broadband download media and apply the existent mobile communication network to the upload media without using higher frequency bands. Consequently, not only asymmetric traffic can be supported, but also the service area can be enlarged and high mobility can be easily achieved. It is important to obtain the propagation characteristics of UHF band radio waves in mobile outdoor environments for constructing the proposed platforms. Using GPS systems and a digital database of 3D terrain information, we compare the UHF band radio propagation maps and the terrain LOS areas from the TV broadcasting transmission stations in order to advance the site-specific propagation prediction in UHF band. [C1832]

"Determination of a suitable macro-cell model for UMTS system in Istanbul"

Macro-cells are large areas with transmitter antennas well above the surrounding buildings and usually there is no direct visibility between the transmitter and the receiver (NLOS). For this purpose, in general, path loss models which consider uniform environmental characteristics are used, as well as the those that are suitable for homogenous urban environments. Istanbul has a complex geographical structure, and is established on seven hills and divided by the Bosphorus. Many old and new buildings with different height and size are located side by side, and there are various types of roads with random shapes and directions. Also, as Istanbul is not a flat area, the most commonly used macro-cell path loss models for GSM 900/1800 are not one to one applicable to UMTS systems. We define different macro-cell propagation models for each MS to MS, BS to MS, BS to BS, MS to BS communications case where the-buildings are assumed to be nearly uniform height, to ensure an efficient UMTS system. In order to improve the system performance, the most appropriate measurement procedure and measurement criteria are examined, as well as filtering intervals in association with handover mechanisms. [C1833]

"A research project of interactive services and technologies for mixed broadcasting, navigation and mobile communication"

New technologies, methods, services and particularly system level solutions for a combined interactive broadcasting, navigation and mobile communication environment are sought in this university research project. Both a large-scale asymmetric infrastructure for DVB-T and those for desktop or mobile consumer devices are studied with the target about five to ten years ahead. All feasible features of the current technical infrastructure and particularly the coming 3G networks are utilized. Systems engineering is applied and individual technological and intellectual tasks are linked together to give coming service providers, operators and manufacturers a sole basis for their product development. A demonstrator system is implemented, partly based on 3G technology and partly on software due to limitations in time and manpower. Anticipated results include also an enhanced usage of the best propagating part of the radio frequency spectrum and new degrees of freedom for manufacturers and broadcasting companies. The cost of the broadcasting infrastructure could be reduced and set-up and reconfiguration efforts and associated investments decrease. Useful tools for authorities are predicted as well. Devices and systems with a high degree of interoperability are made possible due to intelligent arrangements in the use of radio frequency, modulation and signal processing resources. The cost of coming infrastructures will be lower due to mixed applications where broadcasting, Internet-type services, navigation and mobile communications share a common platform and. have flexible software-oriented reconfiguring capabilities. Completely new features and services may turn feasible when proper technologies, components and suitable user interfaces are created. [C1834]

"Factors influencing outdoor to indoor radio wave propagation"

An important requirement from mobile radio systems is the provision of reliable services to the increasing number of users across the outdoor to indoor interface. To achieve this, and at the same time reduce the possibility of interference, the radio network has to be carefully planned and optimised. For this reason, the radio propagation modeller has to appreciate the conditions which can influence the accuracy of modelling predictions or even the practical measurements which are carried out for planning purposes. The paper starts by briefly describing the different factors which have been reported and can influence outdoor to indoor propagation, highlighting some apparently contradictory observations obtained through measurements. Some researchers have suggested that building penetration loss decreases with frequency over a certain range, while specific losses through materials increase with frequency. We try to explain the reasons for those results. Findings have been obtained through simulation. These include the non-linear variation of material loss with material thickness or frequency and the average predicted penetration loss versus frequency for a windowed wall. Detailed explanations are given why these effects take place, providing a possible answer on the contradicting observations. [C1835]

"Signal propagation through vegetation: consideration for future broadband communication systems"

This paper describes the analysis conducted on an extensive set of measurements into signal propagation through vegetation using a wideband channel sounder. The measurements were conducted at thirteen sites and investigated seven different species of trees and four different measurement geometries for in- and out-of-leaf conditions. The purpose of the measurement campaign was to identify the channel characteristics that can influence the design of future broadband communication systems. In order to do this some form of characterisation of the frequency selectiveness and intersymbol interference of the channel must be conducted

alongside the flat fading characterisation. This investigation found little correlation between wideband channel characterisation parameters and the excess loss due to the radiowave propagating through vegetation, indicating that although a propagation loss prediction algorithm might predict adequate coverage the channel quality might not be good enough for communications use. The characteristics of the channel also vary as wind causes swaying of the branches, changing the properties of the multiple paths. Overall, the measurement geometry has a large effect on the multipath characteristics as different geometries have differing multipath possibilities associated with them. [C1836]

"Measurement and analysis of temporal fading due to moving vegetation"

In order to study the wind speed dependency of radiowave propagation in vegetation environments, measurements have been performed on various types of deciduous trees at 0.9 GHz (co-polarised) and 1.8 GHz (co- and cross-polarised). Strong wind speed dependency of the RF signal was found as wind speed increased from low to medium speed. However the signal behaviour did not vary significantly from medium to high wind speeds. At 0.9 GHz, the fade statistics were not greatly dependent on wind speed. The crosspolarised configuration of the receiver was less affected by vegetation during low wind speed than the co-polarised configuration. Finally, it was concluded that RF propagation transmission through vegetation is strongly dependent on wind speed characteristics, frequency and to an extent on polarisation. [C1837]

"COST 273-towards mobile broadband multimedia networks"

A brief overview is presented on COST 273. This COST (European cooperation in scientific and technical research) Action deals with radio aspects of mobile and wireless networks. In particular, radio interface, propagation and antennas, and radio network aspects are addressed by the three working groups of the project. Within the working groups, sub-working groups deal with more specific issues, namely, MIMO systems, antennas for mobile terminals, measurements procedures, and scenarios for network planning. [C1838]

"Wideband wireless indoor communications"

As more high data rate wireless indoor networks are being implemented there is an increasing need to fully characterise the indoor channel. This paper presents the results of an extensive study into radiowave propagation within buildings; investigating 3 different corridors and 8 separate rooms. Different measurement scenarios have been investigated using a wideband channel sounder with the transmitter and receiver located in different positions in each room and corridor, using both directional and omnidirectional antennas. The measured transfer functions and estimated impulse responses have been used to generate statistics (delay spread and coherence bandwidth) to describe the channel. The analysis on the measurements found there was little correlation between different measurement positions indicating that it would be possible to implement systems using diversity gain. Impulse responses in smaller and larger rooms are similar apart from the fact that larger rooms receive components of larger delay times than smaller rooms. The variation of channel characteristics are similar for L-band and X-band for the line of sight condition but for non line of sight the variation of X-band is much greater than that of L-band. [C1839]

"A topological feature extraction system from lidar data with the application of radiowave propagation modelling"

Various implemented software programs and GIS software applications were employed to investigate an effective method of extracting features (primarily buildings) from a LIDAR dataset (Vosselmann, 1999). Boundaries or outlines define the features, with the result being an external output file containing vector data of these features. The method involved the use of various GIS and image processing functions. These functions include in sequence, classification and smoothing using majority and median filters. The goal of classification and smoothing is to condition the tile for edge detection. The fundamental problem with the LIDAR dataset is the classification of pixel heights, in order to provide clear-cut boundaries between topographical features, such as ground level and roof level of buildings. To overcome this, various sized filters were investigated (30, 5Ч5, and 70) as well the number of iterations of the filter to find the optimal classified and smoothed dataset. An edge detection function was performed by determining slope values for the tile. Thresholding was applied next to aid in the sequential processes, thinning and expanding, by removing spurious pixels. The resulting feature outlines were vectorised. Subsequent functions were applied to improve accuracy of feature outlines. Visibility analysis has been implemented, showing visible and obstructed pixels. Basic radiowave propagation techniques have also been implemented for use on the LIDAR data. These include LOS and single-knife edge diffraction. The vectorised features can now be utilised in developing further propagation techniques, such as reflection and scattering. [C1840]

"Effects of the upper atmosphere on terrestrial and Earth-space communications"

COST (cooperation in the field of scientific and technical research) is a framework for scientific and technical cooperation which facilitates the coordination of national research on a European level, and is concerned with basic and precompetitive studies as well as activities of public utility. Earth-satellite radiowave communications are central to many new radio services which are designed to meet increasing communications requirements. The proper understanding of the influence of the upper atmosphere on radiowave propagation is therefore essential to support the design, implementation and operation of many modem communication systems. The main objective of the COST 271 Action, entitled "Effects of the Upper Atmosphere on Terrestrial and Earth-Space Communications" (EACOS), is to promote, stimulate and coordinate European research in ionospheric and plasmaspheric areas. The work of the Action under four working groups is described and current results presented. [C1841]

"Innovative improvements of the parabolic wave equation method for radiowave propagation modeling"

In this paper, some new improvements of the parabolic wave equation method for radiowave propagation modeling are presented. Shadowing is introduced in propagation modeling above Gaussian rough surfaces, and forest cells are also considered for frequencies lower than 500 MHz. The results obtained have been validated with success by comparison to a Monte Carlo approach for the shadowing effects and to exact time domain methods for the propagation in the forest environment. [C1842]

"Measurements of the propagation characteristics of VHF/UHF radiowaves over two over-sea paths in the Channel Islands"

In order to test the current understanding of the propagation mechanisms and to gather statistical information about ducting/super-refraction and signal fading effects, an experimental investigation has been undertaken with a transmitter and two receivers deployed in the Channel Islands. The main objectives of this investigation were to: 1) Measure the propagation characteristics at antenna heights appropriate to inter-ship communications at VHF. and UHF at ranges beyond the direct line of sight. 2) Test current understanding of over-sea VHF/UHF propagation. 3) Identify any propagation effects that are not attributable to currently understood phenomena. 4) Gather statistics of the various effects, in particular the occurrence of ducting and fading. 5) Relate the above to prevailing weather conditions. Rather than discuss the observations in detail a summary of the more important aspects is given. [C1843]

"A spatial channel model and a beamformer for smart antennas in broadcasting studios"

This paper proposes the use of smart (adaptive) antennas for the HIPERLAN/2 (high performance radio local area network/2) standard in order to increase the data rate and user capacity, targeting wired LAN replacement in modern TV broadcasting studio environments. A 2D ray-tracing indoor channel model for predicting the propagation characteristics inside an arbitrary indoor architecture and wall properties is presented. An adaptive beamformer is then developed for the case when the number of users is equal to the number of array elements as well as the underdetermined and overdetermined cases taking into account the multipath behaviour of the transmitted signals in an arbitrary indoor environment. [C1844]

"RET input parameter estimation for a generic model of propagation through vegetation using excess attenuation and phase function measurements"

A new model for radiowave propagation through vegetation has been developed by four consortium members under a contract by the UK Radiocommunications Agency (RA). This generic model combines an edge diffraction and ground reflection model with a direct (through vegetation) signal modelled through the application of the theory of radiative energy transfer (RET). RET predicts attenuation vs foliage depth using parameters to describe the absorption and scatter cross-section, albedo, and scatter function of the vegetation. These parameters are determined empirically for each vegetation type, by fitting RET curves to the measurements. The paper, after a brief introduction to the generic model, addresses possible ways of obtaining these input parameters. [C1845]

"Modeling and model verification for rain-induced attenuation on a line-of-sight link at Ku-band"

A new model for prediction of rain-induced attenuation in the Ku-band for the tropics is proposed by defining a path reduction factor for a link length. The measurements are carried out over a 9 km LOS test-bed in Kampala. The model is developed by comparison of measured cumulative rain attenuation data along the test-bed with

eleven rain attenuation models. The results of the model predictions and how it fits the empirical data are presented. [C1846]

"Large dynamic range prediction of AOA, AOD and PDP for MIMO systems"

Current trend in indoor prediction is showing a shift from empirical models to complex deterministic models due to the decreasing computation cost and increasing demand for a wide band prediction that is by empirical model reduced. State-of-art models are usually based on a ray-tracing algorithm with many stochastic features. A combination of physical models with statistics yields significant benefit. A new approach called the motif model suggested by Klepal (see IEEE VTC Fall 2001, Atlantic City, NJ, October 2001) aspires to be such a model. Issues associated with the indoor propagation environment description are highlighted and the principles of the proposed motif model are described. The author then discusses how the new model addresses issues of new technology. Afterwards stochastic model parameters optimization is mentioned and the model performance is assessed. Finally some interesting prediction results of narrow-band and mainly wideband channel parameters are given and compared with measurement. [C1847]

"A new approach to propagation prediction"

In this paper, a software tool has been developed that provides accurate, site specific radio signal predictions for outdoor to indoor or outdoor to outdoor locations. The tool provides results very quickly, and is adept at providing new results for changes in transmitter and/or receiver antenna locations, and building geometries. The propagation prediction tool combines techniques from several different disciplines, including computer graphics and asymptotic electromagnetic theory, to reduce the calculation time without compromising accuracy. Using computer graphics techniques, the time necessary for shooting the rays through the urban geometry is greatly reduced. [C1848]

"An efficient representation of combined indoor/outdoor 3D mobile radio-coverage"

This paper describes an efficient method for visualizing the simulated received power levels at a specified site in the form of equipower scatter plots. This approach provides an easy way for inspecting the actual radio-coverage limits of a mobile network, for a specified reception threshold. For an increased degree of accuracy to be achieved, a ray launching technique has been implemented for the propagation simulations. The representation is applicable to both indoor and outdoor applications. [C1849]

"Measurements and modelling for fixed wireless access systems at millimeter wave frequencies"

For fixed wireless access systems in urban areas, reflection or scattering from various environmental surfaces can cause propagation channel impairments and influence system planning and deployment. This paper presents an analytical and computational model of the propagation channel to predict the radiowave propagation characteristics with typical channels in broadband fixed wireless access systems (BFWA systems). The objective is to investigate the underlying propagation mechanisms that contribute to the statistical definition of the multipath-fading environment in terms of the K-factor of a Ricean distribution. It is employed in analysing the effects of building scatter on the variance of main link and co-channel interference levels in interference limited networks. So far the model uses relatively coarse characteristics of the urban environment topography and building surfaces reflectivity, while it accounts for the transmitter and receiver antenna radiation patterns, height and orientation. [C1850]

"Wireless LAN planning using the multi-resolution "FDPF" propagation model"

Wireless LAN (WLAN) technologies such as WiFi or Bluetooth have become popular in many countries. The need for an efficient design of them becomes a central problem. Automatic transmitter placement provides cost savings when compared to the traditional human process of site planning. The performance of a LAN is strongly influenced by the access point's characteristics. That's why the amount of them, their location and their emission power have to be determined with care during the planning stage of the network. The planning problem can be exposed in different ways according to the optimisation goals that have been chosen. The traditional approach is to compute a coverage map that satisfies a simple constraint on the signal level based on a minimum threshold. Some more elaborated models introduce constraints of quality of service (as throughput or interference level) on the receiver locations. The evaluation of a solution (an access point configuration) relies on a propagation simulation that computes a coverage map. This simulation is often an expensive computational operation. The goal of the optimisation algorithm is to determine a solution that satisfies to the coverage constraints with a minimum number of propagation simulations. We propose a deterministic algorithm that relies on the multi-resolution Fourier domain parflow (FDPF) propagation model proposed by Gorce and Ubeda (2001). The originality of this algorithm is to exploit the multiresolution specificity of the FDPF method in order to reduce the

computation cost of propagation simulations. Its aim is to find out an access point distribution that provides homogeneous coverage. We work on a two dimensional building floor representation and the variables are the x-axis and y-axis coordinates of the transmitters (access points). We consider that the number of sources to plan and their emission power is fixed. In the next part of this paper, a short overview of the planning problem is provided. In the third part, we define the problem we work on and the characteristics of the FDPF propagation model. In the fourth part, details about our deterministic algorithm are provided and in the fifth part, results are given. We end this paper by a short discussion and enlargement on our work. [C1851]

"Channel modelling based on N-state Markov chains for satcom systems simulation"

Current trends in telecommunications are driven by the demand for multimedia services which require high data rates. In the fixed satellite service, the frequency bandwidths required to carry such data rates are available only at frequency bands such as Ka-band (20-30 GHz), V-band (40-50 GHz) or EHF-band (20-45 GHz). A problem with these frequency bands is the influence of the atmosphere on radiowave propagation. As the operating frequency is increased, attenuation and scintillation effects of atmospheric gases, clouds, rain and the melting layer become more severe. To evaluate the behaviour and quality of service of communications systems, the impact of the propagation channel has to be taken into account. The conventional approach, which consists in predicting only the attenuation distribution with respect to time, is not sufficient and finer information about the propagation channel dynamics is needed. We present the description of a time series generator relying on N-state Markov chains. With such a model, it is possible to synthesise, on demand, events that are characterised by a given depth and a given duration. Another key point of such an approach is the fact that it can be applied anywhere because the process relies on information provided by world-wide radio-meteorological maps and propagation prediction models, especially from the new ITU-R recommendation on fade dynamics. A preliminary validation of the Markov chains has been carried out to check the convergence of the stochastic process. [C1852]

"Nowcasting and forecasting the foF2, MUF(3000)F2 and TEC based on empirical models and real-time data"

This paper describes an interactive on-line procedure for nowcasting and forecasting the critical frequency of the ionospheric F2 layer f0F2, the maximum usable frequency for a 3000 km range, MUF(3000)F2, and the total electron content TEC, based on empirical models and near real-time data initially developed under the EU COST 251 Action (Hanbaba, 1999). It has been recently improved in such a way as to be useful to radio users who need up-to-date information on ionospheric conditions over Europe to meet their operational requirements (Cander, 2003). In particular, the ability to provide and process prompt plasmaspheric and ionospheric data is improving with the aim to better characterise the geographic, temporal, seasonal, and solar cycle dependence of these potentially serious ionospheric effects on radio communication performance during severe space weather conditions. Extensive comparisons between measured and forecast values of f0F2, MUF(3000)F2 and TEC from January 2000 to August 2002 have been conducted, as well as comparisons between automatic and manually scaled parameters. The merits are stressed of real-time use of data to provide more accurate specification of the ionospheric space weather and forecast its effects in the near future. [C1853]

"Hycell, a new model of the rain horizontal distribution: application for propagation studies"

The aim of this paper is to describe a new model, called Hycell, able to generate rain cells at small scale and rain fields at mid scale. The major limitation of this model comes from its difficulty to optimally reproduce the rain rate distribution in the case of rain cells. which exhibit high rain rates on non negligible areas; this occurs for rain constituting tropical rains, monsoon rains or even summer storms in mean latitudes for example. In these cases, the fit forcing equation on the average rain rate leads to overestimate the peak rain rate of the cell. [C1854]

"Performance estimations of mobile terminal location with database correlation in UMTS networks"

The most important cellular location application area is security service, where new terminals must support location within 50-150 meters. Only GPS or short-range systems provide the ultimate resolution below 10 m. The coarse-level location can rely on cell identification. More accurate methods are based on time or time difference of arrival, angle of arrival or signal strength measurements. Multipath propagation, the lack of a line-of-sight path and the hearability problem may hamper OTDOA-type performance in UMTS. The database correlation method (DCM) enables positioning with fewer measurements and avoids multipath problems. The idea is to use a previously collected signal database from the coverage area. The telephone measures the same parameter and sends it to the location server. Position is determined by correlation, which compares the measured and stored signal parameters. DCM can exploit the wide UMTS bandwidth by using the measured power delay profiles and location estimation is possible by using only one base station. Results imply a need of two different

measurement layers: signal strength and power delay profile. Direction measurements can further narrow the possible physical area. The drawbacks are the unstandardized measurement procedure of the power delay profile, its reporting and initial field measurements. Our simulations with 24 sites and 57 cells indicate DCM accuracy within 25 meters (67 percent) and within 188 meters (95 percent). [C1855]

"Twelfth International Conference on Antennas and Propagation. ICAP 2003 (IEE Conf.Publ. No.491)"

First Page of the Article [C1856]

"Broadband fixed wireless access for a combined business and residential market"

This paper is largely based on the EU-funded research activities within the ACTS and IST (Information Society Technologies) programmes. The interest started with local multipoint distribution systems (LMDS) that form part of the more general broadband fixed wireless access (BFWA) systems. The paper deals with combined business and residential markets, access technologies, coverage, propagation aspects, and some possible future trends. [C1857]

"Evaluation of the time-evolutionary directional indoor channel model"

In this paper, a new stochastic time-evolutionary directional indoor channel model is proposed based on real-time measurement data. The model incorporates the dynamic evolution of paths when the mobile moves by adapting the concept of Markov processes. In order to take into account the multiple births and deaths as well as the correlation between the number of births and deaths observable within the measurement data, an M-step, 4-state Markov channel model is proposed. The lifespans of paths and the spatio-temporal variations of paths within their lifespans are also taken into consideration, found to be well-modelled by an exponential and a Gaussian probability density function, respectively. Finally, the validity of the proposed model is evaluated by comparing the statistical properties of the measurement results with the simulation results. [C1858]

"Simulating coverage and capacity in the indoor environment when using the nanoBTS"

In-building, wireless voice-communication services are being driven by businesses looking for ways to become more productive through convenient and cost-effective "intra-office" communication. In such environments, distributed antennas systems (DAS) are commonly used; however, DAS use expensive co-axial cables or optic fibers. The nanoBTS, from ip.access, is a GSM distributed base station (DBS) system specifically designed to be a flexible and inexpensive solution for coverage of the indoor environment. Occupying a small footprint, no larger than that of a PC notebook, each BTS can be mounted unobtrusively on a wall or ceiling, taking its power and traffic from a single 10/100 switched Ethernet connection. Multiple BTS's can be distributed within buildings for providing coverage over wide areas; however, in order to increase the system trunking efficiency, effective channel allocation algorithms need to be used at the BSC; which make use of the overlaps of coverage for distributing the load between different cells. This paper examines the propagation effects which need to be considered when implementing the simulator, which has been designed to evaluate the capacity gains of these channel allocation algorithms within the indoor environment. [C1859]

"Improving predicted coverage accuracy in macrocells by use of measurement-based predictions"

Measurement-based prediction (or MbP) is a unique radio propagation process, which increases the accuracy of conventional propagation model predictions by making use of measured data to improve the model predictions around sites. The process accounts for the first and second order statistics of the survey data by including the specific propagation features of terrain, buildings and trees revealed within the data, and encompasses the electromagnetic effects specified by the model. MbP extracts the main features of the slow fading characteristics of the propagation from the measurements and applies these to predict the shadowing across a wider area. The results are used to provide improved predictions for the surveyed site, regardless of which antenna configurations are subsequently used. All cells associated with the site can share the same survey data. This paper presents the results of an investigation into the performance of MbP compared to a conventional model prediction. [C1860]

"Performance of small-scale multiple site diversity scheme evaluated through a 3D rain model"

The dual-site diversity technique has proven to be quite useful in counteracting rain attenuation; this technique can be extended adopting a multiple-site configuration, where N stations are located on a circle. Simulations for small-scale multiple-site diversity systems have shown significant improvements in terms of diversity advantage and site separation reduction, with respect to the corresponding dual-site configuration. We have also found that the performance of these systems can be conveniently predicted using the ExCell model. This model can be

very easily adjusted to the local environment through the use of the cumulative distribution function of point rain rate. [C1861]

"Statistical modelling of the indoor radio channel-an acoustic analogy"

Many models exist for the prediction of the wideband characteristics of the indoor radio channel. Techniques range from simple empirical models, to complex site-specific algorithms making use of ray-tracing or finite difference methods. The simpler models offer little guidance to the designer of practical systems, while the more complex approaches generally require a level of knowledge of the physical characteristics of the building that is at best time consuming and at worst, impossible, to obtain. This paper proposes an intermediate approach to the modelling of the indoor, wideband, radio channel, following a physical-statistical approach initially inspired by methods employed in acoustic modelling. [C1862]

"Investigation of building dielectric properties and the effects on indoor radio channel"

Since the channel prediction is essential for the successful implementation of an indoor wireless system, there is an increased demand for accurate deterministic modelling of indoor radio channels. Dielectric properties of building materials determine the reflection and the transmission characteristics and consequently affect radio wave propagation within indoor environments. This paper presents an in-situ method for obtaining the dielectric parameters of building materials. A ray-tracing method is developed to examine the effects of these parameters on the channel characteristics. Simulation results demonstrate that the dielectric properties of building materials have various degrees of effects on indoor channel path loss and time delay characteristics. This indicates that the accurate information on building dielectric properties is required for indoor channel characterisation and the method we used for this purpose is recommended. [C1863]

"Review of constitutive parameters of building materials"

Information presented in this paper is important since deterministic models should utilise the constitutive parameters presented in the literature in a sensible way. When possible, formulas presented in the literature can be used to theoretically calculate the missing parameters. If the constitutive parameter information is not accurate, prediction errors can accumulate. Examining a range of reported data on different materials and chemical compositions is of prime importance because it reveals the variation trend. This can allow quick and sensible assumptions to be made for any missing values. [C1864]

"An adaptive multi-resolution algorithm for 2D simulations of indoor propagation"

In this paper a multi-resolution FDPF approach has been proposed. More precisely, a new nonregular pyramidal structure which fits the particular arrangement of the indoor environment has been presented. The use of a full-space discrete simulator instead of classical ray-tracing techniques is a challenge due to the inherent high computation requests. However, we demonstrate that the use of a multi-resolution approach allows one to perform some calculus in a pre-processing phase, independently of source locations. [C1865]

"Study on locating simulation of EM radiation source and transfer characteristic in ELF electromagnetic field"

The Japanese Islands are located in an active position of seismic activity and therefore often have been afflicted by the damage of an earthquake. There is a report that disorder of an electro-magnetic (EM) wave occurs in nature as a precursor of crustal activity. In order to detect the sign, we have been measuring EM waves of 223 Hz at about 40 sites in Japan. Our final goal is to determine the EM source more correctly. To locate the radiation source by multi point observations of EM power, EM wave propagation characteristic needs to be clear. In the presumed method of a generation source, we assume the attenuation model that EM wave intensity declines by the α power of the distance from the EM source. α is an unknown value, however, this paper analyzes α by locating the thundercloud position which generates the EM wave. [C1866]

"A new model for calculating diffraction fields, in urban environments, using physical optics approach"

Major methods that were recently used for solving the electromagnetic field in the urban environment based on approximation methods named GTD,UTD,GO. With attention that these methods are obtained from the Maxwell equations by using the approximation and asymptotic methods, for many applications validity of them is limited. Although these models have variation about wavelength of field but this variation of field is not same as real field variation. Recently mobile systems have become smaller and smaller, and on the other hand must have excellent accuracy. Therefore it is necessary that better methods are used. With generalize the methods are

used for field calculation in front of antennas and extended apertures this is possible to reach more accurate models. [C1867]

"2003 Proceedings of the International Conference on Radar (IEEE Cat. No.03EX695)"

First Page of the Article [C1868]

"Limits to the extraction of information from multi-hop skywave radar signals"

The performance of HF skywave radar systems is customarily referred to in terms of single-hop propagation, a mechanism which provides illumination of the Earth's surface out to ranges of around 4000 kilometres. In practice, the process of ionospheric reflection often supports multiple hops, though the signals are inevitably subjected to much greater distortion and contamination. In this paper, we address the issue of adequacy of conventional models of multi-hop propagation. We formulate a detailed model which accounts for intermediate surface scattering, and obtain a representation in terms of integrals in x&oarr;-k&oarr; space. We proceed to evaluate the resulting expressions for several cases of interest. The results demonstrate that it is vital to understand the complexities of multi-hop propagation if this method of observation is to be exploited for remote sensing of the ocean at extreme ranges. [C1869]

"Radio pulse propagation in a smoothly bent oversized waveguide"

An efficient method to calculate EM pulse dynamics in a wide nonuniform waveguide is proposed. Fourier transformation of the adiabatic approximation into time domain results in a series of traveling pulsed modes whose group velocities depend on the mode number, waveguide cross section and axis curvature. Parabolic equation can be used for numerical implementation of the asymptotic solution. [C1870]

"Algorithm for calculating multi-path distances in rectangular tunnel"

A new multi-path propagation model for predicting radio channel in rectangular tunnel is built. The traditional model is only a special case of the new model. An iterating algorithm for calculating multi-path propagation distances of radio rays in the new model is discussed. [C1871]

"Trapped surface wave and lateral wave on a conductor coated with a dielectric layer"

The simple asymptotic analytical expressions of the electromagnetic fields induced by a vertical electric dipole on a planar or a spherical conductor coated with a dielectric layer have been obtained. These expressions show that the induced fields consist of the direct wave, reflected wave, lateral wave and trapped surface wave for the planar model, and consist of the trapped surface wave and diffractive wave for the spherical model. The propagation wave number of the trapped surface wave is between that of the wave number k0in the air and the wave number k1in the dielectric. The amplitude of the trapped surface wave attenuates as ρ-12/ in the ρ direction near the surface and attenuates exponentially as e-yzin the z direction. The expressions for the direct wave, reflected wave and lateral wave in this paper coincide with those in the paper by King and Sandler in the planar model. When the thickness of the dielectric layer is not small, the lateral wave and the trapped surface wave are combined the total field to produce an interference pattern in the planar model, but the trapped surface wave is dominant in the spherical model. And the comparison between both two models is given. The comparison show that the induced field in the spherical model is very different from that in the planar model. [C1872]

"The influence of communication distance on multipath channel characteristic of tunnel"

Ray-tracing method was used to simulate the characteristic of wide band radio wave transmission in tunnel. The simulation results showed that the root-mean-square delay spread τrmscaused by multipath propagation fade varied with the communication distance in tunnel. Therefore the correlation bandwidth of the channel was connected with the communication distance in tunnel. The attenuation caused by multipath propagation fade varied with the communication distance too. [C1873]

"Probing of the artificial hole in the ionosphere with the HF skywave radar"

This paper explains the experiment in which HF skywave radar probed the artificial ionospheric hole, which is caused by the flames of the rocket vertically launched and penetrated the ionosphere. After the rocket had passed through the ionosphere, the minimum time-delay Pmin-f on the backscatter ionograms obviously appeared with wave and focusing stripes resulting from the irregular structure etc. The results indicated that there was a low electron density zone, the artificially created hole in the ionosphere along the propagation path.

Under the asymmetry quasi-cosine ionospheric hole model, the experimental Pmin-f was simulated with the technique of ray tracing. It was deduced that the range size of the hole in the ionosphere along the radar beams was some 573 km and the critical frequency of the center was 2.6 MHz lower than the background critical frequency (12 MHz). The ionospheric environment 350 km away from the launching site was disturbed and the propagation velocity of the ionospheric disturbance was about 50 m/s. [C1874]

"Superresolution measurement of non-specular wave scattering from building surface roughness"

This paper presents a superresolution measurement of non-specular scattering from 3D building surface roughness. The superresolution method was applied as an approach to handle signal parameters (DOA, TOA) of the individual incoming waves reflected from building surface roughness. In order to comprehend in detail the microscopic mechanisms of scattering, signal parameters are to be incorporated into the geometrical ray tracing. The results show that the multiple paths can be detected from many scatterers, such as ground, window glass, window frame, bricks surface, as well as directly from the transmitter. Most of the scattered waves arrive closely from specular directions. The calculation of glass and bricks reflection coefficient can be performed based on data measurement. [C1875]

"Repeatability of large-scale signal variations in urban environments"

This paper quantifies the repeatability of largescale signal variations in an urban propagation environment. We propose a model and use field measurements taken in downtown San Francisco to quantify how similar the received signals appear when a mobile receiver revisits the same general area. The results establish bounds for repeated measurements within a given street that are taken on different days as well as in different lanes. [C1876]

"Evaluation of long term channel prediction methods using ray tracing simulation [Ccellular radio]"

The subject of this investigation is the evaluation of certain time invariant auto-regressive estimation and prediction techniques. These prediction techniques are based on an over-specified auto-regressive model of order p. The parameters for the prediction model are obtained by solving the Yule Walker equations and adaptively tracking the coefficients as new channel data becomes available. The performance of these methods has been reported for certain simplified models of the mobile cellular environment, but the purpose of this investigation is to analyze these methods using a ray tracing simulation engine, which generates the in phase and quadrature components of the wireless cellular environment. This approach assesses the reliability and accuracy of these prediction algorithms for a more common and more realistic type of mobile environment. The ray-tracing simulator is based on the geometric optic (GO) and geometric theory of diffraction (GTD) approximations for electromagnetic fields at high frequencies. [C1877]

"Measurement and analysis of the indoor UWB channel"

Measurements for ultra-wide bandwidth (UWB) indoor propagation channels, performed in two different environments in a modern engineering building, are reported in this paper. Extensive measurements are taken in order to enable us to model UWB channels in detail. Particularly, we analyze path loss, RMS delay spread, amplitude distribution function, spatial correlation of different antenna separations and delay correlation between adjacent multipath components. The amplitude distribution and correlation within bins are also examined. Results reported in this paper can be used in the design of high-speed UWB communication systems. [C1878]

"Ionospheric perturbation associated with earthquakes, as revealed from subionospheric VLF/LF propagation"

NASDA (National Space Development Agency of Japan) has just finished the Earthquake Remote Sensing Frontier Project conducted since 1996 within the framework of the Earthquake Frontier Projects by the former STA (Science and Technology Agency). The main emphasis of NASDA's Frontier Project was the complete understanding of lithosphere-atmosphere-ionosphere (LAI) coupling by making full use of different kinds of observational items and finally we contribute to the short-term earthquake prediction. The most exciting finding from our Frontier project was the discovery of convincing evidence on the presence of seismo-ionospheric perturbations, which has been extensively investigated by using the subionospheric VLF/LF propagation, and several important findings have been presented, including the initial result for the Kobe earthquake and a few case studies from much data. [C1879]

"Emulation research about feasibility of reducing dihedral corner reflector RCS with plasma"

A dihedral corner reflector has a wide-angle dispersion characteristic, and it is a primary scattering position in

certain orientations of a metal body. Furthermore, the technology is quite complex for its radar cross section (RCS) to be reduced. The paper first investigates the technological feasibility of reducing its RCS with plasma. Then, the RCS variations of a metal corner reflector when its surfaces are covered with plasma are analyzed by software emulation (the experimental equipment is being developed). The results show that the plasma has strong electromagnetic wave absorption characteristics. In addition, the attenuation of RCS declines with increasing incident wave frequency when the plasma. frequency and electron collision frequency remain steady. The results show that application of a plasma has practical engineering value in terms of reducting the RCS. [C1880]

"2003 IEEE 58th Vehicular Technology Conference. VTC 2003-Fall (IEEE Cat. No.03CH37484)"

First Page of the Article [C1881]

"A preliminary analysis for down-looking radar location"

The critical depression angle for down-looking radar location is an important parameter, which is function of refractive index on ground surface and that at radar height. When the initial depression angle is less than or equal to the critical depression one, the ray path is reversed up-ward in space, its reversing height is related to the initial depression angle and refractive index. Based on the radiosonde data measured in our country, atmospheric refraction modification for down-looking radar location is analyzed, the method for calculating reversing height is also presented in this paper. [C1882]

"Measurement and characterization of indoor ultra-wideband propagation"

The propagation of ultra-wideband (UWB) signals in indoor environments is an important issue with significant impacts on the future direction and scope of the UWB technology and its applications. The objective of this article is to present an assessment of the potentials of UWB indoor communications by characterizing UWB indoor channels. The channel characterization refers to extracting the channel parameters from measured propagation data. An indoor UWB measurement campaign is undertaken. Time-domain indoor propagation measurements using pulses with FWHM equal to 85 ps are carried out. Typical indoor scenarios, including line-of-sight (LOS), non-line-of-sight (NLOS), room-to-room, within-the-room, and hallways are considered. Results of indoor propagation measurements are presented for local power delay profiles (local PDP) and small-scale averaged power delay profiles (SSA-PDP). Site-specific trends and general observations are discussed. The results for path-loss exponent and time dispersion parameters are presented. [C1883]

"The effects of antenna directivity on path loss and multipath propagation in UWB indoor wireless channels"

The effects of antenna directivity on path loss and multipath propagation in the ultra-wideband (UWB) indoor channel are analyzed for different transmitter/receiver (Tx/Rx) antenna combinations in the 2 GHz to 6 GHz frequency band. A statistical model of the path loss in the channel is presented, where the parameters in the model (i.e., path loss exponent and shadow fading statistics) are dependent on the particular Tx/Rx antenna combination. Time domain statistics of the channel (i.e., mean delay spread and RMS delay spread) are analyzed thoroughly for each antenna combination. There is a significant reduction in RMS delay spread when directional antennas are used at the transmitter and receiver as opposed to using omni-directional antennas. Results show that directional antennas can be used as an effective way of mitigating the effects of multipath propagation in UWB indoor channels. [C1884]

"Impact of NLOS propagation upon ranging precision in UWB systems"

The ultra wideband (UWB) radiolocation functionality usually relies on the ability to perform a very precise estimation of the time of flight (TOF). Unfortunately, in spite of the fine performances demonstrated by the UWB systems, indoor dense multipath channels may alter the precision of the range estimate from severe blockage situations. This paper addresses the general problem of non line of sight (NLOS) errors in the specific context of UWB range estimation. Typical ranging errors due to the NLOS propagation are exhibited by deriving experimental results from real indoor VNA measurements into realistic statistical error models. [C1885]

"Signal processing model for a transmit-reference UWB wireless communication system"

This paper presents a signal processing model for the delay-hopped transmit-reference ultra wideband communications system introduced by Hoctor and Tomlinson. In that paper, a single-user receiver based on a bank of correlators and a sliding window integrator was proposed. However, the radio propagation channel also introduces correlations, which have a significant effect not taken into account by the Hoctor-Tomlinson receiver.

