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KH2010-E-1471
Einfluss der EMV Prüfleiterplatte auf die Messergebnisse der leitungsgeführten Störaussendung integrierter Schaltungen
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Der in der Entwicklung befindliche anwendungsspezifische integrierte Schaltkreis (ASIC) wird bereits in den einzelnen Entwicklungsschritten (A-, B-, C- Silizium) umfangreichen Tests bzgl. seiner elektromagnetischen Verträglichkeit (EMV) unterzogen um so frühzeitig eine Aussage über dessen leitungsgeführtes Emissionsverhalten treffen zu können. Diese Maßnahme ist notwendig um etwaige EMV Schwächen des Halbleiters so früh wie möglich zu erkennen und diese bereits im nächsten Entwicklungsschritt verbessern zu können. Um den ASIC nach den Vorgaben der gängigen Normen und Spezifikationen bzgl. seiner elektromagnetischen Störaussendung testen zu können wird dieser, inklusive seiner zum Betrieb benötigten Applikationsbeschaltung, auf eine eigens für diesen Zweck entwickelte EMV Prüfleiterplatte aufgebracht und anschließend einer leitungsgeführten Emissionsmessung unterzogen.
Vorgestellt wird ein Verfahren zur Berücksichtigung des Einflusses der EMV Prüfleiterplatte auf die Messergebnisse der leitungsgeführten Störaussendung integrierter Schaltungen. Dazu werden die komplexen Streuparameter der als Vierpol betrachteten HF-Koppelnetzwerke mit Hilfe eines vektoriellen Netzwerkanalysators ermittelt und anschließend dessen Spannungsverstärkung berechnet. Die so erzielten Ergebnisse ermöglichen eine von der Applikationsbeschaltung unabhängige pinselektive Bewertung der leitungsgeführten Emission des Halbleiters.

KH2010-G-1472
Meteor radar measurements of mean winds and tides over Collm (51.3°N, 13°E) 2004-2010
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An all-sky VHF meteor radar (MR) has been continuously operated at Collm (51.3°N, 13°E) since summer 2004. The radar measures horizontal winds, diffusion coefficients and meteor parameters. Here a climatology of mean winds and tidal parameters, based on 6 years of continuous measurements, is presented. The results are compared against empirical models. Measured amplitudes, both of tides and annual/semiannual cycles are larger than those predicted by some models, but agree better with satellite-based climatologies
There exists a temporal overlap of the MR measurements with LF ionospheric drift measurements until 2008. Comparison of MR and LF semidiurnal tidal phases allows to empirically determine the virtual height correction of LF reflection heights necessary due to the group retardation of LF waves. LF reference heights have to be reduced by up to 10 km to match real heights.

KH2010-D-1473
Reliability Analysis of Buffer Stage in Mixed Signal Application
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Continuous and non-constant field scaling in current CMOS technologies has lead to many undesirable reliability issues due to effects such as Negative Bias Temperature Instability (NBTI), Positive Bias Temperature Instability (PBTI), Conducting and Non-Conducting Hot-Carrier Injection (HCI/NCHCI). These physical effects have a negative impact on circuit performance and precision. Significant device level research is carried out over these effects. However, since the superposition of these effects in a circuit is quite complex, the study of their impact on circuit level is still in a preliminary stage.
This paper targets to understand the effects of aging on a buffer circuit designed for Analog to Digital Converter (ADC) application. The entire buffer circuit was implemented and simulated using 32nm high-k metal gate technology with regular Vth nMOS and pMOS devices. So the effect of PBTI which appears due to high-k is also considered. The simulations were conducted with realistic AC stress using aging simulation tool. Due to aging closed loop operational amplifier in the buffer stage suffers from small input referred offset compared to open loop condition. However, this offset leads to gain error in the ADC circuit which should be calibrated and corrected.
We discuss the aging models used for aging simulation and the implemented buffer circuit topology, and present the results of aging simulation of buffer circuits. The aging degradation is evaluated analytically using a new approach based on sensitivity analysis. It helps to understand the root causes of aging effects on the buffer circuit. Finally we demonstrate the effects of buffer circuit degradation on ADC performance.

KH2010-G-1474
Some anomalies of mesosphere/lower thermosphere parameters during the recent solar minimum
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The recent solar minimum has been characterized by an anomalous strong decrease in thermospheric density since 2005. Here we analyze anomalies of mesosphere/lower thermosphere parameters possibly connected with this effect. In particular, nighttime mean LF reflection heights measured at Collm, Germany, show a very strong decrease after 2005, indicating a density decrease of about 30%. This decrease is also visible in mean meteor heights measured with a VHF meteor radar at Collm. This density decrease is accompanied by an increase of ionospheric drift fluctuations that can be associated with gravity wave amplitudes. Simultaneously, gravity wave amplitudes measured with the meteor radar at Collm as well as potential gravity wave energy derived from TIMED/SABER temperature profiles show an increasing trend since the maximum of solar cycle 23.

KH2010-B-1475
Ein neues parametrisches Ordnungsreduktionsverfahren für nicht-affine Parameter
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Wir präsentieren ein neues Ordnungsreduktionsverfahren zur effizienten Berechnung der Systemantwort linearer zeitinvarianter Systeme mit mehreren Parametern. Die hier betrachteten Systeme stellen finite-Elemente- (FE) Modelle passiver Hochfrequenzstrukturen dar. Typische Parameter sind neben der Frequenz die Material- und Geometrieeigenschaften. Frequenz und Materialien gehören zur Klasse der affinen Parameter - sie erscheinen im Originalmodell als explizite Parameterabhängigkeit - und sind somit einer Ordnungsreduktion durch Projektion unmittelbar zugänglich. Geometrieparameter hingegen führen aufgrund der Diskretisierung zu nicht-affinen Abhängigkeiten. Zur ihrer Behandlung schlagen wir ein neues Mehrpunktverfahren vor: Ausgangspunkt hierfür sind reduzierte Modelle über dem Frequenzparameter an diskreten Punkten des Geometrieparameterraums. Diese werden über ein multivariates Interpolationsverfahren zu einem parametrischen reduzierten Modell zusammengefügt, welches sich aufgrund der niedrigen Dimension sehr schnell auswerten lässt. Im Gegensatz zu existierenden Ansätzen ermöglicht das hier vorgestellte Rahmenwerk eine unterschiedliche Interpolation der System- und Projektionsmatrizen. Dieser zusätzliche Freiheitsgrad führt zu einer signifikanten Verbesserung der erzielbaren Konvergenzraten. In Folge dessen werden weniger lokale reduzierte Modelle benötigt, was mit einer deutlich schnelleren Generierung des reduzierten parametrischen Modells einhergeht. Da alle relevanten Operationen auf der Ebene der reduzierten Modelle durchgeführt werden können, ist das vorgeschlagene Verfahren überaus speichereffizient. Im Vortrag stellen wir die theoretischen Grundlagen vor, besprechen ihre algorithmische Umsetzung und belegen die Zuverlässigkeit und Effizienz des resultierenden Verfahrens anhand numerischer Beispiele.

KH2010-A-1476
Remote atomic clock synchronization via satellites and optical fibers
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In the global network of International Atomic Time (TAI) atomic clocks and time scales are compared by means of the Global Posi-

tioning System (GPS) and by employing telecommunication satellites for two-way satellite time and frequency transfer (TWSTFT). The current state-of-the-art primary caesium fountain clocks are compared at the level of 10^{-15} and time scales are synchronized with an uncertainty at the level of one nanosecond. Future improvements of worldwide clock comparisons will require also an improvement of the local distribution systems. For example, the future ACES (Atomic Clock Ensemble in Space) mission shall demonstrate remote time scale comparisons at the uncertainty level of 100 ps. In this framework we have developed a tool for calibrated clock comparisons through optical fibers, to ensure that the ACES ground terminal will be synchronized to the local time scales without a significant uncertainty contribution. An uncertainty below 50 ps over a distance of 2 km has been demonstrated on the campus of PTB. Thus it is a promising candidate for synchronization of enhanced time transfer equipment with the local realizations of TAI. Based on these experiments we estimate the uncertainty level for calibrated time transfer through optical fibers over longer distances. These results are compared with the current status and developments of satellite based time transfer systems.

KH2010-E-1477
Entwurf und Analyse eines generischen Mehrraumsystems unter dem Gesichtspunkt der EMV
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Die EMV-Analyse elektrisch großer Anlagen und Systeme gewinnt immer mehr an Bedeutung. Beispiele für solche Systeme sind große Gebäudekomplexe oder Transportsysteme wie Schiffe. Die Gründe für diesen Zustand sind unter anderen der wiederkehrende Bedarf an Erneuerung der Geräteausstattung, die notwendigen Umrüstarbeiten und nicht zuletzt die ständigen Veränderungen der Störumgebung und der Natur der vorliegenden Störquellen. Diese Veränderungen machen oft eine Neubewertung eines Systems unter EMV-Gesichtspunkten notwendig.
Als Übertragungswege für die vorhandenen Störgrößen in den Geräten und Baugruppen des Systems dienen in der Regel Aperturen, Leiter oder Kabel und Antennen die sich in bzw. an dem System befinden. Um methodische Verfahren zur Analyse der Verwundbarkeit dieser elektrisch großen Systeme gegenüber transienten Störungen vornehmen zu können, wurde ein charakteristisches Beispielsystem entworfen, welches es ermöglicht, die Effektivität von vereinfachenden Methoden bei dem Einsatz numerischer Feldberechnungsmethoden zur EMV-Simulation zu untersuchen.
In diesem Beitrag wird ein solches generisches Mehrraumsystem als Labormodell und Untersuchungsergebnisse an demselben vorgestellt. Das gezeigte Modell weist für den untersuchten Frequenzbereich wesentliche Eigenschaften von in der Praxis vorfindbaren Systemen auf. Es ermöglicht eine systematische Vorgehensweise bei der Untersuchung elektrisch großer Mehrraum-, Mehrleitersysteme mit Hilfe von Ansätzen aus der elektromagnetischen Topologie. Auf der Basis des entworfenen und aufgebauten Modells werden Simulations- und Messergebnisse gezeigt, die die Einkopplung externer elektromagnetischer Felder auf Leitungen im System darstellen. Schließlich wird ein Vergleich zwischen den gewonnenen Simulations- und Messergebnissen vorgenommen und auf die Nutzung und Anwendung der erzielten Ergebnisse eingegangen

KH2010-H-1478
ION & ELECTRON BEAM EFFECT ON ALFVEN WAVES IN MAGNETOSPHERE
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This paper studies, dispersion relation, damping-rate and associated currents of the Alfven wave in the presence of ion and electron beam with general distribution function in homogenous plasma by kinetic approach. Kinetic effects of both electrons and ions are included to study Alfven wave because both are important in the transition region. It is found the loss-cone distribution index affects the dispersion relation, damping-rate and associated currents of Alfven waves.

KH2010-C-1479
Performance of Combined Constellation Shaping and Bit Interleaved Coded Modulation with Iterative Decoding
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Since the capacity of additive white Gaussian noise (AWGN) channel was found by Shannon, most research in information theory is interested in designing a communication system that operates close to Shannon's limit. In the low SNR regime, the binary coding technique can approach the capacity. On the other hand, high order modulation schemes like M-ary quadrature amplitude modulation (M-QAM) have to be used in the high SNR regime to increase the spectral efficiency. Bit interleaved coded modulation with iterative decoding (BICM-ID) is a high bandwidth efficiency system. However, the use of equiprobable signal constellations leads to a loss of $\pi e/6$ (1.53 dB) due to using a uniform distribution rather than a Gaussian distribution over the signal set. Therefore, the use of powerful channel coding with a uniform constellation signal is not sufficient to achieve the channel capacity.
Constellation shaping is a method to generate a transmit signal which matches the AWGN channel. Actually, two techniques for the constellation shaping have been mainly proposed in literature. The first approach is to transmit the constellation points with unequal probability. The other is based on the optimizing of the constellation points, i.e. using equiprobable signal constellations with unequal spacing.
In this paper, we investigate the approaches to combine the constellation shaping with the BICM-ID scheme. Simulation results show that this combination can offer improvement up to 0.5 dB.

KH2010-D-1480
Entwurf eines frequenz-separierten Aufnahmekanals für neuronale Signale in 0.35µm CMOS
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Die Möglichkeit, neuronale Aktivität im Gehirn aufnehmen zu können, ist in der medizinischen Forschung ein sehr interessanter Aspekt. Für eine gute Auswertung und Analyse der Daten müssen mehrere Neuronen parallel aufgenommen werden. Hierfür wird ein „Recording Chip“ benötigt, der viele hundert oder sogar tausende Aufnahmekanäle besitzt. Die Anforderung an einen Kanal in Bezug auf Leistung, Fläche und Rauschen sind sehr hoch, da an der Gewebeschnittstelle die Temperatur nur minimal steigen darf, wenig Fläche zur Verfügung steht, und die Neuronen-Signale im Mikrovoltbereich liegen, während extrem große, besonders Gleichtakt-Störsignale präsent sind.
Diese neuronalen Signale bestehen aus zwei signifikanten Teilen, die Local-Field-Potentials, welche im Frequenzbereich von 0.1Hz bis 200Hz mit Amplituden von 500µV-2.5mV liegen und sogenannte Spikes im Bereich von 200Hz bis 7.5kHz mit Amplituden von 50µV-500µV.
In dieser Arbeit stellen wir eine neue Schaltungsstruktur vor, die eine Teilung des neuronalen Signals vor der analog-digital Wandlung ermöglicht. Die Local-Field-Potentials und die Spikes können nun separat bis zu der maximal möglichen Amplitude verstärkt werden.
Insbesondere wird der entworfene Vorverstärker vorgestellt, der ein eingangsbezogenes RMS-Rauschen von nur 3.5µV im Bereich von 0.1Hz bis 7.5kHz bei einer Leistungsaufnahme von 11µW zeigt. Für die Teilung der Signale wird ein Tiefpass mit einer 3dB-Frequenz von etwa 200Hz benötigt, welcher mittels SC Technik realisiert wird. Die Architektur und der Entwurf des benötigten Anti-Aliasing Filters wird gezeigt.

KH2010-H-1481
First LOFAR Observations of the Sun
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LOFAR (Low Frequency Array) is a radio interferometer realizing a new technology. It was originally designed by ASTRON in the Netherlands. I consists of 18 core and 18 remote stations in the Netherlands and, presently, 8 remote stations distributed over central Europe. All these stations are connected with the central blue gene computer in Groningen by a high data transfer link of 10 Gbit/s. The signals of the individual stations are transfered to Groningen, where

they are correlated to radio images of the sky. LOFAR is able to observe extraterrestrial radio sources at frequency ranges 30-80~MHz and 120-240~MHz. Thus, LOFAR opens a new window at long wavelengths in astronomy.
In LOFAR's frequency range, i.e. 30-240~MHz, the radio radiation from the Sun is emitted from the corona up to a distance height of about 1.6R$_{\cdot}$ (R$_{\cdot}, solar radius). Thus, LOFAR will be able to observe the launch of coronal mass ejections (CMEs), which are the source of solar energetic particle events. Such events can influence our Earth's environment and our technical civilisation. That is usually called Space Weather.
First LOFAR observations obtained during the pre-commissioning phase on June 9, will be presented.

KH2010-E-1482
Proposal for scalable models in EMC circuit simulation
Method of scalable model generation for EMC optimization with nonlinear regression
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In this paper a method 'Component Series Modeling' (CoSeMod) is presented. This allows fast and easy implementation of scalable model generations for passive component series based on measurement data or specification provided by manufacturer [1]. These can be used in circuit models for fast EMC analysis and optimization, especially in frequency ranges where conducted emission and susceptibility dominate. EMC tasks require high precision equivalent circuit models of components. Models generated with CoSeMod provide in many cases as high a quality as original (static) models do. One feature of scalability is that new netlisting is not needed after component changes. The process of model creation is based on similarities of the components of the same model series (packaging, manufacturing process, material etcetera). Required equations of the relationship between nominal and parasitic values are calculated by nonlinear regression [2]. Model generation for unknown components of a known series is possible with interpolation. Implementation is possible with relatively simple actions made in circuit simulator Saber [3]. An EMC application example of the implemented model is also shown in this paper.
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KH2010-A-1483
Time-domain characterization of a 110 GHz sampling oscilloscope using optoelectronic techniques
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We present optoelectronic measurements of the impulse response of an ultrafast sampling oscilloscope with a nominal bandwidth of 110 GHz within a time window of approximately 100 ps. The experimental setup allows for the measurement of frequency components well above the 110-GHz cut-off frequency of the 1.0-mm coaxial line. We also measure the oscilloscope reflection induced by the mismatch of the sampling circuit and the coaxial connector which is larger than 0.5 for certain frequencies. Additionally, an uncertainty analysis using Monte Carlo simulations according to the GUM S1 [1] is presented. This includes correlations in the uncertainty. Our measurements extend previous work which deals with the characterization of 70-GHz oscilloscopes [2,3] and the measurement of 110-GHz oscilloscopes up to their cut-off frequency [4].
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[5] We thank Uwe Karstens from LeCroy Europe GmbH for the loan of a 110-GHz sampling head (SE-100).

KH2010-B-1484
Combining a wideband fast integral equation solver with Multi-Resolution basis functions
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For the scattering or radiating analysis of an arbitrary perfectly electrically conducting 3d object the Method of Moments (MoM) accelerated by the Multilevel Fast Multipole Algorithm (MLFMA) works well in the mid frequency regime. At lower frequencies the MLFMA suffers from the so-called low-frequency breakdown. Furthermore, the numerical solution of the Electric Field Integral Equation (EFIE) via the MoM gets ill conditioned at very low frequencies or for dense-mesh problems.
The combination of the MLFMA with a low frequency approach such as the Low Frequency Fast Inhomogeneous Plane Wave Algorithm (LF-FIPWA) [1] yields a fast method for solving integral equations in a wide frequency range [2]. The application of the recently proposed Multi-Resolution (MR) basis with Local Singular Value loops [3,4] improves the convergence of the system of equations at low frequencies. In contrast to the traditional Loop-Tree basis the MR basis functions are found automatically even on complex topologies which is an essential characteristic in industrial environment. Since the MR basis functions are linear combinations of the Rao-Wilton-Glisson (RWG) functions, a basis change matrix may be used as purely multiplicative preconditioner. Numerical examples will show the performance of the broadband algorithm.
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KH2010-K-1485
GENERATION OF POSTURED VOXEL-BASED HUMAN MODEL FOR THE STUDY OF STEP VOLTAGE EXCITED BY LIGHTNING CURRENT
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With the development of medical technique and computational electromagnetics, high resolution anatomy human models have already been widely used in the computation of induced electromagnetic fields in the human body. Although these so called voxel-based human models are powerful tools for research on electromagnetic safety, their unchangeable standing posture makes it impossible to simulate a realistic scenario in which people have a lot of different postures. In this paper, we describe a poser software package with graphical user interface (GUI) which was developed to overcome this problem. The software package can import original voxel dataset file, set rotation angles of different joints with the help of a simplified human model, generate postured human models, and export the deformed models as new voxel dataset files. The original voxel-based human model can be deformed smoothly, continuity of the internal tissues and organs can be maintained and the mass of different tissues and organs is conserved in a reasonable level.
As a typical application of the postured human model, electromagnetic fields excited by lightning current in a walking human body were calculated with Finite Integration Technique (FIT) implemented by CST MICROWAVE STUDIO®[1]. To speed-up the simulation, the

"reduced *c*" technique [2] was used, in a variant adapted to our problem, to get a much longer stable time step than the value specified by the Courant limit for stability. Variations of internal electric field, current density and power loss with time were calculated and analyzed, which are very useful references for design, manufacturing and optimization of lightning protection equipment.