Here we propose an accurate signal processing model for the transmit-reference system, including the effect of the propagation channel, as well as an algorithm to estimate the resulting effective channel coefficients. [C1886]

"A recursive algorithm for radio propagation model calibration based on CDMA forward pilot channel"

Generic propagation model always have accuracy problems. Without model calibration, it can hardly be used in practice. This article develops a recursive algorithm on radio propagation model calibration for CDMA systems. An evaluation method is introduced and actual drive test results are used to verify the refined model's goodness of fit. From the results it can be seen that the calibration method in this paper is feasible in practice. [C1887]

"Extension of SIMO wideband channel sounder for UWB propagation experiment"

Good knowledge of transmission channel properties is necessary to study the performances of future UWB systems. Thus, efficient equipment is required to characterize and model the UWB propagation channel. This paper proposes a basic idea to convert a SIMO wideband channel sounder into an UWB channel sounder. These minor changes were applied to the France Telecom R&D channel sounder. The modified equipment enables real time measurement in the 3.1 10.6 GHz frequency band with more than 1 GHz bandwidth. [C1888]

"On the relation between bandwidth and robustness of indoor UWB communication"

The paper focuses on the effect of small-scale fading on the throughput of communication systems that operate with different bandwidth within an indoor environment. The small-scale fading of the indoor radio channel has been measured within an office environment. From these measurements, a single intuitive scalar is derived, which characterizes the small-scale fading encountered by a certain signal. This signal has been characterized by its lower frequency and bandwidth. This measure allows for an objective, quantitative analysis of the relation between small-scale fading and signal bandwidth. The paper is complemented by a link-budget analysis to illuminate the relationship between signal bandwidth, fading margin and throughput. The bandwidth has been varied step-wise from 10 MHz to 5 GHz. [C1889]

"An application of SAGE algorithm for UWB propagation channel estimation"

In this paper, a new ultra wideband (UWB) channel estimation algorithm, UWB-SAGE (space alternating generalized expectation maximization) is proposed. In the algorithm, a novel UWB signal model which is an extension of the conventional wideband signal model is employed in order to estimate the UWB channel with SAGE algorithm. The algorithm divides the measured data into individual ray paths and estimates the directions of arrival, propagation time, and the variation of the amplitude and phase during the propagation for each signal. The measurement campaign in indoor environment was conducted and it was shown that the algorithm could correctly extract the inherent propagation phenomena of the channel. The estimation result can be very useful for the design and analysis of UWB communication system, especially for the evaluation of waveform distortion and multipath effect. [C1890]

"A simplified CFDTD algorithm for scattering analysis"

The scattering calculation may be inaccurate while the conventional FDTD method in cartesian coordinates uses staircase approximation to model curvilinear surface. In tins paper, a simplified conformal FDTD (CFDTD) scheme is presented to overcome staircase error. Although the areas and lengths of the distorted cells are also employed in the same way of the previous CFDTD algorithm, this scheme uses a radio of 1/6 (the distorted cell area to the regular cell area) as a criterion to eliminate instability due to the very small distorted cell sizes To show the validity and applicable of the presented scheme, computed RCS's are compared with that from the conventional FDTD. other methods and measured values. [C1891]

"ADI-FDTD algorithm for three-dimensional scattering analysis"

In this paper, the ADI-FDTD algorithm is applied to simulate scattering of three-dimensional objects. A few key techniques include the introduction of an incident plane wave, connective boundary condition between total-field zone and scattering-field zone and near-to-far field transformation are discussed. It is shown from the numerical result that the computation time of the ADI-FDTD algorithm is only 1/6 that of the conventional FDTD method with the same accuracy. [C1892]

"Analysis on oceanic and terrestrial domino effect of atmosphere refractive"

In this paper, we have utilized the set of recently five years meteorologic profiles sounding made in five

representative areas along the coast of southeast China and applied mode of subsection to calculate statistically refractive index. Based on former work, analysis on oceanic and terrestrial domino effect of atmosphere refractive has been carried through using graph coming from statistic data, and standard deviation has also been obtained by least mean square (LMS). [C1893]

"The RF-powered surface wave sensor oscillator-a successful alternative to passive wireless sensing"

This paper describes a novel passive wireless SAW sensor providing a highly coherent measurand proportional frequency, FM modulated with identification (ID) data and immune to interference with multiple path signals. The sensor comprises a highly stable low-power oscillator, stabilized with the sensing SAW resonator and powered by the rectified RF power of the interrogating signal which is received by a λ/4 whip antenna on the sensor part. A few hundred μW of dc power are enough to power the sensor oscillator and ID modulation circuit and achieve stable operation at 1.0 and 2.49 GHz. Reliable sensor interrogation was achieved over a distance of 0.45 m from a SAW based interrogation unit providing 50 mW of continuous RF power at 915 MHz. The -30 to -35 dBm of returned sensor power was enough to receive the sensor signal over a large distance and through several walls with a simple superheterodyne FM receiver converting the sensor signal to a low measurand proportional intermediate frequency and retrieving the ID data through FM detection. Different sensor implementations including continuous and pulsed power versions and the possibility of transmitting data from several measurands with a single sensor are discussed. [C1894]

"Suitability of some propagation models to analyse interference from ultra wideband transmitters in outdoor environments"

In this paper, with five propagation models, a statistical analysis of interference from randomly located ultra wideband (UWB) emitters is conducted. The suitability and limitations of these propagation models on the basis of the results obtained are discussed. Some meaningful conclusions, which are important to design and regulate UWB systems, are drawn. [C1895]

"Ultra wideband signal propagation in desktop environments"

Although ultra wideband (UWB) propagation in indoor environments has been intensively studied, there have, as far we know, been no published studies of UWB propagation in desktop environments, where wireless personal area networks are expected to be most commonly employed. Short-range propagation measurements were carried out using UWB and continuous wave (CW) signals on a rectangular metal plate simulating typical desks with and without a low vertical metal partition panels. The frequency of the UWB signal spanned from 3.1 to 10.6 GHz and that of the CW signal was 6.85 GHz. A vector network analyzer and two omnidirectional UWB antennas were used to obtain frequency-domain response of the propagation paths. With the partition panel, the CW reception level showed approximately a 36-dB spatial variation, induced by the interference between the direct and the reflected waves, but the UWB reception level had no particular plunges. We also measured the additional losses when the propagation paths were blocked with a human arm and when the antenna was covered with a human palm. These losses were found to be 10 to 12 dB caused by an arm; and 6 to 7 dB caused by a palm. [C1896]

"9th Asia-Pacific Conference on Communications (IEEE Cat. No.03EX732)"

First Page of the Article [C1897]

"Efficient computation of radio coverage zone using a spatial partitionment approach"

Previously, we proposed a geometrical approach to the problem of coverage zone computation (Combeau, P. et al., IEEE European Workshop on Integrated Radio Communication Systems, 2002). It is a three step solution. First, the spatial propagation of a wave is computed, using only a geometrical approach. Then, a partitionment is realised, by use of an image segmentation technique. Finally, the evaluation of the coverage zone is computed using external computations for a reduced number of receiver locations. Since the first step of spatial propagation is very time consuming, we now develop an efficient optimization, based on discrete geometric results. Some results are presented showing a very high time reduction. [C1898]

"The electromagnetic-thermal analysis of human exposure to radio base station antennas"

Electromagnetic-thermal analysis of the human body exposed to base station antenna radiation is presented in this work. The formulation of the problem is based on a simplified cylindrical representation of the human body. Electromagnetic part of the analysis involves incident and internal field dosimetry, while the thermal model deals

with the bio-heat transfer processes in the body. The electric field induced in the body is determined from the axial current induced in the body. This current distribution along the body is obtained by solving the Pocklington integral equation for a thick cylinder. The Pocklington integral equation is solved numerically via the Galerkin-Bubnov boundary element method (GB-BEM). Once the internal electric field and related total absorbed power in the human body is obtained, it is possible to calculate a corresponding temperature rise in the body due to the GSM exposure. This temperature rise is determined by solving the bio-heat transfer equation. [C1899]

"Matrix based ray-tracing model for indoor propagation"

This paper presents a fast and accurate method for indoor signal strength prediction. Method is based on pathloss precalculation for the whole coverage area of an access point in free space. Resulting matrix and object masks are used to calculate signal strength for all points simultaneously minimizing the number of needed calculations and reducing prediction time significantly. Also discussed is the upgrade to 3D prediction. [C1900]

"Frequency domain processing of ultra-wideband signals"

The central challenge of ultra-wideband (UWB) radio is to overcome its intrinsic complexity. This paper argues for the use of high-speed sampling and a front-end FFT as the paradigm of choice for robust performance and low energy consumption in certain ultra-wideband designs. Assuming the need to approach optimal performance, it highlights the complexity advantage of frequency domain (FD) over time domain processing. Anechoic chamber and realistically propagated indoor UWB measurements, combined with simulated noise and interference, are used to illustrate FD techniques for initial synchronization and estimation of channel response. [C1901]

"Wideband propagation measurements onboard HMS Bristol"

A modern warship has many complex systems for onboard communications, command and control. At present, all of these systems are hard-wired and are expensive to modify or replace for the many upgrades that occur during the lifetime of the ship. It would be advantageous to replace much of this cabling with wireless links and to use COTS wireless local area network (WLAN) technology. Very little previous research has been carried out, however, to investigate the nature of the propagation environment onboard a ship or to determine whether existing WLAN technologies will have sufficient range and bandwidth. This paper describes wideband propagation measurements carried out onboard a warship. A vector network analyser was used to obtain a frequency domain characterisation of the radio channel at 2 GHz and 5 GHz within several compartments and passageways aboard HMS Bristol. Results are presented that demonstrate multipath fading and path loss. The attenuation caused by the closing of watertight doors is also considered. Comparisons are made with the author's previous measurements taken in typical office buildings (P. Nobles, et al., (1997)). The conclusions provide a fascinating insight into the propagation mechanisms onboard a warship and the challenges of implementing wireless systems in this environment. [C1902]

"MILCOM 2003. 2003 IEEE Military Communications Conference (IEEE Cat. No.03CH37500)"

First Page of the Article [C1903]

"Full wave propagation model based on moving window FDTD"

A new approach to wave oriented radio propagation modeling based on extended finite difference time domain (FDTD) methods has been developed. The new approach takes advantage of the fact that when a pulsed radio wave propagates over a long distance the significant pulse energy exists only over a small part of the propagation path at any instant of time. This allows the use of a relatively small FDTD computational mesh that exists only over a portion of the propagation path, moving along with the pulse energy. At the leading edge of the FDTD mesh inside the moving window the appropriate terrain and atmospheric material parameters are added to the mesh. At the trailing edge the terrain, foliage and atmosphere that has been left behind by the pulse is removed. Absorbing boundaries are used appropriately at the boundaries of the mesh. The potential savings over using a full FDTD mesh over the entire length of the propagation path are enormous. The proposed method promises to be the first full wave method applicable to radio propagation prediction calculations over long propagation paths. The moving window FDTD method has been applied to propagation over different types of irregular terrain. Comparisons with path loss measurements and ray-based methods show good accuracy and illustrate the advantages of a full wave method. Applications to foliage covered terrain have also been demonstrated. [C1904]

"Physics-based propagation models for channels involving mixed paths"

Predicting the radio signal levels and coverage areas for information warfare system communication channels

between base stations, vehicles and warfighters is a challenging problem. The channel may involve radio frequency interactions with hills, foliage, and buildings. The paths may involve long distances over hilly terrain or shorter distances involving interaction with urban building features. Many propagation paths may simultaneously involve hills, foliage, and urban areas. For example, a warfighter sheltered in a doorway in an urban area may need to communicate with a command station located in a rural forested area outside of the city. These mixed path links involving both urban (including indoor) features and rural (including foliage) terrain are beyond the capability of any existing physics-based propagation model. Currently available models are applicable to paths where both the transmitting and receiving antennas are located in an outdoor urban environment, or indoors, or in rural areas. Development of fast and reliable mixed-path models valid over a wide range of communication frequencies is important in order to provide channel characterizations for realistic situations. This development will by necessity bring together different types of models. Full wave models may be applied to predict the antenna pattern from an antenna on a vehicle or a warfighter crouched below a wall. Full wave models may also be used for propagation paths involving terrain or atmospheric effects. Parabolic equation models may also be applied for these situations. Ray-based models are needed for complex interactions with urban features and for indoor situations. All of these need to be combined in new ways in order to obtain accurate mixed-path radio propagation predictions. [C1905]

"Ultra-wideband (UWB) transmitter location using time difference of arrival (TDOA) techniques"

Ultra-wideband (UWB) signals lend themselves to localization measurements using time difference of arrival (TDOA), or time delay estimation (TDE), techniques. However, TDOA estimation is complicated by pulse distortion due to the antenna elements, other system components, and the multipath propagation environment. This paper explores the use of cross correlation based TDOA methods in conjunction with a novel technique for combining the TDOA estimates from multiple antenna pairs to build an estimate of the transmitter position. Experiments that simulate foliage and industrial environments were performed in an anechoic chamber. Results from these measurements are presented. [C1906]

"Calibration of the CONSERT/ROSETTA radar"

The ROSETTA/ESA probe will probably rendezvous Comet 67P/Churyumov-Gerasimenko in 2014 and launch a Lander at the nucleus surface. The CONSERT instrument will perform the sounding of the comet nucleus by measuring a 90 MHz electromagnetic wave propagation from the Lander to the orbiter throughout the nucleus. The goal of this sounding is to determine the internal structures of the comet nucleus at different scales and to deduce information on its composition (density, type and abundance of the refractor). CONSERT is an original concept of spaceborne transmission radar based on the propagation throughout the nucleus while the classical radars are based on the reflection. This instrument fulfills three functions: a chronometer to measure the propagation delay, an imager based on the multipath propagation and a radiometer to estimate the wave attenuation The calibration of the instrument should characterize these three functions but due to the novelty of the instrument concept we have no classical set of parameters to quantify the instrument performances from a data-inversion point of view. The instrument design and the absence of calibration channel due to mass and power constraints require specific signal processing and calibration protocol. In this paper, we review the instrument, its objectives and its time transponder structure. Then we present the philosophy of the calibration. In particular we present the results of the instrument ground calibration and the planed in-fly calibration. [C1907]

"Towards an atmosphere free interferogram; first comparison between ENVISAT's ASAR and MERIS water vapor observations"

During ERS-1 and ERS-2 missions, the application of synthetic aperture radar interferometry (InSAR) become known as a very important method for topographic mapping and high accuracy surface displacement measurments. Further investigations, however, showed that expected accuracy couldn't be achieved. It appeared that radiowave propagation through the atmosphere causes significant distortion to the observed signal and obscures effects of topography and/or deformations. Therefore, it became clear that in order to achieve very accurate measurements of surface displacements additional knowledge of state of atmosphere during InSAR measurements is necessary. In this paper the possibility of using Medium Resolution Imaging Spectrometer (MERIS) in combination with Advanced SAR (ASAR), both are on board of ENVISAT, for obtaining atmosphere free interferograms is discussed. [C1908]

"Self characterization of modelling parameters for synthetic aperture imaging radiometers"

It is now well established that Synthetic Aperture Imaging Radiometers (SAIR) promise to be powerful sensors for high-resolution observations of the Earth at low microwave frequencies. Within this context, the European Space Agency (ESA) is currently developing the SMOS mission. This propagation of modelling errors within a

reconstruction process that attempts to retrieve the brightness temperature of a scene under observation from interferometric measurements depends on the knowledge of the values of the parameters involved in the modelling of the instrument. This contribution describes an approach to characterize these modelling parameters, once the instrument has been launched into space, with an accuracy such that the propagation of errors through the reconstruction process is still under control. [C1909]

"Conductivity of leaves and branches and its relation to the spectral dependence of attenuation by forests in meter and decimeter band"

Conductivity of leaves (needles) and branches of different trees as well as conductivity of their sap was directly measured. Measuring technique is presented. Measured values of needles and branches conductivity are several times less than these values recalculated from sap conductivity values by known models. Influence of leaves and branches conductivity value on the spectral trend of radio waves attenuation by foliage is discussed in this paper. [C1910]

"An improved UTD propagation model for urban cellular communication system"

This paper presents an improved UTD model for cellular mobile radio (CMR) systems in urban environments. A closed form formula is derived based on the uniform theory of diffraction (UTD) and includes multiple diffractions over building rooftops. Good agreement between our theoretical results with measurements and models reported shows the validity and applicability of our model for such communication application. [C1911]

"The accuracy of geometric channel modeling methods"

This paper addresses the subject which is too often overlooked in the analysis of a geometric model for wireless channel-the axioms corresponding to a priori properties of the channel that is modeled using geometric approach must represent realistic wave propagation. When constructing a model of propagation channel, people often create a substitute by giving an arbitrary shape or form to scatterer distributions based on its intuitive appeal for a certain radio environment. Such models do not necessarily represent actual propagation process and yields deceptive results. The principal goal of this paper is to provide an insight into the underlying connection between any geometric models and the physical propagation process they signify. This is achieved through two parameters: the contour mean probability density function and the effective path length. With these two metrics, two heuristic rules are proposed to provide the missing link between the canonical models and the physical channel. We further revisit a few widely used geometric models in macro- and micro-cellular environments based on the unified analysis. [C1912]

"Geometric channel model for multipath propagation in city-street grids"

For rectilinear streets in urban and suburban environments, two geometric channel models have been developed to characterize the street-guided propagation of broadband signals. When the coupling of signal power into cross streets is primarily via reflections from buildings, the Manhattan metric is used to define the propagation distance in the two-dimensional space. A tapped delay line model is thus implemented based on the generic framework proposed in previous work. We further study the effect of width of street blocks (Wst) and K-factor (K0) on the power delay profile and root mean square delay spread of the channel. On the other hand, when diffraction around building corners is the dominant mechanism for signal propagation, hypothetical receivers are located at each street corner and giving rise to the propagation into the next street section. Multi-elliptical scattering model is suggested. We furthermore compare the channel characteristics of non-line-of-sight microcell propagation with those of line-of-sight propagation based on the proposed model. [C1913]

"Ranging and communication systems between high speed trains in tunnels"

This paper describes a theoretical and experimental approach of the propagation in railway tunnels and its application to the design of a system for measuring a distance between two trains up to 5 km. Results obtained with a prototype are also presented. [C1914]

"Characterization of 3D spatial wireless channels"

In this paper a novel three dimensional spatial channels model is developed to provide insight into spatial aspects of multiple antenna communication systems. The spherical harmonic representation of wavefields is used to decompose the spatial channel matrix into a product of known and random matrices where the known portion shows the effects of the physical configuration of antenna elements. The model supports any arbitrary antenna array configurations as well as any distribution of scatterers. Possible applications of the model and its usefulness are outlined. [C1915]

"Computational complexity of narrow band and wide band channel simulators"

Some questions such as: is it convenient to simulate channel realizations with the sum of sinusoids or with the filtering approach, are addressed in this work in order to provide a guide on which algorithms and in what situations should be used in the development of channel simulators. The conclusions presented are gathered from the comparison of the methods proposed in the literature to simulate narrowband and wideband separable channels. The comparisons are performed from the point of view of computational complexity and two metrics of approximation error. We also discuss the properties inherent to the algorithms that could determine if the proposals are suitable for channel simulation, such as synthesis complexity and their capability to approximate the conditions encountered in real channels. [C1916]

"The effect of various channel conditions on the performance of different antenna array architectures"

An extensive investigation into the effect of many different channel conditions on the performance of handset antenna arrays is studied. We concentrate our analysis on investigating the impact of angular parameters associated with mean azimuth-of-arrival (MAOA), azimuth spread (AS), mean elevation-of-arrival (MEOA) and elevation spread (ES) of the propagation channel under study. The performance analysis is done by comprehensive simulations that incorporate various channel conditions ranging from outdoor to indoor environments on three types of antenna array architectures, i.e., uniform linear array, uniform circular array and uniform rectangular array. A theoretical probability of error is also developed which shows excellent agreement with the simulation results. The importance and dependency of the above parameters on the system performance are examined. Results show that the system performance is always dependent on AS and ES while the impact of MAOA and MEOA is array dependent. [C1917]

"Hybrid ray optical models for the penetration of radio waves into enclosed spaces"

With the growing interest for broadband mobile services in 3rd generation mobile communication networks, the investigation of radio transmission into vehicles and buildings is getting more important. Models for the propagation into vehicles and buildings enable the calculation of the field strength or received power inside these objects. The inner structure of the vehicles (e.g. metal parts) and buildings (inner walls, furniture) as well as the surroundings (other vehicles, buildings) must be considered, and also different construction materials must be taken into account. A deterministic ray tracing approach has been developed, enabling the computation of the transition from an urban scenario to an indoor scenario and vice versa, thus allowing a very accurate computation of the field strength or received power inside vehicles or buildings. Due to the ray tracing technique, the approach can also be utilized to evaluate wideband properties of the mobile radio channel by computing its impulse response. In order to validate such propagation models, measurements inside and outside a building were made. [C1918]

"Blind spatial signature estimation using time-varying user power loading and parallel factor analysis"

The problem of blind user spatial signature estimation using the parallel factor (PARAFAC) analysis model is addressed in the context of applications to wireless communications. A time-varying user power loading in the uplink mode is proposed to enable identifiability and the application of PARAFAC analysis. Identifiability issues are carefully studied and two blind spatial signature estimation algorithms are developed. The first technique is based on the PARAFAC fitting trilinear alternating least squares (TALS) regression procedure, while the second one makes use of the joint approximate diagonalization algorithm. These techniques do not require any knowledge of the propagation channel and/or sensor array manifold and are applicable to a more general class of scenarios than earlier blind approaches to spatial signature estimation. [C1919]

"Indoor MIMO channel measurements for evaluation of effectiveness of array antenna configurations"

Recent research has been done on the influence of the array antenna configuration on a multi-input multi-output (MIMO) communication system. In this paper, we present the results from a measurement experiment conducted in an indoor propagation environment, one chosen to represent the typical office environment. The IST-METRA channel model was used for data analysis. In the experiment, a variety of array configurations were used and their effects on the channel capacities were investigated. Based on the results, the channel model, which considers the spatial correlation at both ends of the link separately, is found to be fairly accurate. A criterion to evaluate both the correlation and the mean effective gains (MEG) of the antenna elements was proposed and

supported by measurement data. [C1920]

"Complex wall effect on fading and MIMO capacities for wireless communication environments"

The two-dimensional finite-difference time-domain (FDTD) method is used to calculate the electric field distributions in an indoor communication environment with realistic floor plan. Power and fading characteristics (e.g., the Rician K-factor), and MIMO capacities are then calculated. Three different wall structures, i.e., the simple slab structure, the complex structure, and the effective slab wall of the complex structure, are considered and the corresponding K-factors and MIMO capacities are compared. It is found that the mean values of K-factors of the complex wall cases are larger than that of the slab walls by around 3 to 5 dB, while the K values of effective walls are larger than those of the complex wall cases by as much as 7 dB. It is also shown that the complex wall structures give larger MIMO capacities in most cases and the effective wall structures give the lowest MIMO capacities in all cases. Based on these results, it may be concluded that the complex wall effect on the propagation characteristics and the MIMO capacity may not be appropriately approximated by those estimated based on effective wall structures. [C1921]

"Distributed source model for short-range MIMO"

The plane-wave, or point-source, assumption has been used extensively in array signal processing, parameter estimation, and wireless channel modeling to simplify analysis. It is suitable for single-input-single-output (SISO) and single-input/multiple-output (SIMO) systems, because the rank of the channel matrix is one. However, for short-range multiple-input- multiple-output (MIMO) systems with line-of-sight (LOS), the point-source assumption affects the rank and singular value distribution of the MIMO channel matrix, and results in the underestimation of channel capacity, especially for element spacings exceeding a half wavelength. The short-range geometry could apply to many indoor wireless local area network (WLAN) applications. To avoid this under-estimation problem, the received signal phases must depend precisely on the distances between transmit and receive antenna elements. With this correction, the capacity of short-range LOS MIMO channels grows steadily as the element spacing exceeds half wavelength. We derive an empirically-based threshold distance below which the distributed source model is required for accurate performance estimation in ray tracing. [C1922]

"An efficient time-domain ray model for UWB indoor multipath propagation channel"

In this paper, an efficient time-domain ray model is developed for ultra wideband (UWB) indoor multipath propagation channels. This model is based on a time-domain uniform geometrical theory of diffraction (TD-UTD) technique, which consists of three basic ray mechanisms of geometrical optics (GO) and UTD, i.e., directed ray, multi-reflected rays from lossy surfaces, and diffracted ray from lossy edges. The useful approximated analyses of TD multi-reflected rays with horizontal polarization and vertical polarization are provided. The TD diffraction coefficient is described. A software-based TD ray tracing tool has been developed to determine all paths of multiple reflections and diffractions, propagation delay of each path, pulse waveform and amplitude, and TD path loss. The simulation results in a typical office room are presented. [C1923]

"Coverage prediction of new elements of systems beyond 3G: the IEEE 802.16 system as a case study"

Calculations on the expected coverage of millimeter-wave propagation in suburban areas of systems beyond 3G are presented. Considering that these systems are envisioned to have a minimum aggregate cell payload of 100 Mbps, the cell ranges are estimated. These calculations are performed with the use of different coverage prediction methods and propagation models. The results of these calculations are compared and the best model for each case is defined. Specific emphasis is given to the WirelessMAN™(IEEE 802.16), the under standardization American air interface for broadband wireless access. [C1924]

"Beam diversity for indoor WLAN systems"

Fading caused by multipath propagation and by shadowing is a significant problem for wireless local area networks (WLANs). The use of diversity can mitigate the effects of this fading. In this paper we report on the effect of using beam selection diversity for a 2.4 GHz WLAN system. Propagation measurements were made in a typical office environment using a planar antenna array capable of forming seven simultaneous 10-degree beams. The beam selection diversity receiver selected the best beam, either on a packet-by-packet basis or using a long-term average measurement. Measurement results show that the mean received signal strength can be significantly increased by use of beam selection diversity. We investigated both average and packet-by-packet beam selection diversity. Simulation results demonstrate that beam selection diversity performs well for a wide range of angle of arrival spreads. [C1925]

"A study on the measurement method of the mobile station location in wide-band mobile communications"

Mobile communications must be enhanced by establishing a non-GPS technology that can detect the positions of mobile stations precisely. We propose methods of measuring the direction of a mobile station. Since these technologies depend strongly on the propagation environments of radio waves, we need a propagation model that predicts actual propagation environments well. Previously (Omote, H. and Fujii, T., Proc. 2002 IEEE-APS, vol.1, p.228-31, 2002; Proc. VTC 2003-Spring, p.1659-63, 2003), we proposed a time-space path model that matches the field measurement results in an urban area in terms of both the arrival angle distribution and the delay time distribution at the same time. We now estimate the precision of the proposed methods by using this time-space path model. [C1926]

"Impact of diagonal correlations on MIMO capacity: application to geometrical scattering models"

The paper highlights the impact of channel correlations on the capacity of MIMO communications, with a focus on the so called diagonal correlations. Based on this analysis, the limitations of simplified mathematical representations, such as the Kronecker or the diagonal-decorrelation models, are pointed out. Finally, the correlation properties of characteristic geometrical scattering models are studied in order to analyze whether these models can be adequately represented by the simplified formalisms, as well as to quantify the errors introduced by these simplifications. With respect to channel correlations, neither the Kronecker model nor the diagonal-decorrelation assumptions are good representations of the investigated geometrical scattering models. When comparing capacity values, it is found that the diagonal-decorrelation model may yield significant errors. In particular, relative errors on ergodic or outage capacity may be significant for the Kronecker model. [C1927]

"Performance of fixed wireless access with cdma2000 1xEV-DO"

Fixed and portable wireless Internet access is becoming an important segment for the wireless industry. 1xEV-DO, also known as IS-856, has been designed to offer increased user experience and high capacity packet data services on cdma2000 networks. The initial set of 1xEV-DO performance results in the literature has focused on mobile environments. In this paper, we address some of the fixed wireless aspects and the corresponding impacts on system performance. A network level simulation of both forward and reverse links including physical and MAC layer details of 1xEV-DO is used to quantify performance. In addition to average throughput per sector, we quantify the user performance on both links as a function of total attenuation. This provides insight on how performance varies within the coverage area-a very important aspect for fixed access. Moreover, we also show how different forward link data schedulers can be used to tradeoff system capacity for a more uniform performance regardless of the terminal distance to the serving base station. [C1928]

"The influence of multiple outdoor interferers on in-building DS-CDMA wireless system performance"

This paper examines the influence of multiple outdoor interferers on the performance of a single-floor in-building DS-CDMA wireless system. Signal correlation is identified as a key propagation parameter that can be related to wireless system performance and therefore the optimal base station location chosen when deploying the in-building system. Using measured mean path loss data integrated into a Monte Carlo analysis, it is shown that the presence of multiple outdoor interferers can significantly influence in-building system performance. If there is dominant interference emanating from one side of the building, it is desirable to place an in-building base station on the same side of the building to ensure optimal system performance. However, if there are similar levels of interference emanating from opposite sides of the building, there is not a clear best strategy that can be used to choose the optimal location of the in-building base station. [C1929]

"An effective algorithm for subsurface SAR imaging"

For many applications in subsurface sensing (e.g., landmine detection or road inspection), it is important to make images of the shallow subsurface from the data acquired by a GPR with antennas slightly elevated above the ground. Classical SAR algorithms are not well suited to this purpose. A new SAR algorithm in the space-time domain for a multi-media propagation environment is proposed. In comparison with known algorithms, this algorithm is significantly simplified without loss of accuracy. The simplifications are based on a physical analysis of the sensing wave propagation. We also show that, for a multi-media background, it is not possible to determine correctly the depth of a scatterer and the speed of light in the ground from only one B-scan without additional information about the transverse position of the scatterer. [C1930]

"Theoretical and simulation analysis of random noise monopulse radar"

Coherent random noise radar technology has been implemented successfully in buried object detection, Doppler estimation, SAR imaging, and ISAR imaging. These applications verified the desirable characteristics of random noise radar for stationary target applications. Since the system is phase coherent, we have demonstrated that it can be used for radar interferometry. We are currently developing a random noise monopulse system for angular tracking of moving targets in real time. This paper provides a preliminary analysis of compatibility of random noise radar with conventional phase-comparison monopulse. [C1931]

"An accurate and effective physical layer simulator for micro- and pico-cellular radio systems and networks"

Complex multipath and interference effects have become the important system design and planning considerations in micro- and pico-cellular broadband mobile data networks such as wireless LAN (WLAN) and very short range personal area networks (PAN) like those based on Bluetooth. Another important issue is the interoperability and coexistence of these various network technologies. Bluetooth and IEEE 802.11b use the same portion of radio spectrum (2.4 GHz) and are liable to interfere. Most of the recent propagation models are based on simple statistical path loss algorithms, which become very inaccurate in the complex indoor environment. The deals with an accurate indoor end-to-end physical layer (radio channel) model including the radiowave propagation environment, antenna model, and the RF/IF front end circuit and baseband processes. The simulator's interface geometrical modeler makes the tool very convenient for complex environments. Results are shown indoor propagation effects for short-range technologies interfering on each other in a simple common RF link. [C1932]

"RF propagation in an HVAC duct system: impulse response characteristics of the channel"

Usually, the heating, ventilation, and air conditioning (HVAC) duct system in buildings is a complex network of hollow metal pipes of rectangular or circular cross-section which behave as multimode waveguides when driven at RF and microwave frequencies. The impulse response in the HVAC duct system used as a wireless communication channel is shaped by three physical mechanisms: probe coupling, attenuation, and dispersion. Three types of dispersion exist in this channel that affect the RMS delay spread. In order of importance, they are multipath reflections, intermodal dispersion, and intramodal dispersion. We present a model for the power delay profile in a straight terminated duct which allows exploration of RMS delay spread parametric behavior. As an example, we calculate the delay spread as a function of distance in a straight duct and find it to be in good agreement with experimental data at distances up to 15 m. A real HVAC system has a complicated geometry, which may include bends, junctions, etc. Efficient modelling of its channel properties is a challenging task. Our model for straight ducts should be perceived as a first step towards that goal. [C1933]

"Radiowave scattering from the plasma disturbances created of space vehicle in the ionosphere"

Summary form only given. We consider the radiowave scattering on the electron concentration disturbances created by a space vehicle, which moves with supersonic velocity in the plasma of the ionosphere. The mechanisms of reflection ions from the surface of the moving space vehicle, the absorption of ion charge at the time of ion collision with the surface of the space vehicle and the influence of the ions by the neutral particles reflected from the surface of the space vehicle are investigated. The kinetic equation describing the particle movement is investigated. Here we use the Green function, which solves the task for the unit point source. We define the analytic expression for the disturbances of charge concentration created by the space vehicle in the ionosphere. The analytic expression for the cross section of radiowave coherent scattering from the disturbances of electron concentration is obtained. The method described in this abstract is allowed to define the cross section of the radiowave scattering from the rarefied plasma disturbances produced by a space vehicle moving in the ionosphere. [C1934]

"IEEE Antennas and Propagation Society International Symposium (IEEE Cat. No.02CH37313)"

First Page of the Article [C1935]

"Two dimensional indoor ray tracing including geometrical theory of diffraction"

First Page of the Article [C1936]

"New computational model of electromagnetic field distribution for predicting of the safety zones in the near-field of microwave antennas"

A new program of evaluation of the electromagnetic field strength distribution has been presented. This program has been mainly designed for calculating the area of safety zones around microwave antennas. New

expressions of the E and H fields by modifying vector potentials have been derived. The received formulas allow the calculation of the EM field distribution in the near-field. The calculation program can be used for a wide class of microwave antennas, like GSM or radar antennas. The real topography of the ground is included for calculation of the incident, reflected and resultant rays. [C1937]

"Investigations in radar technologies in Lviv Polytechnic National University"

For estimation of radar imaging system potential properties, the first-order problem is the image formation as a direct task formulation taking into account the objects' scattering, properties of medium and technical means. The character of the information signal formation on the system's receiver output determines further selection of distortion removal, filtration, interpolation and extrapolation, compression, feature extraction, and spectral estimation methods, i.e. methods of inverse problem solution, and structure of the whole system with certain tactical and technical characteristics. The problem of image formation can be solved by methods: by means of active and passive location. In the case of active system image forming consists of electromagnetic energy radiation in the determined direction and the reception of radio waves reflected from the objects. Passive systems use their own radiation of the investigated objects. Investigations in the improvement and development of new radar technologies based on methods of active and passive location are intensively performed. The results of investigation related with radar and radiometry imaging systems that are carried out at the Lviv Polytechnic National University are presented. [C1938]

"Wideband short-range GPR interferometric phase processing for 3D rough surfaces with correction of antenna phase distortions"

This paper pertains to the distortions in the phase data for near-range wideband interferometric processing and imaging of three-dimensional rough surfaces. These distortions can lead to the anamorphorsis of the wideband image reconstructed in the surface height domain (SHD), and can produce the false information in the surface profile. This paper discusses the method of needed corrections. The results compared with those without implementing the correction procedures show better accuracy and focusing pattern. [C1939]

"Some new relationships between observables of Doppler-polarimetric radar and rain parameters"

This study establishes new relations between the microstructure and the dynamics of rain and Doppler-polarimetric parameters of the radar signal. The rain rate and intensity of turbulence in rain can be retrieved on this basis. [C1940]

"Quasi-3D tool to analyse of the radio propagation channel"

This paper presents practical tool to analyse of the propagation channel in outdoor and indoor radio communications systems. It is based on geometrical optics and the ray launching technique. A quasi-3D model considering 2D propagation in two orthogonal planes (horizontal and vertical) has been used to analyse the three-dimensional propagation of the radio waves inside the buildings. [C1941]

"A method of ground reflections reduction on the ground ranges"

A method to increase the accuracy of antenna gain and radiation pattern measurements on far-field ground ranges is presented. The method consists in ground reflections reduction by means of proper range configuration depending on the pattern shape of the source antenna used. The main idea of the method assumes that the first of the radiation pattern of the source antenna is directed toward the central point of the specular reflection zone. This results in a decrease in the illumination of the range surface and allows significant reduction of ground reflections. [C1942]

"On the BER performance of pulse-position-modulation UWB radio in multipath channels"

The impact of multipath propagation on ultra wide band (UWB) radio, which is carrier free, is quite different from that on conventional radio. This paper presents a theoretical analysis of the bit error rate (BER) performance of binary pulse-position-modulation (PPM) UWB radio in multipath channels. The BER formula is derived. Particular attention is paid to the effect of the propagation time-delay on the BER performance. It is also noted that, for the PPM scheme, the multipath propagation time-delay may lead to unbalanced BERs over "0"-"1" in some particular multipath channels. [C1943]

"MIMO wireless channels made simple"

Fundamental understanding of the interaction between the signal space and the channel is key to reliable

communication. We propose a virtual channel representation for multi-antenna fading channels that captures the essence of such such interaction in the spatial dimension. The virtual representation describes the channel via spatial basis functions defined by fixed virtual angles. The resulting virtual channel matrix provides a simple geometric interpretation of the scattering environment and clearly reveals the two key factors affecting capacity: the number of parallel channels and the level of diversity. Via the concepts of spatial zooming and aliasing, the virtual representation also provides a transparent interpretation of the effects of antenna spacing on channel statistics and capacity. [C1944]

"Scenario driven evaluation and interference mitigation proposals for Bluetooth and high data rate Bluetooth enabled consumer electronic devices"

This paper investigates the effects of interference occurring between Bluetooth and high data rate Bluetooth enabled consumer electronic devices in the home and office environment. Software simulated results for frequency collisions between piconets operating in both synchronous and asynchronous modes with typical up and downlink loading factors are presented (for time-bounded and non-time bounded electronic devices). The significance of this interference on the data throughput in a number of example scenarios is investigated using a state-of-the-art indoor space-time propagation model. These results are then compared with measured channel data taken in the test environment using a MEDAV RUSK BRI channel sounder. The paper concludes by proposing to mitigate the effects of interference by employing synchronous communication in future Bluetooth and Bluetooth evolution networks. [C1945]

"Ultra wideband indoor radio channel models: preliminary results"

Knowledge of the signal propagation mechanisms in the channel is vital for the radio system design and the system performance analysis. However, currently published wideband or narrowband radio channel models do not offer spatial resolution high enough for the ultra wideband (UWB) applications and real channel measurements are needed. The preliminary UWB radio channel model for a selected radio link-configuration in an indoor environment is given. [C1946]

"A statistical model for the small-scale multipath fading characteristics of ultra wideband indoor channel"

A new kind of statistical distribution model is proposed to study the small-scale multipath fading characteristics of ultra wideband (UWB) indoor channel, taking into account its unique feature of high resolution in the delay domain. According to this model, a series of analytical expressions called as POCA-NAZU fading distributions are developed. Although POCA-NAZU fading is originally investigated for the propagation scenario with a finite number of indoor scatterers, it also reflects much well the actual physical mechanism of indoor UWB propagation. The comparisons of POCA-NAZU fading with conventional Rayleigh and Ricean fading are provided as well. [C1947]

"Delay hopped transmitted reference experimental results"

This paper describes the experimental hardware design and implementation for a delay hopped transmitted reference communication system. The hardware is designed to generate the delay hopped transmitted reference signal for a number of experimental conditions. It can be used either in an ultra wideband pulse mode, ultra wideband noise mode, or in a narrowband mode. We use the experimental hardware setup to conduct link experiments with a delay hopped transmitted reference communication system. Experiments were conducted in an indoor multipath environment to test the viability of delay hopped transmitted reference for short-range indoor communications. The experimental results presented demonstrate that this modulation format is capable of transmitting data short range indoors without line of sight transmission path with minimal transmitted RF power. [C1948]

"A path loss measurement system for mines"

RF communications is important in mining, since it can improve operational efficiency and worker safety. Successful RF communications requires an understanding of the RF propagation channel in the mine tunnels. One of the problems with performing channel measurements in a mine is the extreme environment. It generally is not economically reasonable to take expensive test equipment into mines. For example, in potash mines the salt dust in the mine is very corrosive when exposed to higher humidity levels on the surface. This paper describes a low cost path loss measurement system that is designed for the extreme environment in a potash mine. The measurement system uses continuous-wave transceivers with RSSI (received signal strength indicator) outputs. A laptop computer with a 16-bit data acquisition card is used to monitor the RSSI of the

receiver. MATLAB, through the Data Acquisition Toolbox, is used to acquire the measurements. These measurements are then converted, using a MATLAB script and previously acquired calibration data, to relative power measurements in dB. This MATLAB based system quickly processes the raw results producing calibrated results that can be viewed and compared at the time of the measurement. This measurement system was used to perform path loss measurements in Cory potash mine near Saskatoon, SK. Some of these channel measurement results are presented. [C1949]

"A statistical field prediction model for urban environment"

A statistical approach to the study and the prediction of urban propagation is presented. The method is based on a "statistical ray tracing" approach where the statistical characteristics of the multipath are derived by analytical processing from the statistical characteristics of the environment. Thanks to the adopted approach, the model does not require a detailed, site-specific description of the environment, nor a high computation time as required by methods such as traditional ray tracing tools. Also, it is more complete and accurate than conventional models such as Hata-like models. [C1950]

"Indoor propagation comparison between 2.45 GHz and 433 MHz transmissions"

This paper describes a study of how 2.45 GHz electromagnetic waves propagate indoors. 2.45 GHz is a typical Bluetooth frequency. Propagation models with both one and several transmitters have been made using an advanced computer program. Furthermore, a model of the propagation of 433 MHz radio waves has been made and used as a standard point of comparison. To make sure that such models are reliable, the study was renewed using a real 2.45 GHz transmitter and receiver and then comparing the results to those given by one of the propagation models. Finally, the suitability of Bluetooth for indoor use is discussed. [C1951]

"Radio wave propagation for mobile communication in high frequency"

The Sun's electromagnetic radiation is a continuum that spans radio wavelengths through the infrared, visible, ultraviolet, x-ray, and beyond. Ultraviolet radiation, through a process termed photo ionization, interacts with upper atmospheric constituents to form an ionized layer called the ionosphere. The paper describes how the ionosphere affects radio signals in different ways, depending on their frequencies, which range from extremely low (ELF) to extremely high (EHF). On frequencies below about 30 MHz, the ionosphere may act as an efficient reflector, allowing radio communication to distances of many thousands of kilometers. Radio signals on frequencies above 30 MHz usually penetrate the ionosphere and, therefore, are useful for ground-to-space communications. The existence of the ionosphere allows the use of high frequency (HF) radio in, for example, ground-to-air or ship-to-shore communication over long distances. The effect of different types of solar activity on the ionosphere and consequently on communications is described. [C1952]

"Beam array scattering by a right-angled impedance wedge"

The dramatic increase in the use of cellular mobile communications requires an understanding of the signal propagation mechanism. A uniform asymptotic solution for high frequency beam scattering has been described previously (Cheung et al.). The calculation here is extended to an array of complex sources to simulate an aperture distribution tilted away from or directly incident on the edge of an impedance right angle wedge. The solution is uniform across incident and reflection shadow boundaries. The surface wave field contribution is apparent for H-polarization with the surface impedance chosen. The numerical results show interesting polarization dependent differences in the scattering patterns for local beam arrays with their beam axes directed away from the edge of the wedge. Inductive surface reactances characteristic of urban building surfaces show evidence of surface waves for H-polarization but, as expected, not for E-polarization. [C1953]

"Microcellular systems, random walks, and wave propagation"

A new, simple model of wave propagation for microcellular systems is applied to predict the path loss of a wireless channel. The model does not rely on the classical theory of electromagnetic wave propagation, but it is entirely based on probability theory. We consider the canonical scenario of a random environment of partially absorbing scatterers and model the trajectory of each photon in the system as a random walk. This model leads to a path loss formula that rather accurately (in comparison to other models and experimental data) describes the smooth transition of power attenuation from an inverse square law with the distance to the transmitter to an exponential attenuation as this distance is increased. This result can justify empirical formulas that are often used for path loss prediction, characterized by a breakpoint distance at which the exponent of a power law is increased from a value of approximately 2 to a value in the range of 4 to 10. Theoretical predictions of the model are validated by showing agreement with experimental data collected in the city of Rome, Italy. [C1954]

"Time-space path modeling for wideband mobile propagation"

In order to estimate accurately spatial processing techniques such as adaptive array antenna and space diversity techniques in wideband mobile communications, we require the time-space path model in which the delay profile and spatial arrival angle profile characteristics of a traveling wave can be analyzed at the same time. We propose a new time-space path model expanding the ordinary scattering model and show that the proposed model explains well the field measurement results of both the arrival angle distribution and the delay time distribution in the urban area. [C1955]

"The performance of the TCP/RCWE enhancement for ad-hoc networks"

Mobile ad-hoc networks (MANET) enable the communication of mobile wireless nodes without any pre-defined infrastructure. Therefore, they are predestined for future mobile applications. To use existing applications and to inter-operate with the world wide Internet, ad-hoc networks have to use TCP/IP, which were not designed for mobile ad-hoc networks and yield poor performance when deployed in this kind of networks. The poor performance of TCP in ad-hoc networks has several reasons, especially the communication medium with high bit error rates (BER) and TCPs optimization on fixed networks. We present an enhancement, the restricted congestion window enlargement (TCP/RCWE), and show its ability to handle TCPs problems in mobile ad-hoc networks. We also illustrate the performance gain of TCP by the enhancement. [C1956]

"A new 3D ray-tracing propagation model"

Various ray-tracing methods have been developed for wireless propagation predication. Most of them are hybrid 2D and 3D models (see Athanasiadou, G.E. and Nix, A.R., IEEE Trans. Veh. Technol., vol.49, no.4, p.1152-68, 2000; Liang, G. and Bertoni, H.L., IEEE Trans. Antennas Propagat., vol.46, no.6, p.853-63, 1998). They assume the walls are vertical, roofs and ceilings are horizontal and the ground is flat. These assumptions are not always true. This paper presents a new 3D ray-tracing method based on 3D geometry and vector calculations. Propagation path concepts of triangular reflection pyramid ray-tubes and diffraction hollow cones have been developed. This method applies to different terrains and both indoor and outdoor environments. Virtual reality (VR) is used to visualise the environments and line-of-sight (LOS) and non-LOS signal paths and allows us to verify the methods we used. [C1957]

"WCDMA radio network planning for location services and system capacity"

The majority of radio network planning processes being developed for WCDMA focus upon providing adequate coverage and capacity performance. These processes generally include the requirement to tune the CPICH physical channel such that sufficient power is assigned to provide coverage without assigning excessive power that would result in less power being available to user traffic. This paper studies the performance of OTDOA based location services when the radio network has been planned without explicitly accounting for the requirement to receive at least three CPICH signals at each location. The paper continues by studying the impact upon both system capacity and OTDOA performance when the power assigned to the CPICH channel is increased. [C1958]

"Calibration of a radio network simulation tool for UMTS"

As power is the resource shared on both UMTS uplink and downlink, a simulation-based approach must be adopted more closely to estimate the users' perceived quality of service. Previous work at the University of Bristol (Vernon (2001)) has proposed a Web-enabled distributed approach to UMTS radio network planning. Software written in the Java programming language is run on multiple Web browsers; users requiring network planning resources can run simulations using surplus processing power on other users' workstations, accessed remotely over the Internet. This paper demonstrates how the planning tool was set up to simulate a real-world scenario. Using vector channel sounding data obtained from a MeDaV transmit-receive assembly interfaced to an Allgon-provided eight element array antenna, scatterer angle-delay-intensity plots were obtained for a number of test locations in Bristol city centre. Using the data obtained from combining a number of plots, the propagation characteristics between source, scatterers and receiver for the area under test may be obtained. Calibration of the planning tool for areal density of scatterers and power coupling into and out of scattering centres can then be performed. [C1959]

"Single scattering of partly oriented aspherical cloud ice crystals at sub-millimeter wavelengths"

The recently suggested sub-millimeter sensors for the global observation of cirrus clouds all bear several channels widely separated from each other and spanning the range from 180 to 880 GHz. While the potential for retrieving the integrated ice water content and the mean effective particle size of ice clouds has been

investigated, the quantitative retrieval of particle shape and orientation information is still an active research area. Here we investigate the influence of the parameters of a Gaussian distribution of the horizontal particle orientation on the single scattering cross section. It is only slightly affected, but the polarization signal is reduced to 90% of the completely horizontally oriented case if the standard deviation σβof the horizontal distribution is 15° and reduced to 50% if σβ= 30°. [C1960]

"Proceedings RAWCON 2002. 2002 IEEE Radio and Wireless Conference (Cat. No.02EX573)"

First Page of the Article [C1961]

"Interference mitigation in WLAN networks using client-based smart antennas"

This paper addresses the design and simulation of a smart antenna system for IEEE 802.11b WLAN cards. A two-element array is driven by ferroelectric phase shifters to achieve a 180° scanning range. The phase shifter in the beamforming network (BFN) occupies an area of less than 5.3 mmЧ5.7 mm. This miniature low cost BFN allows for rejection of interfering signals down to the sidelobe level if the angles of arrival differ. Simulations are conducted using the geometrically based single bounced elliptical model (GBSBEM) method. The results show that on average, up to 4 dB improvement in the C/I ratio of the received signal is achieved in sparse scattering environments (10 or less). This improvement includes the loss of the BFN. As the number of scatterers in the propagation channel increases beyond 20, the receive C/I ratio degrades to that of an isotropic antenna. [C1962]

"RF transmissivity measurements of a multilayered circular transparency to characterize attenuation behavior over a frequency range from 500 MHz to 18 GHz"

Astronauts engaged in preparatory activities prior to Extravehicular Activity (EVA) may spend one or more hours inside the middeck airlock that has been partially evacuated to the vacuum of space. During this time, the astronauts may wish to review and update non-critical mission information and EVA particulars via a Radio Frequency Local Area Network (RF LAN) connection implemented on a laptop computer. In order to accomplish this, the RF transmission must pass through a multilayer 4-inch transparency, and then propagate to a downlink node located inside the Space Shuttle Orbiter (SSO) vehicle. This paper describes the processes used to verify the transmissivity (essentially the inverse of shielding effectiveness) of such a transparency. Two methods of measurement were employed. The results of each were correlated together after the fact, and showed good agreement. [C1963]

"Maximization of data return at X-band and Ka-band at DSN's 34-meter beam-waveguide antennas"

In this paper we offer a new approach to evaluating the performance advantage of Ka-band frequency over X-band frequency for the receiving spacecraft downlink from deep space missions. For a given elevation profile for a pass, this approach uses atmospheric noise temperature statistics to select the optimum data rate to maximize the total data return volume over the pass. For illustration purposes, this approach is used to optimize the performance of a link for both X-band and Ka-band at a NASA Deep Space Network (DSN) 34 m Beam Waveguide tracking stations at both Madrid, Spain and Goldstone, California. Our calculations show that using such an approach an optimized Ka-band link offers between 5.9 dB and 7.2 dB more data volume over an optimized X-band link, and between 8.5 dB and 10.3 dB over an X-band link as currently operated by the DSN. It should be noted that the reliability of link designed in such a manner is relatively low and that a link optimized in this manner may not meet the continuity requirements of a mission. Furthermore, this approach takes only the weather effects into consideration. Other factors which may adversely affect the performance of the link are not taken into account under this approach. [C1964]

"Communicating with Mars during periods of solar conjunction"

A reliable communications link between Mars and Earth will be required during the initial phase of the human exploration of Mars. The direct communications link can easily be realized during most of the 780-day Earth-Mars synodic period, except when this link encounters increased intervening charged particles during superior solar conjunctions. The effects of solar charged particles are expected to corrupt the data signals to varying degrees. During superior solar conjunctions of interplanetary spacecraft, flight projects routinely scale down or suspend operations by invoking command moratoriums, reducing tracking schedules, and progressively lowering data rates. The actual operations scenarios will vary between flight projects and from conjunction to conjunction. This paper presents results of a study conducted to determine to what extent and by what techniques communications may be maintained throughout Mars-Sun-Earth superior conjunction periods that could occur during early human Mars exploration missions. Using a number of techniques discussed in this paper, it should

be possible to maintain some degree of communication throughout all of the superior conjunctions occurring between 2015 and 2026, except for one occurring in 2023, in which actual occultation of the signal source by the Sun's disk occurs. [C1965]

"2002 IEEE 56th Vehicular Technology Conference Proceedings (Cat. No.02CH37359)"

First Page of the Article [C1966]

"Method for calculating the transmission loss of a radio-wave-shielding wall"

Radiowave-shielding walls and floors made entirely of high-dielectric-loss material are being developed. It is necessary to determine the theoretical shielding characteristics of a shielding wall that requires a certain thickness. However it has previously been impossible to easily analyze walls composed of several layers and reinforcing meshes by an impedance method. Using equivalent distributed constant circuits and equivalent two-port networks, the authors have analyzed the characteristics of a radio-wave-shielding wall having an arbitrary number of material layers to an arbitrary polarization and radio frequency wave. As a result, they have derived expressions for theoretically calculating radio wave transmission loss of a wall. This paper describes the analytical method and a calculation example of a shielding wall developed by the authors' company. [C1967]

"Measuring and analyzing the signal strength for Celcom GSM [019] and Maxis [C012] in UiTM Shah Alam campus"

This research is to study, measure and analyze the signal strength for Celcom GSM [019] and Maxis [012] in UiTM Shah Alam campus. Measurements and data collection of the signal strength is done using TEMS investigation equipment provided by Celcom (M) Sdn. Bhd, Kelana Jaya and Maxis. TEMS is a tool for setting up and maintaining a mobile cellular network. It measures the received signal strength from the 'base transceiver station' (BTS) in terms of ERP (effective radiated power). Global Positioning System (GPS) equipment is also used to get the coordinate and elevation at 31 points throughout campus. For one selected point, measurement is taken in the morning, afternoon, evening and night to see if there is any variation in the signal strength at different times. Data analysis includes comparison between signal strength and position, time, elevation and distance from base station. Some recommendation is given to improve the radio coverage in UiTM area. [C1968]

"Sirius Satellite Radio: Radio entertainment in the sky"

Satellite broadcasting of radio programs is an effective means of serving large and distributed markets. A space-based radio system can provide about 100 high quality music, voice, and data channels to users spread over a vast geographic area. Employing digital technology and an elaborate system design, this approach significantly outperforms traditional AM and FM radio broadcasting in signal quality, program quantity, and service availability. Motorists can enjoy their program of choice uninterrupted driving coast to coast. There are two providers of satellite radio in the USA: Sirius Satellite Radio and XM Satellite Radio. Both systems are expected to be fully operational in 2002. This paper will offer an overview of satellite radio and will introduce the Sirius Satellite Radio network. Field trial results including performance data and propagation characteristics will be discussed. It will be shown that satellite radio seamlessly serves both urban and rural areas. [C1969]

"Global mapping of attenuation at X-band and higher frequencies"

The propagation of radio waves for Earth/space slant path at C-band and higher frequencies are dominated by precipitation in the atmosphere. At a given frequency, attenuation depends on the length of the radio path, the size distribution and the phase state of the hydrometeor profile. Using the observations from the TRMM spaceborne Ku-band (13.8 GHz) radar at Low Earth Orbit of 350 km above Earth, global attenuation maps are produced at the Ku-band frequency. A simple precipitation microphysical model developed using hydrometeor size distributions and phase state is used to scale this observed attenuation to Ka-band (35 GHz) where numerous high bandwidth satellite applications are being planned including the next generation space based radar for the Global Precipitation Mission (GPM). In this study, three layers of precipitation that consist of aggregate, dry graupel and rain are considered. Using this precipitation model the attenuation and backscatter reflectivity relations between Ka- and Ku-band frequencies are developed for scaling the specific attenuation and backscatter reflectivity along the observation path. The results show substantial attenuation variation in a 12-month period at both Ku- and Ka-bands over the various regions of the globe. These results can help in the design and development criteria for satellite applications at Ka-band. [C1970]

"The GPS Occultation Sensor for NPOESS"

The Global Positioning System Occultation Sensor (GPSOS) is a precision GPS instrument carried by the

NPOESS spacecraft. It measures primarily the electron density profile and scintillation parameters of the ionosphere. The measurements are obtained by tracking signals of GPS satellites that are observed to rise or set through the atmosphere while recording the signal amplitude and phase. [C1971]

"Fresnel approximation for wave scattering in a random medium"

It is shown that the standard Fraunhofer diffraction approximation cannot be used in the problem of radiowave scattering by a distributed scatterer. The Fresnel approximation is developed for this problem. [C1972]

"Proceedings of the Nineteenth National Radio Science Conference (NRSC'2002) (IEEE Cat. No.02EX567)"

First Page of the Article [C1973]

"Coding and modulation for underspread fading channels"

We study modulation and code design for underspread time-varying fading channels. For a coherent receiver employing maximum-likelihood (ML) decoding, we derive the code design criteria and express the maximum achievable diversity order in terms of the channel's scattering function. [C1974]

"Monitoring atmospheric water vapour using GPS measurements during precipitation events"

This paper considers the monitoring of integrated precipitable water vapour (IPWV) exploiting measurements of Global Positioning System (GPS) ground-based receivers with the purpose of analysing the behaviour of such parameter in occasion of precipitation events. A statistical characterisation of atmospheric water vapour content retrieved by GPS at specific receiver locations will be proposed to improve the knowledge of water vapour field of precipitation systems. [C1975]

"Mapping of precipitable water vapour by integrating measurements of ground-based GPS receivers and satellite-based microwave radiometers"

This paper concerns the remote sensing of atmospheric integrated precipitable water vapour (IPVW) using a Global Positioning System (GPS) network and the Special Sensor Microwave Imager Radiometer (SSM/I) in the Mediterranean area. A comparison of IPWV maps from the two different techniques is presented. Some preliminary attempts to develop a data assimilation method, are also proposed. [C1976]

"An examination of the Fourier split-step method of representing electromagnetic propagation in the troposphere"

The estimation of the electromagnetic propagation around a smooth spherical Earth in anomalous atmospheric conditions in the troposphere using Fourier split-step method is studied. The source of errors of Fourier split-step method and errors due to reducing the exact Helmholtz equation to the parabolic wave equation are reviewed. A quantitative measure for the accuracy of the numerical results is proposed. Optimization of the quantization parameters for accurate representation of electromagnetic propagation is investigated. The method is illustrated on different values of frequency, polarization, antenna pattern, antenna height, maximum angular frequency and range dependent refractivity. Optimal parameters are subsequently discussed. Finally, the region of validity is investigated numerically by comparison with the exact models. [C1977]

"Estimation of EM radiation source in ELF band"

Our goal is to locate anomalous electromagnetic (EM) source caused by seismic activity for earthquake prediction. For the purpose, we have been measured EM wave of 223 Hz at 35 sites in Japan. This paper analyses relation between EM power attenuation and distance from its source. The relation is necessary to estimate the source location. [C1978]

"Experimental investigations of amplitude and phase progression fluctuations on microwave line-of-sight links"

Experimental investigations of amplitude and phase progression fluctuations on microwave line-of-sight links are presented. The transmitter unit is represented as a receiver-transmitter device operating for the same antenna. Here the transmitter signal is the heterodyne signal for the receiver. The low frequency channel is used to get in-phase oscillations in both parts of microwave link. The initial phase of low frequency oscillations is transferred on microwave. [C1979]

"A power divider/combiner block for switched beam arrays"

Switched active element arrays that produce radiation patterns with variable diversity gain, have been recently considered for countering the effects of multipath fading in industrial environments. The functionality of these arrays is highly dependent on the characteristic; of their feeding network. Generating patterns with variable diversity gain requires a feeding network capable of driving different number of elements for each pattern. This paper presents a feeding network building block suitable for producing variable diversity gain in printed circuit switched beam arrays, using active elements with minimal mutual coupling characteristics. The use of this circuit design is illustrated on a seven-elements antenna array, producing numerous radiation patterns, with diverse directivity values. [C1980]

"Study of the variability in the rain drop size distribution over a 2.3 km path"

In an effort to study the drop size distribution (DSD) a state-of-the-art instrument arrangement was deployed on Wallops Island, VA. The instrumentation consisted of a 2.3-km multi-frequency microwave link, three impact disdrometers, and a network of optical and tipping bucket raingauges. A dual-frequency inversion technique was implemented with the link measurements of attenuations at 25 GHz and 38 GHz to estimate the path-average DSD. Concurrently, an X-band, dual-polarization radar, located in the vicinity, collected polarization and reflectivity measurements over the link path. The evaluation of the estimates and measurements generated some preliminary results. [C1981]

"New approach to equipment for angle-of-arrival measurements on microwave"

A new method of angle-of-arrival of microwave measurement is presented. Several receiving units are not set hard and a phase stable feeder is not used. Each unit has its own oscillator. All of the oscillators are not synchronized. [C1982]

"Evaluation of packet loss probability in Bluetooth networks"

We provide a closed-form expression for the packet loss probability in Bluetooth networks accounting for capture effects due to propagation losses. The effectiveness of the proposed approach is assessed comparing the analytical results with those obtained from Monte Carlo simulations. By considering different scenarios, we show the dependence of results on the geometry and on the characteristics of the environment. It is observed that packet loss probability can significantly change with the position of the reference receiver in the area, as well as with the extension of the served area as compared with the coverage area of the receiver [C1983]

"A generic model for MIMO wireless propagation channels"

We study the MIMO wireless channel, and derive a generic channel model that we believe has the ability to explain all important effects, including (i) interdependency of directions-of-arrival and directions-of-departure, (ii) large delay and angle dispersion by propagation via far clusters, (iii) rank reduction of the transfer function matrix. We point out the relevant propagation effects, and propose a geometry-based model that includes the relevant effects. The required parameters for the complete definition of the model are enumerated, and typical simulation results for urban macrocells are presented [C1984]

"Estimation of gaseous absorption using surface and radiosonde meteorological measurements"

For radiowave propagation on Earth-space communication links at high frequencies such as Ka-band, the effect of atmospheric gaseous absorption mainly due to oxygen and water vapor is the primary cause of attenuation. This paper examines the applicability of the surface based Crane's model currently employed by the Advanced Communications Technology Satellite (ACTS) propagation experiment for estimation of attenuation due to atmospheric gaseous absorption (AGA), developed for Oklahoma, to sub-tropical climate regions such as Florida. The millimeter-wave propagation model (MPM) is used as a basis of comparison since it uses the direct atmospheric measurements (temperature, relative humidity, and pressure) made at different levels of the atmosphere with radiosonde instrumentation. The AGA was individually examined for oxygen and water vapor. Finally, accuracy of the Crane's model was verified by computing the attenuation results using real acquired data for both models and comparing their results. A MATLAB based graphical user interface (GUI) was developed and utilized to provide a user friendly environment for visualization purposes and ease of data analysis [C1985]

"Correlated Nakagami channels with different fading parameters: a generic characterization with applications"

Appropriate description of correlated Nakagami (1960) channels is indispensable to many applications in wireless communications such as spatial diversity reception and RAKE receivers. Three essential parameters for generic correlated Nakagami fading channels are correlation, average power and fading parameter. The fading parameter reflects the severity of the fading. The correlated model for Nakagami-faded powers widely used in wireless communications, however, is subject to a severe restriction requiring all fading parameters to be identical. In wireless communications, the fading parameters of different diversity branches can be different as the result of different propagation conditions. We derive a generic characteristic function (CF) for correlated Nakagami powered signals allowing all parameters to be arbitrary. The application of the new theory is illustrated by studying the error performance of an MPSK system with maximum ratio combining. [C1986]

"Signal strength based indoor geolocation"

We have investigated the indoor geolocation based on signal strength modeling. Linear, compensated linear, and multiple regression methods have been applied to set up signal strength models by using simulated data. We have also analyzed this modeling method to better understand the relation between the location error and the signal strength error. Some important results have been obtained to help us determine proper placement of access points (APs) and evaluate the range of location error. A simulation experiment has been conducted based on typical parameters of IEEE802.11b MAC [C1987]

"Performance of TDoA-based radiolocation techniques in CDMA urban environments"

The performance of radiolocation systems which make use of observed time difference of arrival techniques is investigated. We refer to a classical third generation WCDMA wireless system where measurements are performed in the direct connection (from base station to mobile). The system performance is evaluated by using a ray-tracing technique to characterize the behaviour of typical urban environments [C1988]

"TSNU-PSTD modeling of a simplified indoor wave propagation for wireless network communications"

In this research, we develop a transformed-space, nonuniform pseudo-spectral time domain (TSNU-PSTD) Maxwell solver for modeling a simplified indoor wave propagation in a multilayer dielectric system for wireless local area network (WLAN) communications. Herein, we transform a nonuniform grid {xi} to a uniform one {ui} to fit for dimensions of practical structures prior to applying the standard fast Fourier transform (FFT). It is reported that this scheme is as efficient as the conventional uniform PSTD with a computational complexity of O(NlogN) since the difference is only the factor of du/dx between the conventional PSTD and the TSNU-PSTD techniques. An initial-condition excitation of a Gaussian pulse over the entire computational domain is employed as the initial excitation to eliminate undesired Gibbs phenomena, which could seriously deteriorate the implementation of the PSTD. An anisotropic version of the Berenger perfectly matched layers (APML) is used to suppress the wraparound effect at the two ends of the computational domain, which is caused by the periodicity of the FFT [C1989]

"Analysis on coverage and capacity in adoption of repeater systems in CDMA2000"

CDMA2000 is the 3rd generation (3G) communication system based on the 2ndgeneration standard, IS-95. Because the 3G system has more complex features than IS-95, more accuracy analysis on coverage and capacity in adoption of repeater systems are needed. Especially, the issue of whether to use a base station or repeater system to cover the shadow region effectively, taking quality of service (QoS) and economy into consideration, is of critical importance for mobile communication engineers. In this paper, QoS related system capacity and coverage analysis results are provided by simulation. We describe the advantages and disadvantages of repeater systems as a new remote cell with real CDMA2000 environment [C1990]

"The impact of radio propagation predictions on urban UMTS planning"

This investigation outlines the importance of accurate radio propagation predictions in the planning for UMTS radio networks. The UMTS radio technology based on variable spreading DS-CDMA techniques is flexible but complex. The sensitivity of a UMTS radio network to the radio environment and traffic conditions is well publicized but rarely quantified. Theoretical analysis and commercial implementation of CDMA cellular systems also tend to show that radio network planning, simplified on one hand because of the lack of frequency planning, could be cumbersome due to difficulties linked to the so-called cell breathing effect. Since this effect is related to the traffic conditions and the radio propagation environments, the more accurate the coverage predictions are, the closer the expected performance will be from the measured performance. To quantify the advantage of accurate radio coverage predictions a case study was undertaken for a UMTS radio network planning in a 5 km2area of Paris (France). This study in an urban environment concludes that a conventional propagation model

could lead to erroneous planning with less than expected quality of service, unacceptable interference, and more base stations than necessary. An accurate ray-tracing model integrated in an UMTS-capable planning tool allows the radio network designer to reach optimal levels for the base station deployment and configuration while meeting the expected service level requirements [C1991]

"High-resolution channel parameter estimation for MIMO applications using the SAGE algorithm"

This contribution presents an extension of the SAGE (space-alternating generalized expectation-maximization) algorithm originally published in Fleury et al. (1999) that allows for joint estimation of the complex weight, the relative delay, the direction (i.e. azimuths and co-elevations) of departure and of incidence, as well as the Doppler frequency of waves propagating from the transmitter to the receiver in mobile radio environments. The scheme is particularly well suited for MIMO (multiple-input multiple-output) channel investigations. Its performance, in terms of convergence rate and asymptotic behaviour of the root-mean-square estimation errors, is assessed by means of Monte-Carlo simulations in synthetic time-invariant channels. The results demonstrate rapid convergence (six SAGE iteration cycles) of the root-mean-square estimation errors towards values close to the root of the corresponding Cramer-Rao lower bounds for the "one-wave" scenario, even when the waves only slightly differ either in delay, in direction of departure, or in direction of incidence. The SAGE algorithm is also applied to measurement data to assess the propagation constellation in a non-line-of-sight and an obstructed line-of-sight situation. Most of the estimated waves can be easily related to the propagation environments. Finally, the computational expense of the scheme is shortly discussed [C1992]

"Effect of element polarization on the capacity of a MIMO system"

We have analyzed the behavior of a multiple element antenna system in an indoor environment based on the measurements taken in the Lucent Crawford Hill building with a system of 12 transmitters and 15 receivers. The parameters that we investigated were the distance between the transmitting and the receiving arrays, and the polarization of the transmitter/receiver elements. Our measurements show that the capacity of single polarization systems (only vertical or only horizontal) decays with distance in the presence of a strong line-of-sight component. The same is observed in the absence of a strong line-of-sight component if instead there is a dominant propagation path. Systems with elements of both polarizations perform better in terms of capacity in both environments. [C1993]

"On the occupancy of shared wireless channels"

We investigate the occupancy statistics of a wireless channel shared by a large number of terminals randomly distributed in the plane and employing the listen- before-talk coexistence etiquette. Relying on a realistic propagation model that accounts for the path loss with distance and log-normal shadowing, we present a new semi-analytical performance analysis. A state-dependent model is introduced that accurately tackles the spatial characteristics of signal propagation and the effect of hidden terminals. This is used to give a lower bound on the blocking probability of the shared wireless link. [C1994]

"Estimate of mean C/I and capacity of interference limited mobile ad-hoc networks"

A theoretical estimate of the capacity of interference limited mobile ad-hoc networks (MANET), without an interference cancellation scheme, is given. The calculation is carried out using a realistic propagation model, a simplified system model and statistical consideration of mobile distances. An expression for the average carrier-to-interference ratio is then derived. This is subsequently used with the Shannon limit to determine the capacity. Expressions are given for calculating the dependence of throughput on availability and propagation [C1995]

"GPS tomography using the permanent network in Goteborg: simulations"

We will draw attention to a new technique for retrieval of 3D water vapor refractivity fields by using a small network of GPS receivers, referred to as GPS tomography. We present first results of the simulations of tomographic solutions using two different approaches and applied on a recently established network of GPS receivers in the area of Goteborg (Sweden). We study the network capabilities to resolve water vapor structures using grids with different vertical and horizontal resolutions. The sensitivity to resolve vertical structures and the impact of noise present in the data are also shown. The simulation results indicate the feasibility of the GPS tomographic method to be applied on the existing network. [C1996]

"Reduction of multipath-induced bias of GPS time-of-arrival"

We investigate a blind method for cancelling the multipath effects, in order to improve the time-of-arrival estimate. Our approach uses early-late gate processing on an objective function derived from an adaptive FIR

filter that attempts to match the crosscorrelation of the received signal with a multipath-free replica of the desired crosscorrelation. This method performs reasonably well, and decreases the bias by approximately a factor of 2, even in very stressing multipath environments. [C1997]

"An accurate line of sight propagation performance model for ad-hoc 802.11 wireless LAN (WLAN) devices"

We propose a simplified and accurate path loss equation for calculating the free space path loss for 802.11 WLAN line-of-sight links with antennas between 1 and 2.5 meters in height. We validated the accuracy of our WLAN propagation model with empirical measurements using several wireless LAN systems. We compared our model with other models including Lee's (1986), free space's, Hata's (1980) and Cost231 models and found that our model is superior for predicting the propagation performance of radios with very low antenna heights. This result is very useful for modeling and simulation of wireless LANs and mobile ad-hoc radio networks. [C1998]

"Monte Carlo simulation of ionospheric scintillation"

The ionosphere is an important consideration in the design of radars, especially those that operate at UHF frequency and below. A statistical model of ionospheric scintillation is developed on the basis of data analysis and known empirical results. From a mathematical point of view, we model the effect of scintillation on radar signals via a constructed stationary random process. The complex PDF and autocorrelation of the process are designed to match the observed phenomenon. The resulting scintillation algorithm can be used to model ionospheric effects in real and simulated radar data. [C1999]

"Angle-of-arrival of a radar beam in atmospheric turbulence"

Atmospheric turbulence has been shown to have measurable effects on the angle-of-arrival (AOA) of radar beams, but these effects are on the order of a few microradians, which is a negligible level for most applications. In this paper, we present a theory describing this phenomenon and compare this theory to one-way measurements made over a 3.5 km path and two-way measurements made over a 25 km path using an X-band interferometric radar. [C2000]

"Anomalous propagation limitations to high-resolution SAR performance"

We show that the performance of future high-resolution SAR modes will be limited by anomalous propagation effects, rather than by platform measurement errors, or focusing algorithm limitations, or RF wavelength. This is established by calculating the phase history distortions that result from specified atmospheric temperature profiles. Simulations show the effects of such phase distortions upon SAR images. [C2001]

"Reverse link capacity and coverage improvement for CDMA cellular systems using polarization and spatial diversity"

This paper explores the benefits of increased diversity order using spatially separated, polarized antennas at the base station receiver of a CDMA cellular system. Field tests are conducted in real mobile wireless environments. A conventional dual diversity receiver is compared with one that implements four-way diversity combining using spatially separated cross-polarized antennas. Several measured quantities are logged at the base station receiver and the mobile transmitter during a packet data connection at fixed data rate. Existing published results that explore polarization diversity focus on correlation measurements between received signal polarization components. The emphasis of the present study is to quantify reverse link capacity and coverage improvements for a CDMA cellular network as a result of exploiting polarization as an additional source of diversity at the base station receiver. [C2002]

"Channel characterization for CDMA RAKE receiver design for urban environment"

Future mobile communication systems based on DS-CDMA require detailed characterization of the radio channel in the multipath delay domain (for short, the path domain). CDMA system designers need channel information in the form of RAKE fingers for successful receiver design. This work presents analysis of measurement results for obtaining active RAKE fingers and their characteristics. [C2003]

"Performance of low-complexity RAKE reception in a realistic UWB channel"

We evaluate the link performance of an ultra-wide band (UWB) system using reduced-complexity RAKE receivers, which are based on either partial combining (called PRAKE) or selective combining (called SRAKE). The first is suboptimum and combines the first arriving multipath components, while the second combines the

strongest multipath components. We use a statistical tapped-delay-line channel model that is based on extensive measurement campaigns, and reflects both small-scale and large-scale variations of the channel. Through semi-analytical evaluations of the bit error probability, we show that the simpler PRAKE receiver is almost as good as the SRAKE even for a small number of fingers. We show how this behavior can be related to the channel characteristics. [C2004]

"The importance of fractional bandwidth in ultra-wideband pulse design"

Ultra-wideband (UWB) communications systems provide extremely high data rates while using low transmit power relative to narrowband systems. Previous research concludes that such systems have characteristics that make them appropriate for high-speed wireless network applications. One of the distinguishing aspects of the UWB signal is an extremely high fractional bandwidth when compared with conventional narrowband systems. This paper describes how a large fractional bandwidth leads to lower worst-case fading in the presence of multipath for UWB communications systems, thereby providing a significant advantage for a low-power wireless systems. Also included are measurements made using an actual UWB communications systems showing the magnitude of signal strength variations due to multipath interference. [C2005]

"On SIR fade statistics in Rayleigh-lognormal channels"

An analytical approach to derive the level crossing rate (LCR) and the average fade duration (AFD) for the signal-to-interference ratio (SIR) in a mobile radio system is proposed. The channel model is characterized by a log-normal shadowing component and a Rayleigh fast fading component on the useful link and on interfering links. Shadowing components are assumed to be cross-correlated. The approach can be divided in two steps. The first one mainly consists in extending Wilkinson's approximation method for the sum of log-normal random variables to the matching of second order statistics of randomly weighted log-normal processes. In particular, the latter approach is used in order to obtain a log-normal approximation for the ratio between total interference and the log-normal component of the useful signal strength. In the second step the SIR is expressed as the product of a Rayleigh process and a log-normal process, and the LCR and AFD are then obtained through the Rice's (1944) approach. Numerical results are presented in terms of LCR and AFD for various values of cross correlation parameters among shadowing components. [C2006]

"An improved Markov chain description for fading processes"

A new approach to model a fading process (e.g., as generated by Jakes' simulator) is proposed and investigated. This is based on a finite-state Markov chain, with a two-dimensional state given by the quantized values of the amplitude and its speed of variation. This results in better accuracy with respect to classical one-dimensional schemes. The validity of the proposed approach is shown by first comparing the autocorrelation function of the resulting process with that of the simulated process. Furthermore, a simple go-back-N protocol has been used for the same purpose, in order to verify the impact of modeling accuracy on upper layers. Some investigations have also been performed to evaluate the sensitivity to parameter selection. Finally, the widely used model with only two values of envelope amplitude has been studied, in the case of both one-dimensional and two-dimensional Markov chain states. [C2007]

"Indoor channel characteristics comparisons for the same building with different dielectric parameters"

With various building dielectric parameters, simulation results obtained using a ray-tracing method for both the narrowband and wideband indoor channel characterisation are presented. Effects of different building dielectric parameters on the channel characteristics are shown for the same building in terms of the predicted path-loss and RMS delay spread (τrms) of the channel impulse response. Simulation results demonstrate that channel τrmsis more sensitive to the building dielectric parameters compared with the path-loss characteristic. This indicates that the information on building dielectric parameters with higher accuracy is required for indoor channel τrmsprediction. [C2008]

"Evaluation of capacity of indoor wireless MIMO channel using ray tracing"

This paper uses a ray-tracing approach to estimate the Shannon capacity of a MIMO wireless system. Several very simple scenarios are modeled, to determine the principles that limit the capacity [C2009]

"Analysis and evaluation of subband adaptive array under multipath fading condition"

The subband adaptive array (SBAA) is a method for the parallel implementation of the tapped delay line adaptive array (TDLAA) which possesses high ability to mitigate the degradation of the quality of wireless

communications under the environment where plural coherent propagation waves are arriving from different directions (multipath fading environment). This paper presents a unified analytical overview and an evaluation criterion for SBAA accompanied with sampling rate conversion. Here the signal-to-interference-plus-noise ratio (SINR) is adopted as quality factor and the performance of the SBAA under multipath fading is investigated theoretically based on this criterion. As an improvement for the SBAA, the cyclic prefix (CP) which is used in orthogonal frequency division multiplexing (OFDM) communication systems is introduced and experimentally verified to be effective through computer simulations. This paper demonstrates the advantage of this approach from the analytical viewpoint with respect to the correlation matrix in each band. [C2010]

"Investigating the ultra-wideband indoor wireless channel"

The indoor propagation channel appears differently to ultra-wideband (UWB) wireless systems than it does to narrowband (NB) sine wave systems. UWB impulses are short and generally do not overlap as multipath sine waves do. This paper presents the results of measurements made on the UWB indoor propagation channel. The channel impulse response (CIR) of the indoor office channel is extracted from the measurements using a variant of the CLEAN algorithm. The UWB propagation channel statistics are calculated from the CIRs. The analysis produces the following results. i) The pathloss versus distance obeys a power law (1/dN) curve fit, with the peak received power falling off with N=2.9 and the total received power falling off with N=2.1. This suggests that receiver architectures that can take advantage of the total received power can overcome much of the indoor channel pathloss. ii) A 4 element RAKE receiver shows a benefit as the peak power plus RAKE gain falls off with N=2.5, somewhat offsetting the excess pathloss of the channel. iii) The log-normally distributed standard deviation of the mean pathloss versus distance was found to be 4.75 dB, 4.04 dB, and 3.55 dB for the peak, peak plus RAKE, and total power pathloss, respectively. This suggests that a relatively small fading margin is required for UWB systems (compared to NB systems). iv) The RMS delay spread of the indoor channel increases with increasing T-R separation and also with increasing path loss. These results can aid in the design of UWB systems to overcome the challenges posed by the indoor channel. [C2011]

"Space-time processing with a decoupled delayed decision-feedback sequence estimator"

This work aims at investigating the performance of a decoupled space-time processing structure based on a delayed decision-feedback sequence estimator (D-ST-DDFSE), in the context of the Enhanced Data rates for GSM Evolution (EDGE) system. The main idea in using decoupled space-time (D-ST) processing structures is to separate co-channel interference (CCI) reduction from intersymbol interference (ISI) suppression. Consequently, all degrees of freedom of a space-time (ST) front-end are dedicated to treat CCI, leaving ISI to be suppressed by a temporal equalizer. Due to the 8-PSK modulation and the large delay spread values compared to the symbol period, optimum detection becomes too complex in the EDGE system, which makes DDFSE a promising scheme for ISI suppression. The performance of D-ST-DDFSE is analyzed through link-level simulations under the context of COST 259 channel models for typical urban (TU) and bad urban (BU) propagation scenarios. Improved performance of this D-ST technique over a space-time linear equalizer is observed. [C2012]

"A new approach for radio propagation modeling in urban environment: knife-edge diffraction combined with 2D ray-tracing"

The design of a deterministic radio propagation model adapted to built-up areas is a tedious problem when considering the needs of radio planners, i.e. great accuracy and reasonable processing time. In that perspective, an innovative model for micro-cells has been developed by the French company Siradel. It combines two usual modeling methods: the multiple knife-edge approximation to take into account the propagation above rooftops and 2D ray-tracing to predict lateral interactions. Radio grid coverage and comparisons with experimental data are presented to prove the pertinence of the model. [C2013]

"Performance of a high-resolution scheme for joint estimation of delay and bidirection dispersion in the radio channel"

This contribution presents results from an application of the SAGE (space-alternating generalized expectation-maximization) algorithm published in Fleury et al. (2002) to measurement data collected in a selected propagation environment. The scheme jointly estimates the delay, the direction (i.e. azimuth and coelevation) of departure, the direction of incidence, as well as the Doppler frequency of waves propagating from the transmitter to the receiver. An improved initialization and search procedure is proposed which enhances the probability of identifying weak paths and therefore allows for a more comprehensive and detailed characterization of the propagation mechanisms. In order to relate the estimated waves to the propagation environment, a simple method based on ray tracing attempts to reconstruct the propagation paths based on the estimated wave parameters while assuming oneand two-bounce scattering. Significant objects can be identified in the

environment that coincide with the interaction points of the calculated paths. The same conclusions can be drawn from similar analyses of other environments. The presented results demonstrate the high potential of high-resolution estimation techniques performing true joint estimation of delay, direction of departure, and direction of incidence for detailed investigations of dispersion in the radio channel jointly in delay and in direction at both transmitter and receiver sites. These studies are of paramount importance for an accurate characterization of MIMO (multiple-input multiple-output) systems operating in these channels. [C2014]

"Vehicular Technology Conference. IEEE 55th Vehicular Technology Conference. VTC Spring 2002 (Cat. No.02CH37367)"

First Page of the Article [C2015]

""Virtual Cell Deployment Areas" and "Cluster Tracing"-new methods for directional channel modeling in microcells"

We propose a new method for the simulation of microcellular propagation channels, which includes both deterministic and stochastic aspects. First, the geometrical layouts of "typical" deployment areas, called "Virtual Cell Deployment Areas" (VCDA), as well as routes of the mobile station (MS) through the VCDA, are defined. Then, the delays and directions-of-arrival of multipath clusters can be traced by geometrical means. Finally, the small-scale fading within the clusters is modelled stochastically. This approach was adopted by the COST259 DCM, the standard model for directional wireless channels. [C2016]

"A deterministic ultra wideband channel modeling"

We study the realisation of a deterministic channel modeling which allows the construction of a realistic received waveform from a wireless spread spectrum multiple-access (SSMA) using time hopping (TH) modulation. The goal is to reach the symbol decision from a simulated waveform. This paper explains how to use the uniform theory of diffraction (UTD) method combined with a ray tracing to obtain the received TH modulation waveform in indoor or outdoor environment. [C2017]