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KH2010-C-1486
Deterministic and Stochastic Channel Models Implemented in a Physical Layer Simulator for Car-to-X Communications
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In this paper, a physical layer simulator of the IEEE 802.11p standard for wireless access in vehicular environments (WAVE) is presented. With this simulator, the emulation of data transmission via different radio channels and the analysis of the resulting system behavior are possible. For example, the impact of various channel estimation and equalization techniques or the performance of diversity combining methods when using multiple antenna systems in realistic Car-to-X (C2X) communication scenarios can be modeled.
The physical layer simulator is part of an integrated simulation platform including a traffic model to generate realistic mobility and a 3D ray tracer to calculate the multipath propagation channel between transmitter and receiver. The traffic model as well as the ray tracer are fed with real traffic data and vector-based building data of the city of Braunschweig. In this way, realistic scenarios for C2X can be modeled. This approach allows us to simulate the system performance for a specific traffic situation, e.g. two cars are going towards an intersection (transition from NLOS to LOS conditions). Besides deterministic channel modeling by means of ray tracing, the physical layer simulator can also be used together with stochastic channel models in order to compute bit and packet error rates with respect to SNR for different C2X scenarios. Finally, it is also possible to feed the simulator with stored channel impulse responses that are obtained and derived from measurement campaigns. This option has the main advantage that realistic channel impulse responses can be used to simulate the system performance and to verify deterministic and stochastic channel models.

KH2010-C-1487
Channel Equalization Using Watermark as a Training Sequence
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Intersymbol Interference (ISI) is a very common type of distortion which a signal undergoes during transmission. Trained equalization is a technique widely used to cope with ISI. A training sequence is sent over the channel and with the help of received and already known training sequence channel is equalized. Traditional trained equalization scheme works with simple algorithms like Least Mean Squares (LMS). Most crucial drawback of traditional trained equalization is that it consumes extra bandwidth. To save the bandwidth, some blind equalization techniques, which do not require training sequences, are used to equalize channels. These blind equalization schemes are usually based on computationally complex algorithms like Constant Modulus Algorithm (CMA). So the cost of saving bandwidth is increased computational complexity.
In this paper a completely different approach is used. Training sequence is sent along with the data in the form of watermark. In proposed scheme, robust CDMA based watermarking algorithm [1] is used to watermark the data. Watermark, which is spread over the data, do not consume extra bandwidth. So with the help of extracted watermark channel can be equalized just by using simple mean square algorithm. Computational complexity remains less and training sequence must not be transmitted over the channel which saves bandwidth.

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KH2010-D-1488
Emulation Zeitkontinuierlicher SD-A/D-Wandler auf FPGAs
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Das Simulieren von zeitkontinuierlichen SD-A/D-Wandlern ist sehr rechen- und zeitintensiv, da für eine gegebene Genauigkeit nur sehr kleine Simulationsschrittweiten genutzt werden können, und zusätzlich numerische Integrationsverfahren mit den bekannten Nachteilen angewendet werden müssen. Durch sogenanntes Lifting ist es möglich zeitkontinuierliche Systeme diskret zu simulieren, wodurch die Simulationszeit erheblich reduziert wird – dabei können zeitkontinuierliche Effekte durch Korrekturterme berücksichtigt werden. Dennoch ist auch die hiermit erreichbare Simulationszeit noch zu groß, um simulationsbasierte Optimierungsverfahren in großem Umfang einsetzen zu können.
In diesem Beitrag stellen wir einen SD-A/D-Wandler 3. Ordnung mit generischer Filterstruktur vor, der auf einem FPGA realisiert wurde. Diese Emulation dient als Hardwareunterstützung für Matlab-basierte Simulationen von zeitkontinuierlichen SD-A/D-Wandlern unter Nutzung des Liftingverfahrens.
Durch Parallelisierbarkeit der Simulation und gleichzeitige Auswertung der Simulationsdaten auf derselben Hardware kann eine deutliche Reduktion der Simulationszeit erreicht werden.
Dieses Vorgehen ermöglicht zum Beispiel die effiziente Untersuchung der Auswirkungen von Parameterschwankungen oder auch den Einsatz von Optimierungsroutinen wie Genetische Algorithmen, in realistisch kurzer Zeit.

KH2010-C-1489
Physical Layer Simulation Results for IEEE 802.15.3c with Different Channel Models
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During the last years, wireless communication systems using the 60 GHz frequency band have attracted much attention. This unlicensed band, approximately ranging between 57 and 66 GHz, would satisfy the need for increasingly higher data rates required by new wireless multimedia services, such as kiosk downloading or uncompressed HD video transmission.
Thus, three different standards for WLAN/WPAN applications using the 60 GHz band have recently been issued: IEEE 802.15.3c, ECMA-387 and WirelessHD. Moreover, an IEEE 802.11ad draft has already been released.
In the full paper, a simulation environment for the IEEE 802.15.3c standard and associated simulation results will be presented. In order to assess the system performance, it is required to pay much attention to the wireless channel. The IEEE standard includes a 60 GHz channel model, and it has also been implemented. Furthermore, we also model the channel by using real scenario measurements and ray tracing simulations carried out at the Institut für Nachrichtentechnik.
The impairments introduced by the radio frequency equipment in the signal might play an important role in the overall system goodness. Thus, we have modeled the most important RF impairments and included them in our simulation environment.
All simulations have been carried out using Simulink™. This software works integrated in Matlab™ and allows the user to model communication systems with a modular approach. In addition, its time-aware simulation environment will allow the exportation of the implemented algorithms to real time communication systems.

KH2010-B-1490
A method for motion compensation of low-range, wide-beam synthetic aperture radar
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Up to now, SAR systems are used for long range detection. Applying it for low-range applications with wide-beam antennas of course does rise the resolution but rises the probability to detect hidden aims like a fawn while pasture mowing enormously in comparison to other detection systems. The main issue in such applications is the motion of antennas in range direction as they are carried by cars or

traction engines. If the motion is not compensated for, the phase cannot be reconstructed correctly, the resolution gets poorer and, in worst case, the target even disappears. Conventional methods for motion compensation fail for wide beam antennas, since for contributions of wide angles the phase reconstruction is incorrect. The bigger the antenna's aperture angle, the higher the error. We developed an algorithm to compensate the motion of the antenna correctly even for contributions of wide angles. Hence we are able to reconstruct e.g. a point scatterer with its maximum at 3 to 10 dB higher (dependent of the aperture angles) than achieved with conventional methods.

KH2010-B-1491
Elektromagnetische Streuung an einer ideal leitenden Kreisscheibe
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Der Beitrag befasst sich mit dem aktuellen Stand theoretischer Kenntnisse über die Streuung elektromagnetischer Wellen an einer ideal leitenden Kreisscheibe. Die Kreisscheibe ist einer von den zwei räumlich begrenzten kanonischen Streukörpern, für die eine strenge Lösung der Maxwellschen Gleichungen möglich ist (der andere ist eine Kugel). Die Kreischeibe ist eine wichtige Konfiguration, weil sie ein einfaches Modell einer ebenen Platte darstellt und sich die Wirkung einer gekrümmten Kante auf das gestreute Feld exakt untersuchen lässt. Eine strenge Lösung des Beugungsproblems durch Einführung des Hertzschen Vektorpotentials und dessen Entwicklung nach Sphäroid-Funktionen wurde 1950 von J. Meixner und W. Andrejewski beschrieben. C. Flammer schlug 1953 eine alternative Darstellung in der Form einer Entwicklung nach Vektor-Eigenfunktionen vor. Die beiden Lösungen wurden bei uns zur Analyse der Streueigenschaften von Kreisscheiben herangezogen und verglichen. Es stellte sich heraus, dass im Fall bistatischer Streuung einer aus beliebiger Richtung einfallenden ebenen Welle die Flammersche Lösung zu fehlerhaften Ergebnissen führt. Daher wurde die Lösung von Meixner und Andrejewski ausgewählt und als Grundlage für ein Simulationsprogramm im mathematisch-naturwissenschaftlichen Softwarepaket Mathematica verwendet. Dabei wurden einige Probleme mit den in Mathematica eingebauten Sphäroid-Funktionen festgestellt und behoben.
Ein anderer Teil des Beitrags behandelt die niederfrequente Streuung an einer elektrisch kleinen ideal leitenden Kreisscheibe. Es wird gezeigt, dass sich die Polarisierbarkeitstensoren der Kreisscheibe direkt aus der strengen Lösung ableiten lassen und im Einklang mit den Ergebnissen, die durch die Reihenentwicklung von Lösungen der Maxwellschen Gleichungen nach Potenzen der Wellenzahl abgeleitet wurden, stehen.

KH2010-C-1492
A Database Post-Processing Approach for Robust Frequency Estimation
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Many frequency estimators give good results when the signal components are well separated, have similar amplitudes, and the signal-to-noise ratio (SNR) is high. But the performance of these estimators decreases if there are multiple frequencies in low SNR, some signal components are very weak or weak signal components are close to stronger ones. In this case the weak signal components can be masked by the nearby component or by the noise, at least when this signal is in a critical instantaneous phase. Some typical estimators are based on the AR(/)MA [1] noise shaping models or the model of superposed sinusoids. The latter model in combination with separation of signal and noise subspaces by eigenvalue decomposition (EVD) of the correlation matrices leads to the popular ESPRIT [2] algorithm. In a non-stationary environment ESPRIT already gives better results when replacing the traditional EVD by an eigenvalue tracking algorithm like PASTd [3] (which also reduces computational complexity).
Here we present a post-processing method which tracks multi-tone frequencies by servicing a database in order to improve the results of the frequency estimation methods (PASTd-ESPRIT is used as an example). The post-processing method is based on the assumption that a signal is present for some time and does not change abruptly stepwise. Each database entry has six fields containing frequency, frequency drift, and phase difference as well as a quality index for each of these three values. The tendency field tracks slow changes of the frequency over time and adjusts the frequency field coarsely. We also assume the phase to be constant, which is one way of interpreting the signal characteristic described by frequency and phase. The phase difference field is used to improve the frequency estimation over time by investigating the phase slope to correct wrong estimates in the sense of fine-tuning (affecting frequency and tendency field). Of course, for phase analysis a phase estimation like e.g. a Kalman filter [4] has to be involved, too. Quality index fields mark the statistical relevance of the corresponding data field, which is defined by thresholds. In the frequency context relevance means signal presence; in the other two cases relevance indicates possible estimation improvement. The quality indices increase when a signal is present (in case of the frequency field) or the deviation is consistent (in case of tendency and phase difference). They decrease when the corresponding criterion does not match. Increase and decrease can be weighted differently to e.g. penalize the absence of estimation. Quality indices may be reset, when a correction is triggered.
Advantages of the presented method are better tracking of weak frequencies once recognized and smoother frequency estimations enabling good phase/amplitude estimations. Disadvantages are the delay induced by the post-processing and the fact that thresholds have to be reached for change.
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KH2010-B-1493
Network Modelling with Brune's Synthesis
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Network models of electromagnetic structures provide a compact formulation of their signal transmission properties. Systematic methods for generating lumped element canonical Foster multiport representations for lossless
electromagnetic structures already have been presented in previous work. The application of this methods to lossy structures, however, yields problems with respect to stability and passivity of the generated lumped element equivalent circuits. In this work we have applied Brune's method for the synthesis of equivalent lumped element circuits described by positive real (P.R.) rational functions.
Major part of work is the numerical implementation of Brune's circuit synthesis method of one-port from P.R. rational function. The procdure starts with simulating or measuring Z or Y-parameters data. From this data a P.R. rational function is obtained using Vector Fitting (V.F.) procedure. This rational function is an input to the numerical implementation of Brune's synthesis procedure, which in turn gives the lumped element model. The process is performed iteratively and in each iteration some part of the rational function which is simple to synthesize is extracted. Advantages of using Brune's process over other procedures, specially Darlington's method, are discussed.

KH2010-D-1494
Network Model of On-Chip Antennas
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Today CMOS technology allows to realize monolithic integrated frontends for wireless communication links up to millimeterwave frequencies. Due to the small dimensions of antennas on-chip integration of antennas for interchip and intra-chip communication becomes an interesting option. Network models of the communication links generated from electromagnetic full-wave simulation data are a valuable tool for circuit and system design. In this work we describe the systematic generation of a lumped element network model of an intra-chip wireless communication link formed by integrated antennas. To save chip area the antenna electrodes also are used as the ground planes of for the integrated circuitry operating in a frequency band below the carrier frequency of the wireless link. Numerical

fullwave simulation of the wireless link yields a tabular representation of the Z-parameters of the symmetric link two-port. This two-port can be represented by a lattice connection of four one-ports. Using Vector Fitting positive real rational functions approximating the data are obtained. From this, using Brune's method the lumped element equivalent circuit is generated. The model was simulated with SPICE. Measured S-parameter was also compared with the results of the EM filed simulations and the calulations from the equivalent network. The paper concludes with discussion on results and future work.

KH2010-D-1495
Super-regenerative Amplifiers for Cognitive UWB Radio Networks
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Advances in CMOS analog and digital circuits result in tremendous growth in wireless technologies over the last decade to support numerous applications. Various radio excess technologies have been developed to meet different needs, ranging from wireless personal/local/metropolitan area network like Bluetooth/IEEE 802.11b/g to well known cellular services like GSM/EDGE, W-CDMA or CDMA2K. The congestion in pre-allocated parts of the frequency spectrum continues to rise as more users access wireless networks. In this heterogeneous wireless radio environment, it is required to build RF devices, which can dynamically detect available radio access technologies and free spectrum resources, in order to use them to improve the overall spectrum usage. Therefore, our work focuses on the realization of cognitive radio networks. Since the concept of cognitive radios is still at the stage of being developed, there is no consensus for which kind of wireless technologies it should be realized. There are two frequency bands where cognitive radios might operate in the near future: 400-800MHz (UHF TV bands) and 3-10GHz for long and short range applications, respectively. But there are a number of complex requirements for the implementation of a cognitive radio network like no interference with licensed systems, adjustable pulse shapes, bandwidths, transmit power, providing multiple access and ensuring the security of information. UWB technology is considered as an attractive candidate because it has an inherent potential to fulfill the major requirements for cognitive radios.
An efficient RF spectrum sensing technique is required to identify the free and occupied transmission channels in order to build a cognitive radio network. This is one of the severe problems for an implementation. The previously reported RF sensing schemes require complex and power consuming architectures, which are based on reconfigurable LNAs, mixers, variable notch filters, wideband tunable oscillators, IF stages and ADCs. The presented work uses a design concept based on reconfigurable super-regenerative amplifiers in an RF spectrum sensing scheme – this enables low power, low cost and short range medium data rate cognitive UWB radio networks. The super-regenerative principle has been widely used since it has advantages of extraordinary gain, simplicity and low power consumption. However, the poor frequency selectivity of traditional super-regenerators limits its usage in narrow band applications, and makes them more attractive for UWB applications. The frequency selectivity for narrowband applications can be improved by Q-enhancement techniques, external control circuitry, off chip resonant tanks or auto-calibrated current control loops. This shows that the super-regenerative amplifiers have the ability to configure for wide and narrow bandwidths to sense the RF spectrum in coarse and fine manners. Multiple super-regenerative amplifiers are required to cover the whole UWB spectrum. The oscillators in these amplifiers are digitally tuned for a specific range of frequencies during certain periods of time to sense the spectrum in discrete time intervals. Occupied and free spaces within the UWB spectrum are identified by digital correlation between the output patterns of all super-regenerative amplifiers. An impulse-FM-UWB modulation scheme is proposed to build a low power short range cognitive UWB radio network. In transmitting mode, the selected oscillators - tuned within available free spaces - are periodically turned on and off to generate UWB impulses of 500MHz bandwidth. In receiving mode, these oscillators act as super-regenerative amplifiers to detect the impulse-FM-UWB data pattern. Voltage and current controlled quenching methods are used to configure these amplifiers in wideband and narrowband detection mode across the tuned frequency of oscillators.

KH2010-D-1496
Fully Integrated LDO Voltage Regulator for Digital Circuits
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Low-dropout (LDO) voltage regulators are widely used to supply low-voltage digital circuits. Thereby, the trend goes towards fully integrated LDO regulators which do not require any external capacitance.
Commonly, LDO regulators are specified, designed and verified for DC load currents. In contrast, digital circuits present large current spikes to LDO regulators. To guarantee fault-free operation of digital circuits, the supply voltage must remain within a certain error window. As LDO regulators are too slow to react on single current spikes, a minimum on-chip capacitance is required.
Different LDO architectures are discussed regarding their suitability to supply low-voltage digital circuits. The so called any-load stable LDO architecture is selected and implemented on a 130nm test-chip. The LDO regulator is able to drive up to 2.5mA while drawing a quiescent current of 17µA. The transient response to a DC load step and a digital load step is measured and compared.

KH2010-B-1497
Design and Analysis of an Isotropic Two Dimensional Planar Composite Right / Left Handed Waveguide Structure
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A two dimensional isotropic composite right / left handed (CRLH) waveguide structure is proposed which is designed for operation in X-band. The balanced structure possesses left handed behavior over a large bandwidth from 7.5 GHz up to its transition frequency at 10 GHz. Above this region, the unit cell behaves in a right handed manner up to 13.5 GHz. Operating the structure within these bands yields a frequency depended index of refraction ranging from $-2.5 \le n \le 0.8$. Isotropic characteristics are obtained between $8.5 \le f \le 12\,\mathrm{GHz}$ resulting in $-1.5 \le n \le 0.8$. The planar CRLH structure is designed based on transmission line theory, implemented in microstrip technology and optimized using full-wave simulation software. An equivalent circuit model is determined describing the electromagnetic behavior of the structure whose element values are obtained by even and odd mode analysis. The design of the unit cell requires an appropriate deembedding process in order to enable an analysis in terms of dispersion characteristics and Bloch impedance, which are performed both.