"Measurement results and modeling aspects for the UWB radio channel"

We report on ultra-wideband (UWB) indoor channel measurements we have performed for several scenarios in an office building. Results are presented regarding the multipath decay supporting the applicability of the widely assumed exponential decay in a single cluster case, and show some results for a two-cluster situation caused by in-building back reflection. The frequency dependent decay of the channel gain with increasing frequencies is discussed in some detail regarding the competition between a power and a polynomial law. We present a power law for received power versus distance in a corridor environment and finally suggest some modifications allowing to adapt well known propagation model elements. [C2018]

"Subnanosecond UWB channel sounding in frequency and temporal domain"

The performance prediction and simulation of new communication and positioning systems based on UWB technology require an important effort to reach a deep knowledge of the physical channel. The multipath nature of the indoor channel is the limiting factor for positioning accuracy and communication capabilities of UWB systems in real environments, in particular ISI for high data rate applications. Most of the measurement performed to characterise the UWB channel have been performed in the time-domain by using a sampling oscilloscope with resolution greater than 1 ns. This paper describes a frequency approach based on a vector network analyser with a subnanosecond resolution in accordance with usually UWB pulse width. After an introduction the measurement technique is described and the performances of the sounding chain evaluated. Then an experimental methodology is proposed in order to assess the channel characteristics at different scale levels (small, medium, large). Finally the statistical post-processing for the future measurements is described. [C2019]

"The standard for evaluating the correlation characteristics of MIMO channel"

The use of multiple antenna elements both at the transmitter and receiver results in enormous capacity increase. But for the use of this technique, the multipath scattering must be sufficiently rich; otherwise the performance of communications system will get worse compared with not using this technique. In order to make full use of the advantage of this technique under appropriate radio propagation environment, we present a standard for evaluating the correlation characteristics of the MIMO channel. With this standard, we can judge if the multipath scattering of the radio propagation environment is sufficiently rich, and then decide if this propagation mode is used. [C2020]

"Downlink beam-forming method using STBC for mobile propagation environments"

Space division multiple access (SDMA) is an attractive candidate for increasing the channel capacity. In an SDMA system, signals from multiple terminals are spatially separated and this feature enables terminals to use the same frequency and the same timing. However, even slight channel estimation error significantly affects the transmission quality in the downlink. We propose a new closed-loop SDMA downlink beam-forming method that employs transmission diversity for multi-beams and mitigates the influence of multi-path fading. The effectiveness with respect to angular spread and the Doppler frequency is evaluated in computer simulations and the proposed method is shown to achieve an signal-to interference-plus-noise-ratio (SINR) that is 3-dB higher than that of the conventional scheme in a flat fading environment. [C2021]

"Adaptive soft handoff method using mobile location information"

This paper presents an adaptive soft handoff algorithm that dynamically calculates the threshold values for soft handoff based on mobile location, signal strength and RF propagation statistics. An analytical model has been previously developed to study the performance of an adaptive hard handoff method using mobile location information. We extend the adaptive hard handoff algorithm to study the performance of an adaptive soft handoff algorithm and also analyze the soft handoff considerations. Unlike conventional soft handoff algorithms, the threshold values for the adaptive soft handoff algorithm are chosen dynamically based on a set of quantitative descriptors for various propagation environments. Simulation results show that the adaptive soft handoff method reduces the unnecessary handoff probability and the number of base stations in the active set while still maintaining the call quality. This improvement is significant if the propagation signal varies rapidly in the cell or in the dense urban area. [C2022]

"A channel model for MIMO systems in macro- and microcellular environments"

We consider the propagation in macro- and microcellular environments for systems with multiple antennas at both transmitter and receiver. We consider the important propagation effects that lead to (i) interdependency of directions-of-arrival and directions-of-departure, (ii) large delay and angle dispersion by propagation via far clusters, (iii) rank reduction of the transfer function matrix. We propose a generic channel model that reflects those propagation effects, and propose different parameterizations of that model for macro- and microcellular environments. Cumulative distribution functions of the information-theoretic capacity derived from that model quantify the impact of the model on system design. [C2023]

"A scattering model based approach to NLOS mitigation in TOA location systems"

We present a novel approach for reducing the effect of non-line-of-sight (NLOS) error that inhibits accurate location of wireless mobile stations (MSs). The location algorithm is developed based on the distribution of times of arrival (TOAs) generated from multipath scattering models that have been published in the literature. By matching the statistics of the measured TOAs of several multipath arrivals with those produced by the scattering models, estimates of the line-of-sight (LOS) TOAs between each base station (BS) and the MS are obtained. The LOS TOAs can then be used in any traditional TOA location algorithm. The algorithm shows a significant improvement in location accuracy for a TOA system in NLOS environment. [C2024]

"Comparison of generative statistical models for the LMS channel"

In this paper three statistical models frequently used to describe the land mobile satellite (LMS) propagation channel under narrowband conditions are compared. The models are those of Loo (1985), Corazza and Vatalaro (1994), and Suzuki (1979). Statistical models are very well suited for the production of time-series (generative models) for simulation studies. Methodologies to produce synthetic time-series corresponding to the three models are discussed and results are compared. [C2025]

"2002 International Zurich Seminar on Broadband Communications Access-Transmission-Networking (Cat. No.02TH8599)"

The following topics are dealt with: MIMO; space-time concepts; MAC; IP based QoS; traffic and source modelling; turbo coding techniques; multiuser detection; interference cancellation; multicarrier techniques; synchronisation; channel estimation; wireless network optimisation; emerging broadband access; communication theory; propagation and coverage planning [C2026]

"A hierarchical Markov model for wireless shadowed fading channels"

A novel model for slowly varying shadowed fading channel based on Markov chain theory is proposed. It not only leads to accurate first-order statistical description of the composite process but also captures the memory effect of the channel. Following a hierarchical approach, the shadowing/fading process is modeled as a nested Markov chain, where the macrostate variation is assumed to be caused by the shadowing process while microstate transitions is initialized by the fading effect with macrostate-dependent transition probabilities. As an illustration of the mathematical formalism, some simulation results are provided and discussed. [C2027]

"Computationally efficient modeling of propagation effects for automated wireless engineering"

This paper describes the building blocks for a propagation model that is currently used for automated wireless engineering. These building blocks can be used to construct propagation models for cellular, PCS, MMDS/LMDS, and wireless fixed access. The model starts with a basic analytic design to handle the behavior of the path loss as a function of distance. Then other terms are added to account for other effects, such as terrain obstructions, sloping terrain, road orientation, rain attenuation, and the presence of water bodies along the propagation path. The model has been validated in many urban, suburban and rural markets throughout the US. The model achieves an accuracy of 6-8 dB standard deviation in several urban markets with terrain and morphology data at 30 m resolution. Using a mid-range off-the-shelf PC, the model achieves predictions for a 25 Ч 25 km region in less than 20 seconds at this resolution. [C2028]

"WSSUS-channel models for broadband mobile communication systems"

Due to the increasing interest in mobile multimedia applications requiring high bandwidths, channel models need to be derived which represent properly broadband mobile radio channels. Previously defined models, e.g. for GSM by COST 207, are not verified for systems having such large bandwidths. In contrast, the presented new propagation models have been derived based on broadband measurements, taken by a channel sounder applied to a DVB-T network, and on the WSSUS theory, which is well known and adaptable to existing narrowband simulation systems. [C2029]

"Smart antenna and spatial diversity-combining"

The smart antenna and spatial diversity-combining receiver are two of the most important spatial signal processing technologies. This paper studies the radio propagation characteristics of the transmission path, spatio-temporal channel model and channel characteristics in different environments. On the basis of those analyses, the authors analyzed the operating principle of the smart antenna and spatial diversity-combining technology, and especially showed the differences between these two technologies in several aspects. [C2030]

"A simple approach to site sensitive modeling of indoor radio propagation"

The approach presented herein provides a simple and accurate propagation model for indoor environments. The model is able to generate point sources with joint angle-delay-power characteristics that are sensitive to the macrostructure of the site's floorplan geometry. This is achieved in two stages. First, the floorplan geometry is reduced to an essential set of features using an automated routine based on computational geometry. Then an algorithmic set of propagation rules founded on finite difference time domain and ray tracing simulations are applied to the reduced geometry to reconstruct propagation paths. Simulation results are presented and compared with recent data from a measurement campaign for the same scenario. The model is seen to accurately capture the macrostructure characteristics of the channel including angle spread, delay spread, temporal clustering, angular clustering, and power profile. [C2031]

"The prediction of radio interference through ducting and proposal measures for protecting interference"

Radio interference has been occurring in the TRS service on the south seashore in Korea from 1994. After monitoring the radio signal interference, it was found that the main reasons for the radio interference are due to the radio ducting signal from the seaside of Japan. In this paper, an APM (advanced propagation model) to analyze tropospheric radiowave propagation over the sea surface in the presence of range-dependent refractivity is presented. The propagation loss in ducts is calculated using the model and compared with the interference experimental data gathered in 1999 between Korea and Japan. Also we suggest the parameter values, for example transmitting antenna height, receiving antenna height which minimize the interference between nations through simulation results. [C2032]

"Second-order statistics of an improved Jakes' fading simulator"

An improved Jakes' fading channel simulator was proposed by Pop and Beaulieu (2001) to eliminate the

stationarity problem occurring in Jakes' original design. In this paper second-order statistical properties of the improved Jakes' simulator are analyzed. Consistent with Pop and Beaulieu's caution about high-order statistics of the simulator it is proved that some second-order statistics of both the quadrature components and the envelope do not match the desired ones even if the number of sinusoids approaches infinity. Therefore, care must be taken when the simulator is employed to evaluate algorithms and systems. [C2033]

"Influence of diffraction coefficient on ray prediction of power and delay spread in urban microcells"

For a low base station antenna located on one street, signals propagate into crossing and parallel streets by reflection and diffraction at corners of the buildings. In order to accurately predict the received signals, it is therefore necessary to properly model the diffraction coefficient at the building edges. This paper presents a new heuristic diffraction coefficient (NHDC), and compares ray tracing predictions to measurements of received power and rms delay spread. The NHDC has higher diffracted field strength in deep shadow than does the commonly used heuristic diffraction coefficient, and shows better agreement with measurements of both received power and delay spread. [C2034]

"Throughput estimation for EGPRS services based on GSM network measurements"

This paper presents throughput distributions for EGPRS and GPRS services based on measurements from a real network. First, CIR distributions for different frequency reuses are estimated based on mobile measurements reports and in a method here presented. Second, throughput and spectral efficiency values are calculated considering the estimated CIR distributions by means of mapping tables. Finally, the relative throughput and spectral efficiency gains between EGPRS and GPRS are given for different scenarios at the border and at the center of the cell. [C2035]

"Propagation-measurement-based predictions of RAKE receiver performance in W-CDMA systems operating in urban microcells"

A service specification of third generation wireless systems using wideband CDMA is to enable the delivery of data rates up to 2 Mbps to a single user on the downlink channel. One implication of such high data rates is the reduction of spreading gain, which results in increased multiple-access interference and also self-interference (SI). The latter is the result of multipath propagation and the imperfect autocorrelation properties of the spreading sequences that must be used for despreading. SI is estimated using a semi-analytical approach when the number of distinct multipath groups, each the vector sum of all multipath signals received within the delay resolution of the receiver, and their strengths are estimated using measured data. This in turn is used to predict bit error rates as a function of signal-to-noise ratio when a RAKE receiver is used in a mobile terminal. [C2036]

"Modified method of geometric electromagnetics for the analysis of radio field in marine tropospheric waveguides"

Interest in the practical use of tropospheric waveguides (TWG) above the sea surface remains high. This is because there are many new tools for remote sensing of the atmosphere boundary layer and efficient methods for calculation of radiowave fields. An efficient method for such calculations is the method of geometric electromagnetics (GE) based on the Brillouin concept. The authors discuss a modified GE method that enables a more complete account of TWG effects. The evaluation of frontier conditions by the "low wall" TWG above the Black Sea shows that radio waves with length about 10 cm experience almost specular reflection. The absolute value of the reflection coefficient is in the range of 0.87 to 0.95. [C2037]

"Nonlinear stage of propagation of wave disturbances in the topside ionosphere"

This paper presents continued investigations of propagation of disturbances of plasma concentration in the topside ionosphere. Mathematical modeling of the nonlinear stage of instability development has been carried out. It is shown that in the region of maximum enhancement of perturbations, the relative fluctuations of plasma density can be up to several tens of percent. [C2038]

"Capacity analysis of forward-link in DS-CDMA cellular system with power control"

In this paper, we analyze the forward-link capacity of a cellular DS-CDMA system, especially the effects of power control, path loss exponent (γ) and orthogonality factor (f0) of multipath propagation on the system. The problem of finding an optimum power control factor (n) is evaluated. According to n, the proper threshold distance is estimated for optimum performance. With these factors, the numerical results show that the capacity is reduced by changing f0from 0.7 to 0.2 and γ from 5 to 3. [C2039]

"Wave diffraction by axially symmetrical system of finite soft cylinders"

A new strong mathematically rigorous and numerically efficient method for solving the boundary value problem of scalar wave diffraction by a system of infinitely thin circular cylindrical screens is proposed. The method is based on a combination of orthogonal polynomials method and analytical regularization method. The solution is generalization of the investigation done for one cylinder and the method has been demonstrated on flat soft circular ring. As a result of the suggested regularization procedure, the initial boundary value problem was equivalently reduced to the infinite system of the linear algebraic equations of the second kind, i.e. to an equation of the type (I + H)x = b, x, bεl2- in the space l2of square summable sequences. This equation can be solved numerically by means of truncation method with, in principle, any required accuracy. Pilot experiments show good perspective of such cylindrical reflector for development of individual antenna tag for rescue radar or broadcast systems in mm waveband. [C2040]

"Capacity management of the forward link of CDMA systems"

Two strategies to increase the forward link capacity of CDMA systems are compared analytically, and by simulation, with a conventional CDMA system. The strategies are based on reducing the data rate of selected mobile connections. The impact of the propagation environment on the capacity gain of each method is discussed. The comparison shows that maximum capacity gain is achieved when there is large difference between powers allocated to different mobile terminals in the cell. [C2041]

"Wave-propagation from medical implants-influence of body shape on radiation pattern"

The new standard medical implant communications service (MICS) for communication with medical implants uses the 403-405 MHz band. The influence of a patient's body shape and position on the radiation pattern from an implanted radio transmitter has been simulated. Simulations and comparisons have been made with different body shapes (male, female and child) and different arm positions. It can be concluded from the results that the difference between different body shapes are at least as large as the influence of a patients arm movements. [C2042]

"Conference Proceedings. 2002 International Conference on Mathematical Methods in Electromagnetic Theory. MMET 02 (Cat. No.02EX554)"

First Page of the Article [C2043]

"Modelling of the littoral environment for real-time radar performance assessment"

The role of the Royal Navy has changed dramatically since the end of the Cold War. Ships and personnel are now expected to fulfil a wider range of possible missions in theatres all over the world. Consequently ship's radar systems are now expected to give a high level of performance in regions that include the Middle East and the Eastern Mediterranean, despite being originally designed to operate predominately in the North Atlantic. The problem is that the local scenario and environmental conditions can dramatically affect radar system performance in two important ways. Firstly the environment can change the way that energy propagates outwards from the radar leading to large variations in target and clutter strength between different locations. Secondly these variations are often hidden by automatic threshold changes that reduce sensitivity to prevent the radar picture from becoming cluttered. This can give the false impression that the radar is operating optimally and could prevent ship's personnel from adapting their tactics to fit to the local situation. This paper outlines an updated model that is compared to real data in ducting conditions. The model is used to examine radar performance in littoral scenarios and to estimate sea state and duct strength from real radar data. The ultimate aim is to combine information collected by the ship's surveillance radar with modelling to allow ship's personnel to monitor the effect of the local environment on radar performance. [C2044]

"Low frequency radar phenomenology study in equatorial vegetation $preliminary results"

This paper presents a study based on field measurements on several equatorial foliage penetration phenomena in Singapore. The study includes short-range back scattering and propagation measurements in a very wide frequency band from 100 MHz to 1 GHz. The measurement setup and the data analysis are presented. [C2045]

"Wide swathe multi-channel GPR systems for mine detection"

Many national and international programmes are underway to develop more effective detection and clearance system for buried mines. Results from the US national programmes on mine detection suggest that radar can outperform conventional metal detectors, which only respond to the metal content of a mine and hence are

insensitive to minimum metal mines. Radar, and in particular ground penetrating radar, used in conjunction with other sensor arrays can result in a improved fused performance in terms of reduced false alarm rate. This paper reviews some key aspects of the performance of radar as a wide swathe sensor, in particular the system design, antenna characteristics, signal and image processing as well as detection performance. Examples of the radar images of mines and the factors that influence the image quality are presented. Current demonstrator radar systems can detect buried AT mines with some confidence, but the reliable detection of AP mines will require further development of antennas, clutter rejection algorithms and target detection methods. [C2046]

"PC/104 based wireless diagnostics module"

A diagnostics systems module based on PC/104 computer platform standard has been developed. A wireless diagnostics module is battery operated and connected to a diagnostics access point using IEEE 802.11b wireless local area network (WLAN) link. The diagnostics module performance is evaluated in the means of power consumption and wireless link capacity. The results show that the power consumption of a PC/104 diagnostics module is high for battery operating systems. However, it can be significantly reduced by component selection. The IEEE 802.11b wireless link performance is adequate for enabling diagnostics applications, but transfer delays can be significant with high network traffic load. The PC/104 architecture is found to be suitable for industrial use. The architecture can be easily implemented and changed for other types of applications. [C2047]

"3D model of urban radiochannel and calculation algorithm [Ccellular systems]"

A radio-channel model has been designed as a set of impedance parallelepipeds, simulating buildings. An algorithm and software have been developed, which allows the calculation of radiowave propagation in close urban conditions. Experimental researches of electromagnetic wave propagation in the city have been conducted. [C2048]

"A proposed empirical model of the effective Earth radius factor for telecommunications use in South Africa"

Available data for the cumulative probability of occurrence of various values of the radio refractive k-factor for South Africa have been subjected to regression analysis in terms of a proposed equation to describe such a distribution. The results presented have considerable promise in predicting the average cumulative trend of the k-factor in the inland summer rainfall areas. The model is expected to be of value in predicting large values of the k-factor, which may only be exceeded relatively rarely, but which could give rise to long-range interference in radio communication systems. [C2049]

"Modeling and analysis of fast handoff algorithms for microcellular networks"

In urban microcellular environments, fast handoff algorithms are needed to react to sudden changes in path loss characteristics that typically occur when the mobile turns around street corners. We introduce a class of fast handoff algorithms based on a local averaging technique that removes only the fast fading component from the received signal strength. By exploiting the fact that local averaging does not substantially alter the path loss characteristics, we are able to develop an efficient and accurate numerical procedure for analyzing the performance of this new class of fast handoff algorithms. Numerical results demonstrate that the use of local averaging significantly reduces handoff delay in the presence of corner effects compared with conventional handoff algorithms. Consequently, the outage probability is reduced for the entire range of mobile speeds. Our analytical approach can be used as a tool for dimensioning fast handoff algorithms that optimize network performance in the presence of both line-of-sight and non-line-of-sight handoffs. [C2050]

"Generalized model for TCM performance evaluation in different mobile radio channels"

This paper deals with derivation of a mathematical model which will enable BER (bit error rate) performance determination in mobile radio channels when trellis coded modulation (TCM) is chosen as a solution for fading mitigation. Considering different mobile radio signal propagation conditions described with appropriate fast fading statistical distributions, full generalization of the presented model is achieved. Thus, this model for performance evaluation offers possibilities for direct BER calculations no matter the type of the fading encountered in the mobile radio channel. [C2051]

"The 3-dimensional modeling technique for calculating radio propagation characteristics along railway"

The author propose a modeling technique by scanning actual environments along a railway. In this technique, they are able to obtain three-dimensional coordinates of points along railway environments by installing laser

scanners and line cameras on a train. Next, the three-dimensional coordinates are converted into polygon models, and in addition, camera images are pasted. These models are available for calculating radio propagation characteristics. We show the measurement and processing technique for obtaining precise three-dimensional models. [C2052]

"statistical approach to non-line-of-sight BS identification"

One of the major challenges to finding accurate mobile terminal location is the non-line-of-sight (NLOS) propagation caused by the blocking of the signal's direct path by obstacles. Traditional location algorithms perform poorly in NLOS environments and this has made it necessary to develop techniques to identify NLOS transmissions and then employ suitable error mitigation techniques. It is extremely difficult to characterize NLOS error because it varies with time and is location specific. We present statistical based techniques to distinguish LOS and NLOS propagation for various scenarios and present simulation results to validate them. [C2053]

"A new UTD-based model for multiple diffractions by buildings"

In this paper, the most rigorous UTD (uniform theory of diffraction)-based expressions for multiple diffractions by buildings and excess path losses in urban cellular mobile environments are derived and analyzed. For this purpose, buildings are supposed to have rectangular shapes with the same heights and spacings. Also in this analysis, actual electrical properties of buildings are used. Previous studies have been concentrated on the simplified models that buildings were approximated as absorbing half-screens or perfect conducting half-screens (knife-edges) or 90 degree wedges. In this work, buildings are assumed to be flat-roofed parallel rows of dielectric blocks, and their actual dielectric constant and conductivity are applied. [C2054]

"A study on multipath propagation modeling in millimeter wave IVC"

Inter-vehicle communication (IVC) systems using millimeter wave are widely researched. To realize a millimeter wave IVC system, analysis of propagation of the wave is very important. A multipath propagation model of millimeter wave is proposed. In IVC, the reception power of each vehicle varies by the movement of vehicles. In the proposed model, a direct path and a road-reflected path and their phase variation are taken into consideration. The delay spread between two paths is estimated from the path length of the received paths and two paths are combined to generate a desirable signal. A suitable method of reception under multipath fading is examined. [C2055]

"Essential degrees of freedom in time and frequency selective MIMO channels"

A key to reliable communication is a fundamental understanding of the interaction between the signal space and the channel. In time- and frequency-selective MIMO channels this interaction happens in time, frequency and space. We propose a four-dimensional Karhunen-Loeve-like Fourier series representation for space-time channels that captures the essence of such interaction and exposes the intrinsic degrees of freedom in the channel. The four dimensions are: time, frequency and the two spatial dimensions at the transmitter and receiver. The key signal space parameters are the signaling duration, bandwidth and the two array apertures. The corresponding channel parameters are the delay, Doppler and the two angular spreads associated with the scattering environment. The representation induces a virtual partitioning of propagation paths in time, frequency and space that reveals their contribution to channel capacity and diversity. It also exposes fundamental dependencies between time, frequency and space thereby revealing the essential independent degrees of freedom in the channel. [C2056]

"Bi-dynamic indoor measurements with high resolution channel sounder"

We describe the architecture of a fully bi-dynamic 300 MHz channel sounder developed at UMIST for indoor channel characterisation. Results of measurements in different indoor environments are presented. [C2057]

"Fading characteristics of RF signals due to foliage in frequency bands from 2 to 60 GHz"

This paper compares the various temporal characteristics of radio channels for a broad range of frequencies, including 2.45, 5.25, 29 and 60 GHz, in various foliage and weather conditions. A substantial number of data points, in excess of 1.9 billions at 500 samples per second (equivalent to 45 days), was collected and analyzed for three particular types of channels: foliated deciduous trees, non foliated deciduous trees and coniferous trees. The radio channels are statistically analyzed and the resulting PDFs (probability density functions) and CDFs (cumulated density functions) are compared against existing models. Furthermore, wind speeds and rain precipitation are correlated with the power samples to consider RF propagation dependencies. Second order statistics are derived including level crossing rate (LCR) and average facie duration (AFD). The power profile is

analyzed for spectral components. The frequency characteristics of the RF propagation channel are evaluated. Finally, channel-specific RF propagation attributes are presented. [C2058]

"Effects of overhead and adaptive data rate control in CDMA ALOHA for shadowed land mobile satellite and HAPS channels"

The effects of overhead on the throughput and delay performance of mobile satellite communications using slotted CDMA ALOHA systems are examined. Computer simulation is carried out using measured propagation data, and throughput performances for the different propagation characteristics are compared. The packet delay performance is evaluated along with the altitude of satellite when the ARQ (automatic repeat request) scheme is introduced for error control. Also proposed is the adaptive data rate slotted CDMA ALOHA. In this method the data rate is changed for every packet by the situation of the propagation path and is applied to slotted CDMA ALOHA. The improved throughput, delay time and data rate are shown in case of high traffic. [C2059]

"Perfect modeling and simulation of measured spatio-temporal wireless channels"

Various types of spatial channel sounders have been developed with the aim to measure and to investigate the propagation characteristics of spatio-temporal wideband mobile radio channels in typical macrocell, microcell, and picocell environments. After postprocessing the collected data, one usually presents the measured channel characteristics in the form of a so-called delay-Doppler power spectral density (PSD) and a delay-angle PSD. A problem is then to find an analytical channel model and/or a simulation model with the property that both the delay-Doppler PSD and the delay-angle PSD of the model approximate as close as possible the corresponding measured system functions. It will be shown in this paper that an exact and general solution to this problem always exists if the measured system functions are consistent. The proposed fundamental procedure is introduced as the perfect channel modeling approach. [C2060]

"A W-band measurement system for wireless channel modeling"

We describe the details of a W-band scaled measurement system designed for wireless channel modeling. As the measurement wavelength in this system is about two orders of magnitude smaller than actual wavelength in commercial wireless systems, a typical dimension of the propagation environment will be in the same order of magnitude smaller than the actual environment. Hence propagation measurements can be done very efficiently under laboratory conditions using a small model of a city block. This system is intended for verifying the result of propagation prediction software. The system can also be used to investigate the accuracy of representing complex scattering objects such as buildings with simple canonical geometries. [C2061]

"Exploring the performance of turbo MIMO equalization in real field scenarios"

This paper describes the methodology and the results of performance investigations of the turbo MIMO equalizer concept for broadband MIMO systems. Different application setups are introduced and realistic simulations based on measured propagation data are described. Relationships between the propagation characteristics, the antenna configurations, and the achievable bit error rates are shown. Although in many of the considered constellations turbo MIMO detection appears feasible in real field scenarios, there exist cases with poor performance as well, indicating that for practical applications a technique for link adaptation of the transmitter and receiver processing to the environment is necessary. [C2062]

"A study of rain attenuation and interference effects on cell planning for LMDS system"

In our study of radio propagation characteristics at Ka and Ku band, we first deal with planning aspects for LMDS. In a fixed radio access system, cell planning aims to use as much as possible of the channel bandwidth in each sector to maximize link capacity. To minimize interference, frequency decoupling, polarization decoupling and space decoupling methods are used here. In analyzing the inter-cell interference, we simultaneously consider four types of interference, in which the hubs use the same frequency band and polarization as the terminal station, including interference of front-to-front, front-to-back, back-to-back, and back-to-front antennas. We also discuss the S/(I+N) ratio for subscribers located at the boundary of the cell. [C2063]

"2002 3rd International Conference on Microwave and Millimeter Wave Technology (Cat. No.02EX579)"

First Page of the Article [C2064]

"High capacity antennas for MIMO radio systems"

The capacity of radio systems with multiple-transmit and multiple-receive antennas may be improved by antenna arrangements which reduce the effective Rician factor. Channel measurements indicate that the capacity in indoor environments may then be close to the independent Rayleigh fading channel even for large numbers of antennas. High capacities may be achieved with such antennas also in outdoor environments. Experiments in the same scenarios indicate significant improvements compared to patch arrays with an element spacing of λ/2. [C2065]

"Evaluation of P-band foliage penetration through polarimetric high resolution SAR imaging with the RAMSES radar"

ONERA in association with DGA, CNES and several laboratories, conducted an experiment of P-band (435 MHz) imaging at high resolution (2 m) with full polarimetric capability. The test site is a cultivated pine forest in south west France. It is populated with appropriately scattered and oriented dihedrals and corner reflectors. Under-covered reflectors and vehicles are also included. Measures of the under cover reflector returns showed that attenuation in horizontal polarisation depends on the angle of view (more than in vertical polarisation). The wide antenna illumination pattern (±30°) allows one to image up to aircraft nadir, thus confirming an important penetration through foliage on its vertical profile. [C2066]

"A novel technique for indoor radio propagation modeling"

Propagation prediction is important for designing indoor wireless communication systems. A technique combining ray tracing and the finite-difference time-domain (FDTD) method is propounded to for modeling indoor radio propagation, in which ML (perfectly matched layer) absorbing boundary conditions are applied to FDTD meshes. The technique is described by considering a simple 2D environment. [C2067]

"The analysis and research of the radio propagation models in multifloored buildings"

The paper reviews the models for predicting the indoor radio propagation, using classical models of radio propagation to analyze the merits and defects of the floor attenuation factors and the path loss exponent, when they are used in practical prediction. A specific building has been measured and compared at two different frequency bands, which gave relatively good results. [C2068]

"A new FDTD parallel algorithm for wave propagation and absorption on big urban areas"

Using FDTD to study wave propagation in big urban areas requires a huge amount of memory and processing time. This research deals with the problem of memory using a special formulation of 2-D FDTD to save memory. A system of linear equations is presented as a mathematical equivalent of Yee's equations. A recursive algorithm using Gaussian back-substitution is presented. It was adapted to parallel processing in a network of workstations and used to solve this system. Results that validate this approach are presented and the advantages and future improvements to this method are discussed. [C2069]

"Electromagnetic environment: Ap index and radioelectric power in VLF/LF"

The object of this article is to establish if solar emissions can have consequences on the levels of power measured in places of weak latitudes compared to the equipment working out the solar index of activity. For that, we jointly use the results collected by the CTSN network and the solar indices of radiation Ap. The purpose of the network is to better understand the noise in the VLF/LF range. The equipment of acquisition is intended to record the amplitude of the vertical electric field (Ev) from 10 kHz to 80 kHz. They have collected this type of data for several years. [C2070]

"22nd Convention of Electrical and Electronics Engineers in Israel. Proceedings (Cat. No.02EX637)"

First Page of the Article [C2071]

"Electromagnetic pulse propagation over irregular dispersive surface"

Electromagnetic wave propagation over an irregular Earth surface is considered. The time-domain version of the parabolic wave equation is used to describe wide-band pulse evolution due to diffraction and surface dispersion. The Fourier transform is applied to convert the impedance boundary condition (BC) and nonlocal perfectly transparent BC into the time domain. [C2072]

"Dyadic Green's function for an unbounded gyroelectric chiral medium in cylindrical coordinate"

Dyadic Green's function for an unbounded gyroelectric chiral medium is formulated in the Fourier domain in cylindrical coordinates. After a triple Fourier integral of the dyadic Green's function is obtained, a double one is reduced by performing integration over the longitudinal Fourier variable. [C2073]

"2002 3rd International Symposium on Electromagnetic Compatibility (Cat. No.02EX532)"

First Page of the Article [C2074]

"Call blocking in a mobile radio system with directed retry and priority handoff"

The blocking performance of a mobile radio system employing directed retry (DR) has been analyzed considering a priority based hand-off (HO) scheme. The effects of propagation parameters (shadowing, path-loss), characteristics of the cellular scenario (density of base stations), channel reservation, maximum number of cells considered at call set up, etc., have been studied on the blocking performance of DR calls. Assigning priority to HO calls reduces HO failure while increasing DR call blocking. [C2075]

"Target decomposition through polarimetric, disjoint Doppler and frequency band (I)SAR images"

A fully polarimetric (I)SAR image target decomposition process has been developed to aid automatic target recognition (ATR) for disjoint Doppler and frequency bands. In this paper the principle of target decomposition into scattering primitives is first demonstrated for a flat plate and then for a more complex target. [C2076]

"Seismo electromagnetics (latest results of NASDA's earthquake remote sensing frontier project)"

NASDA (National Space Development Agency of Japan) has been conducting the Earthquake Remote Sensing Frontier Project since 1996 within the framework of the Earthquake Frontier Projects (for which the author is the principal scientist) by S.T.A. (Science and Technology Agency). The main emphasis of NASDA's Frontier Project is the complete understanding of lithosphere-atmosphere-ionosphere (LAI) coupling by means of different kinds of observational items and finally we would like to contribute to short-term earthquake prediction. We show our latest results on different subjects (subionospheric VLF/LF propagation, ULF emission etc.). [C2077]

"Radiation safety and environmental effects around cellular base stations of third generation DAMPS, DCS-1800, UMTS"

An environmental survey for base stations of third generation DAMPS, DCS-1800, and UMTS cellular technology was performed for the largest cellular communications company in Israel-Cellcom Israel. The survey details potential environmental effects for man, ordnance, medical, aviation and industrial electronics and radiation hazards for fuel and chemicals. This paper cover risk subjects that include human exposure, ordnance, fuel and electronics. Regarding safety ranges for human exposure, the survey indicates the following. For a quantity of 23 transmitters in the sector of a DAMPS base station, the safety range at the antenna altitude level is 7 meters. In combining all possible transmitters without channel expansion, including DAMPS, DCS-1800 and UMTS, the safety range at the antenna altitude level is 7-m. When the DAMPS channels are expanded from 16 to 23 channels and the DCS-1800 is expanded from 4 transmitters to 6 transmitters, the safety range in relation to all transmitters increases to 8.2 m. [C2078]

"Analysis on propagation of the electromagnetic waves associated with earthquakes"

According to the radial theory and waveguide theory, the paper deals with several problems about propagation of the electromagnetic waves associated with earthquakes. It is supposed that ULF and VLF SEMSs which could propagate far are mainly via groundwaves. The cut-off frequency for the atmosphere-crust wave guide is also estimated. [C2079]

"ULF emission induced by tension and shear cracks"

Penetration of low-frequency waves through a conductive medium due to the inductive seismo-electromagnetic effect is considered by a double-potential method. The source of electromagnetic waves induced by the movement of a conductive medium in a geomagnetic field is produced by tension and shear cracks. The analytical solution for tension cracks is obtained. The system of equations describing this process in the case of shear cracks in spherical coordinates is reduced to a two dimensional nonstationary system, which is solved by a second order algorithm that conserves some integral properties of the initial equations. Results are discussed. [C2080]

"Effect of user mobility on soft handoff performance in cellular communication"

The handoff rate is a fundamental index to evaluate the handoff performance and as a result it affects the overall performance of a cellular mobile communication system. Meanwhile, moving patterns of mobiles are critical to the handoff rate. In this paper the effect of user's mobility on system handoff rate is studied The analytic result shows that the soft handoff rate increases with the mobile speed linearly, which is confirmed by the simulation results. Based on it, the effect of the combinations of users' multiple velocities on the handoff rate is investigated. It turns out that the handoff rate of a system with several user mobility patterns can be estimated with the handoff rates of corresponding single user mobility pattern systems. [C2081]

"Geometrical model for mobile radio channel with hyperbolically distributed scatterers"

A geometrical channel model with hyperbolically distributed scatterers for a macrocell mobile environment is presented. This model provides the statistics of direction-of-arrival (DOA) information, as well as amplitude, time delay and phase data for wireless communication channel. The model is useful for designing a forward link beamformer. Simulation results of the channel impulse response and the probability density function for some channel parameters are presented. The data produced from the model is consistent with real world wireless channel characteristics. [C2082]

"An approach of the geometrical-based single bounce elliptical channel model for mobile environments"

The simulation approach is an important tool used for the design and implementation of mobile radio systems with an emphasis on the propagation modeling for wireless channel. We carried out simulations for three different street positions scenarios of the receiver, (mobile station), using the geometrical-based single bounce elliptical channel model, as might be appropriate for microcellular applications and mobile-to-mobile communication. From the simulation results we use the parameters time-of-arrival (TOA) and angle-of-arrival (AOA), (delay and angular domain, respectively), to estimate the higher order channel statistics, such as the delay spread (DS) and the angle spread (AS), respectively. [C2083]

"A fast ray tracing algorithm for propagation prediction in broadband wireless systems"

This paper discuses a fast ray tracing algorithm for propagation prediction in outdoor wireless channels. The algorithm uses a GTD/UTD (geometrical theory of diffraction/uniform theory of diffraction) in combination with a ray tracing technique to model and to simulate the broadband wireless channels. The algorithm uses a modified shooting and bouncing technique to accelerate the ray tracing method. The algorithm is examined for channel modeling and propagation prediction in various wireless channels including LMDS system. The simulation data is compared with measurement results in the same scenario. An excellent agreement shows the validity and accuracy of the new algorithm. [C2084]

"MIMO capacity performance for both narrowband and wideband systems"

Recent study in information-theory has demonstrated the enormous capacity potential of wireless communication system with multiple transmit and receive antennas. As a result, a number of layered space-time (BLAST) architectures have been proposed. In this paper, the capacity of narrowband and wideband (OFDM) systems in scattering channel models are analysed via Monte-Carlo simulations. In particular, we show that OFDM based MIMO system can combat pin-hole effect which degrades capacity. [C2085]

"InSAR phase unwrapping: a polarimetric approach"

This paper addresses a polarimetric approach to improve the interferometric phase estimation based on an extension of the ESPRIT algorithm applied to different kinds of scatterers. The basics of SAR interferometry are presented. The article introduces the ESPRIT algorithm using polarimetric data with a description of the scattering model, the ESPRIT algorithm and the method used to determine the number of contributions. The results obtained using fully polarimetric SAR images of the DLR E-SAR airborne sensor in the L-band repeat-pass mode are discussed. [C2086]

"An efficient power allocation strategy for low Earth-orbit satellite communication systems"

This paper proposes a method for efficiently allocating power to subscribers oil earth. The idea is that the users located closer to the center of a cell, which usually enjoy larger gain of satellite antenna and lower interference from surrounding beams, can request and get services at a higher data rate without much transmission power allocation, while the users located at the cell's boundary shall reduce the data-reception rate to save the power.

A mathematical model is developed and the results show that the proposed scheme enables more traffic to be carried on a limited power resource of LEO satellite systems. [C2087]

"Measurement-based aggregate throughput of Bluetooth system in limited area"

This paper presents measurement-based calculations for actual aggregate and link throughputs of Bluetooth system. The co-interference between fully loaded piconets formed in a 10*10 sq. meter room is inspected. The results show that the maximum aggregate throughput is gained with 45 active piconets. When comparing the ideal performance with the one based on measured results best overall performance over a distance of 10 meters can be achieved using DM5, DM3 and DH1 packets for data transfer. When the distance is less than 3 meters the use of only DH packets gives the best results. [C2088]

"2002 Military Communications Conference. Proceedings (Cat. No.02CH37397)"

First Page of the Article [C2089]

"An empirically based path loss model for indoor wireless channels in laboratory building"

This paper present a statistical indoor path loss model derived from 1.8 GHz experimental data collected in laboratory building. There are two models which are considered: (1) a distance-dependent path loss model and (2) a floor attenuation-factor (FAF) path loss model. These models have been developed based on the number of floors, concrete and mirror walls between the transmitter and the receiver, and provide simple prediction rules which relate signal strength to the log of distance. The standard deviation between measured and predicted path loss is 8.7 dB for the entire data set. Average floor attenuation factors (FAF), which describe the second path loss (in decibels) caused by the floors between transmitter and receiver are found for as many as three floors in a typical building. [C2090]

"The multipath propagation model of rectangular tunnel channel"

A real multipath propagation model for radio transmission in a rectangular tunnel is presented. Tent law that describes the behavior of radio rays in a rectangular tunnel is introduced. Simulation results for both the traditional model and the new model are given. The new model is more accurate and practical for predicting the radio channel in a rectangular tunnel. [C2091]

"Adaptive modulation and coding techniques in MUOS fading/scintillation environments"

In this paper, adaptive modulation and coding structures are presented that are appropriate for the MUOS environment. The proposed approach adaptively controls the modulation format, FEC coding rate, transmission power and even possibly bandwidth spreading gain in response to changing channel conditions in an attempt to optimize throughput while maintaining acceptable error rate performance. Being able to estimate and then predict the channel is vital to the system performance. Channel prediction algorithms; have been developed and the advantages of the adaptive modulation/coding techniques are presented together with implementation issues. [C2092]

"Distributed jammer performance in Rayleigh fading"

A distributed jammer is a set of small jamming transmitters distributed over a region to disrupt tactical communications. Propagation losses experienced by terrestrial jammers will be comparable to losses seen by the target radio links, with multipath fading, and power failing off faster than 1/r2. An intelligent distributed jammer can partly overcome excess propagation loss by exploiting the proximity and small number of targets in each node's coverage region to extract information needed for frequency following or synchronized pulsed jamming. The coverage radius of an individual jammer node is an important system parameter, determining the number of nodes required. and the resulting jammer cost. A set of equations are presented that give the probability of jamming a target receiver randomly located inside a fixed range, when both communications and jamming signals suffer from Rayleigh fading. and average jammer power falls off faster than line-of-sight power. An upper bound on jammer performance improvement with intelligent jamming is found by assuming the nodes are able to extract desired target signal information. and calculating the improvement in jammer reliability with a fixed coverage range. Both frequency followers and synchronized pulsed jammers are examined. Performance improvement is greatest when each node's coverage region contains a limited number of distinct communications sub-networks. [C2093]

"A physical model for wireless channels to provide insights for long range prediction"

Algorithms that predict the wireless channel for up to a few wavelengths cannot be adequately tested with stationary models. Ray-tracing or FDTD methods do not provide insights into the relationship between reflector configurations and the performance of long-range prediction. Therefore, we present a novel model that: (1) creates non-stationary datasets to test our previously proposed adaptive long range prediction algorithm, which enables practical realization of adaptive transmission techniques; (2) classifies the reflector geometries that have typical or most severe parameter variations, so that the reflector configurations for test datasets can be appropriately chosen; (3) provides limits on the speed of adaptation needed for an algorithm to predict the channel significantly into the future, and thereby reveal the timing of future deep fades, etc.; (4) illuminates the origins of the temporal and statistical properties of measured data. The algorithm performs similarly on channels given by the physical model or actual measured data, but differently on a channel simulated by the stationary Jakes model. The insights of the model accurately describe the performance of the algorithm in several scattering environments when prediction is employed with adaptive power control and adaptive modulation. Moreover, we study limits of the long-range prediction at frequencies other than the observed frequency, of importance in correlated uplink and downlink transmission, orthogonal frequency division multiplexing (OFDM) and frequency-hopping systems. [C2094]

"Frequency selective RF channel simulator"

Performance prediction for wideband communications systems requires a realistic simulation of the RF channel time and frequency-varying characteristics. It is well known that a lapped-delay line filter with time-varying coefficients can be used to represent a frequency selective channel. However, generating the coefficients required to model various scintillation and multipath conditions is not a simple task. The paper describes a software frequency selective channel simulator and the channel effects modeled using a complex exponential series approximation to the channel scattering function. Examples of using the software simulator to create and validate channel models are discussed. [C2095]

"Downlink throughput analysis in a WCDMA network with mixed QoS traffic classes"

In UMTS, four traffic classes have been identified: conversational, streaming, interactive, and background, to fulfill the QoS requests from the application or the user. To effectively manage the radio resources, shared between these different QoS classes has become an important network planning issue. In this paper, the maximum available resource, Rmax, of a cell (per sector per carrier) is defined in terms of the maximum downlink transmission power, the average propagation loss, the orthogonality factor, and the other-to-own-cell interference ratio. The resource sharing factor of each traffic class can be calculated by dividing the total resource allocated for that class by the maximum available resource, Rmax. The summation of the resource sharing factors of all traffic classes is smaller than one. This paper also shows that the average throughput of the downlink is a weighted sum of the resource sharing factors. Downlink throughput calculations for various traffic conditions with mixed QoS classes are presented by using the derived weighted sum equation. [C2096]

"A non-stationary hidden Markov model for satellite propagation channel modeling"

The hidden Markov models are widely used for modeling random processes. Drawbacks in a standard hidden Markov model for modeling state occupancy have often been pointed out. In this paper, we proposed a propagation channel model for predicting the fading properties of satellite-to-Earth propagation channels using non-stationary hidden Markov model approach. An accurate prediction model was developed to provide better performance in modeling channel properties than a standard hidden Markov model and validated by several measured fading signal series. A close match between simulated and measured data shows that the proposed model predicts satisfactorily the first and second order statistics of propagation properties in several user environments. Considering the state stay duration issues, our proposed method can produce more accurate simulation results and extend efficiently the applicability of the HMM approach in modeling propagation channel properties for land mobile satellite communication services. [C2097]

"A double-bounce channel model for multi-polarized MIMO systems"

Measurement campaigns have indicated that propagation paths with multiple reflections are important in indoor and picocell environments. It has also been found that it is difficult to match both angles and delays using single-bounce models. A double-bounce multi-input multi-output (MIMO) channel model is proposed that also includes polarization. The scattering geometry based channel model is extended to two scattering instants per path, i.e. double-bounce, in order to model indoor and picocell environments better. Formulas for determining the required positions of the scatterers in order to yield a desired angular spread are derived under the double-bounce assumption. Furthermore, a physics based full field treatment of the polarization properties of the antennas is possible since the scattering geometry based models keep the same physical layout as the experiments. The

validity of the model is examined by comparing simulations of the channel capacity to measurements taken with a MIMO channel probing equipment at the campus of Brigham Young University. [C2098]

"Signal correlation in a hallway environment using waveguide mode analysis"

We express signal correlation in a waveguide in terms of waveguide modes. We investigate the effect of waveguide dimensions, element location and attenuation on transmitter and receiver correlation. An analytical approach for the calculation of the signal correlation is proposed, and the results are verified with simulations. Good agreement is achieved as well as huge savings in computation time. The analytical method provides an intuitive explanation for the capacity behavior of a MIMO system in a hallway environment. [C2099]

"Robust Doppler spread estimation in nonisotropic scattering environments"

A new parametric approach is proposed for estimation of the maximum Doppler frequency, or equivalently the mobile speed, in narrowband mobile radio channels. Such information is of interest as it reveals the channel's rate of change, which can be used to improve the performance of many wireless communication subsystems. In this work, simple and efficient Doppler frequency estimators are formulated based on using a small number of samples of the channel autocorrelation function. Unlike previous approaches, the chosen parameterization is shown to be robust in a microcellular propagation environment, which may be characterized by nonisotropic scattering and/or a specular component. Simulation results are described to illustrate the effects of additive noise and the finite data record performance. [C2100]

"Multiple-input multiple-output wireless communication systems using antenna pattern diversity"

Multiple-input multiple-output (MIMO) wireless communication systems employ multiple transmit and multiple receive antennas to obtain significant improvement in channel capacity. However, the capacity is limited by the correlation of subchannels in non-ideal scattering environments. In this paper, we investigate MIMO systems that use antennas with dissimilar radiation patterns to introduce decorrelation, hence increasing channel capacity. We develop a ray tracing model that takes into account both the propagation channel and the transmit and receive antenna patterns. Using a computational electromagnetic simulator, we show that: (1) MIMO systems that exploit antenna pattern diversity allow for improvement over dual-polarized antenna systems; and (2) the capacity increase of such MIMO systems depends on the characteristics of the scattering environment. [C2101]

"A general methodology and key metrics for scatternet formation in Bluetooth"

To fully exploit the capabilities of Bluetooth for the deployment of wireless ad-hoc networks, the scatternet concept has been proposed. A scatternet is constituted by an overlapping of simple structures called piconets, each composed of up to eight devices sharing the same radio channel. A scatternet may present different topological configurations, depending on the number of composing piconets, the role of involved devices and the configuration of the links. This paper presents a general methodology for scatternet formation and proposes metrics that can be used to evaluate scatternet performance. Several numerical examples are presented and discussed, highlighting the impact of metric selection on scatternet performance. [C2102]

"Validity of spatial covariance matrices over time and frequency"

A MIMO channel measurement campaign with a moving mobile has been conducted in Vienna. The measured data will be used to investigate covariance matrices with respect to their dependence on time and frequency. This document focuses on the description of the evaluation techniques which will be applied to the measurement data in the future. The F-eigen-ratio is defined expressing the degradation due to out-dated covariance matrices. Illustrating the derived methods, first results based on the measured data are shown for a simple line-of-sight scenario. [C2103]

"Dynamic W-CDMA network planning using mobile location"

Location assisted dynamic network planning enables an operator to obtain geographic specific performance estimates and automatically redistribute radio resources. Statistical data is gathered in a database and refreshed periodically to create a dynamic distributed planning tool. Since mobile terminals now measure the actual path loss to each location, the uncertainties associated with propagation modelling and geographic databases are removed. Dynamic coverage maps enable base stations to increase (or decrease) their coverage and capacity in areas regularly (or not regularly) visited by subscribers. The base stations also make provision for the additional resources required by high data rate users, possibly through the process of intelligent handover. The concept can be viewed as a fusion of location techniques and network planning. The network subsequently has a powerful self-learning capability and adapts over time to slow variations in the propagation environment or traffic

loading conditions. The performance of a number of location techniques is studied and the required location accuracy for dynamic W-CDMA planning determined. [C2104]

"Mobile station location estimation using the maximum likelihood method in sector cell systems"

This paper presents mobile station (MS) location estimation using the maximum likelihood method (see Aso, M. et al., IEEE Vehicular Technology Conf.-Fall, 2001) in sector cell systems. We propose a propagation model for signal strength in sector cell systems and show the results of the performance evaluation. We apply the maximum likelihood method to signal strength. First, the location estimation method based on the maximum likelihood function is explained. Next, the proposed propagation model is introduced. We compare the performance of sector cell with omni-cell systems under various conditions. [C2105]

"13th IEEE International Symposium on Personal Indoor and Mobile Radio Communications. PIMRC 2002. Proceedings (Cat. No.02TH8637)"

First Page of the Article [C2106]

"ML and Bayesian TOA location estimators for NLOS environments"

A major concern of cellular and PCS-based wireless location systems is the effect of the harsh propagation environment, particularly non-line-of-sight (NLOS) propagation. In order to improve location accuracy under such conditions, this paper proposes a novel location technique that estimates the true, or line-of-sight (LOS), ranges based on NLOS range measurements. The algorithms, designed for NLOS environments, make use of well-known multipath scattering models (ring/disk of scatterers and Gaussian distributed scatterers) in order to incorporate the effects of NLOS propagation. From PDFs of the TOAs derived using the models, maximum likelihood expectation-maximization and Bayesian estimators are applied to multipath TOA measurements at each BS to estimate the LOS distance between the MS and the BS. Simulated results show that the algorithms provide considerable improvement over traditional location algorithms. [C2107]

"Measurement and simulation of radio wave propagation in hospitals"

This paper investigates radio wave propagation in hospitals. In contrast to other buildings, hospitals are partly constructed of walls that contain metallic layers in their structure. The type of wall depends on the functionality of the room. Measurements were performed at eight discrete frequencies in the range from 42.6 MHz up to 5.2 GHz in all relevant types of rooms such as operating rooms, X-ray, MRT (magnet resonance tomograph) and others. Due to the large frequency range and in order to investigate extensively the wave propagation properties, various antennas and measurement systems were used. The results show a different behavior of the wave propagation in different rooms of the hospital. Furthermore the results reveal that it is important to consider the room as a whole when determining the attenuation between adjacent rooms. For EM-wave propagation in rooms with metallic layers, slots and openings in the walls are crucial. The measurement data is further used to find a suitable modeling of the walls for simulations with ray-optical methods. The walls are homogeneously modeled with multiple layers of different material parameters. This makes it possible to model walls in hospitals with embedded metallic shieldings. The results of the simulations agree well with the measurements. [C2108]

"4D morphology model with feedback loop"

This paper addresses innovative ways of dealing with the impact of morphology on network engineering. There are many different morphologies and each has unique impact on the network engineering and planning. For example, different types of trees will have different impact on the propagation. Also, it behaves differently if it is weather sensitive. In this invention, a 4D (time of the year, height, width and length of the morphology) database and associated algorithm are proposed to deal with the impact on system engineering. The key point of this algorithm is that it includes means to feedback and integrate measured data from the field so that the 4D morphology model can be tuned (supports full flexibility) to better handle different situations. Inventions include first the fundamental concept of dealing with morphology in a integrated way with system propagation. The morphology specific slope will be derived and applied to the existing model. Second, is the algorithm of deriving these morphology slopes. Third, is to include the morphology in the calculation of shadow loss. Fourth, is to identify and integrate the morphology impact on time variance and associated engineering algorithm. [C2109]

"Multi-user MIMO-OFDM cell throughput under real-world propagation conditions"

An innumerable number of papers has been published on MIMO (multiple input multiple output) systems. The original and most of the current work deals with a single link between a multi-element antenna (MEA) transmitter and a MEA receiver. However, link-level capacity gain does not necessarily translate into a similar system-level

gain. Therefore, several researchers have investigated the performance of MIMO systems on cell or even system level, including intracell and/or intercell interference. While these multi-user MIMO investigations are very helpful, presented (simulation) results have been mostly limited to simple propagation scenarios (e.g., flat fading and/or i.i.d. Rayleigh fading). Here we present results for the uplink sum capacity of multiple MIMO users in a single cell (i.e., intercell interference is not explicitly accounted for) based on a channel model which accounts for partial MIMO correlations, large-scale fading effects, variable delay spread, non-vanishing Rician factor, and random user orientation. We concentrate on the cell capacity. However, estimation of the maximum uplink cell throughput for real-world AMC (adaptive modulation and coding) is similarly possible via the SNR gap approximation and power/bit loading. According to the simulation results, beamforming is the capacity-achieving strategy for a large number of users within the cell. This is consistent with theoretical results derived by other researchers. However, the simulated results here cover the entire range from optimum single-user performance (i.e., transmission on spatial eigenmodes plus water filling) to the capacity when the number of users greatly exceeds the number of base station antennas (i.e., with beamforming being the best strategy). [C2110]

"Mobile location tracking with NLOS error mitigation"

We present a mobile location tracking method with non-line-of-sight (NLOS) error mitigation for network-based wireless location systems. Based on the reconstructed LOS time of arrival (TOA) results from NLOS propagation identification and correction, geometric location techniques are used to calculate the location estimate of a mobile station. General TOA geometric cases and positioning solutions are analyzed. The time sequence of location samples is processed by Kalman filtering for position tracking and velocity estimation. A post-Kalman filter smoothing method is also applied to improve the velocity estimation. It is shown that the location tracking error can be reduced by processing the reconstructed line-of-sight TOA measurements with Kalman filtering. [C2111]

"Simulations and trial results for mobile measurement based frequency planning in GERAN networks"

Capacity, quality and data throughput in TDMA based cellular mobile networks, such as GERAN (GSM EDGE radio access network), is strongly influenced by the quality of the frequency plan. Hence operators are striving constantly to improve the frequency allocation in the network. The quality of a frequency plan is mainly dependent on the accuracy of the interference matrix (IM), which is used to describe the "interaction" of cells in the system. Traditionally, propagation predictions have been used to create the IM. But, as the prediction of radiowave propagation tends to be highly inaccurate, this approach is sub-optimal, leaving operators and subscribers with sub-optimal network quality. Alternatively, mobile measurement reports (MMRs) can be used to build the IM. This paper provides a summary of simulation results and describes the findings of a field trial. They show the superiority of this alternative approach over the traditional method. [C2112]

"Breathing effect on CDMA cellular networking"

An operational problem in code division multiple access (CDMA) is the breathing effect. Breathing is caused by a full cell, so users at long enough distances cannot be connected to the service and the cell appears to have become smaller. If the user numbers are less, then cell capacity becomes the previous value, so the user can be connected again, hence the cell appears to grow. There may be areas not included in a cell boundary (blank spot). In digital communication, the connection quality judgement is by comparison of energy per bit per noise gain density, a parameter known as Eb/N0. The observed Eb/N0value depends on user reflection gain which is determined by the chosen channel model. The paper investigates the free space, Lee, and Hata channel propagation models. [C2113]

"Precise AFC scheme for performance improvement of SDM-COFDM"

The SDM (space division multiplexed)-COFDM (coded orthogonal frequency division multiplexing) system has been proposed to improve frequency utilization efficiency by using a simple feedforward ICI (interchannel interference) canceller to multiply the estimated propagation inverse matrix of a MIMO (multi-input multi-output) channel. However, when a carrier frequency offset between the transmitter and receiver exists, the orthogonality of the subcarrier between the SDM signals becomes lost and the performance degrades. This paper proposes a new AFC (automatic frequency control) scheme which makes it possible to use a common carrier frequency by averaging the estimated frequency error of each receiver. Computer simulation shows that the proposed AFC scheme improves SDM-COFDM PER performance in frequency selective fading environments. [C2114]

"Platform for visualization and analysis of multi-dimensional propagation parameters"

In order to evaluate the performance of multi-input multi-output (MIMO) communication systems accurately,

MIMO channel sounding is necessary. DINO (Dynamic Integrated platform for multi-dimensional data analysis) is proposed for the systematic analysis of the data from a MIMO channel sounder. In DINO, through the visualization of the obtained data by recreating the propagation channel virtually in a computer, a fundamental link between the measured data and the physical environment is established. [C2115]

"MIMO capacities for different antenna array structures based on double directional wide-band channel measurements"

We present an approach for investigating the performance of generic multiple-input multiple-output (MIMO) wireless systems in a realistic way using wideband real-time propagation measurements of the double-directional radio channel. Applying a multidimensional high-resolution channel parameter estimation procedure the descriptive parameters for any relevant propagation path including the path weights, time-delay, Doppler shift and the propagation directions at both ends of the wireless link are extracted simultaneously from the measurement data. from the estimated parameter sets then a local reconstruction of the multidimensional wave fields in the vicinity of the measured aperture volumes in time, space and frequency is possible. Since this way the measurement antenna properties are excluded from the channel, the influence of a variety of application specific array architectures can be investigated. Here, we use this synthesis approach to analyze the performance of given target systems with smart antennas in terms of the resulting channel capacities and eigenvalue distributions. [C2116]

"Interference mitigation proposals exploiting antenna diversity using space time block codes for Bluetooth enabled devices"

Previous research work has focused on residential coverage and achievable data rates using the Bluetooth personal area network (PAN) standard. To meet the bit rate needs of future consumer electronic devices, M-PSK modulation schemes were proposed as likely candidates for high data rate Bluetooth extension. Frequency hopping statistics obtained for both the 79-hop and 23-hop systems in Bluetooth for data medium (DM) and data high (DH) packets in asynchronous mode show a clear need for mitigating interference. This can be achieved by employing synchronous transmissions in order to obtain reliable throughputs, particularly for time-bounded devices. This paper investigates the advantages of exploiting antenna diversity using space time block codes (STBC) with maximum likelihood decoding for high data rate Bluetooth enabled devices in synchronous and asynchronous transmissions. Results are presented for Bluetooth systems employing no antenna diversity and systems employing two transmit and two receive antennas using STBC. Results show that the reliability of both time-bounded and non-time bounded Bluetooth enabled devices can be enhanced by exploiting STBC coupled with suitable interference cancellation techniques. [C2117]

"On geolocation accuracy with prior information in non-line-of-sight environment"

Non-line-of-sight (NLOS) geolocation becomes an important issue with the fast development of mobile communications. Several methods have been proposed to address this problem. However, a comprehensive study on the best geolocation accuracy that these methods may possibly achieve is called for. Qi and Kobayashi (see The Proceeding of the 36th Annual Conference on Information Sciences and Systems (CISS 2002), Princeton University, March 2002 and IASTED International Conference on Wireless and Optical Communications (WOC 2002), Banff, Canada, July 2002) reported a unified analysis of the Cramer-Rao lower bound (CRLB) and achievable bounds applicable to NLOS geolocation, assuming no prior information on the mobile station (MS) position or NLOS induced paths is available. In practice, however, we often have some information about these parameters beforehand. In this paper, we derive a lower bound for the geolocation accuracy in the presence of such prior information, and explore its physical interpretation. Some numerical examples are discussed. [C2118]

"High bit rate ultra-wideband OFDM"

We describe a candidate high-bit rate communication system for short range networking in high performance computing clusters. The system uses a hybrid ultra-wideband orthogonal frequency division-multiplexing scheme. The transmitted signals are sparse pulse trains modulated by a frequency selected from a properly designed set of frequencies. The train itself consists of frequency modulated ultra-wide pulses. The system achieves good detection by integrating several pulses, and high throughput by transmitting frequencies in parallel. Unlike traditional orthogonal frequency division-multiplexing systems, a given tone is transmitted only during parts of the transmission interval. We provide an analysis of the system in a multipath environment and illustrate its performance in a realistic setting. [C2119]

"Space-time characteristics of frequency-flat Rayleigh fading channels and applications on MIMO

systems"

We discuss the interrelationship between the spatial and the temporal correlation of the frequency-flat Rayleigh fading channels, and propose a joint design of the mobile station (MS) antenna separation (AS), base station (BS) antenna separation, and the channel interleaving depth (ID) for achieving the spatial, temporal, and space-time channel independence. The proposed design is based on a model generalized from the Jakes/Clarke (1968, 1974) ring-of-scatterer fading model. A space-time channel correlation function of two BS and two MS antennas is derived and examined to produce the AS and ID design rule. Analytical binary phase shift keying (BPSK) bit error probability with perfect channel state information is used to compare the performance. [C2120]

"An empirical path loss model for HVAC duct systems"

We present a simple path loss prediction model for link budget analysis in indoor wireless local area networks (LANs) that use heating, ventilation, and air conditioning (HVAC) ducts. The model we propose predicts the average power at each location in an HVAC duct network. This prediction model greatly simplifies the analysis for a complex duct network, making it a convenient and simple tool for system design. Our prediction model Is verified by experimental measurements. [C2121]

"Effects of advertised receive buffer size and timer granularity on TCP performance over erroneous links in a LEO satellite network"

This paper presents a preliminary investigation into the impact of TCP's advertised receive buffer size and timer granularity on TCP performance over erroneous links in a LEO satellite environment. Conducted simulations include over 200 different combinations of TCP flavor, advertised receive buffer size, timer granularity, and bit error rate. Results show that TCP can only approximate the variable propagation delay for unsaturated links and that the minimum timer granularity which prevents a premature expiration of the RTO depends on the advertised receive buffer size. Low BERs do not influence TCP's capability to track the variable propagation delay in contrast to high BERs. Final results indicate that the relative performance degradation of TCP over erroneous links does not depend on the ability to estimate the variable propagation delay. [C2122]

"Linearly prefiltered OFDM based on long-term properties of the channel covariance matrix"

In this article we introduce an improved OFDM scheme in the frame of linearly precoded OFDM, based on the long-term properties of the channel. The channel covariance matrix is computed based on the ITU channel model and we show that the propagation delays represent long-term properties which leads to correlation between several subchannels. The long-term channel covariance matrix can be fed back to the transmitter and the extra knowledge used for prefiltering. We propose a scheme in which the symbols are linearly prefiltered with the eigenvectors of the channel covariance matrix corresponding to the significant eigenvalues and use multistream detection at the receiver side. The results of the simulations showed that eigenpreprocessing with adaptive bit and power loading and LMMSE detection at the receiver side provides a significantly lower bit error rate, especially at high signal to noise ratios compared with other types of linear prefiltering that do not use knowledge about the channel covariance matrix. [C2123]

"Cell selection based on shadowing variation for forward link broadband OFCDM packet wireless access"

This paper proposes cell (sector) selection based on shadowing variation for forward-link orthogonal frequency and code division multiplexing (OFCDM) packet wireless access. We clarify its effects using a broadband propagation channel model in a comparison with fast cell selection (FCS) which tracks the fading variation and conventional cell selection (CS) utilizing the distance-dependent path loss, based on radio link level simulations that take into account instantaneous fading and shadowing variations. The simulation results clarify that the achievable throughput with FCS improves slightly in a broadband channel with an increasing number of paths when the average path-loss difference between two cells is greater than 2 dB. Nevertheless, we elucidate that the optimum CS interval equals that for tracking the shadowing variation, i.e., approximately 100 msec considering high mobility, caused by reducing the degradation in throughput when the cell with lower received power is selected, which suffers from shadowing variation. Consequently, we show that the average throughput by employing CS based on shadowing variation with the selection interval of 100 msec is increased by approximately 5 and 15% compared to that with the selection interval of 1 sec, which only tracks distance-dependent path loss, for the maximum Doppler frequency of 20 and 200 Hz, respectively. [C2124]

"Auto-tuning of service-specific requirement of received EbNo in WCDMA"

The paper validates the feasibility of auto-tuning of service- and bit rate-specific EbNo (Eb/N0) requirements.

The EbNo requirement is the level of the received bit energy to the interference and noise density that the receiver equipment requires for proper decoding of the signal. The planned EbNo values can be used e.g., to scale the powers when the service is varying. The proposed methods, one for uplink and one for downlink, are tested using a dynamic WCDMA system simulator with a deployment of macrocells on a city region whose measured propagation characteristics have been incorporated into the model. The results show that the proposed methods tune the initially incorrect planned EbNo values so that the throughput in the system increases. [C2125]

"Enhancing measured MIMO capacity by adapting the locations of the antenna elements"

We show that the multiple-input, multiple-output (MIMO) capacity of measured, indoor flat-fading channels may be improved by adaptively changing the locations of the antenna elements. Moving the antenna elements is a way to provide spatial diversity to a MIMO link without decreasing the number of parallel data streams. First, we demonstrate that significant variations in equal-power capacity are possible using measured data from finely sampled virtual arrays at both ends of a MIMO link. Second, using steepest descent and a simulated path-type channel derived from measured data, we adapt the element locations. In line-of-sight (LOS) and obstructed-line-of-sight (OLOS) examples, the local maximum capacity is reached within 5 and 10 iterations, respectively. The improvements relative to the equally spaced arrays are approximately 22% and 19%, respectively. [C2126]

"Measuring broadband radio channel parameters using a simple experimental set-up"

A method is presented for measuring the main parameters required to estimate the capacity of the radio channel for wideband communications as the root mean square time delay and the coherence bandwidth. This method is based on the possibility of estimating the power delay profile from the knowledge of only the module of the transfer function of the channel in conjunction with the Hilbert transform. The major advantages of the method are first, the possibility to experimentally characterize the wideband channel performance by employing widely used and low cost instrumentation, and second the possibility to extend the technique to outdoor radio channels. The error associated to the approximated method is quantified, so that it can be used from an engineering point of view in the planning and development of wideband wireless communications systems. [C2127]

"Applications of generalized RBF-NN for path loss prediction"

This paper presents the results of the generalized radial basis function neural networks applications for the prediction of propagation path loss in urban and suburban environment. We have studied two types of neural network based models; the first one is used for path loss prediction while the second one is a hybrid prediction model based on error control. The performances of the neural models are compared to the path loss values measured in the city of Kavala and in Oia village on Santorini Island, Greece, based on the absolute mean error, standard deviation and root mean square error between predicted and measured values. [C2128]

"The impact of propagation time difference in transmit diversity"

Transmit diversity has been shown to be an efficient method to improve system performance without the increase of the mobile terminal complexity in wireless communications. The impact of propagation time difference between transmit antennas on the performance of a transmit diversity scheme has been studied under a Rayleigh fading channel. It has been shown that the performance of transmit diversity degrades significantly when the propagation time difference increases. [C2129]

"Applicability of rough surface scattering to 3D radio planning"

A demonstration 3D channel prediction model was used in example scenarios in hilly terrain and undulating rural terrain. The model is comprised of a 2D vertical Tx-Rx-plane component as well as 3D components due to off-axis scattering. The latter components are found using rough surface scattering estimation. In the implementation a novel high performance scattering model called the amplitude/phase model was used. It was shown than when the vertical plane 2D prediction was attenuated more than typically 15 dB compared to free space a 3D channel model is necessary. This value was exceeded in approximately 40% of the coverage area in the hilly terrain, and in about 15% of the area in undulating rural. This leads to the conclusion that in a hilly terrain traditional 2D models are not sufficient. When the 3D components were dominating the distribution was approximately Rayleigh, with a typical difference between the 5 and 95 percentiles in the distribution of more than 15 dB. Weather and seasonal variation may change the mean received signal level by up to 4-5 dB. An erroneous assumption about the permittivity or surface roughness by a factor of two could change the mean of the received radio signal by up to 10 dB. [C2130]

"MIMO capacity in free space and above perfect ground: theory and experimental results"

Multiple input multiple output (MIMO) systems are a promising technique for wireless applications that require high data rates. We theoretically study their capacity potential for propagation in free space and over a ground surface. We investigate how this depends on the array geometry and the electric field polarization. Moreover we validate our theoretical predictions with measurements above a nearly perfectly flat surface. The experiment shows good agreement with the theory for a large range of distances and deviates from it when secondary effects (roughness etc.) become more significant. [C2131]

"An application of smart antenna systems for archiving networks in TV studios"

Data archiving networks and electronic media libraries for video and audio broadcasting have gained a large interest recently. This paper proposes the use of smart (adaptive) antennas for HIPERLAN/2 (HIgh PERformance Radio Local Area Network/2) in order to increase the data rate and user capacity targeting wired LAN replacement in modem TV broadcasting studio environments. Spatial channel models are necessary for the proper design, analysis and implementation of smart antenna systems. A simple 2D ray tracing indoor channel model for predicting propagation characteristics inside a room of arbitrary dimensions and wall properties is presented. The simulation model gives fast estimates of the power-delay profile (PDP) and direction of arrival (DOA) information based on the geometrical optics (GO) theory taking into account double reflections. The effects of the relative positions of the transmitter and the receiver, room dimensions as well as the number of transmitters are investigated. [C2132]

"Initial synchronization procedure in S-UMTS networks for multimedia broadcast multicast services"

W-CDMA and SW-CDMA (satellite W-CDMA) air interfaces require that a user equipment in a given cell acquires slot and frame synchronization, and identifies the primary scrambling code used by the target cell before starting communications. This synchronization procedure is identified as cell search procedure in W-CDMA and beam search procedure in SW-CDMA. Notwithstanding the extensive commonalities between the two air interfaces, the two procedures are actually different. The paper aims at the evaluation of the false acquisition probability achievable by the two procedures in a scenario in which the receiver may experience both satellite and terrestrial radio propagation conditions. This is a sensible evaluation scenario since, in the delivery of multicast-broadcast multimedia services, the satellite UMTS network represents an efficient complement to terrestrial UMTS, since its coverage is extended to indoor and urban areas through, for example, the use of terrestrial intermediate repeaters. Rayleigh fading, Rice fading, and vehicular multipath propagation channels are used for the performance assessment. [C2133]

"WCDMA downlink capacity analysis based on deterministic ray-tracing channel model"

An analysis of WCDMA downlink capacity is presented for a real service environment at Yeouido, Seoul, Korea which is considered as a typical high rise building environment. The ray-tracing technique is used to predict site-specific sector averaged path losses not only from the desired node B but also from undesired node Bs to scattered receiver locations in a given cell. The total required power of node B is estimated, which limits the system capacity depending on the combination of service types, macro diversity and orthogonal factor. [C2134]

"OFDM multi-antenna designs with concatenated codes"

This paper considers practical link designs that include different transmit, receive, and coding schemes for an OFDM system with two transmit and two receive antennas. In conjunction with studies on theoretical outage capacity, we compare link designs in terms of simulated frame error rate (FER) performance in different propagation environments. For channel coding, serial and parallel concatenated turbo-like codes are used and compared. For receive schemes, we compare maximum likelihood (ML) and linear MIMO receive algorithms and propose modifications to improve turbo decoding. For transmit schemes, we compare the Alamouti (1998) diversity scheme, a single-stream MIMO, and a multi-stream MIMO design. Interestingly, a 2Ч2 MIMO-OFDM design with ML receivers is found to under-perform the 2Ч2 Alamouti-OFDM design at low spectral efficiencies (e.g., 2, 4 b/subcarrier), even though MIMO has a slightly higher theoretical capacity. Also, the gap between the SNR required by the theoretical 1% outage capacity and that required by the single-stream MIMO-ML design at 10-2FER is only 1-2 dB at spectral efficiencies of 2, 4 and 6 b/subcarrier, in an environment with rich spatial and frequency diversity. [C2135]

"A novel RBF-based detector for MIMO systems over rich-scattering fading channels"

This paper proposes a novel detection scheme using a radial basis function (RBF) network in a multi-input multi-output (MIMO) environment. In order to evaluate the performance of the proposed MIMO-RBF receiver,

simulations are performed over the rich-scattering fading channel. Simulation results confirm that the proposed scheme shows the similar bit-error rate (BER) performance of a maximum likelihood detection (MLD) and outperforms Vertical-Bell Laboratories Layered Space-Time using minimum-mean-square-error ing (VBLAST-MMSE) as well as VBLAST using zero-forcing ing (VBLAST-ZF). Moreover, we investigate the effect on the performance of the number of RBF center with two modulation formats (i.e. BPSK and QPSK) and different number of transmit and receive antennas. The performance of the proposed detector is verified with respect to an initialization-rate of RBF centers. [C2136]

"Performance of site selection diversity transmission in WCDMA"

Soft handoff is considered to be essential in direct sequence-code division multiple access (DS-CDMA) based mobile communication systems. However the interference resulting from the transmissions from multiple base sites in the forward link during the soft handoff constrains the multiple access capacity. Site selection diversity transmission (SSDT) technique is able to mitigate the interference caused by transmissions from the multiple base sites. The 3rdGeneration Partnership Project (3GPP) has specified this technique for the W-CDMA FDD component of UMTS. This paper describes the SSDT technique and presents capacity simulation results. It is shown that the capacity gain is dependent on the Doppler speed of mobile terminals and correlation of shadow fading between adjacent cells. [C2137]

"Neural model of the propagation curves from ITU-R P.370-7"

The ITU-R Recommendations are the international technical standards developed by the Radiocommunication Sector of the International Telecommunication Union (ITU). ITU-R is based on reading the diagrams defined in Recommendation ITU-R P.370-7. The main problem with ITU-R method is the extrapolation of the curves with the calculated hethat differs from the values shown on the diagrams in Rec. ITU-R P.370-7. We examined a MLP neural model of the propagation curves and proved its accuracy on a few examples providing the best structure of the neural network. [C2138]

"Computer-generated holograms for mm- and submm-wave beam shaping"

Computer-generated holograms (diffractive elements) can be used for shaping mm-wave beams and for producing complex field configurations. The radio holograms studied here are amplitude holograms. An amplitude hologram has been proven to be a feasible alternative as a focusing element in a compact antenna test range (CATR) at mm-wavelengths. Amplitude holograms have also been demonstrated in other mm- and submm-wave beamshaping applications-e.g., on the creation of nondiffracting radiowave Bessel beams, a radio wave vortex, and also a custom-designed beam pattern. [C2139]

"A propagation overview"

Recent progress in propagation research. for wireless channels is reviewed. The emphasis is on the use of arrays for exploring the 3-dimensional character of propagation. The concept of clusters is important and appears both in indoor and outdoor environments, as well as in the delay domain. This has led to a new understanding of especially urban propagation. Arrays are also important for multiuser discrimination, and the relevant propagation aspects are discussed. MIMO systems rely heavily on a sufficient number of independent channels, which again are very dependent on angular and polarization properties of the propagation channel. [C2140]

"Capture effect in IEEE 802.11 basic service area under influence of Rayleigh fading and near/far effect"

We analytically analyzed the influence of capture effect over theoretical throughput and delay of a traffic-saturated IEEE 802.11b BSS in infrastructure and ad-hoc configurations. The capture probabilities are derived in presence of the near/far effect and/or Rayleigh fading, i.e. with or without power control mechanisms. The peak aggregate throughput of the BSS operating in Basic access mode is sensitive to the capture, while its impact in RTS/CTS access mode can be disregarded. The frame delay is also insensitive to the capture effect. [C2141]

"Topology optimization of a CDMA-based network of hyperbolic remote-positioning cells"

As a consequence of previous studies and results, a new positioning network is presented, based on three-element positioning NAUTA cells, a system belonging to the wave-based non satellite-based category of positioning systems. An algorithm to derive its optimized topology is proposed, which uses some results from empirical studies in cellular radio propagation, in addition to the geometrically dependent position-dilution-of-precision indicator, as the two main groups of optimization factors. The algorithm can be applied to to derive the

best network topology for a specific geographic area, assuming a digital representation of the terrain given from a geographical information system is available. [C2142]

"A study of stochastic and deterministic procedures for the design of simulation models for spatial channels"

We discuss three methods for the computation of the model parameters of spatial channel simulators basing on Rice's (1944, 1945) sum of sinusoids. Each method is universally described and can in principle be applied to the modelling of any type of scattering object with given spatial characteristics. However, examples illustrating the procedures are presented for a Laplacian scattering object only. The performance of each procedure is investigated with respect to important spatial characteristic quantities such as the spatial cross-correlation function (SCCF), the mean angle of arrival (AOA), and the angular spread. [C2143]

"Spatial domain modeling of microcellular systems operating in multipath Nakagami channels"

In conventional channel models, the AoA's at the BS, are assumed to be uniformly distributed. However, measurements in urban areas have shown non-uniform AoA distributions. In this paper, the spatial characterization of wideband urban mobile radio channels is investigated and the resulting and spatial correlations at the BS receiver are computed. A geometrically based modeling is used to spatially characterize both TU and BU environments. The clustered scatterers are assumed to have bivariate Gaussian densities. The AoA pdf's are derived. The spatial correlations are computed for tooth environments and the effects of the channel parameters such as the scatterer's variance, the BS-MS distance, the mean angle of arrival on these correlations are investigated. [C2144]

"A 2-D fading forecast of time-variant channels based on parametric modeling techniques"

A new approach for predicting the future channel situation on the basis of actual and past channel characteristics is suggested. Applying high resolution estimation techniques to the time-variant transfer function of the radio channel, a 2-D fading forecast based on parametric modeling is introduced. In contrast to existing methods this allows a small-scale fading forecast not only in the time domain, but also in the frequency domain. Moreover, considering the evolutional nature of the channel and its parameters, an increased prediction range is expected, as compared with previously proposed approaches. Explaining the extended approach and corresponding modeling of the parameter variations, an appropriate prediction scheme is introduced considering a mobile moving with constant speed on a straight line. Applied on simulation data of a ray-tracing modeled indoor scenario of moderate complexity, the performance as well as the boundary conditions of the proposed procedure are illustrated. [C2145]

"Cellular coverage in underground transport systems: a case study-the Rio de Janeiro Metropolitan"

The paper describes the cellular coverage system design and implementation for the Rio de Janeiro Metropolitan underground transport system. The project was developed at WiNGS Telecom and implemented by a pool of companies for Algar Telecomunicac$80o˜es Leste (ATL), the B-band operator in Rio de Janeiro, Brazil. The project characteristics, assumptions made and chosen solutions are described, as well as the propagation models and measurements. The threshold degradation due to the use of several antennas to provide coverage in tunnels and platforms is analyzed and complete link budget equations obtained. [C2146]

"Performance analysis of diversity transmission modes in UTRA FDD under time-varying multipath channels"

This paper analyses the effect of the propagation environment on the theoretical performance of the downlink transmit diversity techniques specified in the standard of the UTRA FDD mode. These techniques are classified as open loop and closed loop modes. Simulation results, obtained via a C simulator of the physical layer of UMTS, show the negative effect of mobility. The diversity gain obtained with the closed loop techniques, which are the best ones, drops drastically when the Doppler frequency rises. In that case, the open loop mode of diversity performs well. Nevertheless, it is highly dependent on the correlation of the antennas, which reduces the theoretical improvement. [C2147]

"The essential degrees of freedom in space-time fading channels"

The key to reliable communication is a fundamental understanding of the interaction between the signal space and the channel. In time- and frequency-selective multi-antenna (space-time) fading channels this interaction happens in time, frequency and space. In this paper we propose a four-dimensional Karhunen-Loeve-like

Fourier series representation for space-time channels that captures the essence of such interaction and exposes the intrinsic degrees of freedom in the channel. The four dimensions are: time, frequency and the two spatial dimensions at the transmitter and receiver. The key signal space parameters are the signaling duration, bandwidth and the two array apertures. The corresponding channel parameters are the delay, Doppler and the two angular spreads associated with the scattering environment. The representation induces a virtual partitioning of propagation paths in time, frequency and space that reveals their contribution to channel capacity and diversity. It also exposes fundamental dependencies between time, frequency and space thereby revealing the essential independent degrees of freedom in the channel. [C2148]

"Outdoor-to-indoor propagation modelling with the identification of path passing through wall openings"

This paper proposes a new propagation model to accurately predict outdoor-to-indoor propagation loss. Account is taken of the structural openings along the paths; it is assumed that outdoor-to-indoor paths are possible only through wall openings such as doors and windows. Introducing the angle dependency of the losses with the paths that penetrate the indoor area makes it possible to accurately predict outdoor-to-indoor propagation loss. Measurements in a microcellular environment show that the proposed model can predict outdoor-to-indoor propagation loss more accurately than the COST231 model. [C2149]

"Wave propagation over a forest edge-parabolic equation modelling vs. measurements"

This paper presents a propagation model, based on the parabolic wave equation technique (PE), for calculating the attenuation of propagation in a forest environment. A finite difference scheme is chosen to simplify implementation of boundary conditions. The standard parabolic equation is also modified into the so-called Claerbout equation to accept angles up to 45° from the paraxial direction. Furthermore, the implementation of the phase shift map solution for piecewise linear terrain would perform well for terrain slopes up to 10-15°. The model has been tested against measurements in a fir forest environment. [C2150]

"Phase function measurement for modelling radiowave attenuation and scatter in vegetation based on the theory of radiative energy transfer"

Modelling radio wave propagation through vegetation is becoming increasingly more important. Many empirical solutions have been suggested in the past. The theory of radiative energy transfer offers an analytical method to the problem. This theory requires however 4 input parameters, which need to be established experimentally. A measurement of the angular scatter pattern, the so called 'phase function', can be utilised to determine 2 of those parameters. In this paper 3 different methods of measuring the phase function for measurements in a real forest environment are presented and compared. One method is presented as the most suitable one. [C2151]

"Fading depth evaluation in mobile communications-from GSM to future mobile broadband systems"

A technique for fading depth characterisation in wideband mobile communications systems is described. The approach, based on the eigenvalue decomposition technique, allows deriving the cumulative distribution functions of the received power for Rayleigh and Ricean fading channels. Application examples for different systems, namely GSM, UNITS, HIPERLAN and MBS, working within different environments, as proposed by standard-setting bodies, are shown in detail, and the results are discussed, giving a general insight into the fading depth behaviour. In the considered environments, the fading depth experienced by GSM is between 9.4 and 18.4 dB. The fading depth observed by UNITS is below the one for GSM by 2.1 to 10.3 dB. Regarding HIPERLAN, the observed fading depth is 2.6 to 4.9 dB below the one for UNITS. MBS experiences fading depths that are usually below 9.7 dB (a worst case of 10.6 dB is observed in city streets under NLoS). Since the observed fading depth depends on the system and environment characteristics, different fading margins should be considered for each system and working environment. [C2152]

"Estimation of nominal direction of arrival and angular spread using the determinant of the data matrix"

In this paper, two complex nonlinear operators on a single snapshot data are used to estimate the parameters of a spatially distributed source. The nominal direction of arrival is estimated based on the space-invariant property of the modulus of one nonlinear operator. The angular spread is estimated by using the difference between the modulus of the two nonlinear operators. Unlike the previous estimators based on multi-dimensional searching or their low-complexity versions, the proposed method gives the closed-form estimation using a single snapshot data and the calculation of either multi-dimensional searching or eigenvalue decomposition is not necessary.