KH2010-F-1498
Weiterentwicklung des Plans GE06 unter Beachtung des Prinzips der Verteilungsgerechtigkeit
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Bisherige Versuche, die Nutzung des UHF-Spektrums über den im Wellenplan der Regionalen Funkkonferenz Genf 2006 niedergelegten Umfang auszudehnen, können hinsichtlich der erreichten Verteilungsgerechtigkeit nicht befriedigen. Ursachen dafür sind die im genannten Vertragswerk mangelnde explizite Definition von „equitable access" sowie die durch den „Artikel 4" vorgegebenen schwachen Randbedingungen einer lediglich auf Pareto-Optimierung beruhenden Neukoordinierung nutzbarer Frequenzen. Daher wird untersucht welche Planungsgrundsätze einzuhalten sind, um auch bei Erweiterungen des Wellenplans die im ursprünglichen Plan implizierte Verteilungsgerechtigkeit aufrecht zu erhalten. Dies gelingt durch Einführung von „effektiven Bedeckungszahlen".

KH2010-E-1499
Eine neue Methode zur Bestimmung von Antenneneffektivitäten in Modenverwirbelungskammern
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Die Antenneneffektivität gehört zu den am schwierigsten zu messenden Antennenparametern. Etablierte Methoden basieren meist entweder auf der Wheeler-Cap-Methode – und sind somit auf kleine Antennen beschränkt – oder sie erfordern einen kompletten 3D-Scan im Nah- oder Fernfeld der Antenne. Die Modenverwirbe-

lungskammer ist sehr gut geeignet zur Messung der gesamt abgestrahlten Leistung und somit auch zur Messung der Antenneneffektivität. Wir präsentieren ein neuartiges Verfahren zur Durchführung dieser Messungen in Modenverwirbelungskammer. Dieses Verfahren erlaubt die begleitende Bestimmung der Antenneneffektivitäten während einer Emissionsmessung und liefert somit einen wichtigen Beitrag zur Verringerung der Unsicherheiten. Präsentiert werden Ergebnisse von 3 verschiedenen Antennentypen (Horn, Log-Per, Schnechenantenne) in drei Modenverwirbelungskammer sowie der Vergleich mit 3D-Scans in einen Antennenmessraum.

KH2010-G-1500
The dynamic of the high-latitude upper thermosphere and magnetospheric drivers
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At high latitudes, important features of the thermospheric behaviour are better ordered with respect to geomagnetic coordinates than geographically. This points to the fact that main drivers of the high latitude upper thermosphere are bound to geomagnetic coordinates due to the dominance of electrodynamic forces. The mass density has been measured with the accelerometers onboard the polar orbiting CHAMP and GRACE satellites and the data set was recently thoroughly re-analysed within an ESA study that was performed also with regard to the planned multisatellite mission SWARM. This satellite constellation will allow a more detailed analysis of the complex interaction of the plasma and neutral components in the high-altitude atmospheric layers and its characteristic response times and pattern to the solar wind driving forces. An application for a common scientific project was positively evaluated and is now funded by the DFG to investigate this specific space weather phenomenon, exploiting unique data sets of these Low-Earth Orbiting (LEO) space missions.
The high-latitude thermospheric wind is strongly influenced by varying solar wind conditions via electromagnetic coupling with the magnetosphere. In this study we present a statistical study of both magnetospheric plasma convection measured by the EDI instruments on board Cluster and neutral wind measurements obtained from cross-track acceleration measurements of the CHAMP satellite at high geomagnetic latitudes. These data sets are analyzed in their dependence on the strength and
orientation of the interplanetary magnetic field (IMF). The magnetospheric driving processes are mediated via field-aligned current (FAC) responses to magnetic reconnection in terms of the vorticity of the ionospheric plasma convection. Similar pattern can be seen in the high-latitude neutral wind vorticity and its IMF dependency. FAC closure in the ionosphere further acts via Joule heating as an important energy source of the whole magnetosphere-ionosphere-thermosphere system.

KH2010-X-1501
does not exist.

KH2010-B-1502
Eigenmodal Analysis of the Field Scattered by an Elliptic Cone
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The scattering of a plane electromagnetic wave by a perfectly-conducting semi-infinite elliptic cone can be analytically treated in sphero-conal coordinates, where this geometry is identical to one of the coordinate surfaces. The elliptic cone includes a large variety of interesting degenerations, such as the circular cone, the wedge, and the plane angular sector. The practical interest in these structures is due to the fact that they possess tips and corners, and the related field could be used to complete asymptotic methods in Electromagnetics.
For the solution of the scattering problem, first the exact surface current on the PEC cone is found from the dyadic Green's function of the elliptic cone, where the case of an incident plane wave can be obtained by locating a Hertzian dipole in the far field and by multiplying the resulting modal expansion by a suitable factor. The scattered field caused by this surface current can be found by means of the equivalence theorem where now the dyadic Green's function of the free space in its modal form (in sphero-conal coordinates) is applied. The attempt to obtain a convergent partial-sum sequence by a simple summing-up procedure fails because we are describing a far-field distribution which contains plane or cylindrical wave caustics by means of a spherical-multipole expansion. However, by means of a linear summation technique we are able to obtain useful approximate results.
The eigenmodes of the elliptic cone which are found from solutions of a two-parametric eigenvalue problem with non-periodic and periodic Lamé functions determine the analytical and numerical properties of the proposed method. Hence, the presentation deals with an investigation of the eigenvalues and -modes particularly with respect to their relevance to the scattered far-field.

KH2010-D-1503
Schnelle komplexe Multiplizierer zur Umsetzung der schnellen diskreten Fourier-Transformation für OFDM-Sender mit Datenraten über 100 Gbit/s
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Optische Übertragungsstrecken mit Datenraten von bis zu 100 Gbit/s pro Wellenlängenkanal stehen kurz vor der Kommerzialisierung. Bei diesen Datenraten stellen Intersymbolinterferenzen (ISI) auf Grund von chromatischer Dispersion (CD) und Polarisations-Moden-Dispersion (PMD) ein großes Problem dar. Ein möglicher Ansatz, um dieses Problem zu lösen, besteht darin, anstelle einer NRZ-Übertragung die einzelnen Symbole auf mehrere Unterträger zu verteilen, wodurch sich die Einzelsymbolrate verringert. Um Nachbarkanalnebensprechen (ICI) zu vermeiden, wird orthogonaler Frequenzmultiplex (OFDM) eingesetzt. OFDM-Signale lassen sich einfach mit Hilfe der inversen diskreten Fourier-Transformation erzeugen, wofür schnelle komplexwertige Multiplizierwerke erforderlich sind.
In diesem Beitrag werden verschiedene Multiplizierwerke für komplexe Zahlen vorgestellt, die sich für den FFT-Algorithmus nach Cooley und Tukey eignen. Es werden Feldmultiplizierer basierend auf Ripple-Carry- und Carry-Save-Addierern, Wallace-Tree-, und Booth-2-Multiplizierer hinsichtlich kombinatorischer Laufzeit, Flächenbedarf und Stromaufnahme untersucht und charakterisiert. Simulationsergebnisse zeigen, dass sich der FFT-Algorithmus bei einer Taktfrequenz um 1 GHz in einer 65 nm CMOS-Technologie mittels Full-Custom-Entwurf umsetzen lässt. Darauf aufbauend kann vorhergesagt werden, dass mit Hilfe dieser Architektur Datenübertragungsraten von mehr als 100 Gbit/s in naher Zukunft realisierbar werden.

KH2010-D-1504
A CMOS Integrated Impedance-to-Frequency Converter for Sensing Cellular Adhesion
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Sensing cellular adhesion via impedance measurements provides a versatile and easily accessible means for monitoring in-vitro cell cultures. Most previous works used external electronics connected via cables to microelectrodes to achieve this goal, thus incurring parasitic impedance, electromagnetic interference, and bulky measurement setups. In this work we present a CMOS impedance-to-frequency converter integrated with biocompatible planar surface electrodes to make a compact and robust sensor chip for in-vitro cell monitoring. The system features an 8x8 array of individually addressable electrodes connected to four impedance-to-frequency converter circuits with externally adjustable biasing and square wave output. The measurement principle exploits the capacitive behaviour of the electrode-electrolyte interface at low polarization voltages in conjunction with the insulating properties of biological cell membranes by injecting a constant current in the nA range into the electrode while keeping the bulk electrolyte at a fixed potential. The time needed to charge and subsequently discharge the electrode potential between two reference voltages determines the frequency of the output signal. Cell adhesion is detected as a rise of the output frequency, which arises when the high spreading resistance of a cell-covered electrode causes an ohmic voltage drop through the electro-

lyte. The impedance-to-frequency converter circuits consist of a switchable constant current source, two comparators, and associated logic for addressing the pixel array and generating control signals. In designing the electrodes and circuit components, special attention had to be paid to keeping the current density and polarization voltage at the electrode low enough to avoid damaging the cells or triggering unwanted electrochemical reactions. Accurately sensing the electrode potential in order to detect ohmic voltage drops of few millivolts presented an additional challenge. We present first measurement results obtained with the integrated electronics that demonstrate the successful operation of the system and show good agreement with models of the electrode and cell impedances.

KH2010-B-1505

Fast Analysis of Microstrip Lines and Antennas in Cylindrical Multilayer Structures with Non-circular Cross Section

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A technique is presented for the fast analysis of conformal microstrip lines and antennas, which is based on the discrete mode matching (DMM). This method has proven to be exceptionally effective for planar and cylindrical structures composed of numerous thin dielectric layers. The main advantage is that in contrast to several other simulation tools, the numerical effort is reduced, since the dimension of the structure in the direction of the layers is treated analytically by means of a full-wave equivalent circuit (FWEC) and thus need not be discretized. The computational domain may be enclosed with electric and magnetic walls or by using absorbing boundary conditions (ABCs) for problems involving radiation.
This work describes an extension of the DMM that allows the analysis of electromagnetic problems in quasi-cylindrical coordinates. These are mainly cylindrical shapes with non-circular cross section. In this case, the radii of the interfaces are functions of the angle ϕ. Thus the usual spectral-domain formulation is not possible and the analysis involving the FWEC is performed in the space domain. The continuity conditions in the interfaces between the dielectric layers and on the metallizations are enforced by using suitable discretization schemes.
For validation, some typical test structures are analyzed and the results compared with data obtained from literature or by using other simulation tools.

KH2010-E-1506

Anwendung der Fehlerbaumanalyse für IEMI und deren Grenzen

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Bei komplexen elektronischen Systemen ist es nicht möglich, das System gegen alle Bedrohungen (bzw. den schlimmsten Fall) zu schützen und gleichzeitig kosteneffektiv zu sein. Daher sollte je nach den Sicherheitsanforderungen ein Gleichgewicht zwischen den Kosten und dem potentiellen Risiko gefunden werden. Zur Ermittlung des Risikos ist eine statistische Beschreibung des Systems notwendig. Für diesen Zweck eignet sich die Fehlerbaumanalyse (FTA: Fault Tree Analysis), wie sie bereits aus dem Bereich Funktionale Sicherheit bekannt ist. In diesem Vortrag soll gezeigt werden, wie die FTA-Methode auf die IEMI-Problematik angewandt werden kann. Mithilfe der FTA lassen sich zunächst qualitativ die Ursachen für ein potentielles Systemversagen untersuchen. Anschließend kann aus der Wahrscheinlichkeit der Basisereignisse die Ausfallwahrscheinlichkeit des Gesamtsystems bestimmt werden. Der klassische Fehlerbaum besteht aus binären Elementen, die nur zwei Zustände haben können. Durch Definition neuer Verknüpfungen werden auch physikalische Effekte wie Einkopplung von elektromagnetischen Wellen im Fehlerbaum implementiert. Die Grenzen dieser Vorgehensweise werden erläutert. Im Gegensatz zur klassischen Zuverlässigkeitsanalyse besteht bei IEMI das Problem von erhöhter Wahrscheinlichkeit des gleichzeitigen Ausfalls mehrerer Komponenten. Diese Problematik soll diskutiert werden.

KH2010-C-1507

Approximate Iterative Least Squares Algorithm for Global Positioning Systems

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In this paper we apply Global Positioning System (GPS) [1] and Differential GPS (DGPS) [2] methods for positioning tasks in smart phones. With the increased integrated hardware in smart phones, e.g. GPS, Network Access, WLAN, more and more applications become available. Therefore with the help of the information from base stations, Assisted GPS (AGPS) and DGPS can do the positioning faster and more precise than GPS. Consequently, stand-alone GPS will disappear (in most application scenarios). Using DGPS will enable easier, more accurate positioning methods consuming low power.
In order to do the positioning, the initial set of pseudoranges between the receiver and the tracked satellites is needed. Based on the measured pseudoranges non-linear Least Squares method is used for positioning. Linearization is done to convert the non-linear system of equations into an iterative algorithm solving a linear system of equations in each iteration. This is the most commonly used algorithm for position computation from pseudoranges. In this paper, CORDIC-based approximate rotations are used while computing the QR decomposition for solving the linear equations. By choosing accuracy of the approximation [3], e.g. with a chosen number of optimal CORDIC angles per rotation, the Least Squares computation can be simplified.
The accuracy of the positioning results is compared for various numbers of required iterations and various approximation accuracies using real GPS data.
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[2] P. Enge, R. Kalafus, M. Ruane; Differential Operation of the Global Positioning System; IEEE Communication Magazine 1988, Volume: 26, No. 7, Page(s): 48 – 60.
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KH2010-A-1508

Evaluation of a concept for density measurement of solid particle flows in pneumatic conveying systems with microwaves (8 – 12 GHz).

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Pneumatic conveying is of interest for handling particulate bulk materials like grain, pellets, etc., and pulverized fuel like coal dust. Mass or volume flow rate are parameters to quantify the material flow. Available methods for the measurement of the particles velocity are correlation and Doppler techniques. Besides the flow velocity, the mass density and volume concentration of the solid particles inside the conveying tube are further parameters to be assessed. In this contribution, concepts for the measurement of the latter parameters by means of microwaves in the X-band (8 to 12 GHz) are discussed and evaluated.
The proposed concept is based on transmission measurements through the cross section of an acrylic glass conveying tube. The setup consists of two horn antennas, which are arranged opposite to each other with the line of sight being oriented perpendicularly to the tube axis. The complex transmittance between both antennas is measured in order to assess electrical material properties and composition of the gas / particles material flow. Both, amplitude and phase are analyzed over a wide frequency range. Hereby the amplitude contains information about the attenuation, and the phase about the effective permittivity of the quasi-continuous medium. Distortions, which are caused by reflections at the walls of the tube, are compensated for by taking into account reference measurements of the empty tube. For a given type of particles, quantitative measurements of the volume concentration are obtained, based on reference measurements with known and changing concentration of particles.
Electromagnetic field simulations have been performed to evaluate the concept and the performance of the designed setup. A test stand for measurements on coal dust under reproducible conditions and with well-defined particle concentration has been developed and implemented. Coal particles with a diameter between 20 and 100 µm are dispersed inside the test tube with a diameter of 200 mm and a

length of 300 mm by injecting nitrogen, and transmission measurements are performed with a calibrated network analyzer. Results of the evaluation of the concept by measurements with different concentrations of coal particles are presented and discussed in detail.

KH2010-D-1509
Low Latency Architectures of a Comparator for Binary Signed Digits in a 28-nm CMOS Technology
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Low latency addition is of crucial importance in many digital signal processors and has been discussed widely in literature. For single operations carry look-ahead architectures with carry trees are an attractive solution. Yet in many applications like filters or crypto processors multiple additions in a series have to be implemented. In this case a switch from two's complement number representation to a redundant number system is recommended. Carry-save and signed digit are the preferred number systems for these applications because the carry propagation can be limited to one position to the left. Thus the delay can be kept low even for large word widths.
However, the sign operation or the truncation of numbers is more involved. Typical applications of the sign operation are the comparator of a digital delta-sigma modulator or to correctly extend the word width in digital filters. Especially for feedback systems a fast implementation is desirable because it can quickly become the limiting component in terms of maximum clock frequency.
In this work different architectures of a comparator for binary signed digits are presented and compared with respect to latency, complexity and power consumption. While a linear architecture has the smallest delay for small word widths, a tree based solution has an O(log n) complexity and thus becomes more favorable at larger word widths.

KH2010-C-1510
Prädiktion der Kanalkapazität von MIMO-Systemen mittels Multi Channel Coupling
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Bei der Installation von **M**ulitple **I**nput **M**ultiple **O**utput – Systemen hat die Positionierung der Antennen einen hohen Einfluss auf die erreichbare Übertragungsqualität. Um die Antennenstandorte zu ermitteln, mit denen die maximale Übertragungsqualität des MIMO-Szenarios erzielt wird, ist die Simulation zur Vorhersage der Übertragungseigenschaften von MIMO-Systemen zwingend erforderlich.
Eine Vielzahl von Untersuchungen hat sich bereits mit der Prädiktion der Leistungsübertragung mit Hilfe von Ray Tracing beschäftigt. Die Ergebnisse in diesem Bereich stimmen zwar gut mit Messungen überein, allerdings reicht insbesondere bei MIMO-Systemen die Leistung alleine zur Beurteilung der Qualität nicht aus.
Um eine Aussage über die, für die Decodierung so wichtige, lineare Unabhängigkeit der im MIMO-System enthaltenen **M**ulitple **I**nput **S**ingle **O**utput - Systeme, treffen zu können, muss statt der Leistungsübertragung die Kanalkapazität prädiziert werden.
Unsere Untersuchungen zeigen jedoch, dass Ray Tracing, durch die Beschränkung der Simulation auf eine endliche Anzahl an Interaktionen des Strahls mit der Umgebung, für eine zufriedenstellende Prädiktion der Kanalkapazität zu ungenau ist.
Wir werden deshalb einen neuen Algorithmus zur Prädiktion der Kanalkapazität von MIMO-Systemen auf Basis der 1997 von Liebendörfer et al. vorgestellten und 2000 von Karthaus bereits einmal erweiterten Methodik des Multi Channel Couplings präsentieren.
Weiterhin werden wir Prädiktionsergebnisse sowohl eines Image Ray Tracers als auch des neuen Algorithmus' mit Messungen am realen MIMO-System vergleichen und zeigen, dass die Genauigkeit der Prädiktion durch die Verwendung unseres Ansatzes erheblich verbessert werden kann.

KH2010-F-1511
Point-to-Point Link Atmospheric Transmission Measurements for Precipitaion Quantification
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For future requirements in hydrology and water resource management new precepitation measurement techniques that are complementary to rain gauges and ground based weather radar will gain importance. The established hydrometeorological methods have disadvantages. Very often they offer only point measurements and coverage is unsufficient especially in moutainous regions. Within the virtual institute "Regional Precipitation Observation by Cellular Network Microwave Attenuation and Application to Water Resources Management" (PROCEMA) attenuation data from point-to-point radio backhaul links is collected. Currently there are five commercial links in the alpine region around Garmisch (Upper Bavaria) being exploited. Seven more links in the pre-alpine region also provide input to our database. Data acquisition modules to measure and record the gain control voltage have been added to the point-to-point radio modules. The measured data is transfered to a database server via GSM. By that means the average received signal power is recorded once a minute. These data have been compared to data from rain gauges operated by the German Weather Service as well as to three own rain gauges at different altitudes at Mount Wank. Additionally a dual frequency (22.235 GHz and 34.8 GHz) and dual polarization transmission experiment has been installed at meteorological test site near Weilheim in August 2010 for the purpose of an in depth analysis of microwave interaction with precipitation. A pulsed monostatic setup with trihedral mirror yields a coherent system providing accurate transmission phase information. The system's Doppler bandwith of 6 kHz allows for studying noise processes, e.g. rain induced phase fluctuations.

KH2010-F-1512
Modelling of Electromagnetic Scattering in Rain Fields for Precipitation Quantification
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For water resource management with improved resolution and accuracy of precipitation observation additional measurement Techniques will be required in the future. Exploiting the attenuation data from the existing network of commercial point-to-point radio links has already proven to be an important supplement to rain gauges and ground based weather radar. Within the virtual institute "Regional Precipitation Observation by Cellular Network Microwave Attenuation and Application to Water Resources Management" (PROCEMA) these methods are currently being investigated. In addition to path attenuation also polarimetric information and noise processes are under consideration. This work presents the current state of the development of numerical simulations for the modelling of electromagnetic volumetric scattering in rain fields. In the already existing code the rain drops are assumed to be spheroidal. Frequencies up to 35 GHz are considered. Therefore Mie-Scattering is the applied model. The frequency and temperature dependant refractive index of water is also included. Extension to meteorologic models for flatended drop shapes is foreseen in the next stages. The simulation takes the drop size distribution (e.g. after Marshall-Palmer) as input parameter. Their rate of fall is then derived from the drop diameters. As a result we obtain the electric field vector in time-domain at the receiver location. Post-processing may follow to investigate attenuation, doppler broadening, statistical properties of the polarimetric scattering matrix, and amplitude and phase noise.

KH2010-X-1513
does not exist.

KH2010-D-1514
Zuverlässigkeit digitaler Schaltungen unter Einfluss von intrinsischem Rauschen
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Die kontinuierlich fortschreitende Miniaturisierung in integrierten Schaltungen führt zu einem Anstieg des intrinsischen Rauschens. Um den Einfluss von intrinsischem Rauschen auf die Zuverlässigkeit zukünftiger digitaler Schaltungen analysieren zu können, werden Methoden benötigt, die auf CAD-Verfahren wie Analogsimulation statt auf abschätzenden Berechnungen beruhen. Dieser Beitrag stellt eine neue Methode vor, die den Einfluss von intrinsischem Rauschen in digitalen Schaltungen für eine gegebene Prozesstechnologie analysieren kann. Die Amplituden von thermischen, 1/f und

Schrotrauschen werden mit Hilfe eines SPICE Simulators bestimmt. Anschließend wird der Einfluss des Rauschens auf die Schaltungszuverlässigkeit durch Simulation analysiert.
Zusätzlich zur Analyse werden Möglichkeiten aufgezeigt, wie die durch Rauschen hervorgerufenen Effekte im Schaltungsentwurf mit berücksichtigt werden können.
Im Gegensatz zum Stand der Technik kann die vorgestellte Methode auf beliebige Logikimplementierungen und Prozesstechnologien angewendet werden. Zusätzlich wird gezeigt, dass bisherige Ansätze den Einfluss von Rauschen bis um das Vierfache überschätzen.

KH2010-B-1515
Combined Lumped Element Network and Transmission Line Synthesis for Passive Microwave Structures
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Compact circuit models of electromagnetic structures are a valuable tool for embedding distributed circuits into complex circuits and systems. However, electromagnetic structures with large internal propagation delay are described by impedance functions with a large number of frequency poles in a given frequency interval and therefore yielding equivalent circuit models with a high number of lumped circuit elements. The number of circuit elements can be reduced considerably if in addition to capacitors, inductors, resistors and ideal transformers also delay lines are included. In this contribution a systematic procedure for the generation of combined lumped element / delay line equivalent circuit models on the basis of numerical data is described. The numerical data are obtained by numerical full-wave modeling of the electromagnetic structure. The simulation results are decomposed into into two parts representing a lumped elements model and a delay line model. The extraction of the model parameters is performed by application of the system identification procedure to the scattering transfer function. Examples for the modeling of electromagnetic structures are presented.

KH2010-C-1516
Increasing the Bandwidth Efficiency of OFDM/FM
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Constant envelope modulation like frequency modulation is one solution when an efficient usage of nonlinear power amplifiers is desired. However, in general constant envelope modulation schemes suffer from a poor bandwidth efficiency. The first step to increase the bandwidth efficiency is to find a suitable baseband signal that causes as least out of band power as possible after the constant envelope modulation.
We consider the combination of Orthogonal Frequency Division Multiplexing (OFDM) and frequency modulation (FM). The OFDM signal is used as baseband signal which is finally frequency modulated. OFDM/FM obtains a comparable bandwidth efficiency as Gaussian Minimum Shift Keying (GMSK). However, the spectral shape of OFDM/FM can be improved by filtering the output of the FM modulator. The filter process can be applied as band-pass filter. The correct layout of the band-pass filter preserves the OFDM/FM signal from additional bit errors and can reduce the bandwidth by up to one third. It is shown why OFDM/FM is especially suitable for this technique of bandwidth reduction. The reduction of the bandwidth has the side effect that the envelope is not constant, anymore. After the amplification with a nonlinear power amplifier additional out of band power is generated due to the nonlinearities. The bandwidth efficiency after the nonlinear amplifier is compared to the unfiltered FM spectrum. The results are presented for different amplifier models and different values of input back offs (IBO).

KH2010-F-1517
3D Transponder Antennas for future SHF RFID Applications
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The radio frequency identification (RFID) technology is omnipresent since a few years. Some of the most popular fields of application are the use for security tasks, logistics and the consumer segment. For example, chip card or key ring sized RFID transponders can allow wireless access to secured rooms. The number of applications for wireless data transmission for identification and tracking of objects increases every year. There is a large development need for highly functional and cheap RFID transponders due to the ever-increasing demand on improved reliability, higher data rates and read and write ranges of the RFID systems. Therefore, research was performed on new 3D transponder antennas for the so far not utilized Super High Frequency Band around 5.8GHz. Additionally, wave propagation effects and the influence of different dielectric environments were considered. Parallel to the design of the novel antenna structures the cheap manufacturing using a printing process was investigated. The gained results are the basis for the prospective RFID applications.

KH2010-G-1518
Observations of polar mesosphere summer echoes during a solar cycle and the relation with background electron density
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Strong radar echoes are observed at polar and mid-latitudes in the summer mesopause region. These so-called (polar) mesosphere summer echoes (PMSE) are well known from VHF radar observations for decades. PMSE are caused by inhomogeneities in the electron density of the radar Bragg scale within the plasma of the cold summer mesopause region in the presence of negatively charged ice particles.
Continuous and homogeneous observations of PMSE have been done at Andenes (69.3°N, 16.0°E) since 1998 using the ALWIN VHF radar at 53.5 MHz. Calibrated measurements of PMSE strengths (expressed by the backscatter cross-section) are presented for the last solar cycle. In addition, co-located observations of D-region electron densities with the 3-MHz Saura MF radar are available since summer 2003 and provide the opportunity to study the relation the relation between PMSE echo strength and background electron density. The relation is discussed for low and moderate levels of solar activity during quiet and disturbed geomagnetic conditions according to the K-indices from Tromsø (about 120 km from Andenes) as indicator for localised precipitation of energetic particles.

KH2010-A-1519
Interconnects in Membrantechnologie – Vorteile und Perspektiven
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Rückführbare Messungen von Streuparametern sind in der Welt der koaxialen Wellenleiter längst möglich. So ist z. B. der Leitungswellenwiderstand aus der koaxialen Geometrie heraus sehr genau berechenbar.
Für planare Strukturen ist dies zurzeit noch nicht möglich. Nur unter der Annahme idealer Geometrien und Materialien sind diese gut berechenbar. Eine gute Näherung einer idealen und somit berechenbaren, planaren Struktur stellt eine koplanare Wellenleitung (CPW) auf einer dünnen, isolierenden Schicht dar, die in Membrantechnologie gefertigt wird. Im Gegensatz dazu sind für eine in Standardtechnologie gefertigte CPW auf einem Substrat von einigen hundert Mikrometern Dicke die frequenzabhängigen Substrateigenschaften nicht vernachlässigbar.
Die im Rahmen dieser Arbeit angewandte Membrantechnologie beruht auf mikrotechnischen Verfahren. Der entwickelte Prozess bietet die Möglichkeit, CPWs aus Gold auf einer ca. 1 µm dicken Membran aus Mehrfrequenz-Nitrid (Rohde & Schwarz), gehalten von einem Siliziumrahmen, herzustellen.
Die Vorteile der Membrantechnologie gegenüber konventionellen Technologien werden mit Hilfe einer Sensitivitätsanalyse demonstriert, die auch als Messunsicherheitsbudget zur Bestimmung der Wellenleitereigenschaften verstanden werden kann.
Für beide Technologien wird der Einfluss der Unsicherheiten in den Querschnitts- und Materialparametern der CPW auf die Dämpfungskonstante α und die Phasenkonstante β mittels Monte Carlo-Analyse untersucht.
Es wird gezeigt, dass mittels der Membrantechnologie die Gesamtmessunsicherheit in der Dämpfungskonstanten α im Vergleich zur Standardtechnologie auf 60 % reduziert wird. Für die Phasenkonstante β als Zielgröße ermöglicht die Membrantechnologie sogar eine bis zu zehnfache Reduktion der Gesamtmessunsicherheit.

KH2010-D-1520
Energieeffizienter vollständig integrierter CMOS Gleichrichter
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Telemetrische Versorgung ist besonders in biomedizinischen implantierten Systemen zur elektrischen Stimulation und zur Aufnahme von neuronale Aktivitäten von großem Interesse. Die notwendige Energie für ein solches System wird durch eine externe AC-Quelle zum Implantat über induktive Kopplung von der Primärspule im Sender zur Sekundärspule im Empfänger übertragen. Die empfangene AC-Energie wird anschließend in eine Gleichspannung gewandelt und geregelt, welche dann zur Versorgung des Implantates dient. Da die Größe des Transponders begrenzt ist, stellt die sehr geringe Kopplung der Primär- und Sekundärspule eine Begrenzung für die verfügbare Energie im ganzen Implantat dar. Deshalb ist es notwendig, dass alle Systemkomponenten – u.a. auch der Gleichrichter - eine hohe Energieeffizienz aufweisen, um ein stabiles System zu gewährleisten.
In dieser Arbeit wird ein MOS Diodengleichrichter mit selbstreduzierender Schwellspannung für verschiedene Nieder- und Hochspannungsgleichrichter vorgestellt. Hierbei wird die Schwellenspannung einer konventionellen MOS Diode reduziert, indem eine zusätzliche „Gate"-Spannung generiert wird.
Messungen zu dieser Methode ergaben eine sehr hohe Spannungsübertragungseffizienz.

KH2010-C-1521
An Uncooled VGA-IRFPA with Novel Readout Architecture
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An uncooled VGA Infrared Focal Plane Array (IRFPA) based on microbolometers with a pixelpitch of 25 µm for thermal imaging applications is presented. The IRFPA has a 16-bit digital video data output at a framerate of 30 Hz. Thousands of Analog to Digital Converters (ADCs) are located under the microbolometer array. One ADC consists of a Sigma-Delta-Modulator (SDM) of 2^{nd} order and a decimation filter. It is multiplexed for a certain amount of bolometers arranged in a so called "cluster". In the 1^{st} stage of the SDM the microbolometer current is integrated time continuously. The feedback is applied time discrete using switched capacitor (SC) technique. Measurements of Noise Equivalent Temperature Difference (NETD) as a key parameter for IRFPAs will be presented.

KH2010-B-1522
SENSITIVITÄTSANALYSE VON WELLENLEITER-EIGENWERTPROBLEMEN
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In Leiterplatten eingebettete, optische Wellenleiter auf sogenannten Electro-Optical Circuit Boards (EOCB) versprechen u. a. schnelle Board-to-Board Verbindungen mit hohen Datenraten. In einem aktuellen Design kommen dazu Wellenleiter in Dünnglastechnologie bei einer Wellenlänge von 1310 nm zum Einsatz. Sie weisen ein Gradientenindexprofil mit einer näherungsweise ellipsenförmigen Kerngeometrie auf und sollen erstmals eine Single-Mode Übertragung gewährleisten.
Das tatsächliche Indexprofil weist allerdings starke fertigungsbedingte Störungen und Toleranzen auf und kann nur durch aufwändige Messungen ermitteln werden, die einigen methodischen Schwächen unterliegen. Daher sollen die Übertragungseigenschaften der Wellenleiter auch numerisch berechnet werden. Hierbei interessiert insbesondere die Abhängigkeit der Ausbreitungs- und Dämpfungskonstanten von der Materialverteilung im Querschnitt.
Zu diesem Zweck werden Ergebnisse der klassischen Perturbationstheorie für Eigenwertprobleme auf das mit Hilfe der Methode der Finiten Integration (FIT) formulierte diskrete Eigenwertproblem für Wellenleiter angewandt. Zur Berechnung der Ableitung des Eigenwerts (der Wellenzahl) nach Strukturparametern wird dabei der Linkseigenvektor der nicht-symmetrischen Systemmatrix benötigt, der aber aufgrund besonderer Matrixeigenschaften nicht gesondert berechnet werden muss. Des Weiteren muss die Ableitung der Systemmatrix nach den gewünschten Parametern zur Verfügung stehen, wozu verschiedene Implementierungsansätze diskutiert werden. Erste numerische Ergebnisse bestätigen die Effizienz des Ansatzes, der in vielen Fällen aufwendige Parameterstudien ersetzen kann.

KH2010-B-1523
Modellordnungsreduktion elektroquasistatischer FEM-Simulationen im Zeitbereich mit POD-Techniken
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Bei der Entwicklung moderner Systeme der Hochspannungstechnik wird immer mehr auf neuartige Mikrovaristormaterialien zur elektrischen Feldsteuerung gesetzt. Eine wesentliche Eigenschaft dieser Mikrovaristormaterialien ist ihre starke nichtlinear feldstärkeabhängige Leitfähigkeit. Dies bedeutet, dass in der Modellierung kapazitive und nichtlineare resistive Effekte betrachtet werden müssen.
Mittels der elektroquasistatischen Näherung der Maxwellgleichungen ist es möglich genau diese Effekte in Betracht zu ziehen. Man erhält die Gleichung der Elektroquasistatik aus der Kontinuitätsgleichung, welche die zeitliche Entwicklung des elektrischen Skalarpotentials angibt. Die räumliche Diskretisierung dieser Gleichung mit Hilfe der Finiten Elemente Methode (FEM) ergibt ein hochdimensionales nichtlineares System steifer gewöhnlicher Differentialgleichungen. Das damit beschriebene Anfangsrandwertproblem kann mit impliziten Zeitintegratoren gelöst werden, in denen in jedem Zeitschritt mindestens ein nichtlineares Gleichungssystem zu lösen ist. Dies macht die Simulation von kapazitiv-resistiven Modellen bei hoher räumlicher Diskretisierungsauflösung sehr kostenintensiv; insbesondere werden Parameterstudien sehr aufwendig.
Um an komplexen Modellen Parameterstudien durchführen zu können, sind nieder-dimensionale Formulierungen der Systeme notwendig. Um eine Projektion auf ein niederdimensionales Model zu bekommen sind Verfahren, welche auf der Singulär-Wert-Zerlegung (SVD) basieren, anwendbar. Ein etabliertes Verfahren der Modell-Reduktion, welches auf der SVD basiert ist die so genannte Proper Orthogonal-Decomposition (POD).
In diesem Beitrag werden POD-Techniken adaptiert auf elektroquasistatischen FEM-Zeitbereichsformulierungen zur Modellordnungsreduktion eingesetzt. Erste numerische Resultate verifizieren diesen Ansatz und zeigen das Potential zur Beschleunigung der FEM-Simulationen komplexer technischer Systeme der Hochspannungstechnik auf.

KH2010- C-1524
Signal Processing For Line Accumulating X-Ray Imaging
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In food industry, most finished products are scanned for contamination. Traditionally metal detectors are employed, which are effective for metallic objects however they are not able to detect glass pieces or ceramic bearing balls. Nowadays, nearly all sensitive products are scanned by X-ray imaging, which is capable to detect a wide variety of product contaminations.
A continuous scanning process is needed to examine the products as it is passing by on a conveyor belt. Therefore signal processing has to be fast enough to remove contaminated products from the product stream.
The simplest solution to deploy x-ray imaging is to use a single line sensor which takes an image every increment the conveyor belt moves. This approach gives a sharp image and is computationally efficient but the low achievable resolution limits the capabilities of the following signal processing. Another drawback is that a lot of x-ray power is wasted since only a single line of the planar image is read out. A high x-ray power is needed, implying high power consumption, a lot of heat that needs to be dissipated and a thick shielding to protect people around the machine.
A much smarter solution is to use line accumulating CCD sensors, which have 128 or even 256 lines. The image is shifted according to the belt speed and each line which leaves the sensor is sent to the signal processing unit. The resulting image can be comprised as a superposition of 128 or 256 images, depending on the used sensor. With this approach, the necessary x-ray power can be decreased and a higher output resolution is achievable. However, difficulties and possibilities in signal processing arise, which will be discussed in this paper.

KH2010-B-1525
Suppression of Grating Lobes for MMW Sparse Array Setups
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In this paper the properties of arrays regarding resolution and unambiguity intervals will be discussed and methods for the suppression of ambiguous grating lobes are suggested. For arrays the placement of the single elements determines the angular resolution and the unambiguity interval. The width of the total array determines the resolution capabilities. The wider the elements are placed from each other, the more space in Fourier domain is covered by the measurement and the resolution in time domain will improve. On the other hand the density of the elements has an effect on the interval where objects can be detected unambiguously. For objects within the unambiguous interval grating lobes will appear outside this area and vice versa. By designing the antenna patterns of transmit and receive antennas appropriately the amplitudes of the grating lobes can already be suppressed to a certain extend. When the concept of virtual arrays with a certain amount of Tx and Rx antennas is used, the apertures of Rx/Tx can be increased even more, which leads to a better suppression.
In order to suppress the influence of the grating lobes the evaluation of different frequency bands can be used in addition. When the spacing between the evaluated sub bands is large enough, the position of the grating lobes is different such that the grating lobes of the sub bands can be resolved from each other. The main lobe will always be at the same position. A further processing step after the original array processing for the single sub bands can then discriminate between grating lobes and main lobes.
A preliminary setup in the MMW range that is intended to be used for distances of 50m to 100m with a bandwidth of up to 6 GHz is used to verify the validity of the approach. A setup with 16 virtual elements that can be formed with 4 transmitters and 4 receivers will be considered. Measurement results from this setup and simulation results will be presented.