[C2153]

"MIMO channel sounding taking into account small angular spread"

The use of multiple receive antennas as well as multiple transmit antennas has attracted worldwide attention to extend the performance of existing mobile communication systems. Therefore, it is of great importance to know the features of the real propagation channel. The real propagation channel is investigated by MIMO channel sounding, where high-resolution parameter estimation schemes are used to resolve the physical channel with respect to its spatial (and temporal) structure. However, due to narrow diffuse scatterers, the commonly used model of discrete wavefronts is no longer valid. We introduce a simple approach to model wavefronts with small angular spread. Additionally, we show that the ESPRIT (estimation of signal parameters by rotational invariance techniques) algorithm with a slight modification is applicable to estimate the direction of arrival and the angular spread jointly. The approach is based on the assumption of Gaussian distributed wavefronts. [C2154]

"Multi-hop radio access cellular concept for fourth-generation mobile communications system"

This paper proposes a multi-hop radio access cellular (MRAC) scheme for achieving both high speed and high capacity and good area coverage in fourth generation mobile communications systems. In this scheme, we assume two kinds of hop stations, one is a dedicated repeater station installed at a good propagation location such as a rooftop, and the other is a user terminal that temporarily experiences good propagation conditions. For both cases, the path diversity effect can be obtained between single-hop and multi-hop paths. Four propagation models were studied representing the paths among the base station, hop stations, and mobile station. Based on the propagation models, suitable MRAC operation conditions are discussed. For mobile stations located at the cell edge area, MRAC operation is effective in reducing the transmit power. Consequently, MRAC reduces the interference in cellular systems and enhances the area coverage. [C2155]

"Measurements and numerical evaluation of the electric field in the near-zone of radio base station antennas"

The increasing presence in many countries of radio base stations (RBSs) for mobile communications has caused, in recent years, a growing anxiety to people living close to RBS, worried by biological effects on human body of the electromagnetic pollution. We present a fast and efficient method for the evaluation of the electromagnetic field levels in the near zone of linear array RBS antennas. The theoretical model is explained and a comparison between experimental measurements and the proposed method is reported [C2156]

"Measured results of urban satellite-diversity (Sat. D) and space-diversity (SD) characteristics for mobile broadcast geostationary satellite system"

This paper deals with the urban satellite-diversity (Sat D) and space-diversity (SD) characteristics measurements for mobile broadcast geostationary satellite orbit (GSO) system using the GPS (Global Positioning System) signal. For designing a digital broadcast system from a geostationary satellite, we must clarify attenuation characteristics by urban buildings, electrical light poles and trees etc. Southern orbital arc GPS satellite signals with elevation angle between 40~50 degrees data are used for propagation characteristics measurements, rather than actual geostationary satellites. To overcome urban attenuation, the Sat D system and SD system characteristics are systematically examined by using measured data for low and high elevation angles, ie, 40 and 80 degrees. From processing the Sat D characteristics results, improvements of half fade duration time and twice non-fading duration time can be achieved in urban areas by selecting two diversity satellites with separation angle about 90 degrees. On the contrary, for the SD system, the improvement for urban attenuation can not be obtained sufficiently [C2157]

"6th IEEE High Frequency Postgraduate Colloquium (Cat. No.01TH8574)"

The following topics are dealt with: amplifiers and oscillators; antennas and propagation; materials and passive devices; HF and optoelectronics [C2158]

"3D antenna measurement and electromagnetic simulation for advanced vehicle antenna development"

This paper presents a sophisticated vehicle antenna measurement system which allows, in addition to standard far field measurements, a full 3-dimensional measurement of the radiation pattern of a vehicle antenna. To prove measurement results, a simple vehicle model has been created, which allows comparison with simulation results [C2159]

"The impact of multipath propagation on the performance of smart antennas in micro- and pico-cellular CDMA environments"

Simulation results given here support the fact that for small cellular environments, grouping multipath rays in the same bin into a single ray, does not lead to a realistic model for such environments. This results from the fact that for these environments, propagation time between transmitter and receiver is very short and therefore, coherence bandwidth of the channel can become very large. Finally, it is shown that even in the presence of a LOS path, it may not be justifiable to neglect weak correlation between multipath rays [C2160]

"Improving indoor signal coverage by use of through-wall passive repeaters"

Improving indoor coverage of wireless networks is an important issue for service providers and users alike. Standard procedures include the deployment of active in-building repeaters and the careful selection of transmission power levels for base stations. Various manufacturers also offer passive repeaters for enhancement of cellular signals in automobiles. In this paper we study the improvement in coverage attainable by use of low-cost through-wall passive repeaters. The analysis considers various situations of signal propagation [C2161]

"Sixty years at Harvard: the career of Professor Ronold W. P. King"

The article provides a summary of the career of Ronold King. Professor King has published over 300 papers, most of which are in the field of antennas and electromagnetic wave propagation. He is the author of 11 books and several articles in encyclopedias and handbooks. His research interests have been in the broad area of electrical science both from the point of view of advancing the frontiers of knowledge and applying existing knowledge to practical problems. His publications are concerned primarily with applications of electromagnetic theory to problems in antennas, radio wave propagation, and subsurface communications [C2162]

"Effects of road traffic on probability distributions of path loss in an urban microcellular environment"

One of the key parameters of radiowave propagation characteristics is the temporal change in the surrounding environment. Here, we report the development of a system for measuring line-of-sight (LOS) centerline blocking and its use in measuring the path loss when the LOS centerline is blocked in LOS propagation in an urban environment with low base station antenna height. The results of statistical processing of path loss for when there is centerline blockage by vehicles and when there is no blockage are presented [C2163]

"12th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications. PIMRC 2001. Proceedings (Cat. No.01TH8598)"

The following topics are dealt with: CDMA multi-user detection; WCDMA; network planning and management; wireless IP/TCP; modems and equalization; radio resource management; wireless LAN; OFDM; software defined radio; fourth generation mobile communication; mobile and base station antennas; MIMO systems; coding; interference cancellation; value added services; radio propagation and modeling UMTS/IMT 2000; CDMA transmitters and receivers; CDMA capacity enhancement; mobile QoS; multiple access control; GSM/GPRS/EDGE; mobile handoff/location; CDMA network analysis; spread spectrum communication systems; CDMA2000; TD/CDMA systems; satellite systems; multi carrier CDMA; packet CDMA [C2164]

"Non-line-of-sight error mitigation in TDOA mobile location"

We investigate the non-line-of-sight (NLOS) propagation identification and correction for time difference of arrival (TDOA) based mobile user location in wireless communication systems. Based on the defined TDOA residual, an NLOS base station identification algorithm is proposed. Different choices of the reference location for the residual calculation are compared via simulation. To correct the NLOS error with a certain distribution, we propose a maximum likelihood (ML) estimator for TDOA location systems. Simulation results demonstrate that the proposed NLOS recovering algorithm performs better than that using only LOS measurements, especially when the number of available base stations is small and/or the LOS base stations have an undesirable geometric layout [C2165]

"The channel estimation technique based on the propagation path model of an OFDM system"

OFDM is widely known as a modulation scheme which can utilize the given frequency band very efficiently, even if the channel is distorted by multipath propagation. However, in order to improve the efficiency, a high-precision estimation technique is recommended. In this paper, we pay attention to the method which introduces a condition based on the propagation path model in order to obtain better precision. Although this method performs better

than another conventional method especially under the fading environment, this method has large computational complexity. Hence, we simplify this method by using the FFT algorithm to make this method more effective. As a result, the proposed system performs better than the conventional system especially under fading environments, and the computational complexity is reduced [C2166]

"Admission control for mixed services in downlink WCDMA in different propagation environments"

An admission control algorithm for downlink WCDMA systems is proposed and analysed, through dynamic simulations, considering a detailed propagation model. The evaluated admission control algorithm allows access to radio resources based on a filtered version of transmitted power at a base station. It takes advantage of the suggested prediction mechanism of the future transmitted power and is capable of handling access requests of different service classes. Comparisons with both a reference scenario and basic admission control are included as well. Results indicate that the proposed algorithm can exploit the resource allocation flexibility of power limited systems especially well where propagation conditions introduce heavy spatial non-uniformity. In fact in the simulated urban scenario, the capacity gain, introduced by the proposed algorithm, is shown to be more than doubled compared to the uniform environment case. In addition, it is shown that the algorithm, working with different kinds of services, can maintain almost the same traffic mix, regardless of the absolute system load [C2167]

"Dielectric properties of soils"

The knowledge of soil electric properties is very important, specially for electromagnetic wave propagation at low and medium frequency (LF and MF). This knowledge allows to compute the wave attenuation in order to know the transmitting power to cover a specific service area. In this paper dielectric constant, loss factor, loss tangent, and conductivity for different soils: dry sand, humid sand, and earth of Buenos Aires Province, Argentina, have been measured as a function of the frequency. Frequency range, was between: 104Hz-3.108Hz. Experimental results are based on the universal dielectric theory in order to obtain the equations of ε', ε" and σ. The conductivity of DC has also been measured; which has enabled to compare it with the conductivity measured in the RF range [C2168]

"A radio coverage and planning tool"

With the increased utilisation of mobile communications, and the speed necessary to keep radio systems efficient, a 'RAdioWave Coverage And Planning Tool', RAWCAPT, is proposed. This tool could prove not only cost efficient, but also time efficient for users needing to ascertain the optimal position for a transmitter-receiver radio systems for any urban terrain. The tool utilises a Lidar dataset as the input, due to fact that Lidar data is reasonably cheap compared to other forms of data. On completion of the tool, the full process of radio path planning will be contained within a solitary software application [C2169]

"Modal analysis of MIMO capacity in a hallway"

Systems with multiple element transmitter and receiver arrays have been shown to achieve very high spectral efficiencies. This is especially important in wireless applications that are power, bandwidth and complexity limited. The achievable capacity depends on the channel between the transmitters and the receivers, and a common assumption is that of a rich scattering environment. However an environment such as a hallway is more closely approximated as a waveguide, and we look into the limitations this poses on the achievable rates. We first show that the number of allowable propagation modes in a lossless waveguide limits the number of equivalent spatial sub-channels. We then apply a similar analysis to a lossy waveguide, where the losses are due to imperfectly conducting boundaries and imperfections in the dielectric. For demonstration purposes we show these effects for a waveguide of small dimensions. A hallway, which is a more practical environment for wireless applications, can be treated as an overmoded waveguide. In a hallway the losses are higher because the boundaries are dielectric materials that allow high power leakage. We again demonstrate the above effects, taking into account the losses off the walls [C2170]

"Proposal of new information traffic platforms in UHF band for communication and broadcasting services"

In the second half of the twentieth century, the technological environments in communication and broadcasting services have been greatly advanced, and the information services (IS) of the next generation are going to be developed towards the twenty first century. The IS will require broadband, mobile and asymmetrical communications. What media will be suitable for the IS in the future information traffic platforms? In this paper, it is considered that the UHF band used in the existent analog terrestrial TV broadcasting will be suitable for the download channel of the new IS. In order to clarify the validity of using the UHF band, the propagation loss is

compared between 470 MHz of UHF TV broadcasting and 2 GHz of IMT-2000. Furthermore, since it is necessary to seamlessly provide the IS not only in outdoor but also in indoor environments, the basic radio propagation is measured in indoor environments [C2171]

"A hierarchical time-domain modulation scheme for wideband communications in a dispersive multipath channel"

In this paper a time-domain modulation scheme for ultra-wideband communications is proposed and the performance of such modulation scheme in a highly dispersive channel is evaluated using a coherent and physics-based propagation model. In this scheme a relatively large number of orthogonal waveforms, that are scalable in time and frequency domains (like wavelets), are modulated (pulse position or amplitude modulation) with a piece of information data individually and transmitted through the channel. This scheme offers two major advantages: (1) noting that pathloss and channel characteristics are very much frequency dependent, at least a portion of information reaches distant observation points, (2) each waveform can easily be radiated from a small and relatively narrowband antenna and hence issues related to the design of efficient, dispersionless ultra-wideband antennas is circumvented. This approach also allows for data categorization according to a specific hierarchy. To demonstrate the advantages mentioned and assess the performance of such system, an ultra-wideband wave propagation in a forested environment over a frequency range of 10-210 MHz, is presented [C2172]

"Confirmation of random matrix model for the antenna array channel by indoor measurements"

A random matrix model for communication via antenna arrays, introduced recently by one of the authors (see Muller, R.R., Proc. of 38th Ann. Allerton Conf. Commun., Control & Comp., 2000), characterizes the space-time nature of the channel in terms of the asymptotic eigenvalue distribution of its space-time covariance matrix as a function of the. number of transmit antennas, receive antennas and significant scattering objects. This paper finds that Muller's theoretical predictions accurately match data obtained from indoor measurements of MIMO channels. The number of significant scattering objects is found to vary strongly with frequency. The latter effect is described by the newly introduced richness spectrum [C2173]

"Development of a new shooting-and-bouncing ray (SBR) tracing method that avoids ray double counting"

A simple, effective, and accurate method is proposed to solve the ray double counting problem in the ray tracing method using the reception sphere mechanism. The principle behind the method is based in characterizing received rays according to the objects they encounter from the source to the observation point and avoiding counting rays with the same characteristics. Using this method, the double counting of rays in the usual shooting-and-bouncing ray tracing procedure can be easily avoided. Results are given to validate the proposed procedure and illustrate the improved accuracy [C2174]

"FM pulses propagation in focal regions of catastrophe types"

Numerical modeling of frequency-modulated (FM) radio-pulse propagation in plasma in focal regions of three-dimensional catastrophe types is fulfilled. As it was shown by D.N. Chystyakov et al.(see Proc. Progress in Electromagnetics Research Symp., p.1085, 2000) and A.S. Kryukovsky et al. (see Jour. of Communications Technology and Electronics, vol.44, no.4, p.423-30, 1999), the catastrophes with corank equal three describe mutual space-time (ST) focusing of electromagnetic waves. In dispersive media, the propagation of an FM electromagnetic wave may be described by an integral uniform asymptotic solution of the Klein-Gordon equation [C2175]

"Estimation of propagation structure by means of Hopfield neural network"

In order to develop the spatial-temporal equalization technique for 3G/4G mobile communication systems it is necessary to understand the indoor or outdoor propagation structure. It has been proposed to apply an artificial neural network (ANN) to DOA estimation (see El Zooghby, A.H. et al., IEEE Transactions on Antennas and Propagation, vol.45, no.11, p.1611-17, 1997; Goto, K. et al., T. IEE Japan, vol.118-C, no.3, p.442-7, 1998). The purposes are to direct narrow beams to the terminals after detecting their directions. We propose an algorithm using an ANN (Hopfield neural network) to estimate coupled DOA and TOA of multiple incident waves [C2176]

"Multiple-input multiple-output (MIMO) radio channel measurements"

We present results from the first field test to characterize the mobile multiple-input multiple-output (MIMO) radio channel. We measured the capacity normalized to a single antenna system, and fading correlation between

antennas of a system with 4 antennas on a laptop computer and 4 antennas at a rooftop base station. The field test results show that close to the theoretical 4 times the capacity of a single antenna system can be supported in a 30 kHz channel with dual-polarized, spatially-separated base station and terminal antennas under a variety of test runs, including suburban drives, highway drives and pedestrian routes. Therefore, these results show that it may be possible to provide in excess of 1 Mbps in a 200 kHz mobile radio channel (for the 3G wireless TDMA system EDGE) with the appropriate base station antennas [C2177]

"A radioscientist's reaction to Marconi's first transatlantic wireless experiment-revisited"

On 12 December 1901 signals from a high power spark transmitter located at Poldhu, Cornwall, were reported to have been heard by Marconi and his assistant George Kemp at a receiving site on Signal Hill near St. John's, Newfoundland. For this reception experiment, Marconi used a kite supported wire aerial, an untuned receiver, a detector of uncertain performance and a telephone receiver. The signals, if heard, would have traveled a distance of 3500 kilometres. Even at the time of the experiment there were those who said, indeed there are some who still say, that he misled himself and the world into believing that atmospheric noise crackling was in fact the Morse code letter "S". A little later, in February 1902, when Marconi was returning to North America on the SS Philadelphia, using a tuned ship-borne antenna, he received signals using his filings coherer from the same sender up to distances of 1120 km by day and 2500 km by night. Even these distances are rather remarkable considering the receiving apparatus he used. This paper revisits that first transatlantic experiment and concludes that it is difficult to believe that signals could have been heard on Signal Hill [C2178]

"New computationally efficient 2.5D and 3D ray tracing algorithms for modeling propagation environments"

This paper presents the development of 2.5D and 3D extensions of a 2D procedure that is described in an earlier paper (see Zhang, Z. et al., Electronics Letters, vol.36, no.5, p.464-5, 2000) for modeling propagation environments. These methods are based on dividing the propagation region into cells whereby the number of cells is decided by the number of vertices of structures instead of their dimensions. Results from the 2.5D and 3D methods show significant improvement in computational efficiency. Specifically, the CPU time for the 2.5D method is less than 5% of that of the visibility ray tracing method. Accuracy, on the other hand, is related to that of a traditional ray tracing method and includes accounting for reflected, transmitted and diffracted rays [C2179]

"Application of the reciprocity theorem to complex propagation problems"

Based on the reciprocity theorem, the present report has developed a propagation algorithm that can take account of the effects of changing ground properties, topography and the presence of buildings. By segmenting the problem at boundaries where significant changes take place, the approach can obtain accurate results from no more than geometric optics dipole fields. Since a geometric optics solution is readily derived for situations where the refractive index is continuously varying, the technique can easily incorporate the propagation effects of the atmosphere and/or semi-transparent objects [C2180]

"Analytic scattering model for indoor propagation"

A closed-form analytic solution was developed to predict the electric field scattered from long conductive planar structures that are on the order of a wavelength wide. The scattered field measured from a 3-sided steel stud typically found in commercial construction was compared to simulations based on this analytic solution. This approach provides a computationally simple basis for indoor propagation modeling [C2181]

"Fully-polarimetric ground penetrating radar application"

The ground penetrating radar (GPR) has broad applications in the fields of geology, civil engineering, archeology and military . It is usually used as a non-destructive inspection sensor for monitoring, inspecting and characterizing obscured objects by means of electromagnetic radiation, propagation and scattering. Unlike radars operated in the open air, the medium between the GPR and the target usually determines the performance instead of the target and the radar. The sensitivity of GPR applications is limited by clutter instead of noise or radar system. The increasing needs for better detection and discrimination capability have driven GPR users and researches to investigate the pattern and polarization characteristics of the GPR antenna designs. New GPR antenna designs were developed to provide improved sensitivity and stability. An example of fully-polarimetric GPR application that has not been seen previously is presented. Some important issues such as clutter sources, radiation patterns and propagation efficiency faced by the most GPR applications are also discussed [C2182]

"Outdoor/indoor propagation modeling for wireless communications systems"

The development of accurate propagation prediction models for outdoor/indoor communication environments is challenging and requires the development of innovative approaches to: (a) improve the accuracy of available models; (b) improve the computation efficiency; and (c) implement sufficiently general calculation procedures that would help in characterizing complicated and unique outdoor/indoor propagation features and environments. In this paper we describe a new propagation prediction model that addresses the above stated requirements. Specifically, the computational efficiency of the shooting-and-bouncing ray (SBR) was significantly improved by employing ray tracing techniques based on computer graphics approaches. The accuracy issue was addressed by employing a multi-grid FDTD method to calculate diffraction coefficients from unique and difficult to handle analytically indoor and outdoor structures. Additional improvement in accuracy was achieved by calculating reflection and transmission coefficients from walls of complex structures. Finally, the multi-grid FDTD method was used to characterize unique outdoor/indoor environments such as windows, doors, etc. The overall model was integrated, and propagation prediction results for typical outdoor/indoor communication environments are presented and compared with available data [C2183]

"IEEE Antennas and Propagation Society International Symposium. 2001 Digest. Held in conjunction with: USNC/URSI National Radio Science Meeting (Cat. No.01CH37229)"

The following topics are dealt with: FDTD theory; broadband microstrip antennas; antenna applications for mobile communications; reconfigurable antennas; FEM; electromagnetic theory; medical imaging and treatment with microwaves; RF coil design for high field MRI; electromagnetic education; mobile antennas; radio propagation theory; microstrip antennas; random media and rough surfaces; reflector antennas; diverse waveguiding structures; antenna measurements and calibration; EM health effects of cellular phone radiation; array design; mutual coupling; multiband antennas; electromagnetic scattering; conformal antennas; time domain antennas; wideband array antennas; photonic bandgap structures; higher-order basis function methods; integral equation techniques; inverse scattering; lens antennas; multiresolution methods; fractal antennas; finite element methods; PCS antennas; CPW feeds; circularly polarized microstrip antennas; aperture-coupled microstrip antennas; fixed beam microstrip arrays; RF MEMS; antenna arrays; rough surface scattering; remote sensing; fast multipole methods; phased arrays; adaptive arrays; dual band antennas; spiral antennas; antenna theory; radar imaging; frequency selective surfaces; patch antennas; complex media; time domain theory; helical antennas; slotted antennas; genetic algorithms; RCS calculations; active microstrip phased arrays; wavelets [C2184]

"Coupling at cross, T and L junctions in tunnels"

While the modal representation for a straight tunnel is well known, coupling into the branches at L, T and cross junctions has not been studied. In order to explain the coupling at these junctions in tunnels, we make use of modal analysis. For the propagation into branches off the main tunnel, mode coupling at the discontinuities is obtained by ray-mode conversion. By accounting for the mode diffraction at each comer in 2-D tunnels, we compute the coupling loss into cross-junctions, the arms of T-junctions and L-bends. The coupling loss at junctions of 3-D tunnels can be found from the mode coupling at 2-D waveguides because the discontinuities at the side walls only couple modes having the same variation in the vertical direction. Since the cross tunnel has four edges, they generate more comer diffracted modal fields than other structures, thus have the strongest coupling [C2185]

"Modeling shadow region due to propagation through discrete random media"

Because of the development of cellular systems, the prediction of the propagation through discrete random media appears to be very useful. Recent works have shown the existence of a region with additional attenuation to that caused by free-space propagation. This paper aims at approaching the main phenomena responsible for this attenuation with an analytic formulation. The results are essentially based on the resolution of the problem of diffraction by thin-wire structures with the method of moments (MoM) [C2186]

"Coupling of finite integration technique and ray tracing"

We present a hybrid formulation which combines the finite integration technique (FIT) with a ray tracing technique. Ray tracing allows the treatment of complicated structures with very large objects. A typical application of ray tracing techniques is the simulation of indoor propagation. The presented hybrid technique has therefore a rather broad field of applications in contrast to other hybrid methods. A critical point in the implementation of the hybrid method is the modeling of the sources for the ray tracing part. The sources used by these techniques are considered usually as point sources with a given directivity. Applying the Franz integral representation for the far fields, the field distribution over the boundary surface can be substituted by a single point source. This approach can improve the performance of the method dramatically [C2187]

"A hybrid FDTD-MoM procedure for the modeling of electromagnetic radiation from cavity-backed apertures"

Electromagnetic emission from a cabinet which encloses radiofrequency equipments, such as avionic transmitters and high speed digital computers, requires proper consideration during the system design task. At a frequency of hundreds of megahertz, apertures for air cooling, cable connectors and upgrades are not electrically small and act as possible sources of radiation outside the cabinet. A segmentation numerical method is presented for the computation of electromagnetic emission from apertures of size comparable with the wavelength. The procedure requires that the cavity interior, including any object, is modelled by the finite difference time domain, and that the moment method is used for the solution of the exterior problem. A reaction theorem approach allows the coupling of the two methods. The proposed procedure reduces the computational effort in comparison with a full FDTD solution and allows partial reuse of already computed electromagnetic data [C2188]

"Outdoor and indoor channel characterization by a 3D simulation software"

This paper presents a 3D simulation software of radiowave propagation for mobile systems in outdoor and indoor environments. The software allows us to predict the coverage zone of a base station and the behaviour of the transmission channel. After a brief recall of the radio channel characteristics for narrowband and wideband signals, the theoretical basis of our model and applications are described. Different results provided by our software are proposed: the evolution of the received power on a mobile route, the delay spread and the correlation bandwidth. To evaluate the capability of our software for the prediction of the previous parameters, measurements in outdoor and indoor environments are considered as a reference [C2189]

"Calibration of antenna factor in nonstandard environments"

In this paper, we consider the problem of calibrating antenna factor in an environment which is "nonstandard". The so called "nonstandard" environment does not satisfy certain standards, such as ANSI C63.5 which requires an environment having only direct path or slight multipath EM wave propagation between two or three well mounted to-be calibrated antennas. Instead of utilizing instruments measuring the steady state frequency response between antennas, we propose a time domain method to calibrate the antenna factors which is based on a signal parameter estimation algorithm, which is effective in an environment with unknown multipath propagation. The unknown multipath propagation between antennas need not be calibrated and compensated as long as the excess delay is sufficiently large [C2190]

"Spaceborne synthetic aperture radar raw data simulation of three dimensional natural terrain"

Spaceborne synthetic aperture radar (SAR) raw data simulation of a natural terrain is a very useful tool for interpretation of SAR images, optimization of SAR system design scenario and evaluation of interferometric processing algorithms, as well as testing the performance of SAR payload hardware via EGSE (electronic ground support equipment). A method for simulation spaceborne SAR raw data starting from digital elevation map (DEM) data of natural terrain is proposed, based on fractal theory, the facet model and clutter scattering statistic model, as well as the Earth model and orbit propagator. Digital elevation data of a natural terrain is used in computer simulation. The simulated raw data is processed by means of the chirp scaling algorithm. Special phenomena in spaceborne SAR images of natural terrain are reflected in the final images, such as shadowing, layover and foreshortening, as well as the dynamic range of the radar. It is illustrated that the method is suitable for verification and optimization of a spaceborne SAR system scenario [C2191]

"Dominant lateral waves of radio communication in layered anisotropic forest environment"

A four-layered forest geometry with two anisotropic slabs representing canopy and trunk is used for the investigation of wave characteristics in a forest environment. Propagation of radio waves is examined in which the transmitter is embedded inside the canopy layer, while the receiving point is located in the trunk layer. Dyadic Green's functions in their eigenfunction expansion forms for planarly layered anisotropic media are applied to analyze this problem. The analytical close forms of these electric fields are then obtained by using the saddle point techniques and branch cut integrations in the complex plane, and hence, expressed in terms of direct waves, multiple reflected waves, and lateral waves. Propagation mechanisms of these waves are studied and radio losses in a typical forest are calculated numerically. [C2192]

"Reinterpretation of the Michelson-Morley experiment based on the GPS Sagnac correction"

By examining the effects of rotational and orbital motions of the Earth on wave propagation in the Global Positioning System and a transpacific microwave link, it is pointed out that Earth's orbital motion has no influence on these Earthbound wave propagations, while Earth's rotation does contribute to the Sagnac effect.

As the propagation mechanism in the Michelson-Morley experiment cannot be different from that in the aforementioned ones, it is concluded that due to Earth's rotation, the shift in interference fringes in this famous experiment is not exactly zero. However, by virtue of the round-trip propagation path, this shift becomes second order and hence is too small to observe within the present accuracy. [C2193]

"A modified model for multi-paths distribution under mobile environment"

In mobile communication systems, objects which can reflect and scatter radio waves exist between transmitter and receiver. The relative position of these objects varies with the random movement of transmitter and receiver, making the radio waves reach the receiver via different paths. The extent of fading and distortion of the reception signals depends on the actual path distribution of the radiowave propagation. The author presents a Poisson distribution function of paths by use of two stochastic processes. The first process, which is a Poisson process, describes the paths occurring, and the second one, which is an exponential process, describes the paths standing. However, a notable error exists between the Poisson and the measurement results. The author also provides a modified Poisson model which is more consistent with the measurement model [C2194]

"Experimental study of attenuation due to rain for an LMCS link at 29 GHz"

The Communications Research Centre (CRC) Canada conducted a preliminary evaluation of an experimental 29 GHz LMCS point-to-point lint: in the fall of 1999. The objective was to evaluate the performance of an LMCS transmission system over time under various rainfall conditions and to compare the results with two prediction models. Specifically, the following parameters. have been monitored for two months during the fall of 1999: The received signal power; The radiowave attenuation due to rain (computed from the above signal power); The corresponding rain rate in mm/hour at three different locations along the path. The 2.88 km line-of-sight link was set up at Shirleys Bay, in the West End of Ottawa. Horizontal polarization was used. The most severe rain fade recorded during this measurement campaign was 49 dB, during the storm of November 2, 1999. However. most rain fades did not exceed 20 dB. Comparisons with predictions from empirical and theoretical models relating attenuation to rainfall rate based on the analysis of single events show a good agreement if we average readings from the three rain gauges, ie, using a path averaged rainfall rate [C2195]

"The influence of the lower atmospheric refraction on measurements of down-looking radar"

According to the Snell refraction law of spherically stratified atmosphere, a radar with down-looking mode is different from one working with an up-looking mode. A down-looking radar is limited by the critical depression angle, which is related to the radar height and profile of the atmospheric refraction index. The difference between measurements of the down-looking radar and up-looking ones is analyzed statistically by using some measured profiles of the atmospheric refraction index [C2196]

"2001 International Conferences on Info-Tech and Info-Net. Proceedings (Cat. No.01EX479)"

The following topics are dealt with: digital Earth; remote sensing for geology, water resources, agriculture and land; SAR technology; GIS technology; data and image processing; telecommunication traffic control and engineering; network operation and management; high speed switching and routing; 3G and beyond; advanced optical communications; broadband access networks; MAC and scheduling issues; resource management and QoS control; multicasting; smart antennas and propagation; modeling and performance of communication networks; mobile communication systems; signal processing in communication systems; modulation and coding; intelligent networks; information retrieval; data mining; network computing; agent technology; neural networks; computer vision; self-organization maps and intelligent systems; multi-agent systems and hybrid controls; intelligent transport systems; fuzzy systems; intelligent control systems; variable control systems and robust control; blind separation and object identification; intelligent automation in Internet environment; nonlinear control systems; evolutionary computation; robot control systems; fuzzy control; information security and network security; Web technology; information network management, architecture and protocols; Internet engineering and applications; computer supported cooperative working; wireless computing networks; e-commerce; network-based learning and education; intranets and enterprises automation [C2197]

"Ray-tracing and UTD analyses for microcellular communications in urban scene: a software methodology that uses 3-D GIS data of buildings"

Prediction methods of electromagnetic propagation in urban areas are now more accurate because calculators are more powerful and especially environmental data have better quality and a greater trade. Several methods, both empirical and more deterministic algorithms, have been proposed in scientific literature. Deterministic computation uses detailed geometrical data of buildings or of generic obstacles and assures better predictions within microcell areas. Many deterministic methods have been proposed, e.g: vertical-plane-launch (VPL),

vertical-plane/slant-plane (SP/VP), etc. We introduce our method, based on vertical-plane-launch, that includes a different approximation for multiple diffraction at horizontal edges. Our algorithm uses terrain altitude data to take into account reflections from terrain. We have dedicated special care to final conversion of the data structures. In order to decrease the calculation time of the simulations we have added a three-dimensional (3-D) extension of circular representation (CR) proposed by Lee. We show simulation results of multipath propagation in urban areas. In particular we examine the special case of a transmitting antenna located on the rooftop of a building inside the centre of Rome. Regarding these tests we use 3-D building data, elaborated by using a data-base of Rome municipality ownership. Finally, the software architecture of our GIS platform TERRAPACKLt;is described [C2198]

"Connectivity analysis for a tactical radio network"

Ad hoc networking requires that links between individual radios be maintained in the face of multiple-access interference, mobility, fading, and terrain variation. Much research has been devoted to developing protocols for establishing links and maintaining routing information in an ad hoc network. In particular, clustering algorithms may be used to form a network. An additional problem is to guarantee that enough links are present to provide connectivity to every node in the network. We address this problem by studying the network topology that results when a clustering algorithm is applied to particular scenarios. We apply terrain and propagation models to a geographic distribution of radios to determine the propagation losses between all pairs of radios. This, in turn, establishes a set of network links for given power thresholds. The clustering algorithm then determines the network's topology. Our results show the effects of frequency-band selection and antenna heights on the network's connectivity. We draw conclusions about the processing and coding gains required to establish full connectivity in different scenarios. These conclusions may be used to evaluate the suitability of commercial DS-CDMA waveforms for battlefield communications. [C2199]

"Correlation properties of MIMO radio channels for indoor scenarios"

Multiple input- multiple output (MIMO) systems have the potential to achieve very high capacities, depending on the propagation environment. Capacity increases as signal correlation decreases. We present the measurements of a MIMO system under strong and weak line-of-sight conditions. The system capacity decreases as the separation from the transmitter increases; indeed the transmitter correlation increases as the separation increases. The receiver correlation is lower than the transmitter correlation under both propagation conditions. Also, there lies a benefit in using vertically polarized, vertically separated antennas [C2200]

"Satellite systems performance with TCP-IP applications"

Mobile access to the Internet is becoming extremely popular because users depend on the Internet for many activities in their daily routine. Satellites are well suited for mobile Internet applications because of their ability to enhance coverage and support long-range mobility. Satellites are an attractive alternative for mobile (pedestrian and, more importantly, vehicular) access to the Internet in sparsely populated areas where high bandwidth UMTS cells cannot be economically deployed or in regions where deployment of terrestrial facilities remains impractical. In this paper, we analyze various mobile Internet applications for both GEO and LEO satellite configurations (Iridium-like and Globalstar-like) using an enhanced version of 'ns2' (Network Simulator 2). As part of enhancing ns2, we developed a channel propagation model that includes shadowing from surrounding building skylines. The model incorporates actual data measurements collected in a built-up area. We compute via simulations the performance of FTP applications as perceived by mobile users traveling along "urban canyons" in LEO and GEO configurations. The results show that throughput and delay performance is strongly affected by skyline shadowing and that shadowing degradation can be compensated by satellite diversity, such as provided by Globalstar. For all the experiments, we compared the performance of different TCP schemes (Reno, SACK, Westwood). [C2201]

"Analysis of indoor radio propagation and wideband digital transmission characteristics based on the equivalent transmission-path model with ray tracing"

A very simple but general scheme for calculating irreducible bit error rate (BER) (namely, BER floor) due to inter-symbol interference (ISI) in frequency-selective Nakagami-Rice fading environments has been developed. The scheme, to which we call the equivalent transmission path model (ETP model), plays a role in connecting wave propagation with digital transmission characteristics in a general manner. By reconfiguring our papers on the ETP model presented so far, self-consistent calculation formula for BER due to ISI is presented. Finally, application of the model to indoor propagation environment is demonstrated. [C2202]

"Chaotic characteristics of radar scattering from ground and sea"

Along with the development of nonlinear science, the chaotic dynamics of radar scattering are being paid more attention. The data of ground-based and airborne radar are analyzed with the chaos theory. The correlation dimension and Lyapunov exponent are calculated from space reconstruction, the chaotic characteristics for many types of scattering are revealed. It shows that radar scattering is produced by nonlinear chaotic systems with four to seven freedoms and the invariant of chaos are concerned with sea wave, terrain and relative movement between the airborne radar and the terrain or sea. [C2203]

"Joint frequency hopping and adaptive spectrum exploitation"

Frequency hopping (FH) and adaptive spectrum exploitation (ASE) complement each other to achieve spectrum efficiency and high performance in a wireless battlefield environment. While the research to date has mostly pursued these two areas separately, this paper addresses the various factors associated with the integration of the two technologies. These factors include US and international frequency allocations, signal propagation, real time signal environment data measurements, and robust control channels for a new hopset distribution. Our main focus is placed on the central issue of the need and a design concept for a robust control channel. Alternatives for a robust control channel are investigated. An example design considering incorporation of an M-ary frequency and amplitude modulation (mFAM) with ASE is provided. This research demonstrates the practicality of integrating FH systems and the ASE. [C2204]

"2001 MILCOM Proceedings Communications for Network-Centric Operations: Creating the Information Force (Cat. No.01CH37277)"

First Page of the Article [C2205]

"Refractivity-from-clutter using global environmental parameters"

This paper examines the sensitivity of radar clutter returns to variations in parameters used to describe the refractive environment that is associated with surface-based ducts. This supports determining efficient parameters so as to minimize the search space required in the inverse problem of inferring the refractivity environment from observations of radar sea clutter. First, the sensitivity of replica fields to variations in range-independent parameters are considered. Next, variations in the parameters with range are modeled as a Markov processes. It is seen that either source of variation could explain variations in radar clutter observations obtained during a surface-based ducting event with the 3.0 GHz Space Range Radar (SPANDAR) at Wallops Island, VA. We then use the Simulated Annealing/Genetic Algorithm (SAGA) general purpose inversion code to infer refractivity parameters from observed clutter. SAGA is configured to use an embedded parabolic equation electromagnetic propagation model, a four-parameter model for atmospheric refractivity, and a linear least-squares objective function. The mismatch between (a) the optimal replica field and the observed clutter and (b) the inferred refractivity profile and the range-dependent refractivity structure obtained by in situ measurements, is discussed [C2206]

"Performance of a wireless local loop system based on SDMA for different propagation conditions"

The propagation conditions in a wireless local loop (WLL) system have been an interesting topic of study for the research community. The present paper assesses the impact on interference levels in a WLL network employing the promising multiple access technique SDMA and the issues related to the call set-up process. The study is carried out via simulations. Different propagation conditions are explored and the results are analysed [C2207]

"Prediction of fast fading mobile radio channels in wideband communication systems"