KH2010-C-1526
A MIMO FMCW Radar Approach to HFSWR
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This paper describes one possible approach of how to apply multiple-input multiple-output (MIMO) to monostatic Frequency Modulated Continuous Wave (FMCW) High-Frequency Surface Wave Radar (HFSWR) in a maritime environment. In the past conventional single-input multiple-output (SIMO) systems have been using a "floodlight" transmit antenna in conjunction with a receive antenna array in the order of several antenna elements making use of digital beamforming. Due to the required high dynamic range to be processed by the analogue-to-digital converter in the HFSWR receiver most systems employ stretch processing to lower the sampling rate requirements.
The question is now how to extend or combine these traditional systems using FMCW and stretch processing with the collocated MIMO concept to "reuse" the very limited HF radar band resources.
In our approach the transmitter employs several transmit elements (N), each transmitting a different time-synchronized FMCW waveform with the same chirp duration and same start frequency but a different bandwidth. This is in contrast to other approaches that use time-staggered or a dual-frequency FCMW approach. At the receiver side we use several collocated receive antenna elements (M), performing stretch processing at each antenna element for all N transmitted FMCW waveforms.
The first question for a MIMO approach is always the question of orthogonality of signals to be able to separate them at the receiver side. With our approach a significant level difference between the auto correlation and cross correlation can be achieved. Thus at each antenna we have a total of N times the same information about the radar channel/scenario. In the simplest case digital beamforming for each transmitted waveform over all receive antenna elements can be performed, followed by Range-Doppler processing.

KH2010-C-1527
Fast Beampattern Evaluation by Polynomial Rooting
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The behaviour of a sensor array estimating DOAs (direction of arrival) depends on its beampattern. To find the array configuration leading to the best angle estimation by a global optimization algorithm, a huge amount of beampatterns have to be calculated to detect their maxima. In this paper, an algorithm is proposed to find all maxima of an array's beampattern fast and reliably, leading to accelerated array optimizations.
The algorithm works for arrays, having element distances as integer multiple of a base size, i.e. they are positioned on a grid. This can always be approximated with arbitrary precision. We use a generalized version of the gcd (greatest common divisor) in order to reformulate the cost function as a polynomial. We differentiate and root the polynomial to get the extrema of the beampattern. In addition, we show a method to reduce the computational burden even more by decreasing the order of the polynomial.
We show simulation results, which compare a classical sampling and maximization algorithm with the polynomial rooting approach. It is shown under which conditions the proposed algorithm is faster than the classical one. For typical arrays, the rooting algorithm is one to two magnitudes faster than the sampling approach.

KH2010-C-1528
Smoothing Techniques for Decision-Directed MIMO-OFDM Channel Estimation
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With the purpose of supplying the demand of faster and more reliable communication, multiple-input multiple-output (MIMO) in conjunction with Orthogonal Frequency Division Multiplexing (OFDM) are subject of extensive research. Successful Decoding requires an accurate channel estimate at the receiver, which is gained either by evaluation of reference symbols which requires designated resources in the transmit signal or decision-directed approaches. The latter offers a convenient way to maximize bandwidth efficiency, but it suffers from error propagation due to the dependency between the decoding of the current data symbol and the calculation of the next channel estimate. In our contribution we consider linear smoothing techniques to mitigate error propagation by the introduction of backward dependencies in the decision-based channel estimation. Designed as a post-processing step, frame repeat requests can be lowered by applying this technique if the data is insensitive to latency.
The problem of high memory requirements of FIR smoothing in the context of MIMO-OFDM is addressed with an recursive approach that acquires minimal resources with virtual no performance loss. Channel estimate normalized mean square error and bit error rate (BER) performance evaluations are presented. For reference, a median filtering technique is presented that operates on the MIMO time-frequency grids of channel coefficients to reduce the peak-like outliers produced by wrong decisions due to unsuccessful decoding. Performance in terms of Frame Error Rate is compared to the proposed smoothing techniques.

KH2010-D-1529
Pushing Energy Savings in Adiabatic Logic by Carbon Nanotube Field Effect Transistors
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One potential future replacement for bulk MOSFETs is based on Carbon Nanotubes (CNT), made out of a cylindrical wrapped around carbon monolayer. Due to their superior electrical characteristic, the high conductivity resulting from a (near-)ballistic charge transport, carbon nanotubes are interesting candidates for lowest energy dissipation in adiabatic logic (AL).
Simulations are carried out with the HSpice CNT compact model provided by the Nanoelectronics group of Stanford University. Gates built in the adiabatic logic families Efficient Charge Recovery Logic (ECRL) and the Positive Feedback Adiabatic Logic (PFAL) are compared with respect to static CMOS, all three based on CNT devices. The Energy Saving Factor (ESF) of CNT-based AL inverter gates is increased up to 18 (energy of static CMOS gate with respect to the adiabatic counterpart) and the Optimum Operating Frequency (f(opt)) for lowest energy consumption is as high as 500MHz. Furthermore, the impact of the chiral vector on the ESF and the f(opt) is investigated, as well as the impact of sizing (increasing number of tubes within a CNT-based FET), and voltage scaling.
The investigations provide a peek into the potentials of implementing CNT-FET based adiabatic logic ultra-low power digital systems.

KH2010-E-1530
A low-noise high-dynamic range time-domain EMI Measurement System for CISPR Band E
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Time-domain electromagnetic interference (TDEMI) measurement systems allow to reduce the scan time by several orders of magnitude compared to traditional EMI receivers. A novel TDEMI measurement system for CISPR band E up to 18 GHz is introduced. The TDEMI measurement system combines ultra-fast analog-to-digital conversion and real-time digital signal processing in a field-programmable gate-array (FPGA) with ultra-broadband multi-stage down-conversion. A scan of the whole frequency range from 9 kHz to 18 GHz with a 9 kHz IF-filter takes around 3 minutes. Assuming the use of a dwell-time of 100 ms, the measurement would take over 55 hours on a conventional EMI receiver.
The EMI signal below 1.1 GHz is low-pass filtered and analog-to-digital converted. The EMI signal spectrum is calculated via the Fast-Fourier-Transform (FFT). The EMI spectrum from 1.1 GHz to 18 GHz is fed to an ultra-broadband multi-stage down-converter. This frequency conversion converts the EMI signal in CISPR band E to the band below 1.1 GHz, where it is sampled and the amplitude spectrum is calculated. In the frequency range from 1.1 GHz to 6 GHz, 325 MHz subbands are consecutively mixed up to a fixed high first intermediate frequency at 7 GHz. A second mixer converts the signal down to the frequency band below 1 GHz. A single band-pass filter is suppressing the image band. The EMI spectrum from 6-18 GHz is down-converted to the frequency band from 1.1-6 GHz. Three preselection filters suppress the image band and out-of-band interference.
Measurements show that the system exceeds the dynamic range requirements demanded by CISPR 16-1-1 for band E by over 10 dB. The system's low noise figure of 6-8 dB allows for measurements with high sensitivity like the evaluation of narrowband signals near the noise-floor, while reducing the scan time by several orders of magnitudes.

KH2010-E-1531
Störemissionen von Induktionskochplatten – Wirkung auf Herzschrittmacher
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Induktionskochplatten erzeugen starke magnetische Wechselfelder, die zum erhitzen des Topfbodens genutzt werden. Hier kommt es zum einen zu Hystereseverlusten und zum anderen zu ohmschen Verlusten durch die induzierten Kreisströme, wodurch die Wärme erzeugt wird.
Ein Großteil des magnetischen Feldes wird im Topfboden, aufgrund seiner hohen Permeabilität, gebunden. Der Nutzer der Kochplatte ist jedoch Streufeldern ausgesetzt. Die magnetische Feldstärke überschreitet hierbei nicht die gesetzlich vorgeschriebene Norm, sodass keine Gefährdung für gesunde Menschen vorhanden ist. Im Falle von Personen mit aktiven Körperhilfsmitteln, wie z.B. Herzschrittmachern, könnte das magnetische Wechselfeld eine Störspannung in die Elektronik des Implantats induzieren und so Störungen verursachen.
Für diese Studie werden die magnetischen Felder einer kommerziell erhältlichen Induktionskochplatte vermessen. Zusätzlich werden diese magnetischen Felder mit Hilfe einer Feldberechnungssoftware simuliert. Anhand dieser Ergebnisse können Aussagen darüber getroffen werden welchen Sicherheitsabstand Träger von Herzschrittmachern zu Induktionskochplatten einhalten müssen, um eine Fehlfunktion ihres Implantats auszuschließen.

KH2010-E-1532
Electromagnetic Field Coupling to Transmission Lines in Rectangular Resonators
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The coupling of electromagnetic fields to different transmission line and antenna - like wiring structures is one of the main paths of interaction of intentional and natural electromagnetic interferences with electronic and electrical equipment. Usually such problems are considered for objects in free space [1], however, often such structures are inside resonator – like structures of different kind (racks, cases, housings, fuselage of aircraft, etc.). Then, due to the presence of the resonator, the interaction can change strongly. Existing numerical methods (MoM, TLM, etc.) allow to consider specific cases only, but do not describe the general physical picture of the interaction. Thus, the analytical description of the interaction of high-frequency fields with wire structures in cavities becomes actual (see, for example, [2,MURI]).
To solve this problem several methods can be offered. The approximate methods are based, as usual in theoretical physics, on the use of small parameters. One group of such methods uses the smallness of the dimension of the wiring structure in comparison with the wavelength. This leads to the description of common modes of the scattered current with the aid of the model of small dipole antennas [3, 4, 5] and to the differential mode of the scattered current using the method of small loop antennas [6]. The mutual influence of antenna and cavity modes increases with the length of the antenna. This influence can be quantitatively characterized by a shift of the resonance frequency of the system "antenna in cavity" in comparison with the resonant frequency of the empty cavity. It is proportional to the cube of the ratio of linear dimensions of the antenna and the cavity. Therefore, it follows that the maximum electromagnetic coupling occurs when the size of the antenna or transmission line is about the size of the cavity.
However, of course, for such a large extension of the scatterers, the "Method of Small Antenna" is not applicable. Another small parameter which can be used to solve the coupling problem for electrically long antennas and transmission lines inside a resonator, is the thickness of the wire compared to other geometric parameters of the problem (wavelength, height of the wire above floor, etc.) [7, EMTS 2010, Berlin]. The relevant mathematical technique is the method of analytical regularization [8] where the approximate resolution operator for the singular part of Green's function is given by the transmission line approximation, and the regular part of the Green's function is defined by one or more eigenmodes of the cavity. This approach allows to consider the coupling of electromagnetic fields with electrically long transmission lines and antennas of arbitrary geometric configuration inside the resonator, when the frequency is close to one of the resonance frequencies and all the other resonance modes account for forming the singular part of the cavity Green's function. This method was verified by comparison with results of the TLM method and yielded an acceptable agreement [7, Berlin 2010].
However, it is interesting to check the method of Ref. [7, Berlin2010] by comparison of the results with the exact solution and to investigate the structure of the exact solution, even for partial cases. Moreover, the problem can be used for the investigation of the change of the quality factor of the resonator caused by the presence of loaded transmission lines [9]. For the exact solution of this problem we use a technique of theoretical physics and will consider a "wire in resonator" system which has high symmetry. This system consists of a rectangular resonator and an internal wire parallel to the resonator axis connecting opposite walls of the resonator. The wire can be loaded in an appropriate way (including two lumped loads near the terminals). Moreover, the method allows to consider a finite number of such parallel (or perpendicular) wires. The electric field integral equation or mixed potential integral equation (using only thin-wire approximation) which describes the induced current in such wires can be solved by Fourier transform. The advantage of the geometry of such system leads to the equality of series expansion functions in the Fourier transform for the induced current and of series expansion functions in the Fourier transform for the resonator Green's function in the direction of the wire. Moreover, during the investigation of the exact equation for the induced current one can separate terms corresponding to the transmission line approximation and those corresponding to cavity modes and evaluate the effect of different resonances.
During the investigations the results of the theory were compared with experimental results in the medium – size mode stirred chamber of the University of Magdeburg (without stirrers) and good agreement was found.
In conclusion, we shortly describe the possible directions of future research. As usual in theoretical physics, after using symmetry properties for some specific system one can generalize the results using a topological approach [10]. Note that from a topological point of view, the investigated transmission line with symmetric geometry is equivalent to a usual transmission line inside the resonator.
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KH2010-G-1533
Storm induced Travelling Ionospheric Disturbances observed over Europe
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Travelling Ionospheric Disturbances (TIDs) are signatures of atmospheric gravity waves.
By monitoring the total electron content as a direct result of ground based GNSS measurements one can determine the properties of TIDs. A dense network of GNSS receivers over Europe allows the estimation of wavelength, propagation direction and phase speed of the TIDs. Usually, large scale TIDs observed after geomagnetic storms have a wavelength of the order of about 2000km, a southward orientation and a mean phase speed of about 680 ms^{-1}. A correlation of TID amplitudes with the auroral electrojet index, AE, indicates ionospheric Joule heating, located within the vicinity of the auroral oval, as a possible source of TIDs. The source region of the TIDs has a similar southward extension as the polar electrojet system during enhanced geomagnetic conditions. Their propagation is discussed in relation to the southward propagation of enhanced ionization fronts and the perturbation induced dilation of the auroral oval towards lower latitudes.

KH2010-G-1534
Storm induced Travelling Ionospheric Disturbances observed over Europe
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Travelling Ionospheric Disturbances (TIDs) are signatures of atmospheric gravity waves.
By monitoring the total electron content as a direct result of ground based GNSS measurements one can determine the properties of TIDs. A dense network of GNSS receivers over Europe allows the estimation of wavelength, propagation direction and phase speed of the TIDs. Usually, large scale TIDs observed after geomagnetic storms have a wavelength of the order of about 2000km, a southward orientation and a mean phase speed of about 680 ms^{-1}. A correlation of TID amplitudes with the auroral electrojet index, AE, indicates ionospheric Joule heating, located within the vicinity of the auroral oval, as a possible source of TIDs. The source region of the TIDs has a similar southward extension as the polar electrojet system during enhanced geomagnetic conditions. Their propagation is discussed in relation to the southward propagation of enhanced ionization fronts and the perturbation induced dilation of the auroral oval towards lower latitudes.

KH2010-E-1535
Bedrohung elektronischer Systeme durch die kriminelle Nutzung von HPEM Systemen
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Im Jahr 1999 hat die URSI auf ihrem XXVIth General Assembly in Toronto in der Resolution on Criminal Activities using Electromagnetic Tools auf die zunehmende Gefährdung durch die mögliche kriminelle Nutzung elektromagnetischer Systeme hingewiesen. In dieser Resolution wurde besonders darauf hingewiesen, dass durch die Nutzung elektromagnetischer Phänomene, kriminelle Aktivitäten verdeckt verübt werden könne und eine Identifizierung der Störquellen sehr schwer oder oftmals nicht möglich sei. Da elektromagnetische Felder mechanische Barrieren wie Zäune und Mauern relativ ungedämpft durchdringen können, stellen diese Barrieren zudem keinen wirksamen Schutz dar. In der Resolution wurde eine Intensivierung der Erforschung der Wirkungsmechanismen sowie eine Ableitung von Schutzmaßnahmen angeregt.
In den zehn Jahren, seit Verabschiedung der Resolution on Criminal Activities using Electromagnetic Tools wurden weltweit die Wirkungs- und Störmechanismen, die Störfestigkeit ausgesuchter elektronischer Baugruppen und Systeme untersucht und veröffentlicht. In dieser Zeit führte der technologische Fortschritt dazu, das Komponenten für HPEM Quellsysteme zunehmend auf dem freien Markt verfügbar wurden. In diesem Beitrag soll untersucht werden, in wie weit die technologische Entwicklung zu einem Anstieg der Bedrohung elektronischer und elektrischer Systeme durch kriminelle HPEM Attacken gestiegen ist.
Der Beitrag beginnt mit einer Übersicht über HPEM Attacken und ähnlichen Vorfällen, über die in frei zugänglichen Quellen berichtet wurde. Diese beobachteten Attacken und HPEM Effekte werden hinsichtlich der verwendeten Technologie, der Motivation der Täter als auch des erzeugten Schadens analysiert und klassifiziert. Basierend hierauf widmet sich der Beitrag der Fragestellung, warum noch nicht mehr HPEM Vorfälle bekannt geworden sind. Die technische Herausforderung der Erkennung und Identifizierung von HPEM Attacken als auch der Rückführung von Funktionsstörungen und Zerstörungen auf systemexterne HPEM Umgebungen wird eingehend diskutiert. Der Beitrag schließt mit einer Prognose der aktuellen Bedrohung elektronischer Systeme durch die kriminelle Nutzung von HPEM Systemen.

KH2010-E-1536
Bedrohungspotential gestrahlter HPEM Umgebungen
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Die technische Entwicklung der letzten Dekaden ist durch einen kontinuierlichen Anstieg elektronischer und elektrischer Subsysteme und Komponenten gekennzeichnet. So werden sicherheitskritische Systemfunktionen in zunehmendem Maße ausschließlich durch elektronische Schaltungen gesteuert. Diese Entwicklungstendenz führt jedoch auch dazu, dass kritische Infrastrukturen und wichtige technische Einrichtungen immer stärker von der fehlerfreien Funktion ihrer elektronischen Komponenten (z.B. Systemsteuerung) abhängig sind. 1999 verabschiedete die URSI auf ihrem XXVIth General Assembly die Resolution on „Criminal Activities using Electromagnetic Tools" in der auf die mögliche kriminelle Nutzung elektromagnetischer Quellen hinwies. Seit dem hat der Schutz kritischer Infrastruktur vor einer bewusst hervorgerufenen Störung ihrer elektronischen Anteile durch elektromagnetische Felder zunehmend an Bedeutung gewonnen.
Seit 1999 hat die Technologie zur Erzeugung elektromagnetischer Felder hoher Leistung erhebliche Fortschritte gemacht. Im Rahmen der Untersuchung der Wirkungsmechanismen als auch der Störeffekte von elektromagnetischen Feldern hoher Leistung wurden die zunehmend verfügbareren Komponenten für den Bau von Testeinrichtungen genutzt. Die Leistungsdaten der so entstandenen Testumgebungen und Prüffelder wurden zum großen Teil in der Fachliteratur veröffentlicht und dienen heute als Referenz der Störfestigkeit von Systemen.
In diesem Beitrag wird aufgezeigt, dass diese Vorgehensweise bei der Beurteilung der Verwundbarkeit kritischer Infrastrukturen einerseits zu deutlich überhöhten Forderungen und zum anderen zu einer Fokussierung auf wenige Signalformen führt. Eine Erweiterung der Bedrohungsanalyse um andere Aspekte wie: Wahrscheinlichkeit des (unerkannten) Auftretens, und Zugang des Quellsystems zum potentiellen Zielsystem führt zu einer realistischen Bewertung der Bedrohung. Basierend auf diesen Überlegungen wird in dem Beitrag ein methodischer Ansatz zur Bewertung des Bedrohungspotentials gestrahlter High-Power Electromagnetic (HPEM) Umgebungen vorgestellt. Nach einer eingehenden Diskussion einzelner Aspekte und Parameter dieses Ansatzes wird dessen Anwendbarkeit an Beispielen verdeutlicht.

KH2010-B-1537
Inverse Equivalent Current Methods with Higher-Order Basis Functions and Full Measurement Probe Correction
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Inverse equivalent current methods compute equivalent electric and/or magnetic current sources from given field samples, where the field samples are often obtained from near-field measurements. The relationship between the equivalent currents and the field samples is given by integral equations, which are closely related to the integral equations employed for the solution of electromagnetic radiation and scattering problems. Therefore, it is possible to transfer the enormous progress achieved in integral equation solutions over the past years to the case of the inverse equivalent current methods.
In this contribution, we will in particular focus on higher order basis functions for the equivalent current representation and on speeding up the integral equation solution by adaptation of the multilevel fast multipole method.
Another important focus of this contribution will lie on the compensation for the influence of the measurement probe on the measured fields. It will be shown that a so-called full probe correction becomes possible through the fast multipole framework, where only the far-field patterns (amplitude and phase) of the probe antennas will be required.
A variety of application results from the fields of near-field far-field transformation for antennas as well as from antenna diagnostics will be shown. Robustness and accuracy issues will also be addressed.

KH2010-E-1538
Application of Transient Pulses on Power Supply Networks
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In den letzten Jahren ist die allgemeine Bedrohung ziviler und behördlicher Einrichtungen durch terroristische Aktivitäten gestiegen. Auch ist es vielen potentiellen Tätergruppen aufgrund ihres akademischen und finanziellen Backgrounds möglich, einfache elektromagnetische Pulsgeber zu entwickeln und zu fertigen, um mit diesen Schaden an elektronischen Geräten auf kurzer Distanz zu erwirken und somit im Sinne der asymmetrischen Bedrohung aktiv zu sein.
Teil einer Untersuchung ist hier die Entwicklung eines Ultra-Wide-Band-Pulsers auf der Basis eines handelsüblichen Elektroschockers. Dieser wird zur Applizierung einer transienten Störung auf eine herkömmliche Energieversorgungsleitung genutzt.
Dabei wird darauf Wert gelegt, mit möglichst einfachen und leicht zu erwerbenden Bauteilen (Commercial off-the-Shelf) den Pulsgeber aufzubauen, um das Potential eines möglichen Einsatzes solcher EM-Waffen zu eruieren.
Die Problematik mit den sich ausbreitenden Pulsen entsteht durch die Ausbreitung doppeltexponentieller Pulse auf der Stromversorgungsleitung eines Gebäudekomplexes. An dieses Netz angeschlossene Geräte z.B. einem Rechnerpool, Überwachungs- und Sicherheitssysteme, könnten durch eine derartige Beaufschlagung beeinträchtigt oder beschädigt werden.
Dieser Vortrag beschäftigt sich in erster Linie mit der Erzeugung doppelt exponentieller und gedämpfter Sinus-Pulse mit Hilfe aufgebauter Pulsstufen, welche mit Hilfe einer hochspannungsfähigen Stromquelle geladen werden können. Im Weiteren beschäftigt sich der Vortrag mit der Ausbreitung der Pulse auf typischen Netzversorgungsleitungen und der damit verbundenen Dämpfung und Dispersion der Signale während der Ausbreitung auf den Leitungen am Beispiel eines einfachen Hausmodells.

KH2010-D-1539
Entwicklung einer Anregeschaltung mit Amplitudenregelung basierend auf Phasenverschiebung für einen mikromechanischen Drehratensensor
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Zur Anregung eines Drehratensensors wurden ein Phasenregelkreis (engl.: phase locked loop - PLL) sowie eine auf Phasenverschiebung basierende Amplitudenregelung entwickelt. Der Phasenregelkreis gewährleistet eine Anregung des Drehratensensors in der Resonanzfrequenz seines Primärschwingers, so dass der Sensor leistungsoptimiert betrieben wird. Des Weiteren ist es mittels der PLL möglich, Vielfache der Anregefrequenz zu erzeugen, welche z. B. für die Abtastung des Sigma-Delta A/D-Umsetzers in der zugehörigen Ausleseschaltung des Drehratensensors benötigt werden.
Neben der PLL sorgt die Amplitudenregelung für eine konstante Amplitude der Primärschwingung des Drehratensensors, unabhängig von Schwankungen im Produktionsprozess oder äußeren Einflüssen. Die implementierte Amplitudenregelung basiert nicht wie üblich auf der Änderung der Potentiale der Anregespannung, sondern auf der Phasenverschiebung des Anregesignals. Dieses Prinzip beruht auf dem Übertragungsverhalten des Drehratensensors, welches in der Resonanzfrequenz eine starke Amplitudenverstärkung besitzt. Verschiebt man nun die Phase um einen gewissen Wert, so sinkt die Amplitude, da der Sensor nicht mehr optimal in Resonanz angeregt wird. Durch diese Methode kann auf Hochspannungs-Operationsverstärker in der Treiberstufe verzichtet werden, welche einen hohen Entwicklungsaufwand sowie eine große Chipfläche erfordern. Des Weiteren kann der Sensor mit einer höheren Spannung angeregt werden, wodurch die mechanischen Strukturen des Sensors verkleinert werden können.

KH2010-A-1540
Einsatz der Gamma-Korrektur für die Messung der HF-Dämpfung auf Basis hochlinearer thermischer Leistungssensoren
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Zur Rückführung der HF-Dämpfung auf SI-Einheit eignet sich hervorragend die Leistungsverhältnis-Methode. Dabei wird die HF-Leistung mit und ohne Dämpfungsglied mit einem Leistungsmesser bestimmt. Aus dem Verhältnis der HF-Leistungen erhält man die HF-Dämpfung des Dämpfungsgliedes. Konventionell werden für diese Messungen Bolometer eingesetzt, die aufgrund ihrer Funktionsweise nicht nur inhärent hochlinear sind, sondern auch die HF-Leistung direkt auf die SI-Größe Spannung rückführen. Ferner werden zur Reduktion des Einflusses der Fehlanpassung Tuner eingesetzt.
Im Folgenden soll ein neues Messverfahren vorgestellt werden, dass die Rückführung der HF-Dämpfung auf die SI-Einheit Spannung im Hinblick auf Frequenzbandbreite, Effizienz und Prozesssicherheit ohne Verlust an Genauigkeit signifikant verbessert. Zwei Neuerungen kommen hier zur Anwendung: Erstens werden moderne hochlineare thermische Sensoren für die Messung der HF-Leistung eingesetzt. Zweitens findet statt dem Einsatz von Tunern die „Gamma"-Korrektur Anwendung. Zur Verifizierung der neuen Methode wird ein Dämpfungsglied von 10 MHz bis 50 GHz im koaxialen System PC 2.4 mm vermessen. Die Messwerte werden mit den Werten eines nationalen metrologischen Staatsinstituts verglichen und bewertet.

KH2010-B-1541
Comparison of two coverage configurations for train-to-wayside communication in a railway tunnel in the presence of locomotive and its environment using integrative modeling technique
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In railway tunnel environment, the reliability of a high-data-rate and real-time train-to-wayside communication should be maintained especially when high-speed train moves along the track. In Europe and China, the frequency around 900 MHz is widely used for railway wireless communication. At this carrier frequency band, commonly, continuously laid leaky coaxial cables (LCXs) would provide much smoother field coverage for more homogenous electromagnetic wave radiation than distributed base-station (BS) antennas. However, some problems of LCX, such as high cost of installation and maintenance, etc., could be well solved by BS antenna. Hence, in this paper, the comparison of two radio coverage configurations using LCX and BS antenna are given for providing some guidelines of system design. Furthermore, within such confined areas like tunnels especially loaded with train, the complex communication environment becomes a very important factor that would affect the quality of the signal transmission. This paper will apply a full-wave numerical method to this case, for considering the LCX or BS antenna, train antennas and their interacted environment, such as the locomotive body, tunnel walls, conducting wire for power supply, pantograph, steel rails, ballastless track, etc. Involving FDTD method and PML technique, the entire RF wireless links of LCX or BS antenna to tunnel space to train antenna will be precisely modeled (so-called

integrative modeling technique). At the operating frequency of 900 MHz, the variations of the output voltage and current of the monopole antenna mounted upon locomotive with the train locations and installation positions of LCX or BS antenna, will be presented.

KH2010-D-1542
Gegenmaßnahmen zur NBTI Degradation bei 6T-SRAM Speicherzellen
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Mit zunehmender Strukturverkleinerung moderner CMOS Technologien wird das Design von funktionsfähigen SRAM-Speicherzellen schwieriger. Stärker werdende Variationen verkleinern den Bereich, in dem sowohl Schreiben als auch Lesen - die gegensätzliche Designanforderungen haben - funktionieren. Um trotz dieser nach Fertigung vorhandenen Variationen SRAM-Zellen verlässlich betreiben zu können, sind bereits diverse Assist-Techniken eingeführt worden.
Weiterhin bilden Alterungseffekte, die erst während der Laufzeit des Speichers entstehen, zusätzliche Herausforderungen. Der Degradationsmechanismus NBTI (Negative Bias Temperature Instability), dessen Einfluss aufgrund steigender elektrischer Felder ebenfalls mit zunehmender Strukturverkleinerung zunimmt, hat sich in aktuellen Technologien als schädlichster Effekt für SRAM herausgestellt. Die Degradation der pMOS Transistoren, die mit einer Vergrößerung der absoluten Schwellenspannung um ΔV_{th} modelliert werden kann, führt zu einem Verlust an Stabilität.
Es sind daher weitere Gegenmaßnahmen nötig, um funktionsfähige SRAM-Speicherzellen über viele Jahre gewährleisten zu können. In diesem Vortrag wird die Auswirkung der NBTI Degradation auf eine SRAM Einzelzelle anhand der gängigen Performanceparameter SNM(read), SNM(hold), I(read) und Write Level beschrieben. Ausgehend davon werden mehrere Maßnahmen gegen den Stabilitätsverlust aufgrund der NBTI Degradation erarbeitet. Simulationen in 90nm-Technologie quantifizieren die Vor- und Nachteile dieser Gegenmaßnahmen. Hierbei wird betrachtet, wie sich die Performanceparameter beim Vorhandensein gegebener ΔV_{th} verändern und ob und wie sich das real vorhandene ΔV_{th} unter den in der Zelle existierenden Belastungsbedingungen verändert. Aufgrund der Simulationsergebnisse und der Anwendbarkeit in der Praxis werden die besten Kandidaten ausgewählt und detaillierter beschrieben. Abschließend wird dem Benutzer je nach gesetzter Priorität beim Speicherdesign die am besten geeignete Gegenmaßnahme empfohlen.

KH2010-E-1543
Accelerating the numerical computation of indirect lightning effects by means of vector fitting
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In the context of numerical computation of indirect lightning effects it is customary to use volume-discretizing methods in time domain, such as the Finite Difference Time Domain (FDTD) method, the Finite Integration Technique (FIT), or the Transmission Line Matrix (TLM) method. If standard lightning electromagnetic pulses (LEMPs) of durations of several microseconds are used as excitations, these methods require long computation times, as implied by the Courant criterion. We investigate the possibility to use shorter pulse forms by employing the vector fitting method which has been formulated both in frequency and time domain [1, 2, 3]. By this method and depending on the noise of the primary numerical data, the duration of the exciting pulse can typically be shortened by at least one order to obtain LEMP transfer functions with sufficiently high accuracy.
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[3] F. Delfino, R. Procopio, and M. Rossi: “High-Frequency EHV/HV Autotransformer Model Identification from LEMP Test Data”, accepted for publication in *IEEE Trans. Power Delivery*.

KH2010-B-1544
The active phased array antenna of the Middle Atmosphere Alomar Radar System (MAARSY)
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The Leibniz-Institute of Atmospheric Physics (IAP) is installing a new powerful VHF radar on the North-Norwegian island Andoya (69.30°N, 16.04°E) in 2009/2010. The new Middle Atmosphere Alomar Radar System (MAARSY) replaces the former ALWIN radar which has been operated continuously on Andoya for more than 10 years. The new system is designed for improved studies of the Arctic atmosphere from the troposphere up to the lower thermosphere with high spatial and temporal resolution. Classical Doppler beam swinging observations with free beam steering capability, multiple beam observations and multi-receiver and multi-frequency operation for interferometric applications will be applied. MAARSY is a monostatic radar operated at 53.5 MHz with an active phased array antenna consisting of 433 Yagi antennas. Each individual antenna is connected to its own transceiver with independent phase control and a scalable output up to 2 kW. This arrangement allows very high flexibility of beam forming and beam steering with a symmetric radar beam of a minimum half power beam width of 3.6°, a maximum directive gain of 33.5 dB and a total transmitted peak power of approximately 800 kW. The generation of these versatile beam configurations is feasible within an off-broadside angle of 30 degrees without producing any grating lobes.
Various model studies have been made using NEC (Numerical Electromagnetic Code) in order to find an optimum structure for both the array and the antenna elements. Samples of the antenna have been built to prove the modeled characteristics. The final result is a circular array with an aperture of approximately 6300m^2 consisting of 3-element Yagi antennas arranged in an equilateral triangle grid with a spacing of 0.71 wavelengths. The bandwidth amounts 4.5 MHz at a reflection loss of 20 dB well related to the minimum pulse width of the transceivers of 330 ns. The IF signals of each 7 transceivers connected to each 7 antennas arranged in a hexagon are combined to 61 receiving channels. Selected channels or combinations of IF signals are sent to a 16-channel data acquisition system with 25 m sampling resolution which will be upgraded to 64 channels in the final stage.

KH2010-G-1545
MAARSY a 3D Tomograph for upper atmosphere research: first results
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Since May 2010 the Middle Atmosphere Alomar Radar System (MAARSY) is in operation using a sub-array of 147 antennas on transmission and 196 antennas on reception out of the full array of 433 antennas. This configuration results in a 6° degree beam width and a peak power of approximately 300 kW. One of the main objectives during the design of MAARSY was the possibility to investigate horizontal structures in the Mesosphere/Lower Thermosphere (MLT) with high temporal and spatial resolution. During the 2010 summer PMSE season first multi beam experiments using the Doppler Beam Swinging (DBS) technique were conducted. The DBS was carried out applying pulse to pulse steering covering angles till 25° off-zenith and up to 91 beam positions in a sequence of several experiments. These experiments provide a first insight into the horizontal variability of PMSEs at a time resolution between 3-9 minutes and a spatial resolution of about 9 km at 85 km altitude.

KH2010-G-1546
Radar meteor observations over the last 6 years
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Meteor radars measure the backscattered power from ambipolarly diffusing plasma trails formed by meteoroids entering the Earth’s atmosphere. These radars usually determine,among other parameters, the meteor altitude, position in the sky, meteor head velocity, and decay time of the echo. The observed meteors typically burn up in the mesosphere/lower thermosphere (MLT) altitude range between 70 to 110 km with a peak detection height around 89 km for radars operating between 30 and 40 MHz. An analysis of the peak altitude for two mid-latitude radars at Juliusruh and Collm, Germany,

indicates a characteristic seasonal pattern related to the sporadic meteor sources as well as a tendency for a linear trend of a descending peak altitude, which is accompanied with a decreasing temperature at the same altitude observed by lidars. This descent of the peak altitude can be explained by a shrinking atmosphere in the layers below the MLT through greenhouse cooling and solar cycle effects in agreement with phase height observations at Kühlungsborn. However, the available time series is too short to separate both trends from each other.

KH2010-B-1547
Absorbing Boundary Edge Elements for Time-Domian Surface Integral Equations
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For the investigation of wake-fields excited by moving charged particles in accelerator cavities, it is usually assumed that the tube-arms are infinite along the longitudinal axis. The effect of infinitely long pipes, however, can not be appropriately modeled using the bounded 3D mesh in the classical boundary element method. An air-filled round cylidrical waveguide with PEC sidewalls [1] is considered to study the excitation of the electromagetic oscilations by moving electron bunches. It is shown that the effect of confined surface mesh does not allow to model a bunch entering or leaving the pipe without generating unphysical wake-fields. To avoid distortion of the field distribution when the bunch is entering to or leaving infintely long tubes, absorbing boundary edge elements are derived for the open ending patches. Incorporating the absorbing fictitious current elements into the time-domain electric field integral equation formulations let the incoming and outgoing self-field of the bunch to be generated properly. The real-time observation of the charges moving in a structure demonstrates that plugging the additional degrees of freedom into the marching-on-time scheme allows the charged particles to enter or leave the beam tube without causing excessive artificial reflection.
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KH2010-B-1548
Numerical Optimization of Traveling Wave Tube in Terms of Efficiency
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The Traveling Wave Tube (TWT) is one of the most important types of the microwave and millimeter wave vacuum tubes. This paper focuses on three-dimensional and one-dimensional numerical simulation of a typical Ku-band helix-based TWT and presents a way to optimize electronic efficiency.
In this thesis a typical TWT geometry is built in CST STUDIO SUITE. A detailed three-dimensional simulation procedure is demonstrated, which includes the analysis of the gun perveance, the helix dispersion characteristics, the PPM focusing magnetic field, cold RF transmission, and above all, the ultimate nonlinear beam-wave interaction that is simulated by the use of Particle in Cell (PIC) code. The simulation results agree very well with the measurements in terms of its output power and gain.
Based on transmission-line equation and Rowe's space charge expressions, a study is performed in the coding of one-dimensional nonlinear calculation program in order to obtain a quick optimization of slow wave structure. At last, according to the optimized parameters of slow wave structure proposed by one-dimensional nonlinear theory, the new TWT geometry is modeled in CST STUDIO SUITE and simulated again to verify the optimization of electronic efficiency.