The fast fading mobile radio channels place fundamental limitations on the performance of wireless communication systems, such that the prediction of the changing channel behaviors is of interest. For the frequency-selective fading channels in wideband systems, the knowledge of the channel transfer function over the entire frequency band is required. We propose an ESPRIT-type algorithm to model and further predict the wideband time-varying channel at different frequencies jointly, assuming that the scatterers remain constant. Simulation results show that the joint-frequency prediction scheme has superior performance over conducting the channel prediction on a single frequency [C2208]

"Mobile telephony RF mapping using fuzzy-CMAC neural networks"

In this work, an engineering solution to a very common problem in mobile telephony is proposed using the artificial neural networks theory. The radio frequency (RF) level mapping problem is described and some considerations about its solution are taken. The structures and operation details of CMAC and fuzzy-CMAC neural networks are also discussed and a solution to the above problem is derived. The steps needed to reach

accurate and reliable results are depicted. Results obtained with real field data acquired by Telemig Cellular Company from Brazil are shown and a final analysis is made considering the performance achieved with the described approach. Finally, some improvements to the presented solution are proposed, as suggestions to continuing the current research [C2209]

"OH and UG fault indication via radio networks"

Fault indication on electrical distribution circuits using today's communication technology options can provide secure, near instantaneous feedback to utility operating personnel, allowing them to make intelligent switching decisions resulting in reduction of outage time and increased power delivery quality. The application of fault indicator technology to terrestrial radio wave propagation is spawning a new generation of interest in fault indicator products and their capabilities [C2210]

"Adaptive handoff method using location information"

This paper presents an inter-cell (hard) handoff algorithm that calculates adaptive handoff hysteresis values based on mobile location information and cell RF propagation statistics. The analysis is focused on the probability of handoff and the probability of dropped calls in the system. Simulation results show that the probability of unnecessary handoff is reduced using the adaptive handoff algorithm with only a minor increase in the dropped-call probability. This improvement is significant if the propagation signal varies rapidly in the cell [C2211]

"Cable-less measurement set-up for wireless handheld terminals"

Attaching cables to mobile terminals for accurate measurements is progressively influencing the radiation characteristics with the diminishing size of the terminals. Simulations show the large influence of cables and their exact curvature on the radiation properties of mobile terminals that are small with respect to the wavelength. These results are confirmed by measurements in an anechoic chamber. As corrections for these almost irreproducible influences are hardly feasible, we propose to omit conducting cables completely. Instead, optical fibres are used for transparent transport of the RF signals. Off-the-shelf system components allow for two channels in a box of size comparable to modern small terminals. When driven at an appropriate level this set-up shows ample dynamic range for mobile radio channel sounding [C2212]

"Coded beamforming for block fading vector channel"

Most recent studies of transmit diversity and space-time coding have focused on random channels which feature rich scattering around both transmitters and receivers. In this paper, we consider a highly structured vector channel in a block fading scenario. Specular propagation and local scattering are assumed at the base-station and mobile station respectively. The channel knowledge required for the transmit design includes: a subspace formed by direction vectors of specular propagation and length of the fading coherent interval. The relatively stationary subspace information reflecting the spatial power spectral distribution is exploited to derive a code design criterion. The optimal design turns out to be a joint coding and beamforming scheme and resistance to fading within the subspace is provided by such code [C2213]

"Forward link capacity losses for soft and softer handoff in cellular systems"

In CDMA cellular systems, all radio channels use the same frequency band, and the same radio channel can be reused in all neighboring cells. On the forward link there are at least two base stations involved in the soft handoff process, where each base station supports a forward link channel to the mobile, this produce capacity gain by macrodiversity and produce capacity loss due to the use of extra channels. In this paper the losses of soft and softer handoff on the forward-link capacity for unsectorized and sectorized cells due to the use of at least two BSs in the handoff process are evaluated analytically. We follow two approaches, the deterministic approach and the random approach (considering shadowing) and we take into account the IS-95 standard. We obtain that the capacity loss is approximately from 13% to 25% depending of propagation parameters values and handoff threshold [C2214]

"Stochastic modelling of atmospheric effects in SAR differential interferometry"

A stochastic model for the atmospheric disturbance in DInSAR images is presented. Using a ray-propagation approach, the random path between two points in a turbulent atmosphere is modeled as a three dimensional random walk. First and second-order probability density functions of the differential phase of the atmospheric disturbance are derived and the model is experimentally validated by comparison between the characteristic function of real data and that predicted from the theoretical model [C2215]

"Adaptive compensation of Mars ionosphere dispersion in the MARSIS experiment"

MARSIS (Mars Advanced Radar for Subsurface Ionosphere Sounding), selected as scientific payload of the ESA mission Mars Express, is a low-frequency nadir-looking pulse limited radar sounder and altimeter with ground penetration capabilities, which uses synthetic aperture techniques and a secondary receiving antenna to isolate subsurface reflections. In order to maximize the penetration capabilities of the transmitted pulse MARSIS must operate at a frequency as low as possible (few MHz). Moreover the requirement for fine range resolution calls for a relatively large transmitted bandwidth (1 MHz) so that MARSIS will operate with a very high fractional bandwidth and very dose to the expected Martian ionosphere plasm frequency. This will result in a generally large phase distortion across the spectrum of the received pulses (due to either the antenna frequency response or the propagation through the ionosphere) which will cause severe degradation of the matched filter performance in term of SNR, pulse spreading and sidelobe level. This paper deals with the definition and implementation of an adaptive range compression algorithm, which makes use of the contrast maximization technique to estimate the phase dispersion spectrum, in order to perform a matched filtering of radar sounder echoes in the presence of phase distortions across the signal bandwidth [C2216]

"Reconstruction parameters of underground objects based on FDTD and optimization method"

The inverse of the parameters of underground targets is still highly in expectation in ground penetrating radar (GPR) applications. In this paper, the FDTD method and time-domain optimization algorithm have been used to reconstruct the permittivities of underground multiple targets. An iterative optimization algorithm has been put forward. The forward scattering data are also calculated by a 2.5 D-FDTD algorithm in order to better simulate the practical GPR situation. The relationship between the convergent rates of the inverse algorithm and the initialization values are studied [C2217]

"Instantaneous parameters calculation and analysis of impulse ground penetrating radar (GPR) data"

We use the wavelet transform (WT) method to analyse impulse GPR signals received from anti-personnel (AP) plastic mines. The mine radar echoes examined in this work are characterized by an average low amplitude and low signal-to-noise ratio (SNR). We focus on the use of WT to extract such weak transients from the noisy background. In particular, we calculate the instantaneous parameters of the radar signals by means of the WT. Instantaneous wavelet power and energy spectra allow enhanced identification of plastic mines echoes in low SNR. We further propose a novel non-linear transform method to process the results after WT in order to increase the energy difference between the mine signal and the clutter [C2218]

"Two-dimensional rain mapping using transmissions from geostationary satellites"

This paper proposes a rain mapping method using a computerized tomography (CT) technique. Since satellite transmissions at Ku-band frequency suffer from attenuation due to intervening rain. The propagation data along several paths toward satellites geostationed at different longitudes are analyzed to reconstruct the two-dimensional rain distribution by a CT technique. A brief description is given on the approach and the results of simple numerical tests are described to show the feasibility of the proposed method [C2219]

"Model-based estimation of forest canopy parameters using polarimetric and interferometric SAR"

Synthetic aperture radar (SAR), interferometric SAR (INSAR),and polarimetric INSAR (POLINSAR) have been shown to be sensitive to various biophysical forest canopy parameters. The two general classes of models employed in parameter extraction are random-media and structure-based. Since the quality of canopy parameter retrieval depends on the attributes of the forward-scattering models that are inverted, we review the general characteristics of each type of model. The random-media models invoke simplifying assumptions, such as independent scattering statistics, to yield analytical expressions. Some of the central assumptions, however, do-not hold as resolution increases. Structure-based models can be used in these high-resolution scenarios. We are developing a new structure-based wideband SAR/INSAR/POLINSAR model to explore the effects of increasing resolution on POLINSAR observables. A simple example of a structure-based SAR simulator is presented [C2220]

"Effect of tropospheric range delay corrections on differential SAR interferograms"

The tropospheric range delay is estimated from meteorological data or GPS data, and then is used to correct JERS-1 SAR differential interferograms. Topography of the concerned area is considered in mapping the delay [C2221]

"Localization of target tracking and navigation by correcting atmospheric effects"

For any type of target tracking and navigation, the localization is critical for tracking/navigation missions. The real-time localization error correction for the atmospheric refraction can be achieved through the ray bending compensation by the refractivity profiles or ray-tracing. Ray-tracing can be computed through the real-time weather data (surface temperature, pressure, and relative humidity or dewpoint) from daily/hourly, local meteorology, or global climatology data. Operational results of this new technique Indicate that the time difference of arrival (TDOA) of radio-waves vary dynamically in hours, days, months, seasons and geographically. Errors for the low elevation angles less than 10 degrees are much higher than expected for higher frequencies above 300 MHz, and it should be calibrated or corrected in tactical operation and strategic system implementation. The localization of tracking and navigation mission can be achieved within a couple of hundred meters if the integrity of measured tactical data is well within the confidence boundary [C2222]

"Digital signal processing challenges in MIMO wireless communications"

Summary form only given. The requirements on data rate and quality of service of future wireless communications systems call for new digital signal processing techniques to increase spectrum efficiency and improve link reliability. Deploying multiple antennas at both transmitter and receiver of a wireless link (MIMO technology) has the potential to achieve these ambitious goals. MIMO techniques are starting to find their way into standards, such as UMTS and IEEE 802.16. This article gives an overview of MIMO wireless covering issues such as propagation models, broadband transceivers, signaling techniques and coding and modulation. Special emphasis is put on the digital signal processing aspects [C2223]

"Modern aspects of ionospheric propagation research"

Ionospheric propagation research has seen substantial progress through (a) large capacity digital data storage, computing facilities and methods, (b) new satellite systems and receivers onboard satellites providing novel data sources. This paper concentrates on the possibilities gained with ionosphere tomography and satellite to satellite radio links. The improved information about the state of the ionosphere and the progress in ionospheric modelling brings advantages in all fields of application for radio wave propagation affected by the ionosphere, from classical to modern HF applications to applications of transionospheric propagation with signal frequencies from VHF to L band and higher [C2224]

"Calculation of interference levels due to rain scatter on high-altitude platform links"

The possibility of using high-altitude platforms (HAPs) in telecommunications, traffic monitoring and environmental remote sensing has attracted a lot of interest. The main reasons for this are the low implementation and deployment costs and attractive propagation characteristics of HAPs. Compared to satellites, HAPs are highly advantageous in terms of free space path loss, time delay, and ease and cost of deployment. HeliNet is a project supported by the European Union, involving several industrial and academic partners, including the University of York, with the aim of examining the feasibility of an airborne platform to support telecommunications, traffic monitoring and remote sensing applications. The main responsibility of the University of York is to assess the potential of HAPs to support broadband telecommunication services. This study explores degradation due to interference from rain scattering, which may be much worse than in LEO satellite systems in which the cells are up to 10 times larger. This is because, for a cell diameter d, in general the carrier power has a d-2dependence while the power received by the scattering process has a d-4dependence. The implications of this interference in system design are discussed [C2225]

"A new formulation for rain scatter interference"

Fundamental to frequency management and spectrum efficiency is the need to share the available radio spectrum among a number of services in such a way that maximum exploitation and minimum interference are achieved simultaneously. One of the most widespread applications in which spectrum is shared between two services is that of terrestrial and satellite-based radio communications systems, where it is of primary importance to protect sensitive earth station receivers operating to satellites in the geostationary orbit from harmful interference from terrestrial transmitters using the same frequency bands. A new model for the path loss in rain scatter has been developed in which the earth station elevation angle is now an input parameter, in order to derive more reliable and more widely applicable estimates of rain scatter interference. This paper describes the rain scatter process and the development of the new formulation, together with comparisons between the resulting predictions of path loss with those derived from the existing model. Comparisons are also given between the new model and the predicted path losses and experimental measurements of rain scatter interference obtained within the COST 210 project, which considered the influence of the atmosphere on

interference between radio communications systems at frequencies above 1 GHz, and led to the rain scatter model in Recommendation P.452-9 [C2226]

"Measurement of the tropospheric scintillation decorrelation scale-length at millimetre wave frequencies"

Millimetre wave propagation for both terrestrial and satellite communications is highly dependent on the dynamic nature of the atmospheric boundary layer. Small-scale changes in temperature, pressure and humidity may result in the formation of turbulence. Turbulence can affect radiowave propagation by either scattering a small part of the signal's energy outside of the incident beam or by focusing and defocusing energy within the beam. In the former case, this redirected energy may be used to provide communications on over-the-horizon paths (typically at frequencies up to 5 GHz), or may indeed result in interference with other systems. In the latter case, turbulence may result in rapid amplitude fluctuations in signal strength scintillation. Systems that employ power control algorithms may be adversely affected by the rapid fluctuation of a scintillation event. Therefore, as the characteristics of the channel will ultimately determine the data throughput, a technique to mitigate scintillation could prove to be very useful. One such mitigation technique that could be used is spatial diversity. To achieve the diversity advantage requires the spatial coherence of events. This paper therefore investigates the spatial coherency of scintillation to determine the suitability of small-scale spatial diversity as a mitigation technique [C2227]

"Degradation in neural network prediction models of f0 F2 with time"

Ionospheric forecasting services fall short of the precision required for many practical applications. In-service models of ionospheric parameters often fail to offer much of an increase in performance over simple persistence or recurrence. In particular, predictions of storm events and disturbances are very poor. This performance shortfall can be attributed to several causes one of which is an inability to adequately model solar-magnetospheric-ionospheric physics. To circumvent this knowledge gap some authors have adopted knowledge independent (time-series) modelling techniques that can utilise typical ionospheric data sets. A number of experimental and theoretical studies have demonstrated the importance of non-linear behaviour within the solar-terrestrial environment. Attention has also turned to time series predictive methods derived from studies into artificial intelligence (AI) and the application of neural network (NN) based techniques to geophysical prediction problems. Francis et al. (2000) undertook a study of neural networks for the prediction of the ionospheric parameter f0F2 based on the use of historical data from the 1970s. The resultant model for the one hour ahead prediction of this parameter had an RMS error of only ~0.4 MHz. A version of this model, but re-optimised, was incorporated in the Ionospheric Forecasting Demonstrator (IFD). However, it soon became clear that the predictive capability of the IFD was degrading with time. This paper reports on our studies to understand the reasons for this degradation and to improve the model [C2228]

"Analytical study of radiowave absorption by the brain and the eyes in an eccentric spheres model of the human head"

Biological effects of radio-frequency and microwave radiation draw strong interest nowadays. Special attention is paid to the absorption of electromagnetic (EM) radiation by the human head because of the widespread use of handheld transceivers for wireless communications. Although numerical techniques can deal with more complex geometries, analytical solutions are indispensable as benchmarks. So far the most complex head model that has been used by analytical techniques is the layered eccentric spheres model of Skaropoulos et al. (1996), which comprises a stratified spherical brain tissue core eccentrically placed within a stratified spherical skull. Eccentric spheres models have also been used within the framework of EEG and MEG research. The head model used herein consists of a stratified spherical skull and three layered spherical inhomogeneities representing the brain and the eyes. The absorption of EM radiation as well as the distribution of the specific absorption rate (SAR) are calculated by use of the indirect mode matching technique (IMM). Excitation is provided either by a plane EM-wave or by an electric dipole, placed near the head. Interest is focused on frequencies used by cellular phones [C2229]

"Spectral characteristics of propagation impairments on experimental Earth-space links at Ka and V bands"

Due to the increasing demand for multimedia services which require large bandwidth, and due to the saturation of low frequency bands such as L, S, C bands, as well as Ku band, satellite telecommunication systems are migrating to higher frequency bands such as Ka band (20/30 GHz) and V band (40/50 GHz). In such high frequency bands, the presence of the atmosphere strongly affects radiowave propagation and attenuation effects become so severe that system availability would not be sufficient if systems were designed in a conventional

way with a static propagation margin. Thus new concepts known as fade mitigation techniques (such as up-link power control, adaptive coding or modulation, diversity techniques) have to be implemented into the system in order to be able to compensate in real time propagation effects that could cause link outage. The objective of this study is to perform a spectral analysis of the Ka and V band propagation channel for channel modelling and fade mitigation techniques implementation. To reach this objective two months of Olympus and Italsat data were processed [C2230]

"Source separation with collocated antennas: application to digital communications in HF"

This article shows how an array of collocated antennas, deprived of space diversity, can be successfully used to separate interfering signals and improve digital communications in HF [C2231]

"Base station antenna design optimisation based on UTD ray-tracing models utilising radio site topographical data"

In cellular communications, requirements for increased system capacity, improved coverage, better quality and reduced transmitted power, coupled with the need to rationalise cellular system planning have prompted a considerable interest in the development of valid and efficient radiowave propagation models. This work utilises advances that improve the accuracy and efficiency of ray tracing models, using a three-dimensional representation of the terrain and urban topographies, in conjunction with adaptive and selective ray tracing. These improvements allow utilisation of the field computation algorithm in the design and radio coverage planning processes. They include optimum automated selection of base station locations and phased array excitation. A reliable ray tracing scheme can be directly utilised in the optimum beamforming of base station antenna systems by interfacing field computations with design aims. Part of the cellular planning process involves determination of the antenna array position and beam shape or, equivalently, the excitation coefficients, for a desired power distribution over a defined area [C2232]

"Vehicle telematics: the challenges for antennas and propagation"

The drive to place more wireless based systems within vehicles is fuelled by the enhanced vehicle functionality achieved but tempered by the need to preserve body styling and maintain low costs. The challenges thrown up by these new systems for antennas and propagation are discussed [C2233]

"Macro cell measurements with the Nokia WCDMA experimental system"

Macro cell measurement with Nokia WCDMA experimental system were conducted in semi-urban surroundings in Espoo, Finland. The main interest of the measurement campaign described in this paper was to investigate the gain of using different antenna configurations (both with and without Rx diversity) at the base station (BS), while keeping the mobile station (MS) antenna orientation fixed (vertical, no diversity). Two main measurement routes were selected, with clearly different propagation environments. The results show that depending on the propagation environment, the antenna diversity varies roughly between 3 to 4.5 dB, while the polarization diversity cases are more difficult to interpret in such a measurement campaign where the MS end antenna is fixed at vertical. However, the results suggest that the relation of the received and transmitted polarization should also be accounted for when selecting antenna configurations for the BS [C2234]

"Antennas for sounding of a cometary nucleus in the Rosetta mission"

CONSERT (COmet Nucleus Sounding Experiment by Radiowave Transmission) is a 90-MHz radio wave experiment in the Rosetta mission to be launched by ESA in 2003. It is designed to sound the interior of a comet to determine spatial structures and the electrical properties of the cometary material [C2235]

"Upper- and lower-bound evaluations in microwave urban LOS propagation"

To model the path-loss characteristics in microwave urban line-of-sight (LOS) propagation, we performed measurements at frequencies of 3.35, 8.45, and 15.75 GHz in metropolitan Tokyo. The actual breakpoint distance was shorter than the theoretical one because of the influence of vehicles, pedestrians, and other objects on the road. This effect can be characterized by the effective road height. We also found that the breakpoint disappeared when the receiving antenna height approached the effective road height. Based on these breakpoint characteristics, we propose new upper- and lower-bound formulas for LOS path losses in urban environments [C2236]

"Simple asynchronous multiple access (SAMA) for ad hoc wireless networks in unlicensed bands"

Effective spectrum sharing between non-interoperable radio devices as well as collocated but non-communicating radio networks is an important goal for the designers of RF spectrum. Apart from the traditional approach of selecting separate channels for distinct systems, there are methods such as spread spectrum, scheduling of transmissions in non-overlapping intervals to reduce collisions and also spatial diversity to reduce the effects of interference. The last two are the most promising methods to use to achieve multi-megabit data rates and high traffic densities. The listen-before-transmit (LBT) etiquette has been used with limited success in the past in decentralized RF environments to enable non-interoperable systems to share spectrum. We introduce the simple asynchronous multiple access (SAMA) scheme that combines some of the known channel access techniques in a novel way to achieve an implicit reservation effect that allows high throughput with modest overhead and low complexity without demanding interoperability or even explicit communications between the collocated systems. We analyze the throughput and spatial performance of SAMA. The analysis is based on the radio propagation law and the geometry of the users and antennas in the plane. It is aimed at establishing the fundamental performance bounds dictated by our basic assumptions. We cover the omni-directional antenna case and give preliminary results for the directional antenna [C2237]

"Parabolic equation method for electromagnetic guiding structures"

In order to demonstrate the versatility and computational efficiency of the numerical parabolic wave equation (PE) approach, we present a number of examples from different branches of applied electromagnetics: UHF radiowave propagation over irregular terrain, full-wave 3D simulation of VHF radio communication in a curved tunnel, optical propagation in a rough dielectric slab, and wave fields in tapered waveguides. An important application of the PE techniques has been found in numerical modeling of the imaging performance of X-ray Fresnel microlenses (zone plates) [C2238]

"A Markov chain and quadrature amplitude modulation fading based statistical discrete time model for multi-WSSUS multipath channel"

The computation of the tap gains of the discrete time representation of a slowly time varying multipath channel is investigated. The simplest nondegenerate class of processes which exhibits uncorrelated depressiveness in the time delay and Doppler shifts is known as the “wide sense stationary uncorrelated scattering”, (WSSUS) model introduced by Bello (1963). The channel is assumed to be locally WSSUS. Our model presence the quadrature modulation fading simulators (MMFS) form. Assumptions on the multiplicative noise are made to follow Clarke's (1968) model for flat fading. An extension to multipath is provided by utilizing several fading simulators in conjunction with variable gains and time delays. The multipath extended Clarke's model resembles QMFS. However, the multiplicative coefficients are claimed to be Rayleigh distributed (extension to Ricean is easily deduced). The result is a closed form solution for tap gains, this was possible by the use of operator commuting with an error bound of 6fDT2. An extension to large area analysis where WSSUS assumption cannot be in force is made possible through the use of a Markov chain. Finally, further comments and figure results are displayed [C2239]

"CDMA forward link performance evaluation using propagation measurements"

Many IS-95 CDMA networks currently deployed in the field are forward link capacity limited. The introduction of IS-2000 is intended to improve forward link performance and increase system capacity. However, the performance improvement provided by IS-2000 will vary with propagation environment. A technique for collecting forward channel impulse response measurements using IS-95 pilot signals is presented. This technique is used to characterize the forward channel in residential and urban regions in Calgary, Canada. The propagation data is then processed in a simulation in order to generate a comparison of IS-95 and IS-2000 performance that is specific to these environments. The results illustrate how the propagation environment can affect the performance improvement provided by IS-2000 [C2240]

"A 3D spatio-temporal simulation model for wireless channels"

A three dimensional model is proposed for simulating the wireless channel. The model allows simulation of the effects of realistic channels on space-time processing and coding systems. The model is characterized by a set of scattering centers with a given mean angle of arrival (departure), angle spread (azimuth and elevation) and propagation delay. Additionally the model accommodates either transmitter or receiver motion. Several examples are considered and the simulation characteristics match the previously obtained analytical model results [C2241]

"An asymptotic analysis of BLAST-like systems"

A random matrix model is introduced that probabilistically describes the multi-path propagation between a transmitting and receiving antenna array with a limited number of scatterers for indoor environments. The model

allows to analytically calculate signal-to-interference and noise ratios and channel capacities for communication systems that apply, similar to the BLAST (Foschini 1996) proposal, antenna arrays at both ends of the wireless link to boost spectral efficiency [C2242]

"Estimating position of mobile terminals from delay measurements with survey data"

An accurate method to locate mobile terminals is to measure the radio propagation time from the base stations to the mobile terminal. From these measurements, the distance from the base stations to the mobile terminal are estimated and an estimate of the location for the mobile terminal can be calculated. This method is highly accurate when the shortest distance propagation paths between the mobile terminal and base stations are not blocked. Unfortunately, when these paths are blocked the propagation delays are non-linear functions of the mobile terminal location and the accuracy of the standard location solution is reduced. This paper demonstrates how the conditional density of the location given measured propagation delays can be approximated as a sum of kernel density functions based on data collected during propagation surveys. These approximate density functions allow an accurate location estimate for the mobile terminal to be calculated from propagation delay measurements even with obstructed radio propagation [C2243]

"Measurement and identification of mobile radio propagation channels"

MIMO vector radio channel sounding devices allow multidimensional analysis of wave propagation in mobile radio channels. 6-dimensions represent Doppler, TDOA, 2D DOD and 2D DOA. Antenna array architectures, calibration and K-D unitary ESPRIT parameter estimation are discussed. Parametric channel models can be derived from the estimated data [C2244]

"Tomographic imaging of a ground surface using radio ground waves"

In this paper, the theory of ground wave propagation is applied to the imaging of ground surfaces. The image of a surface is obtained by finding the distribution of surface impedance on the surface from the measured scattered field. A solution is obtained in an iterative manner using the error minimisation technique and steepest decent search method. Numerical simulation results obtained using the technique for the imaging of a wet surface with icy patches, and a forest covered surface with a hidden object are presented. The effect of noise on the image reconstruction is also simulated. It is shown that the images of the ground surface can be well reconstructed using the technique [C2245]

"High temporal-resolution channel characteristics at 40 GHz from a 30 km slant path radiowave propagation experiment"

Propagation at millimetric frequencies (30-300 GHz) is highly dependent on tropospheric phenomena such as rain, clouds, fog, water vapour and atmospheric gases, all of which combine to cause signal absorption, dispersion and scattering. The need to accurately characterise the signal propagation channel in both time and frequency is essential not only for cost effective system design, but also to minimise interference and optimise globally deployable mobile links. Although models exist to predict (e,g, MAPEL, ITU) the long term attenuating characteristics of the tropospheric channel due to clouds, rain, water vapour and atmospheric there is limited information regarding characteristics of the channel. For example, MAPEL may predict a 1% (~7 hours) monthly signal-outage in June at a signal to noise threshold of 15 dB. To optimise and evaluate key system elements such as AGC loops, mobile antenna tracking loops, adaptive data-rate schemes, etc., it is important to know if the predicted 7 hour outage is distributed. For example, does it occur in a few long (e.g. 1 hour) periods, or in small (<1 min) segments; how long before such an event occurs again ? To obtain high (<l s) temporal-resolution channel data, a slant path experiment was designed to represent a short range air-ground link. Although the complete trial data-set comprises 28 days of data, this paper only presents an analysis of a small sub-set in order to provide illustrative channel characteristics [C2246]

"Simulation of indoor UHF propagation using numerical technique"

Indoor wireless communication system performance predictions are still difficult to make because of the difficulty associated with a full understanding of how radio waves behave in complicated channels. Several techniques are available to simulate the indoor propagation channel, such as statistical methods or ray tracing methods, they are inspired from their application to characterize mobile radio channels. Nowadays, with the advent of supercomputers, various numerical methods emerged as powerful tools for studying practical indoor propagation problems. This paper reports on a deterministic model developed on the basis of the finite-difference time-domain (FDTD) technique, using the equivalence principle to simulate the base station antenna radiation pattern. The proposed method is validated in a complex room for an indoor radio channel operating at the UHF band,

and provides interesting prediction results [C2247]

"Performance prediction of smart antennas in micro- and pico-cellular propagation environments"

A new expression for SINR for systems using antenna arrays and adaptive beamforming at the base station of cellular systems has been derived. The common assumption of grouping multipaths arriving in the same bin to a single path has been relaxed in this work. In fact, we have treated sub-paths separately. Our results confirm that even in the presence of noncoherent multipath, an improvement proportional to the number of antenna elements is achievable, but it strongly depends on the distribution of the users and scatterers in the medium. Simulation results from our site-specific radiowave propagation model are presented which show that for micro- and pico-cellular environments multipath in the same bin may not be correlated as they have widely separated DOA's [C2248]

"Concurrent storm damage data collection by high altitude airborne IFSAR"

This paper discusses the use of high altitude airborne interferometric synthetic aperture radar (IFSAR) operations for concurrent severe storm damage data collection. The primary storm damage observable is changes in surface topography induced by storm effects. The surface topography in the form of a digital surface matrix (DSM) derived from concurrent IFSAR operations is compared to an archived DSM collected prior to the storm. Information on storm damage is developed from analysis of DSM changes. Combined with a-priori photo and radar imagery, the technique provides means for detection, location, quantification and characterization of storm damage. The paper discusses limitations to the concept due primarily to radar signal propagation effects. Results of simulations of IFSAR measured surface topography are presented [C2249]

"Double-directional channel measurements"

The spatial mobile radio channel contains delay information and angular information about the multipath components (m.p.c.s.). Signal delay and ensuing intersymbol interference has played an important role since the inception of digital mobile radio systems like GSM. The multipath signals impinging from different directions of arrival (DOAs) at an antenna array received quite some attention in the past few years. We call this a directional channel. The investigation of smart antennas has lead to better understanding of the radio channel itself and to more accurate and realistic spatial channel models. The identification of useful m.p.c.s. and the suppression of undesired co-channel interference has great potential in smart antennas. The paper describes the use of a superresolution method to identify as many m.p.c.s. as possible. We offer also a novel solution to the “pairing problem”, i.e. which DODs and DOAs match the underlying physical propagation path connecting them. Though the measurements we describe were made, for practical reasons, in predominantly static environments, we aim at mobile radio applications [C2250]

"MFIE-based propagation prediction"

This work presents an MFIE-based prediction for vertically polarized radio waves propagating over a smoothly irregular terrain. The present theory is compared against its EFIE counterpart. It is shown that the MFIE-based technique yields accurate predictions with fewer basis functions than the EFIE one, specially for those regions where the line-of-sight is obstructed. [C2251]

"Time domain 3D vector analysis of pulse-excited perfectly conducting wedges: the UAT approach"

A time-domain version of the uniform asymptotic theory of diffraction, henceforth named TD-UAT, is introduced here and it is used to obtain the fields scattered by a perfectly electrically conducting wedge illuminated by an arbitrarily oriented electric dipole with a rapid spatial variation near the edge. An impulse response of the wedge is determined as well as the response to a pulsed source which generates a finite energy pulse. The results of TD-UAT are compared with those obtained from an implementation of TD-UTD and its applicability is demonstrated by comparing its impulse response with an exact result. [C2252]

"MIMO measurement for double-directional channel modelling"

A parametric modelling approach for double-directional radio channels is introduced that is based on measured data. The MIMO (multiple-input multiple-output) measurement principle using multiple antennas at both the transmitter and receiver site can be effectively exploited to estimate the propagation direction, delay and Doppler shift of any significant path at both ends of the wireless link simultaneously. From the estimated parameter sets, a precise reconstruction of the multidimensional wave field in the aperture domains of time, frequency and space is possible. Since the measurement antenna properties are excluded from the channel, the influence of a variety of other array architectures can be investigated with the reconstructed wave field. This builds the basis for

manifold analyses and simulations of MIMO transmission links in a very realistic way. [C2253]

"Accurate FDTD simulation of biological tissues for bioelectromagnetic applications"

For practical bio-electromagnetic applications, such as the interaction of electromagnetic fields with the human head and body, accurate simulation of biological tissues is a key factor for reliable results. The characteristics of biological tissues are frequency dependent and thus called dispersive materials. For accurate FDTD simulation of biological tissues, a numerical technique is proposed to derive the Debye coefficients from the measured frequency-dependent permittivity of different biological tissues, and then a scattered field FDTD formulation is developed for such dispersive media characterized by multi-term Debye expressions. The proposed scattered field FDTD formulation is valid for three dimensional analysis of practical EM problems involving combination of dispersive and non-dispersive materials. The developed procedure has been verified for different types of biological tissues over a very wide band of frequency (from 30 Hz to 20 GHz). The reflection coefficients of a semi-infinite dispersive medium using one, two, and three-term Debye expressions are computed and compared favorably with the corresponding analytical solution. Hence, the accuracy and stability of modeling multi-term Debye dispersive materials using the proposed scattered FDTD formulation is assessed [C2254]

"Bistatic radar denial/embedded communications via waveform diversity"

Use of an interferometer along with a host radar is proposed for simultaneously achieving coherent reference denial and embedded communications. To prevent self-jamming, spatial orthogonality is achieved between the interferometer antenna pattern and main beam of the host radar. Costas and orthogonal frequency division multiplexing (OFDM) signals are suggested for the host radar and interferometer, respectively. The effectiveness of the interferometer masking signal on a non-cooperative bistatic radar is discussed [C2255]

"Possibility of detection of atmospheric fronts as areas with anomalous radio waves propagation by means of RASS and SODAR sounding"

The possibility of the shot-term local forecast of atmospheric fronts conditioning anomalous radio wave propagation in the atmosphere boundary layer is shown. A temporary and spatial scale of front originating precursors by SODAR and RASS sounding is determined. [C2256]

"Implementation of a wideband directional channel model for link level simulations"

A wideband directional channel simulation model is presented, from its theoretical description, passing through its assessment with measurements, until its implementation and total integration into a radio channel module. It simulates signal propagation in a multipath environment, providing delay and direction of arriving signals. It introduces variations of stationary conditions during the simulations. This module allows the simulation, in UMTS, of microcells and macrocells; FDD and TDD modes; uplink, downlink or bi-directional transmissions; single- or multilink transmissions (several mobile terminals for a single base station) with moving terminals. This module is to be integrated into a link level simulation platform, in order to assess the performance of multiple access interference mitigation techniques. [C2257]

"Performance evaluation of a space-time turbo equalizer in frequency selective MIMO channels using field measurement data"

Evaluating in-field performances of our proposed MIMO turbo equalizer, soft canceller (SC) followed by MMSE (SC/MMSE) space-time (S/T) MIMO turbo equalizer, is the primary objective of this paper. The SC/MMSE S/T MIMO turbo MIMO turbo equalizer discussed in this paper performs joint MIMO channel estimation, SC/MMSE MIMO signal detection, and decoding of the channel code used, all in an iterative manner. Full diversity gain can be achieved with practical computational complexity in the presence of rich scattering in space and time domains in MIMO communication environments. A series of field measurement campaigns took place in an urban area of Tokyo using a channel sounder system, and sets of collected channel impulse response data were used in off-line simulations to evaluate in-field performance of the MIMO turbo equalizer. In 2-user 2-receive antenna MIMO uplink environments, bit error rate performance was evaluated for the two simultaneous users. Results of the simulations are presented in this paper. [C2258]

"Multi-user detection using MIMO channel estimator applied to GSM communications"

We propose in this paper to use multiuser detection techniques on the 2G GSM system allowing either higher data rates for point to point communications or multiuser transmissions thus increasing the uplink capacity. Multiuser detection techniques are applicable in such non spread spectrum systems if the number of reception antennas is equal to or larger than the number of transmitters. This system is actually tested in subway

propagation conditions for an IST funded project named ESCORT. [C2259]

"Capacity of adaptive MIMO systems in a finite scattering channel"

We have investigated the capacity of MIMO systems on a channel containing a finite number of multipath scatterers, using a normalisation which allows us meaningfully to enquire whether capacity increases indefinitely with the number of transmit/receive antenna elements. This normalisation ensures that received signal power equals total transmitted power, and does not increase with increasing number of receive antennas. This allows us to separate out effects due to the receive array gain. We show that for the most common case, where the channel is unknown at the transmitter, the capacity does not increase indefinitely, but tends to a limit determined by the number of scatterers. We upper bound this limit, and also describe an estimate which is closer to results obtained by simulation. We also consider an adaptive system, in which the channel is known to the transmitter, and show that here capacity can increase indefinitely with the number of antennas. [C2260]

"Effect on capacity of clustering in indoor MIMO channels"

Published experimental results suggest that in indoor environments multipath rays arrive in clusters. The clusters arrive with a uniform probability density in azimuth angle, whilst rays within a cluster arrive with a Laplacian probability density with angular spread σ. Using Monte Carlo type simulations, assuming 'narrowband' channel conditions and 'single bounce' scattering between TX and RX, we make comparisons between the MIMO capacity of Rayleigh matrix channels with independent elements and matrix channels constructed using this clustering model. We confirm, as intuition would expect, that in general clustering of rays leads to a decrease in capacity, due to increased spatial correlation across a MIMO array. In addition, we find that the MIMO channel capacity can also increase as the number of scatterers increases through scatterer redundancy or diversity. Further, we look at the growth of capacity with n the minimum of the number of antennas at TX and RX; for independent Rayleigh matrix channels this growth is known to be linear offering the possibility of unprecedented spectral efficiencies as n increases. However, taking published results at 7 GHz that suggest an angular spread $\sigma \approx 25°$, we find that the growth of capacity with n, although no longer linear, is still significant compared to optimal RX diversity with maximal ratio combining. [C2261]

"Broadband vector channel sounder for MIMO channel measurement"

3G and 4G mobile communication systems consider multiple antennas at both receiver and transmitter for reaching enhanced channel capacity at well defined quality of service. Perfect design of such systems requires profound knowledge of the radio channel, especially its time-variant characteristics in various radio environments. A precise characterization of the radio channel is given by the vector channel impulse response (VCIR). In multi input multiple output (MIMO) systems the VCIR is measured for each transmitting antenna to a configured RX antenna array. The time variance of the radio channel requires high speed recording of VCIR with respect to the maximum Doppler frequency. The presented vector channel sounder covers all MIMO aspects. Up to 256 MIMO channels can be configured by software. The broadband technique grants high time resolution. Superresolution techniques can be used for joint estimation of time delay, direction of arrival and direction of departure with respect to multipath propagation. The measurement data can be used directly (as stored radio channel) as well as indirectly (as derived channel model) for realistic link- and system-level simulation. [C2262]

"A MIMO WLAN based on linear channel inversion"

Multiple-input multiple-output (MIMO) techniques may increase the capacity of wireless local area networks (WLAN) since they profit from rich scattering of radio waves in indoor environments. On the other hand, much signal processing must be performed in a very short time to reach practical data rates. This paper reports on elementary steps towards MIMO transmission when the channel is known to the transmitter. In most cases, channel information can be obtained at the transmitter by means of reciprocity. Linear channel inversion (LCI) may then be employed allowing simple processing suitable for real-time applications. In contrast to signal processing at the receiver, LCI offers isotropic noise gain which simplifies coding. On the other hand, power distribution at the transmitter depends on the statistical properties of the MIMO channel. Results in the case of Rayleigh fading indicate that at least one additional antenna is needed at the transmitter for reliable operation. A simple formula for the mean transmitter power is reported and confirmed by simulation. Performance can now be expressed in terms of transmitter power and a fair comparison with transmission based on signal processing at the receiver is possible. [C2263]

"Comparison of diffraction over mountain ridges-experimental results with diffraction loss calculation by different theoretical methods"

For diffraction loss calculation of real mountain obstacles it is proposed usually to use the results of the method

of diffraction over smooth rounded obstacles, such as a sphere and a cylinder, with application of boundary conditions on the surface of these geometrical bodies. Optical diffraction methods are also proposed. Such methods is recommended for rough surface obstacles. There is a large difference between the results of calculation by the different methods. However, there is not an alternative criterion for application of the first or second method [C2264]

"Characterisation of 62.4 GHz radiowave propagation through a single tree using wideband measurements"

A 62.4 GHz wideband channel sounder has been designed and implemented for use in characterising terrain and vegetation objects as well as mobile radio channels. The system is capable of having a resolution as low as 0.5 nsec. The system is positioned by using a high precision computer controlled rotary tables. Initial measurements at 62.4 GHz were conducted inside an anechoic chamber to characterise the scatter function from a single tree and to measure its attenuation as a function of its rotation angle. It has been observed that the attenuation due to tree rotation exhibits large variations that require further investigation. It has also been found that the scatter function peak appears at +80 from the line-of-sight direction [C2265]

"Correlation studies of VHF radiowave propagation and radiometeorological conditions"

This article presents the radiometeorological factors contributing to specific fluctuations of signal level in the southwestern part of Nigeria. Earlier in this region, diurnal and seasonal signal level variations in the VHF band were studied in over-the-horizon radiowave propagation (Aboaba 2000). The large variation in the received field strength was correlated with radiometeorological parameters such as atmospheric pressure, temperature and water vapour pressure measured during the period Oct. 1998-Nov. 1998 [C2266]

"Constraints and possibilities of adaptive antennas for wireless broadband"

The communication aspects of having multiple element arrays in a scattering environment are discussed. The angular spreading of the signals in the mobile environment leads to a number of independent channels, which may give rise to increased spectral efficiency depending on the propagation conditions. Simple models of random scatterers are used to show the significance of size, distance and polarization. Since polarization remains orthogonal even with zero angular spread, it is advantageous to have polarization diversity [C2267]