KH2010-B-1549
Investigation of a staggered Discontinuous Galerkin Method
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In recent years Discontinuous Galerkin (DG) Methods [1] have become popular for the solution of Maxwell's equations in the time domain. In contrast to Finite Element time domain methods, DG time domain methods have a block diagonal mass matrix and are therefore explicit. In contrast to traditional DG methods which allocate all degrees of freedom in the same cell, in this contribution a staggered DG Method is presented. The spatial positions of the staggered degrees of freedom are fixed by the condition that the DG method should coincide with the Finite Integration Technique (FIT) [2] for constant elements.
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KH2010-C-1550
A fifth-order low-pass continuous time delta-sigma ADC with four pairs of conjugate complex NTF zeros
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The goal of this work is to develop a compact, low cost, high-performance single bit continuous-time (CT) delta-sigma (DS) analog-to-digital converter (ADC) chip with bitstream interface for FPGA based signal processing and control applications.
CT DS ADCs usually are designed with noise transfer functions (NTFs) containing conjugate complex zeros to extend the usable bandwidth. Traditionally, these zeros are implemented with local feedback around two integrators representing a Tow-Thomas biquad low pass resonator in active-RC loop filters. In a fifth-order modulator only two pairs of conjugate complex NTF zeros can be obtained with this type of resonator.
Instead, we propose implementing one or several resonators per loop filter integrator with novel types of single opamp low pass resonators. Compared to the traditional Nth order active-RC loop filter topology with the same total number of opamps additional pairs of conjugate complex NTF zeros can be obtained for increased ADC bandwidth or reduced modulator order. The novel types of single opamp low pass resonators are more compact than the well known Twin-T single opamp low pass resonator.
A 25 MHz fifth-order low-pass CT-DS-ADC with four pairs of conjugate complex NTF zeros was implemented in 0.9 mm2 core size on a 0.35 um CMOS technology to prove the concept. Transistor level simulations predict a performance of 95 dB dynamic range in 250 kHz bandwidth.

KH2010-D-1551
A Modified Prefix Operator Well Suited for Area Efficient Brick-Based Adder Implementations
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A recent approach to tackle lithography problems in the nanometer-scale domain is the so called Brick-Based Design, which is expected to yield area savings of up to 25% compared to classical layouts based on Design-for-Manufacturing (DFM) rules.
In this paper, a modified prefix operator for fast adders is proposed which is well suited for brick-style layout implementation and, in addition, offers a 29% reduction in area compared to the classical implementation in static CMOS technique using complex aoi and oai gates. Compared to the classical implementation using "recommended" DFM rules, the area saving is as high as 54%.
The proposed prefix operator makes it possible to use a mirror gate for the generation of both generate and propagate signals, which exhibits a forbidden input signal combination. This so-called ``forbidden state'' causes an increase in power dissipation due to transient short circuit currents.
The effect of the forbidden state under the influence of threshold voltage variability was quantified as part of a comparison against the classical prefix operator, based on 64-bit Sklansky adders implemented in a 40-nm CMOS technology.
While the effects of the forbidden state turned out to be well acceptable, the version based on the proposed operator exhibits a 15% higher ATE-efficiency at a power dissipation increased by 13%.

KH2010-B-1552
Möglichkeiten und Grenzen der drahtlosen Hochfrequenz-Energieübertragung mit kapazitiv belasteten resonanten Leiterschleifen
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Die hochfrequente Energieübertragung zu mobilen elektronischen Geräten wie Handys oder Laptops wird aktuell stark beachtetet. Mit der „resonanten Energieübertragung" (Stichwort „wireless electricity") lassen sich nämlich weit größere Entfernungen überbrücken als mit den derzeit schon verfügbaren induktiven Kopplungen.

In diesem Beitrag werden die Möglichkeiten und Grenzen der hochfrequenten Energieübertragung beispielhaft für zwei resonante Kreisschleifen aufgezeigt. Mit Hilfe eines erweiterten Transformatorersatzschaltbildes, das auch die Leiter- und Abstrahlverluste enthält, wird eine geschlossene Näherungslösung für das Übertragungssystem bestimmt. Mit dessen Hilfe werden die erforderliche Frequenzgenauigkeit und der Wirkungsgrad in Abhängigkeit vom Abstand ermittelt, wobei sich die optimale Lastimpedanz als stark abstandsabhängig erweist.
Die geschlossene Lösung wird mit numerischen Feldberechnungen mittels der Momentenmethode (FEKO) überprüft und stimmt in einem weiten Parameterbereich gut mit deren Ergebnissen überein. Mit FEKO gelingt die eindrucksvolle Visualisierung der Energieübertragung, unter anderem durch die räumliche Darstellung der Poyntingvektoren. Über die numerische Bestimmung der SAR-Werte in direkter Nachbarschaft zur abstrahlenden Leiterschleife wird aufgezeigt, bis zu welchen Übertragungsleistungen derartige Anordnungen gesundheitlich unbedenklich bleiben.

KH2010-E-1553
Verringerung der Störaussendungen getakteter Stromrichter durch Anpassung von Kühlkörpern
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In der Leistungselektronik führt die derzeitige Entwicklung durch den Einsatz moderner Leistungshalbleiter (MOSFETs, IGBTs) zu steigenden Schaltfrequenzen und zu schnellen Schaltvorgängen für Spannungs- und Stromverläufen. Diese verursachen ein breites Störspektrum. Dieses Spektrum kann sowohl leitungsgebunden als auch strahlungsgebundenen zu Störungen führen.
Der in dieser Untersuchung betrachtete Leistungsschalter ist in Form eines MOSFETs ausgeführt und auf einem geerdeten Kühlkörper montiert. Es bildet sich zwischen dem Gehäuse des Transistors und dem Kühlkörper eine Kapazität mit dem Isoliermaterial als Dielektrikum. Diese Kapazität wird beim Schalten des Transistors umgeladen.
Durch diese Kapazität werden hochfrequente Gleichtaktströme in den Kühlkörper eingekoppelt. Dieser Gleichtaktstrom, der durch den Kühlkörper zur Bezugsmasse abfließt, hängt von der Spannungssteilheit und der parasitären Koppelkapazität maßgeblich ab. Bei hohen Frequenzen beginnen die Kühlkörper Felder abzustrahlen und somit als Antenne zu wirken. Zur Reduzierung der Abstrahleigenschaften ist es erforderlich, den Gleichtakt, der hier gleichermaßen als Antennenstrom wirkt, zu unterdrücken.
Das Ziel dieser Arbeit ist es, die Kapazität zwischen Leistungsbauteilen und Kühlkörper zu verringern, damit der signifikante Antennenstrom, der durch den Kühlkörper fließt, unter Berücksichtigung der erforderlichen Entwärmung des Leistungshalbleiters begrenzt wird. Im Rahmen dieser EMV-Analyse werden sowohl die Abstrahleigenschaften diverser Kühlkörper als auch die frequenzabhängigen Eingangsimpedanzen der Kühlkörper durch Simulation und Messung untersucht. Ergebnisse der aktuellen Untersuchung zur Reduzierung von Abstrahlung werden dabei vorgestellt.

KH2010-C-1554
An Efficient Architecture for the Integration of Sensor and Actuator Networks into the Future Internet
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In the future, sensors will enable a large variety of new services in different domains. Important application areas are service adaptation in fixed and mobile environments, traffic management, home automation, assisted living as well as management of utility grids. All these applications will share a common property, the usage of networked sensors and actuators. To ensure an efficient deployment of such sensor-actuator networks, concepts and topologies for managing and distributing sensor data as well as for triggering actuators need to be developed.
In this paper we present an architecture for integrating sensors and actuators into the future Internet. Therefore, sensors and actuators need to be connected to the Internet. In our concept, all sensors and actuators are connected via gateways to the Internet. Additionally, an entity is needed for registering all sensors and actuators, managing sensor data and controlling actuators. We decided to use a hierarchical structure, comparable to the Domain Name Service. This approach realizes a cost-efficient architecture disposing of “plug and play” capabilities and accounting for privacy issues.

KH2010-C-1555
Context-based User Grouping for Multi-Casting in Heterogeneous Radio Networks
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Along with the rise of sophisticated smartphones and smart spaces, the availability of both static and dynamic context information has steadily been increasing in recent years. Due to the popularity of social networks, these data are complemented by profile information about individual users. Making use of this information by classifying users in wireless networks enables targeted content and advertisement delivery as well as optimizing network resources, in particular bandwidth utilization, by facilitating group-based multi-casting. In this paper, we present the design and implementation of a web service for advanced user classification based on user, network, and environmental context information. The service employs simple and advanced clustering algorithms for forming classes of users. Available functionalities include group formation, context-aware adaptation, and deletion as well as the exposure of group characteristics. Moreover, the results of a performance evaluation, where the service has been integrated in a simulator modeling user behavior in heterogeneous wireless systems, are presented.

KH2010-C-1556
Investigation of the Influence of Model Expansion Points on the Accuracy of Reduced-Order Network Models
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An increased desire for detail within the analysis of LTI dynamic systems accounts for the trend towards more complex physical models in recent years. The need for complex physical models is motivated by the necessity to describe physical phenomena resulting from continuous miniaturization of off-chip and on-chip interconnects feature sizes and increase of clock speeds in high-speed circuit designs. As a consequence, such models lead to high analysis and computation costs with conventional numerical techniques.
Krylov-subspace based projection methods as a basis for various Model Order Reduction (MOR) techniques have become a popular instrument for the efficient computation and accurate approximation to dynamic systems. The foundation for the most common projection methods at present, like the PRIMA algorithm, is the so called implicit moment matching. Projection methods based on implicit moment matching require parameters like expansion points and the number of moments to be matched as input variables. The optimal choice of these input parameters remains an open question to date, prohibiting the automatic generation of order reduced models by means of implicit moment matching. This work focuses on the systematic choice of the input variables for implicit multipoint moment matching procedures using the example of Partial Element Equivalent Circuit (PEEC) circuit models. The quality of the reduced PEEC models is being investigated dependent on the number of expansion points, number of moments to be matched, influence of the model discretization as well as inductive and capacitive coupling on the model's pole/zero distribution, amongst others.

KH2010-B-1557
Performance Analysis of a Low Cost Wireless Indoor Positioning System with Distributed Antennas
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In recent years, Indoor Positioning Systems (IPS) have gained importance in research, as commercially available satellite based positioning systems become inaccurate or even drop out completely inside buildings. Ultra-Wideband (UWB) or active Radio-Frequency Identification (RFID) systems are a state-of-the-art replacement. They provide accuracy in the centimetre range. However, these systems are very costly due to complex digital signal processing.

Thereby additional hardware is required. Aside from picocell base stations, distributed indoor antennas fed through power splitters are also used in order to provide GSM and UMTS in indoor coverage. A very cost efficient approach is to deploy such already installed systems for the purpose of localisation. Hence, only little additional hardware is needed. In this work investigations on a distributed antenna system in conjunction with power detection were performed under the assumption of the presence of the Line-of-Sight (LOS) path.
For planning and evaluation purposes, a system model was developed and simulations were carried out. Thereby the influence of the signal bandwidth, coupling coefficients, radiation patterns, separation distance, antenna position, and the number of individual antenna elements were taken into account. Within the simulation, the distributed antenna system is modelled by a scattering parameter approach. The characteristics of the multipath environment are considered by using ray tracing techniques based on geometrical optics. A detailed comparison between various scenarios with different numbers of rays provides a deep insight into fundamental limitations of positioning accuracy and reliability. To verify the simulation and also to identify the potential for commercial use, a prototype of the antenna system was developed. It consists of a chain of identical passive 3-port coupling circuits with Vivaldi antennas. An automated measurement setup including two network analyzers and one signal generator was realized to test the overall performance of the system. Measurements in different environments were carried out. They show very good agreement with the simulated results regarding accuracy and variance.

KH2010-C-1558
Anwendung einer Switched-System Modellierung zur Stabilitätsanalyse von Zeitkontinuierlichen Singlebit ΣΔ Wandlern
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Im Hinblick auf die Optimierung von CT Sigma-Delta-Wandlern ist ein genaues Verständnis der dynamischen Eigenschaften des Systems von essentieller Bedeutung. In dieser Arbeit wird der Sigma-Delta-Modulator dafür in die Klasse der Mixed-Signal Systeme eingeordnet und als Übertragungssystem mit geschalteter Rückkopplung betrachtet. Mit diesem Switched-System-Modell können unter Zuhilfenahme einer geeigneten Zustandsraumdarstellung die Signalamplituden der internen Integratoren sowie die Maximalamplitude am Quantisierereingang bestimmt werden. Unter Verwendung einer Worst-Case Analyse ist es damit möglich, Aussagen über den Aussteuerbereich der Integratoren sowie der maximal stabilen Eingangsamplitude zu treffen. Die Vorgehensweise wird anhand eines Beispielmodulators dargestellt.

KH2010-A-1559
Experimental Determination of the Gaussian Beam Width used for the THz Exposure of Biological Cells
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With the evolving THz applications also concerns about the biological effects of THz waves occur. In order to take precautions the Federal Office for Radiation Protection in Germany is funding a project about the “Genotoxic Effects of THz radiation in vitro”. Part of this project is to establish powerful sources of THz waves and to provide the traceability to the SI for the physical quantities involved. The biological cells are grown as a monolayer in special containers transparent for THz signals. These are irradiated from underneath by a Gaussian beam of millimetre and sub-millimetre waves. From a statistical point of view the local power distribution should be uniform across the experimental region and all biological cells, but for obvious technical reasons only Gaussian beam profiles are available. Both the absolute power and the local power distribution (FWHM) within the Gaussian beams are measured. For the last one a scanning method based on dielectric waveguides was established, since the knife-edge method can only be used on laser sources due to the fringing effects at millimeter wavelengths. Scalar experimental results are obtained using a THz power meter. Vectorial measurements are performed using frequency converter extensions of a vector network analyser.

KH2010-D-1560
Modellierung der Signalflankenform und Entwurf einer statistischen Timing Analyse digitaler CMOS-Schaltungen im Subthresholdbereich
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In den letzten Jahren hat sich die umgesetzte physikalische Leistung digitaler Schaltungen in vielen Anwendungen, beispielsweise im Bereich von tragbaren Geräten oder der Medizintechnik, als kritische Größe erwiesen. In einem solchen Fall können Schaltungen eingesetzt werden, die auf den Betrieb im Subthresholdbereich ausgelegt sind, da diese nahe am Optimum der Power-Performance-Skala operieren. Dieser Vortrag behandelt zwei wichtige Aspekte der Abstraktion des zeitlichen Verhaltens von der Transistor- hin zur Gatterebene bei kombinatorischer CMOS-Logik im Subthresholdbereich.
Zum Einen wird ein mathematisches Modell zur Beschreibung der in diesem Betriebsmodus auftretenden Signalformen vorgestellt und gezeigt, dass das entwickelte Modell eine sehr gute Näherung der untersuchten Signale darstellt. Es wird gezeigt, dass die untersuchten Signale durch ihre Slewrate ausreichend spezifiziert werden können und eine optimale Wahl der Definition dieser Slewrate wird präsentiert. Der Test des Modells bestätigt, dass die relevanten Fehler mit den optimierten Werten der Definition der Slewrate bei unter 2% gehalten werden können.
Zweitens wird ein Algorithmus entwickelt, der das statistische Verhalten eines Signalpfades auf Grundlage von Daten zur statistischen Charakterisierung der verwendeten Logikgatter, sowie einer Repräsentation des Pfades auf Gatterebene modelliert. Ein solcher Algorithmus ist erforderlich, da in diesem Betriebsbereich die Streuung im Verhältnis zum Mittelwert deutlich höher ist als in den traditionell verwendeten Betriebsmodi. Die entwickelte Implementierung kann die gesuchten Standardabweichungen mit einem Fehler von weniger als 8% modellieren und senkt die erforderliche Prozessorzeit im Vergleich zu einer entsprechenden Monte-Carlo-Simulation auf Transistorebene um einen Faktor von 2300.

KH2010-D-1561
A low Power Clock Generator with adaptive Inter-Phase Charge Balancing for Variability Compensation in 40nm CMOS
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Power dissipation besides chip area is still one main optimization issue in high performance CMOS design. Regarding high throughput building blocks for digital signal processing which are optimized down to the physical level a two-phase clocking scheme is often advantageous concerning ATE-efficiency. Depending on the switching activity of data the clock system dissipates a significant part of overall power up to more than 50% in some applications.
An efficient power saving strategy for complementary two-phase clock signal (CTPC) generation is the charge balancing technique applied to complementary clock phases. The efficiency of this approach requires careful optimization of timing relations within the control to ensure a high degree of charge that is recycled and to prevent shorts between the output drivers.
As in modern CMOS processes variation of device characteristics not only from die to die or in larger areas within a die but also towards near neighbors of a device increase, the timing relations between sensitive control signals even in a compact and local circuit can be affected seriously and so efficiency can be degraded unacceptably.
In order to compensate the influence of local device variations in this work an adaptive control system for charge balancing in a CTPC generator is presented. An adjustment of the degree of charge recycling is performed in each clock cycle. For every clock transition the charge balancing event is evaluated. In the case of insufficient recycling or a too long clock transition the delay elements which define duration and timing position of the recycling pulse are corrected by switchable timing units.
In a benchmark with the conventional clock generation system without charge recycling and with no parameter adaptation a gain for power reduction of up to 24.7% could be achieved. This means a saving in power of more than 12% for a complete number-crunching building block.

KH2010- D-1562
Probabilistic Modelling of Noise Transfer Characteristics in Digital Circuits
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For CMOS technology nodes beyond 45nm the ITRS roadmap predicts increasing reliability problems in future VLSI design: As the energy representing logic states is further reduced noise susceptibility increases, resulting in a design conflict between reliability and power dissipation.
At the present reliability is an issue mostly in mission critical applications and dealt with at circuit (e.g. shielding etc.) and architectural level (redundancy).
Current research approaches focus on the concept of fault tolerance by error detection and correction. Prominent examples are delay sensing circuits like RAZOR, probabilistic logic, arithmetic noise tolerance, just to name a few.
However, since parts of circuitry remain unprotected all of these techniques cannot guarantee 100% reliability, and only improved resilience. But even more important, all these techniques come with a giant area overhead and dramatically increased power dissipation.
To avoid this, it seems to be attractive to use the error correction and concealment capabilities that are integrated anyway in most systems, such as channel decoders. To facilitate this, quite accurate knowledge about the statistics of intermittent errors is required.
To estimate the error rate for each stored bit (BER) we propose a probabilistic modelling scheme without extensive and time consuming circuit simulations. Signal, noise and variability parameters are described by probability density functions (pdf). Based on their static transfer curve and the influence of noise as well as variability, probabilistic transfer characteristics of logic gates can be estimated. With the pdf of the voltage levels at the input of a logic gate it then becomes possible to estimate the voltage level pdf at the output. Taking the output of one gate model as the input of another, allows the modelling of complete logic paths and to estimate the voltage level pdf at the input of a latch or register at the end of a pipeline stage. From this an estimate of the error rate of each stored bit can be derived.