"New fast approach to wideband propagation prediction in picocells"

For the design and maintenance of cellular networks of wireless personal communication services a knowledge of the signal propagation in different environments is required. Indoor propagation is one of the most complicated propagation topics based on the specific type of the building structure and materials used. There are two conventional approaches to the modelling: empirical and deterministic. These approaches are overviewed with their advantages and disadvantages. Then a new semi-deterministic approach is introduced. The new model performance and comparison of its results with measurements are discussed as well. An outlook for the future work concludes the paper [C2268]

"Modelling of the re-radiation functions of single trees based on wideband measurements at L-band"

In urban and rural areas, radiowave propagation is generally dominated by diffraction loss and reflections from buildings and trees. In the case of land mobile systems, trees, singly or in a group, are usually present in the environment surrounding the receiver. An important part of the modelling process is aimed at identifying the individual contributions of the elements giving rise to the scattered signal. Studies around the 2 GHz band were performed on a mature deciduous tree in order to characterise the complex propagation modes emanating from a single tree. Measurement campaigns were conducted in autumn/winter and spring/summer on the same tree. A measurement system has been developed for short-range outdoor radio channels incorporating a vector network analyser (VNA), configured for swept frequency measurements. The results of an investigation based on the measured complex impulse response (CIR) at various positions around the tree for both co-polar and cross-polar received signal components, are presented. A discrete mathematical model is used to compute RMS delay spread of the power delay profiles (PDP) for both foliated and de-foliated states of the tree. Seasonal variations and the effects of leaf movement on the channel characteristics caused by wind, are also discussed [C2269]

"An experimentally based investigation on the refinement and development of mid-latitude trough models over Europe-description and initial measurements"

A new experiment to examine the propagation characteristics of radiowaves propagating through the mid-latitude ionospheric trough region has been described. The aim of this new investigation is (a) to determine experimentally the accuracy of the currently available models of the trough by a comparison of ray tracing simulations with measurements of the direction of arrival of a number of HF radio signals propagating through the trough region, and (b) to improve the accuracy of the models by imposing physically realistic refinements to the models to give a better fit to the experimental data. Example measurements have been presented that reveal important information about the propagation characteristics of the signal [C2270]

"Capacity evaluation in cellular system"

Spectrum efficiency and good coverage are the main objectives of radio system planning. In the past years, different techniques were implemented to enhance the system capacity. The capacity evaluation technique used, introduces different parameters, which affect the cellular system by reducing the assumptions made of system. In this paper, implementing different statistical propagation models proves that accurate signal coverage and modulation schemes can significantly enhance the system capacity [C2271]

"A comparison of multiple input radio channel models using geometric and stochastic methods"

We present two types of multiple input channel models that have been implemented: a geometric model and a stochastic model. We consider the relative merits and limitations of these models. There are a number of factors that will indicate whether geometric or stochastic multichannel models are appropriate for a particular test scenario. The advantage of a geometric model is that all of the factors used to characterise the channel (e.g. Doppler spread, delay spread, angle of arrival, etc.) are correlated. The geometric model, by its physical ray tracing nature, automatically implements these artefacts of the signal and can be used in indoor picocells and outdoor macrocells without the need for empirical data. The disadvantage of the geometric model is that it is a simplification of the physical world, and so some of the statistical detail is likely to be lost [C2272]

"Spatial channel characterisation of FDD wireless links"

For smart antenna deployments in frequency division duplex (FDD) applications the downlink weight vector can be derived from the uplink steering vector. However, this assumes a degree of correlation between these channels. It is shown here that de-correlation between uplink and downlink power azimuth spectrums (PAS) is significant for frequency offsets as small as 5 MHz in urban environments, with this increasing to 15 MHz when long term averaging is applied. Results reported here are computed from measured data taken within the UMTS (Universal Mobile Telecommunications System) frequency band for a cluttered urban environment [C2273]

"Eleventh International Conference on Antennas and Propagation (IEE Conf. Publ.No.480)"

First Page of the Article [C2274]

"Parallel simulation of radio-base antennas on massively parallel systems"

The rigorous characterization of the behaviour of a radiobase antenna for wireless communication systems is a hot topic both for antenna or communication system design and for radioprotection-hazard reasons. Such a characterization deserves a numerical solution, and the use of a Finite-Difference Time-Domain (FD-TD) approach is one of the most attractive candidates. Unfortunately it has strong memory and CPU-time requirements. Numerical complexity can be successfully afforded by using parallel computing. In this work we discuss the parallel implementation of the FD-TD code, individuating the theoretical lower bound for its parallel execution time, and we present the findings achieved on the APE/Quadrics SIMD massively parallel systems. Results, obtained from the simulation of actual radiobase antennas, clearly demonstrate that massively parallel processing is a viable approach to solve EM problems, allowing the simulation of radiating devices, which could not be modeled through conventional computing systems. The tests on actual systems evidenced sustained computational speed equal to 17% of the theoretical maximum [C2275]

"Performance of a TDOA-AOA hybrid mobile location system"

A time difference of arrival (TDOA) technique has been proposed for providing location services in future UMTS networks. The performance of such a system is limited by errors in the time difference (TD) measurements primarily cause by non-line of sight (NLOS) propagation conditions. In future systems angle of arrival (AOA) measurements at the serving base station (BS) may be available, primarily as a requirement to increase downlink capacity via beamforming. These measurements may also be useful far location purposes, though they will also be subject to errors caused by NLOS propagation conditions between the mobile (MS) and the serving BS. In this paper the performance improvement of a TDOA location system utilising the AOA measurement from

the serving BS, over a TDOA only system is evaluated. Simulation results are presented which show that location accuracy improvement is possible even in highly NLOS conditions. Furthermore location estimation is now possible when only two BSs are detectable, rather than the three BSs required in the TDOA only system, thus increasing the coverage of the system [C2276]

"Definition and drivation of level crossing rate and average fade duration in an interference-limited environment"

Wireless signals are subject to multipath propagation, which results in Rayleigh fading characteristics and the fading signal fluctuates around its mean signal level. The level crossing rate (LCR) and average fade duration (AFD) are often used to characterize the signal-fading statistics. This paper explores the LCR and AFD issue in an interference environment. New definitions of LCR and AFD are introduced and the corresponding expressions are derived for an interference-limited environment [C2277]

"Propagation simulation with the ParFlow method: fast computation using a multi-resolution scheme"

The increase of potential applications of wireless networks in indoor environments calls for robust and efficient tools for predicting the wave propagation in such complex environments. The ParFlow technique is a discrete approach which accurately reflects the behavior of wave propagation but in turn requires very high computation and time resources. Initially this method has been implemented in a parallel architecture to reduce the computation time. A new resolution scheme is proposed to solve the discrete ParFlow equations. This approach is based on a multi-resolution formulation in the Fourier domain. The major result of our approach is that the computation complexity may be settled in two parts. Firstly, the multi-resolution pyramid is built (taking into account the geometry arrangement of the indoor environment). Secondly, the propagation from a point source is evaluated through the soft pyramidal architecture with a high gain in terms of computational efficiency. We guess that this approach could increase the interest of the ParFlow technique which could be more accurate than ray-tracing methods at least in a theoretical point of view [C2278]

"Fading channel characterization for oscillating-beam-pattern smart antennas using geometric-based stochastic channel modeling with circular coverage area"

Whenever the channel coherence time is less than the symbol duration, a mobile station (MS) receiver can exploit time diversity to enhance its probability of error performance. One way to ensure a channel coherence time less than the symbol duration is by use of a carefully controlled oscillating-beam antenna array at the base station (BS). Here, beam pattern movement creates small coherence times. In this paper, with an oscillating-beam-pattern antenna array at the BS, the time varying channel is modeled to evaluate the channel coherence time and the available diversity in the MS. Here, a geometric-based stochastic channel model (GSCM) is used, and a circular coverage area is assumed. For a mid-sized city center, coherence times are shown to correspond to 1/7ththe symbol duration, suggesting a 7-fold time diversity is available at the MS when the BS's antenna array pattern is carefully controlled [C2279]

"An azimuth-Doppler-delay scattering function: definition and estimation"

We define a generalized scattering function for the spatio-temporal propagation channel. The definition is free of the restrictive assumption that there is a finite number of scatterers. We derive the time-varying vector channel between the source and the array in a unified manner and define a correlation function and a power spectrum that incorporate the spatial parameter-directly giving rise to the new scattering function of the spatio-temporal channel. In practice, the scattering function can be estimated by applying a well-known non-parametric spectrum estimation method to data obtained from an appropriately designed channel sounding experiment. The estimator's performance is evaluated theoretically and by simulation [C2280]

"Performance of diversity combining for uniform circular arrays"

We present the bit-error-rate (BER) performance for a proposed hybrid antenna system that combines a uniform circular phased array and diversity array using maximal-ratio-combining (MRC) in wireless communications. By phased array and diversity array we mean the circle of radius of the uniform circular array (UCA) is one-half wavelength and greater than half wavelength, respectively. The phased array is used in non-fading wireless channels, while the diversity array is used for wireless channels with multipath fading. The BER performance for the proposed antenna system is evaluated through the use of computer simulation. For channels without fading, the BER performance of the phased array with MRC is evaluated as a function of the number of antenna elements. For the fading channel, the BER performance of the diversity array with MRC is function of the spatial

antenna correlation. Comparative results on the BER performance for a uniform linear array (ULA) and UCA are given [C2281]

"On the estimation of azimuth distributions and azimuth spectra"

The increased popularity of array antennas for wireless communication, has inspired investigations of the spatio-temporal properties of the radio channel, among others the azimuthal shape of the scattering clusters. Based on a statistical analysis, we show that trying to estimate the shape of the scattering is an ill-posed problem and that the heavy-tailed power azimuth spectra reported in the literature may be an artifact stemming only from the measurement procedure [C2282]

"Time evolutionary wideband propagation channel model for user positioning in UMTS"

A new time variant wideband propagation channel model is presented for user location applications in third generation mobile environments. The model considers evolutionary angle of arrival (AOA) and evolutionary time of arrival (TOA), based on the real instantaneous relative user equipment and base station position. The channel model proposed is used also in a link level simulator (LLS) to estimate realistic delay and angle of arrival coherence time, that is, the time in which position and time delay and angle of arrival for the received signal remain almost constant. In order to increase the time integration period and consequently reduce the error in geographical positioning, the maximum coherence time has to be known in the time delay and angle estimating process. The new wideband propagation channel model will provide the delay and angle estimating process with realistic coherence time and Doppler spread. The model also provides spatial correlation matrices for different diversity base station (BS) antenna schemes and compares them with experimental results [C2283]

"Propagation characteristics of horizontally and vertically polarized electric fields in an indoor environment: simple model and results"

This paper presents measurement results that demonstrate the different propagation characteristics of the vertical and horizontal polarizations and their crosscorrelation coupling under line-of-sight and non-line-of-sight conditions. We also present a simplified model for the propagation environment that uses an approach similar to the method of images, and achieves results that match the measurements [C2284]

"Effective indoor propagation predictions"

There is an increasing demand for efficient and accurate indoor signal propagation prediction tools. A novel semi-deterministic approach based on a simple ray launching technique, the Monte Carlo method, and general statistics is developed. Without complicated calculations, all the electromagnetic issues, including diffuse scattering, are taken into account in the prediction using a new "motif concept". The motif model based on this approach is developed, implemented and tested. The signal strength as well as wide-band parameters can be predicted at very high speed. Software implementation of the model and first evaluations prove good performance and accuracy. A three-dimensional enhancement of the model is proposed [C2285]

"Approximation of the propagation curves from the Recommendation ITU-RP.370-7"

The ITU-R method for field strength prediction is basically a graphical method. The main disadvantage is the extrapolation of the curves with the calculated heffthat differs from the values shown on the diagrams in Rec. ITU-R P.370-7. We provided the mathematical model of the propagation curves and a simple computer algorithm, which would solve the problems mentioned above [C2286]

"A realistic description of the environment for inter-vehicle wave propagation modelling"

The modelling of a realistic environment for road traffic scenarios is presented. The model serves as a basis for a new wave propagation tool for inter-vehicle communications. A proper modelling of the environment implies an accurate characterisation of the dynamic road traffic and a realistic description of the vehicle's vicinity. For an accurate model of dynamic road traffic and realistic driving behaviour, different individual characteristics of vehicles are taken into account. Characteristics such as desired velocity or safety margin are determined stochastically within certain limits. It is therefore possible to create complex traffic scenarios without the need of having detailed and extensive traffic data for selected roads. Additionally, the road surrounding is generated stochastically, depending on morphographic data. The result is a proper traffic scenario, which serves as input data for wave propagation calculations [C2287]

"Wideband direction-of-arrival estimation using fast chirplet-based adaptive signal decomposition

algorithm"

The direction-of-arrival (DOA) is one of important parameters, in addition to time-of-arrival (TOA) and attenuation, to describe most radio propagation channel models. Time-frequency analysis is a powerful technique to deal with time-variant or non-stationary signals. Although M.G. Amin (see Gersham, A.B. and Amin, M.G., IEEE Sig. Proc. Letters, vol.7, no.6, p.152-5, 2000; Belouchrani, A. and Amin, M.G., IEEE Sig. Proc. Letters, vol.6, no.5, p.109-10, 1999) and L. Jin et al. (see IEEE Int. Symp. on Circuits and Systems, p.375-8, 2000) combined it with a coherent signal subspace (CSS) approach, it is not easy to extend from the narrowband to the wideband case. We first overview the fast chirplet-based signal decomposition algorithm, then build the general time-frequency covariance matrix to overlap the narrowband and wideband of CSS. After discussing the difference between the two cases, we propose a wideband DOA estimation algorithm with fast chirplet-based adaptive signal decomposition. The algorithm has no restriction to the array manifold. We give the comparison of our proposed algorithm with the optimal solution of maximum likelihood (ML). We can see that the proposed algorithm has very low complexity. Its robust performance is demonstrated with numerical simulations [C2288]

"The κ-μ distribution: a general fading distribution"

This paper presents a general fading distribution-the κ-μ distribution-that includes the Rice and the Nakagami-m distributions as special cases. Therefore the one-sided Gaussian and the Rayleigh distributions also constitute special cases and the lognormal distribution may be well-approximated by the κ-μ distribution. Preliminary results show that the κ-μ distribution provides a very good fitting to experimental data [C2289]

"The estimation of the directions of arrival (DOA) of the spread-spectrum signals with three orthogonal sensors"

An effective method for estimating the DOAs of incoming signals using three orthogonal sensors is proposed. First, the channel impulse response vectors of the three sensors are estimated, then all of the corresponding propagation delays and amplitude weights of the three sensors' channels can be obtained. By comparing the propagation delays of the three sensors' channels, we can identify the same signal replica, then its DOA can be estimated through the relationship of the three corresponding amplitude weights. Simulation results show this method can reach fairly high accuracy, and it needs only three sensors [C2290]

"A comparison of the accuracy of propagation models using hit rate analysis"

A new way of gauging the accuracy of radiowave propagation models is presented. The prediction models used are the parabolic equation (PE) and a new slope-uniform theory of diffraction (slope-UTD). The results from these models applied to a terrain database are compared to experimental data from the University of Aalborg, Denmark. This comparison is enabled by using newly defined hit rate metrics. Hit rate metrics are obtained by comparing the predicted and measured availability on a point-by-point basis at a given path loss threshold. The hit rate metric is complementary to first order statistics such as mean and standard deviation of error, in determining the accuracy of a model [C2291]

"Radio channel description and quality of service for TETRA direct mode operation in forest environments"

This paper describes radio channel and BER investigations performed in various scenarios typical to the TETRA direct mode operation (DMO), in a forest area. The data from radio channel sounding measurements was analysed in terms of average fade duration and envelop CDF. The same data was used to evaluate the unprotected BER on a TETRA communication link. The BER level distribution was compared to the distribution obtained when simulating a pedestrian speed TETRA DMO radio channel. The dynamics of the mobiles can have a strong influence on the radio link quality. As a general tendency, higher practical BER values can be expected as compared to the simulations when using the simple TETRA radio channel model [C2292]

"A new amplitude and phase compensation scheme under fast fading environment for OFDM packet transmission systems"

This paper proposes a new amplitude and phase compensation scheme for OFDM packet transmission systems in order to compensate severe and time-variant fluctuation of the received signal amplitude and phase under fast fading environment. The proposed scheme, in addition to the conventional scheme that averages and updates the estimated propagation characteristics on each subchannel, detects subchannels that are momentarily distorted by noise and inter-carrier-interference (ICI) over the fast frequency-selective channels, or by the sudden intercept owing to the shadowing effects. The information of the detected subchannel is used to improve accuracy of the compensation when update the estimated propagation characteristics. The performance of the

proposed OFDM packet transmission system was evaluated from several aspects by computer simulation. As a result, by using the proposed scheme, packet error rate (PER) is improved under a high-mobility environment in comparison with the conventional scheme [C2293]

"Angle clustering in indoor space-time channels based on ray tracing"

Clustering of paths in angle in RF multipath scenarios has been observed in measured data, explicitly used in stochastic propagation models, and shown to have a significant impact on the capacity of MIMO links. A 3D ray tracing is used to characterize the path delays and angles in a rectangular building in which all interior walls are parallel and perpendicular to the exterior walls. Path delays and angles are recorded for 200 random transmitter and receiver locations, maintaining constant range and throughout a particular building model. The main contribution of this paper is the observation that when all of the path angles from all 200 trials are measured relative to one building wall and collectively analyzed in a histogram, clustering is clearly apparent. Furthermore, the mean angles of the clusters are a function of the range between the transmitter and receiver. While this angle clustering in the ensemble of channels is not the same as clustering in a single channel trial, it may partially account for the clusters observed in single trials. As a practical matter, these results may impact the use and placement of directional antennas for wireless LANs in buildings of this type. By simply measuring the angles relative to the line-of-sight (LOS) path rather than the building wall, the data is shown to be consistent with the joint probability density function (PDF) of delay and angle based on the geometrically based elliptical model (GBEM) [C2294]

"Coverage and capacity analysis in cdma2000 network for voice and packet data services"

cdma2000 is 3rdgeneration (3G) communication standard based on the 2ndgeneration standard, IS-95. In the 3G service, there are two kinds of traffic-voice traffic and various rate packet based data traffic. Because this feature is different from a voice only service, more elaborate analysis on coverage and capacity are needed. QoS (quality of service) related system capacity and coverage results are provided by simulation with digital GIS data, a radiowave propagation prediction model, a link level analysis algorithm etc. Because there is coverage and capacity unbalance which results from various processing gain and Eb/Ntrequirements in the forward link, their relations are also provided [C2295]

"Capacity in a CDMA macrocell with a hotspot microcell: exact and approximate analyses"

This paper studies the number of voice users supported on the uplink (user capacity) of a single-macrocell/single-microcell CDMA system. A "hotspot" microcell is embedded within a larger macrocell and operates over the same bandwidth as the larger cell. Analytic methods are presented for computing user capacity which account for propagation loss, multiple-access interference, power-control, and random locations of user terminals, as well as two distinct methods by which users select base stations (tiers). Along with the exact user capacity, a technique for approximations is also presented. Simulation results verify both the exact and approximate analytical methods. This simulation is also employed to study capacity gains of a third, more optimal, tier-selection scheme. The results point to differences in capacity performance based on the tier-selection method as well as on the traffic density within the hotspot region [C2296]

"A TOA-based location algorithm reducing the errors due to non-line-of-sight (NLOS) propagation"

An effective location algorithm, which considers non-line-of-sight (NLOS) propagation, is presented. By using a new variable to replace the square term and adding the loose variable, the problem becomes a mathematical programming problem, and then the NLOS propagation's effect can be evaluated. This method is simple and does not add much computation time. Compared with other methods, it has high accuracy. [C2297]

"Reducing the complexity of the space-time channel estimate at minimum risk"

In a mobile communication system there is the need to define a channel length that could be useful to describe many different and varying propagation environments, over-parameterization is a simple solution. The channel matrix estimated when using an array of antennas may contain more parameters than those really needed to parsimoniously describe the space-time channel. The problem is even worse when a long channel has to be estimated from short training sequences. Classically the reduction of complexity is carried out by masking some samples of the channel estimate according to a threshold heuristically defined. We propose to adaptively classify (and mask) the estimated channel samples by minimizing the Bayes risk for space-time systems. The parameters of the probability densities are iteratively estimated from the estimated channel samples and contribute to define the optimum threshold. Simulation shows that in Rayleigh fading channels the adaptive threshold is close to the one that minimize the mean square error. The performance can improve by approx. 3-5 dB in signal to noise ratio when the method is applied to reduce the complexity of space-time channels in a

CDMA system with realistic propagation environments. [C2298]

"Training-based channel estimation and de-noising for the UMTS TDD mode"

We provide a theoretical framework of de-noising for UMTS TDD-like mobile radio communication systems. Based on the Bayesian approach, we show how to de-noise channel estimates provided by the training-based estimation procedure. The proposed schemes allow not only for eliminating major drawbacks of hard thresholding but also for a low complexity implementation [C2299]

"Accurate high-speed urban field strength predictions using a new hybrid statistical/deterministic modelling technique"

To effectively dimension and rollout a cellular network, accurate site-specific field strength predictions are required. Traditionally, operators make use of high-speed statistical propagation models for each proposed base site. Today's advanced cellular networks place a greater emphasis on urban microcellular deployment. It is well known that statistical models perform poorly in such environments. To overcome these limitations, the use of deterministic propagation modelling is common. However, although such models enhance prediction accuracy, they also require excessive computation time. A new hybrid statistical/deterministic field strength prediction model is proposed that combines the speed of a statistical model with the site-specific accuracy of a deterministic ray model. Results indicate that the new hybrid model can produce very accurate field strength prediction grids with computing times reduced by one to two orders of magnitude. For the example considered, the computing time for a one square kilometer grid comprising 10000 points (100 by 100) has been reduced from 20 mins to just over 4 minutes (running on an 800 MHz Pentium III). For more complex ray models and/or higher grid densities, even higher speed-up factors can be achieved [C2300]

"The performance of BLAST with hybrid ARQ in Ricean fading channels"

The BLAST architecture provides a physical layer transmission technique that achieves very high spectral efficiencies in rich scattering environments using multiple transmit and multiple receive antennas. We perform a system performance evaluation in term of spectral efficiency where BLAST and hybrid ARQ are combined together. While the previous work is focused on Rayleigh fading channels, we extend it to a general wireless environment with different level of scattering [C2301]

"On the second-order statistics of a new simple model for land mobile satellite channels"

A new simple model has been proposed for land mobile satellite channels. We study the second-order statistics of the new model. First we develop a characteristic function-based approach for calculating the level crossing rate of the new model in diversity systems, where the branches can have different fading statistics. Then we compare the level crossing rate and the average fade duration of the new model with measured data. Similar to the first-order statistics, our results show that the second-order statistics of the new model can be expressed in compact closed forms, convenient for both mathematical analysis and numerical calculations. [C2302]

"Tesla's contribution to radiowave propagation"

We review Nikola Tesla's contribution to radiowave propagation and wireless power transmission. Tesla's patents, published and unpublished notes about radiowave propagation and wireless power transmission are less known, and if known to some extent, they are usually wrongly interpreted [C2303]

"A path link model for ultra wide band pulse transmissions"

Pulsed UWB (ultra wide band) signals are more nearly transient phenomena than they are continuous waves. Multipath effects for the most part manifest themselves as time delayed replicants of the pulses. Short pulses propagate with the free space law, and only when the differential delay among pulses and replicants is less than about half the pulse length do the signals exhibit destructive interference. The propagation model described here is based on the free space law with the additional effect of transmission losses through typical home or office walls. The conditions for destructive inference of pulses is also derived [C2304]

"A statistical model for the UWB indoor channel"

We evaluate a measurement campaign for ultrawideband indoor channels in a typical modern office building. We show that the power delay profile can be well modeled by a single exponential decay with a statistically distributed decay-time constant. We also analyze path loss, amplitude distribution function, and temporal correlation between adjacent multipath components, and give statistical distributions for all those parameters.

These results form the basis of a stochastic tapped-delay-line model of the ultra-wideband indoor channel [C2305]

"Performance analysis of channel assignment schemes"

This paper studies channel allocation strategies in mobile communication systems. Simulated incoming telecommunication traffic have been used as traffic load for performance analysis of the channel allocation strategies in mobile cellular networks. Information sources are represented by Markov process, while offered telecommunication traffic is presented by Monte-Carlo simulation. The influence of traffic load parameter and space traffic imbalances on the quality of service and total throughput of the mobile network have been studied. Comparative studies of the fixed channel allocation strategy (FCA), interference adaptive dynamic channel allocation strategy (IA-DCA) and maximum packing channel allocation (MPA) show that dynamic allocation schemes (IA-DCA, MPA) outperform fixed channel allocation schemes in all but heavily loaded systems with little space traffic load imbalance [C2306]

"On the distribution of relevant radio channel figures in different propagation environments for performance evaluation of WCDMA systems"

A statistical distribution for the number of CDMA RAKE fingers, N T, to be assigned in order to track a given percent of the total received power has been derived. The obtained distribution reveals a strong dependence of NT on the system bandwidth, the median RMS delay spread, its standard deviation and other environment specific parameters. Also, a statistical distribution for the fading width fw, is presented. Some numerical results for both NTand fw are presented as a function of the system bandwidth at different probability levels [C2307]

"Asymptotically optimal open-loop space-time architecture adaptive to scattering conditions"

Recent results have demonstrated the enormous capacity potential of wireless communication schemes employing multiple transmit and receive antennas, in particular when the transfer functions between the various transmit and receive antenna pairs are independent. In practice, however, those functions tend to be correlated, often because the underlying propagation environment is in fact Rician. We introduce a new multi-transmit multi-receive architecture that is capable of adjusting the spatial characteristics of its radiated signals to exploit the structure of such a channel. In the limiting case of a purely specular channel, the new architecture simply defaults to beam steering. On the other hand, in the limiting case of a rich-scattering channel, it reverts to a layered space-time structure radiating multiple parallel streams of data [C2308]

"The effects of multipath interference on the performance of UWB systems in an indoor wireless channel"

Multipath propagation for the indoor wireless channel is very complicated and difficult to predict. Several papers have been written attempting to apply an analytical model for this channel to help systems engineers evaluate various architectural components of a wireless system, including modulation, multiple access, and waveform design techniques, without having to resort to empirical data collection. This paper attempts to apply one of these analytical models, known as the Δ-K model, to help study the performance of an ultra wide band (UWB) system and look at performance trade-offs for different multilevel modulations as well as the benefits of RAKE reception [C2309]

"Static WCDMA system simulator for indoor environments"

A static system simulator has been developed for indoor purposes specifically. Based on an existing macro/microcell simulator, this new indoor simulator includes novel approaches for planning a WCDMA network using picocells in the 3D environment of a multi-storey building. A new computation-efficient propagation model for indoors was also developed, allowing for fast modification of the network plan and requiring only bitmap images of the building floorplan as input. Using some on-site measurements, the tunable parameters of this zone-based propagation can be set. The simulator allows modelling of typical indoor radiator solutions, such as omnidirectional and directional antennas and also radiating cables. Special emphasis is also put upon graphical presentation of results on a floor-by-floor basis, allowing for identification of base station (BS) dominance areas, soft handover areas, link loss displays, loading of BS etc [C2310]

"Direction-time transmission for fast fading vector channel"

Transmit diversity and space-time coding have received a lot of attention in previous years. We propose a direction-time transmit scheme for a fast block fading channel which exploits the parametric structure of the time-varying vector channel. Specular propagation and local scattering are assumed at the base-station and

mobile station respectively. The partial channel knowledge needed for the transmit design includes: the number of specular paths, path direction vectors and length of the coherent interval. Transmission matrix codewords are formed according to this partial channel information such that multiple channels are induced and symbols are spread over different transmission directions. Diversity gain and blind channel estimation are achieved simultaneously at the mobile station through equalization [C2311]

"EUROCON'2001. International Conference on Trends in Communications. Technical Program, Proceedings (Cat. No.01EX439)"

The following topics were dealt with: new media in education; equalization; communication theory; routing; image processing; mobile cellular systems; electronic commerce; communication subsystems architecture and technology; advanced sequences for communications; Internet services; telecommunication management; social and economic impacts; multimedia and distant tutoring; protocols; radio propagation; radar signals; satellite systems and services; framing synchronization; video coding and retrieval; security and cryptography; models and simulation; local loop technologies; speech compression and DSP; quality of service; distributed systems and model checking [C2312]

"Detection of fading overlapping multipath components for mobile positioning systems"

The Federal Communications Commission (FCC) mandate for locating the position of wireless 911 callers is fueling research in the area of mobile-positioning technologies. Overlapping multipath propagation is one of the main sources of mobile-positioning errors, especially in fast channel fading situations. In this paper we develop a technique for detecting and providing an estimate of the number of overlapping fading multipath components. Such information is vital for accurate resolution of overlapping multipath components as well as avoiding unnecessary computations and errors in single-path propagation cases. The proposed technique exploits the fact that multipath components fade independently as well as the pulse shape symmetry. The paper also presents supporting simulation results [C2313]

"Spatial characteristics of the MIMO wireless channel: experimental data acquisition and analysis"

Detailed performance assessment of space-time coding algorithms in realistic channels is critically dependent upon accurate knowledge of the wireless channel spatial characteristics. This paper presents an experimental measurement platform capable of providing the channel transfer matrix for indoor and outdoor wireless communications scenarios. The system allows direct measurement of key multiple input multiple output parameters for 16 transmit and 16 receive antennas. The basic hardware blocks are outlined, and the data post-processing algorithms are presented. Representative data showing, channel capacity and spatial correlation for several indoor sites are provided [C2314]

"A wireless MIMO channel probing approach for arbitrary antenna arrays"

This paper introduces a method for experimentally probing indoor wireless channels to compute MIMO transfer function matrices, H. The data is gathered using rotating transmit and receive antennas to observe the multipath ray structure of the channel. H can be computed for any arbitrary transmit and receive array sizes and geometries using the single probe data set. Estimating H is crucial for space-time coding communications algorithm performance analysis. Example results are presented [C2315]

"Modeling and capacity of realistic spatial MIMO channels"

Accurate and tractable channel modeling is critical to realizing the full potential of antenna arrays in wireless communications. We propose a framework for modeling multi-antenna multipath channels based on the notion of virtual spatial angles. The virtual angles are fixed a priori and are determined by the number of antennas at the transmitter and receiver and the spacing between the antennas. The model essentially corresponds to a coordinate transformation via fixed spatial basis functions at the transmitter and receiver. The resulting linear virtual channel representation encompasses all existing models and provides a natural link between the physical propagation environment and the channel statistics induced by it. For any given scattering environment, the model facilitates realistic estimates of channel capacity and clearly reveals the two key parameters affecting capacity: the number of parallel channels and the level of diversity [C2316]

"Site-specific BER simulation for indoor wireless communications"

A new method for simulating site-specific BER performance of digital communications in indoor environments is presented, including those environments where the channel presents arbitrary statistics that are difficult to fit to an analytic expression. The method is based on importance sampling in conjunction with a site-specific channel

model obtained by ray-tracing [C2317]

"Performance evaluation of CDMA/PRMA techniques for LEO constellations"

A CDMA/PRMA protocol is proposed for application to low Earth orbit (LEO) communication systems. The large carrier frequency shift caused by the high speed movement of satellites (Doppler effects) and the large propagation delay on the up-down link are very critical issues in LEO communications, both affecting the selection and the implementation of a suitable access technique. Extended simulation trials prove that the proposed scheme seems to be a very promising access method for the case of mixed voice/data traffic [C2318]

"A field prediction model for urban environment based on pattern recognition and statistical ray tracing"

A novel statistical method for field prediction in an urban environment is presented. The method is based on a sort of "statistical ray tracing", that is, the main parameters of the generic ray (orientation, number of reflections, path length etc.) are evaluated through their statistical distribution on the basis of the characteristics of the environment. These characteristics can be extracted from a sample map by means of an automatic graphical algorithm [C2319]

"Performance improvement of Wireless 1394 using multiple-element antenna systems"

In Wireless 1394, hub station is a device that manages the whole Wireless 1394 home network. Also, hub station plays the role of ad-hoc repeater while the direct communications of leaf stations are obstructed. Multiple-element antenna systems are considered for the hub station. We study the channel capacity when using a multiple-element antenna MIMO architecture for Wireless 1394. We analyse the dependence of the channel capacity on the actual indoor propagation environment. A new geometrical-physical-based channel model including the NAZU (Nakagawa-Arita-Zhang-Udagawa) scattering coefficient is proposed The relation of the POCA (Polydorou-Capsalis) distribution with the MIMO system's capacity and multipath richness is investigated. It is found that this capacity is limited by the number of significant indoor scatterers [C2320]

"Joint spatial and temporal characterization of the wideband wireless communication channel for MIMO applications"

We present a joint study of the spatial and temporal behavior of the wideband wireless channel focussed on the possibility of applying multiple-input multiple-output (MIMO) techniques for achieving extremely high data rates. In particular, we address the time dependence of small-scale spatial variations in the transmitted field resulting from pulse propagation, which could be crucial for such applications. We have performed measurements of the field associated with the propagation of a pulse in a strongly scattering environment over a local area of several wavelengths at slightly different positions of the radiation source, which allowed us to simulate the performance of a multiple-antenna system over a wideband wireless channel. From the data obtained we are able to estimate the "instantaneous" achievable capacity of multiple-antenna systems, which is found to rise to within 5% of the upper theoretical bound. The results obtained for the capacity of wideband MIMO systems are in accord with the observed behavior of the field temporal and spatial autocorrelation functions [C2321]

"Radio wave propagation measurements in tunnel entrance environment for intelligent transportation systems applications"

Underground environments are of great interest to intelligent transportation system (ITS) applications, since they occur frequently in both urban and rural situations, and have peculiar propagation characteristics. This investigation includes two of the major fields in ITS applications: road-to-vehicle, and vehicle-to-vehicle communications. Besides that, the propagation measurements presented also focus on the transition effects when moving between the regions outside and inside a tunnel, which represents its entrance environment. The experimental results of path loss and delay spread profiles are presented and analyzed [C2322]

"IEEE VTS 53rd Vehicular Technology Conference, Spring 2001. Proceedings (Cat. No.01CH37202)"

The following topics are dealt with: adaptive antennas and arrays; channel measurement, modeling and prediction; indoor propagation; wireless access; multiple access technology; spread spectrum technology; OFDM; access protocols; channel assignment; resource allocation; short range access; Bluetooth; modulation and demodulation; source/channel coding; interference rejection; equalization; synchronization; multi-user detection; software radio; transceiver design; mobile multimedia technology; mobile data networks; mobile computing

networks; wireless packet networks; wireless personal communications; IMT-2000; broadband mobile communication systems; cellular radio technology; location techniques; 2.5G and 3G system performance; radio network design; power control techniques; mobile satellite communications; intelligent transportation system; wireless Internet methods; software agents [C2323]

"Experimental study of spectra and X- and Ka-band backscattering from the rain agitated water surface"

On the basis of experimental research the shape of the spectra of rain agitated water surface was qualified. It was shown that for frequencies above 15 to 20 Hz the spectral density decreases more slowly than in the lower frequency areas. This spectrum area corresponds to the backscattering of the cm and mm radiowaves at low grazing angles. The quantity estimation of the RCS of agitated. surface was found for the single drops and for the artificial rain. On that basis the decision was made that, at low grazing angles the main effect in backscattering comes from the stalk and crown in place of splash at impact point, but at high grazing angles,the main effect is backscattering by the ring waves [C2324]

"BLAST system capacity measurements at 2.44 GHz in suburban outdoor environment"

There are ever increasing demands, in wireless communications, for additional capacity to handle voice, data and wideband Internet applications. These demands are constrained by the bandwidth that has been allocated to wireless communications. A novel unorthodox concept to substantially increase the spectral efficiency in highly scattering environments, named BLAST (Bell-labs LAyered Space-Time), has been introduced (see Foschini, G.J., Bell Labs Technical Journal, vol.1, no. 2, p.41-59, 1966; Foschini, G.J. and Gans, M.J., Wireless Personal Communications, vol.6, p.311-35, 1998). A measurement campaign was undertaken to assess the BLAST gains in spectral efficiency in the suburban outdoor environment for stationary subscribers. The measurements employed directive antennas for better control of interference from adjacent cells. Extensive calibration methods, assisted by simulations, were developed to assure accurate results for the BLAST capacities of the measured remote subscriber sites [C2325]

"Predicting multi-element receive & transmit array capacity outdoors with ray tracing"

We construct a few canonical cases consisting of diffracting wedges and simple linear arrays, as steps towards predicting capacity for an entire cell, highlighting important propagation mechanisms. We show that a diffracting wedge can collapse capacity of multi-element arrays. If more that one wedge is present, the capacity increases. These effects are demonstrated theoretically and numerically through ray-tracing [C2326]

"Keyholes, correlations and capacities of multi-element transmit and receive antennas"

Multi-element system capacities are usually thought of as being limited only by correlations between elements. We show that degenerate channel phenomena, called "keyholes" may arise under realistic assumptions which have zero correlation between the entries of the channel matrix H and yet only a single degree of freedom. Canonical physical examples of keyholes are presented. For indoor environments, it is shown that the number of communication modes in a hallway may not exceed the number of waveguide modes [C2327]

"An indoor IS-2000 transmit diversity evaluation using propagation measurements"

Several transmit diversity schemes have been proposed to improve the forward link performance of next generation IS-2000 CDMA systems. These techniques are expected to perform particularly well in indoor environments. A simulation that processes propagation measurements is used to illustrate how indoor transmit diversity performance varies with base station configuration. Dynamic impulse response measurements are collected using IS-95 base station pilot signals. These measurements characterize the forward channel in an indoor office environment for three base station configurations. The propagation data is processed in a simulation to evaluate the performance of space time spreading, time delay transmit diversity, phase sweep transmit diversity and orthogonal transmit diversity for the different base station configurations [C2328]

"A mixed-cell propagation model for interference prediction in a UMTS network"

With the support of mixed cells and hierarchical cell structures in UMTS, propagation information (coverage and interference) between different cell types is required. A mixed-cell propagation model is presented which is suitable for predicting interference in mixed macrocellular and microcellular environments. The main features of the model are described together with examples of interference prediction including C/I and most-likely-server plots. Comparisons between model predictions and measurements for a mixed cell environment are also presented [C2329]

"Optimal training for block transmissions over doubly-selective fading channels"

High data rates give rise to frequency-selective propagation, while carrier frequency-offsets and mobility-induced Doppler shifts introduce time-selectivity in wireless links. To mitigate the resulting time- and frequency-selective (or doubly-selective) channels, an optimal training strategy is designed for block transmissions over doubly-selective channels, relying on a basis expansion channel model. The optimality in designing our pilot symbol aided modulation (PSAM) parameters consists of maximizing a tight lower bound on the average channel capacity, that is also shown to be equivalent to the minimization of the minimum mean-square channel estimation error. Numerical results corroborate our theoretical designs. [C2330]

"On dimensionality of multipath fields: spatial extent and richness"

We establish that an arbitrary narrowband multipath field in any circular region in two dimensional space has an intrinsic functional dimensionality of (/spl pi/e)R//spl lambda/, /spl ap/8.54R//spl lambda/, that scales only linearly with radius R/spl bsol//spl lambda/ in wavelengths. This result implies that there is no such thing as an arbitrarily complicated multipath field. That is, a field generated by any number of nearfield and farfield, specular and diffuse, multipath reflections is no more complicated than a field generated by a limited number of plane waves. As such, there are limits on how rich multipath can be. This result has significant implications including: i) means to determine a parsimonious parameterization for arbitrary multipath fields; ii) means of synthesizing arbitrary multipath fields with arbitrarily located nearfield or farfield, spatially discrete or continuous sources. We give examples of multipath field analysis and synthesis. [C2331]

"MIMO wireless multipath ray parameter estimation from channel transfer matrix measurements"

In MIMO wireless communication using space-time coding techniques, it is important to understand channel characteristics so that optimum coding schemes, array configurations, and performance analysis can be developed. Increasingly, understanding of MIMO channels is being aided by direct channel probing experiments to measure transfer matrix, H. An alternate channel representation based on propagating ray parameters has many advantages. We propose an algorithm to compute high precision estimates of channel ray parameters directly from H measurements. Examples are presented where rays are identified, and departure angles, arrival angles, and complex path gains are estimated. [C2332]

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