KH2010-G-1563
Inter-relation between D-region electron densities from 3-MHz Doppler radar observations at 69°N, co-located riometer absorption, and the empirical model IMAZ-2
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Electron densities of the lower ionosphere are estimated using the Saura MF Doppler radar data since summer 2003. The radar is located near Andenes, Norway (69.3°N, 16.0°E) and operates at 3.17 MHz. The experiment utilizes partial reflections of ordinary and extraordinary component waves from scatterers in the altitude range 50-90 km to estimate electron number densities from differential absorption (DAE) and differential phase (DPE) measurements. Height profiles of electron density are obtained between about 55 km and 90 km with a height resolution of 1 km. The diurnal and seasonal variability of electron densities as well as the response of D-region electron densities to solar activity storms, solar proton events, and geomagnetic disturbances have been estimated.
The imaging riometer AIRIS near Andenes monitors excessive radio wave absorption due to precipitating energetic particles. The vertical beam of the Saura MF radar coincides with the volume observed with the vertical AIRIS beam. The data from both systems allow the verification of the lower part of the neural network-based ionospheric model for the Auroral zone IMAZ-2. The model provides electron density profiles between 60 and 140 km for a given riometer absorption, time, and ionospheric state. It is based on electron density profiles from EISCAT UHF/VHF radars for altitudes above about 85 km and high-latitude rocket measurements, but the data below 70 km is almost exclusively due to sounding rockets.
Comparisons of the IMAZ model with measured electron density profiles are discussed for different levels of solar activity and various particle precipitation events.

KH2010-D-1564
A Sensing Circuit for Single-Ended Read-Ports of SRAM Cells with Bit-line Power Reduction and Access-Time Enhancement
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The conventional sensing scheme of single-ended read-only-ports as integrated in 8T-SRAM cells suffers from its low performance compared to double-ended complementary sensing schemes. In the proposed sensing scheme the pre-charge voltage level of the single-ended read-bit-line is set to a voltage overshoot exceeding the threshold voltage level of the sensing device. The voltage difference between the overshoot and the threshold voltage is minimized to speed up the read access on the one hand and kept large enough to provide a sufficient bit-line noise margin on the other hand. The pre-charge voltage level of the proposed sensing circuit is self-adjusted with respect to the threshold voltage level of the sensing device in order to ensure a minimum bit-line noise margin under process variations. To reduce the bit-line voltage swing from unnecessary discharging as soon as the addressed memory cell's data bit is detected, the proposed sensing scheme employs a modified 8T-SRAM cell. Compared to the conventional 8T-SRAM cell, the read port of the proposed cell provides a virtual ground line running in parallel to the bit-lines. An internal driver of the sensing circuit releases the virtual ground line during the evaluation period to inhibit the charge dissipation, with having a rised voltage level of the virtual ground line. The reduced pre-charge level and the increased virtual ground line leads to a reduced bit-line voltage swing and thus a bit-line power reduction. Access time, energy dissipation and noise margin of the proposed sensing circuit are compared with conventional sensing circuits from the literature for different numbers of memory cells connected to the bit-line. It is shown, that for a specific number of memory cells per bit-line the proposed circuit achieves fastest access time at low power operation.

KH2010-A-1565
RADIO-FREQUENCY PLASMA DIAGNOSTICS WITH THE MULTIPOLE RESONANCE PROBE
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Nowadays plasma techniques are used in many technical applications and are counted among the key technologies for future innovations. But the supervision and the control of technical plasmas is still a huge problem. The requirements of the measurement system are very high and most of the existing methods are not applicable in industrial environments. Approaches on the basis of active “plasma resonance spectroscopy” belong to the most promising. These use the ability of the plasma to resonate on or near the plasma frequency. This work describes a concept for the realization of an optimized approach, the “multipole resonance probe” (MRP). The MRP allows the measurement of specific resonances of the plasma under investigation, which can be used to calculate the plasma parameters by an analytical model. In comparison to other techniques the MRP has the advantage to possess a highly symmetrical geometry, which can be expressed by a compact mathematical description via an electrostatic approximation. The MRP mainly consists of two conducting hemispheres, fed symmetrically by an rf-signal to suppress undesired modes and a surrounding dielectric material to separate the probe from the plasma process. The high frequency characteristics of the MRP are investigated through 3D electromagnetic field simulations with CST Microwave Studio. The Drude-Model accounts for the investigated plasma, which allows a simulation of the probe within the plasma. Based on the analytical and simulated results, a prototype consisting of an optimized assembly is presented. The comparison of the analytical, the simulated, and the first measured results verify the functionality of the probe.

KH2010-A-1566
Verification of Scattering Parameter Measurements in Waveguides up to 325 GHz
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Vector network analysers are often applied in RF technology as they allow to determine the scattering parameters of passive and active networks and signal transmission through any RF link. The frequency range of vector network analysers may be increased by external frequency converters, here for waveguides, which are connected to the basic device using coaxial cables. Before use usually the system error correction (following e.g. the TRL algorithm) is applied to such devices to provide a decent measurement performance (which is often misleadingly denoted as a calibration). Typically the system error correction is completed by a verification where a known device is measured and the data is compared to those from a calibration certificate. This has to be performed consecutively for all waveguide bands.
Here a simple method is presented to verify the system error correction and to check the linearity of the frequency converters. After performing a system error correction using a standard TRL calibration set a known RF attenuation is connected at the measurement ports. We use a standard rectangular shim rotated by 90 degrees and a shim with a circular hole, both for the waveguide bands from 50 GHz to 325 GHz. Both shims provide a known attenuation from numerical computation using the data of precise mechanical measurements.

KH2010-C-1567
Methoden zur Reduktion der benötigten Speicherkapazität von numerisch gesteuerten Oszillatoren
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Numerisch gesteuerte Oszillatoren (Numerically Controlled Oscillator; NCO) werden als lokale Oszillatoren für digitale Mischer eingesetzt. Ein Problem stellt hierbei der hohe Platz- und Energiebedarf der NCOs dar.
Ziel dieser Arbeit ist die Implementierung eines NCO für die Generierung von Sinus- und Cosinussignalen. Unter dem Aspekt eines möglichst geringen Energieverbrauchs für die Erzeugung hochfrequenter Signale werden Methoden zur Reduktion der benötigten Speicherkapazität untersucht.
Hierfür wird zum einen die Symmetrie des Sinus genutzt und zum anderen eine lineare Approximation zwischen zwei gespeicherten Funktionswerten durchgeführt. Durch Nutzung der Symmetrie ist es möglich, nur Funktionswerte von je einem Achtel der Periodendauer zu speichern und dennoch sowohl Sinus- als auch Cosinussignale zu generieren. Mittels Linearer Approximation erfolgt eine Reduzierung des Speicherbedarfs, was die Verwendung einer doppelt so hohen Abtastfrequenz bzw. die Generierung einer doppelt so hohen Ausgangsfrequenz ermöglicht.
Der NCO wird als lokaler Oszillator in einem digitalen Mischer eingesetzt. Der Mischer wurde zunächst simuliert und im Anschluss mittels FPGA implementiert.

KH2010-C-1568
Berechnung von Nichtlinearitätsparametern von RF MOS Mischern mittels Volterra-Reihen
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Die Nichtlinearität einer Mischerschaltung bezüglich des Informationssignals führt zu unerwünschten Spektralanteilen am Ausgang des Mischers. Da der Mischer von einem Filter gefolgt wird, sind nur die Spektralanteile am Ausgang kritisch, die innerhalb des Durchlassbereiches des Filters liegen. Demzufolge müssen bei der Nichtlinearitätsanalyse nicht alle Spektralanteile bestimmt werden, sondern nur diejenigen, die innerhalb des Durchlassbereiches des Filters liegen. In einer Monographie von Wambacq und Sansen [1] wurde eine Methode zur direkten Berechnung der Spektralanteile von Multi-Input schwach nichtlinearen zeitinvarianten Systemen bei Einzeltonanregung basierend auf der Volterra-Reihe vorgestellt. Da die Volterra-Kerne für Multi-Input Systeme Tensoren darstellen, ist eine Nichtlinearitätsanalyse mit der klassischen Volterra-Reihe sehr aufwendig. Mit der Methode nach [1] können alle unerwünschten Spektralanteile ermittelt werden, ohne die Volterra-Kerne bestimmen zu müssen. Damit wird die Komplexität der Nichtlinearitätsanalyse von Mischern in Grenzen gehalten. Im ersten Teil dieser Arbeit wird die Methode nach [1] für den Fall der Zweitonanregung erweitert und auf einen einfach balancierten MOS Mischer angewandt. Hierbei werden die nichtlinearen Stromquellen und die Spektralanteile bis zur dritten Ordnung symbolisch ermittelt. Im zweiten Teil der Arbeit wird der Fall von schaltenden Mischern behandelt. Bei dieser Klasse von Mischern wird die Amplitude des Lokaloszillatorsignals so gewählt, dass die Transistoren in der Schaltung periodisch ein- und ausschalten. Somit kann der schaltende Mischer als ein Single-Input zeitvariantes schwach nichtlineares System modelliert werden, wobei das Lokaloszillatorsignal als Teil des Systems betrachtet wird. Um die Spektralanteile bei den schaltenden Mischern zu ermitteln, wird die Methode nach [1] für zeitvariante schwach nichtlineare Systeme erweitert. Die Methode wird auf einen schaltenden einfach balancierten MOS Mischer angewandt und die unerwünschten Spektralanteile werden ermittelt. Die Ergebnisse der Anwendung der jeweiligen Methoden werden mit Simulationen von SpectreRF verglichen.
[1] P. Wambacq, W. Sansen: Distortion Analysis of Analog Integrated Circuits, Kluwer Academic Publishers, 1998

KH2010-B-1569
MODELLIERUNG VON FELDSINGULARITÄTEN AN DIELEKTRISCHEN KANTEN IN GITTERBASIERTEN METHODEN
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Seit langem ist bekannt, dass das elektrische Feld an Ecken und Kanten eine Singularität aufweisen kann, und mit Hilfe von Energiebetrachtungen können für eine Reihe von Fällen (unterschiedliche Winkel und Materialien) lokale analytische Lösungen gewonnen werden. Gitterbasierte Simulationsansätze, die auf polynomialen Ansatzfunktionen beruhen, weisen an solchen Punkten eine deutlich geringere Genauigkeit und Konsistenzordnung auf, die auch die Berechnung globaler Zielgrößen erheblich beeinträchtigen kann. Aus diesem Grund werden den numerischen Modellen üblicherweise spezielle Ansatzfunktionen hinzugefügt, die die Singularität lokal nachbilden können.
Wir untersuchen solche Ansätze für die Methode der Finiten Integration (FIT) und den Discontinuous Galerkin-Ansatz (DG). Für FIT wird eine Korrekturmethode aus der Literatur modifiziert, indem auch die diskreten Flüsse durch duale Gitterflächen berücksichtigt werden, was zu einem zusätzlichen Genauigkeitsgewinn führt. Für DG wurde die Erweiterung mit singulären Ansatzfunktionen für verschiedene Fälle implementiert und das Verhalten insbesondere auch im Zusammenspiel mit h-Verfeinerungen untersucht.
Beide Ansätze können neben Singularitäten an Metallen auch das Verhalten an dielektrischen Kanten nachbilden. Die bisherigen numerischen Ergebnisse beziehen sich weitgehend auf statische Feldprobleme, die Ansätze selbst sind aber auch auf die Simulation von Wellenausbreitung im Zeit- und Frequenzbereich übertragbar.

KH2010-C-1570
Ion Beam Analysis based on Cellular Nonlinear Networks
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The development of a non- destructive measurement method for ion beam parameters has been treated in various projects. Although results are promising, the high complexity of beam dynamics has made it impossible to implement a real time process control up to now. In this paper we will propose analysing methods based on the dynamics of Cellular Nonlinear Networks (CNN) that can be implemented on pixel parallel CNNbased architectures and yield satisfying results even at low resolutions.

KH2010-F-1571
An Assessment of Current Remote Sensing Radars: Whither Progress
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Advances in Radar Remote Sensing cover an impressive list of scenarios: Direct Aperture Radar, Synthetic Aperture Radar (SAR), SAR – Interferometry and –Polarimetry, Smart radars, and Multi-static Observations.
Applications of Radar Remote Sensing are continuing to play a vital role in the areas of earth observation and disaster management, for instance. At this juncture of time, one might well ask, where do we stand today in this field of Radar Remote Sensing? The aim of this contribution is to address this issue. In this contribution, we shall explore the current state-of-the-art in order to critically assess the present-day status with respect to the following questions:
1. How can we systematically present today's scientific state of remote sensing with regard to radar performance in obtaining high-resolution and high-information target-images?
2. Where does the performance of remote sensing radars today stand in relation to the physics of observation, particularly in establishing how much performance is yet to be extracted from the confines of the physically and technologically feasible.
3. How does the technology of Radar Remote Sensing match with the needs of the end-user community?
The issues listed above should help to identify where the state-of-the-art stands today and in which areas progress needs to be made or can be made. This study has been initiated by the international URSI Commission-F action to compile on a White Paper on the subject of Microwave Remote Sensing. This contribution is an initial report of these investigations.

KH2010-D-1572
Realisierung eines PDIC für 12x Blu-ray-Disc-RW Laufwerke mit Hilfe neuartiger effizienter Entwurfsmethodiken
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Die Blu-ray-Disc hat sich als Nachfolger der DVD mit um eine Größenordnung höherer Speicherkapazität erfolgreich etabliert. Dabei wird für die höheren Datentransferraten eine deutlich schnellere Elektronik (Bandbreite > 200 MHz) gebraucht, welche hochfrequente Laserlichtimpulse mit hoher Dynamik in elektrische Spannungssignale wandeln kann.
Am IMMS wurde ein PDIC (Photo Detector IC) für Blu-ray-RW Laufwerke entworfen und realisiert, welcher das Auslesen von Blu-ray-Discs mit bis zu 12-facher Geschwindigkeit erlaubt.
In diesem Beitrag werden neben experimentellen Resultaten neuartige Entwurfsmethodiken vorgestellt, mit deren Hilfe es gelungen ist, den Gesamtentwurf mit einer Effizienzsteigerung von mehr als 25% im Vergleich zu vorhergehenden vergleichbaren Entwürfen durchzuführen. Die dabei erzielten Signalbandbreiten für rotes Licht (DVD) sind vergleichbar mit anderen veröffentlichten Realisierungen und übertreffen diese für des kurzwelligere blaue Licht (Blu-ray).

KH2010-C-1573
Realisierungsaspekte von FS/2 Sigma-Delta ADCs
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Die Auswertung konstanter und niederfrequenter Signale mit kleiner Amplitude benötigt einen Analog zu Digital Wandler mit einem geringen Offset. Bei der Realisierung als Tiefpass Sigma-Delta Wandler in SC – Technik wird dies durch die Offsetkompensation der Operationsverstärker auf Schaltungsebene erreicht. Ein FS/2 - Wandler bietet die Möglichkeit, die Offsetkompensation auf Systemebene durchzuführen.
Die betrachteten Wandler basieren auf Resonatoren, die auf System- oder Schaltungsebene implementiert werden. Auf Systemebene wird dies durch eine Rückkopplung über zwei SC - Integratoren erreicht. Bei der Umsetzung auf Schaltungsebene werden direkt SC – Resonatoren eingesetzt.
Beide Verfahren werden anhand von Robustheit auf Fertigungsschwankungen, Strom und Flächenbedarf verglichen.

KH2010-C-1574
Integrierte CMOS-Empfäanger für die Mikro-Magnetresonanztomographie
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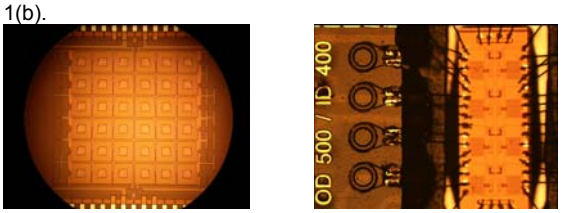
In den letzten drei Jahrzehnten hat sich die Magnetresonanztomographie (MRT) zu einem der wichtigsten bildgebenden Verfahren in der Medizin entwickelt. Dabei sind insbesondere der erhöohte Kontrast gegenüber anderen Verfahren wie der Computertomographie (CT) oder Positronen-Emissions-Tomographie (PET) für weiche Gewebestrukturen, sowie die im Verfahren inherente Möglichkeit der dreidimensionalen Bildgebung die Hauptgründe für den Siegeszug von MRT im klinischen Bereich. Um auch kleinste Gewebestrukturen auflösen zu können, gibt es in den letzten Jahren vermehrte Anstrengungen zur Miniaturisierung der Empfangsspulen zu verzeichnen. Eine solche Verkleinerung führt zu einem Anstieg des unitären Magnetfeldes, was, sofern durch technologische Maßnahmen eine Reduktion des Gütefaktors vermieden werden kann, zu einem verbesserten intrinsischen Signal-Rausch-Abstand (SNR) der Empfangsspulen führt. Im Bereich der MikroMagnetresonanztomographie kann dieses verbesserte SNR für eine erhöhte räumliche Auflösung bis in den Mikrometerbereich bei gleichzeitig moderaten Bildzeiten (imaging time) genutzt werden. Ordnet man viele solcher miniaturisierter Empfangsspulen in Arrayform an, kann eine sehr hohe räumliche Auflösung bei gleichzeitig großem field-of-view (FOV) erzielt werden. Im Rahmen des Vortrags wird erläutert, wie moderne CMOS-Technologien beim Design solcher Empfangsarrays sinnvoll eingesetzt werden können. Dabei werden sowohl vollintegrierte Arrays diskutiert, bei denen Empfangsspulen und Empfängerelektronik auf demselben Chip kointegriert sind, vgl. Abb. 1(a), als auch hybride Systeme, bei denen CMOS Empfängerarrays mit externen Mikrospulen mit hohen Gütefaktoren verbunden werden, vgl, Abb. 1(b).



a) b)
Abbildung 1: (a) Mikrofotografiee eines voll-integrierten Empfängerarrays (b) Mikrofotografiee eines hybriden Empfängerarrays

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EINFLÜSSE VON WETTERPHÄNOMENEN AUF AUTOMOBILE LIDAR-SENSOREN
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Laserradarsensoren (kurz "Lidar") spielen eine zunehmend wichtigere Rolle in zukünftigen Systemen der Fahrerassistenz und aktiven Fahrzeugsicherheit. Da Lidar-Sensoren als optischen Übertragungskanal die Atmosphäre nutzen, unterliegen sie vielfältigen Einflüssen durch Wetterphänomene wie Nebel, Regen und Schneefall. Diese Einflüsse unterscheiden sich aufgrund unterschiedlicher Strahlgeometrien
und unterschiedlicher Sensorausprägungen von den klassisch in der Wetterbeobachtung oder Atmosphärenforschung bekannten Phänomenen und werden im Rahmendieses Vortrages näher untersucht. Auf Basis einer verallgemeinerten Lidar-Gleichung können Signalformen von Rückstreusignalen in Nebel theoretisch vorhergesagt werden. Die modellierten Signal wurden nach Langzeitmessungen mit den real beobachteten Signalen von automobilen Lidar-Systemen verglichen und zeigen gute Übereinstimmung mit der erarbeiteten Theorie. Die auf diese Weise gewonnenen Daten können mit Hilfe eines neu entwickelten, elektromischen Lidar-Zielsimulators zum Test und zur Optimieren von automobilen Lidar-Systemen verwendet werden und bieten somit die Möglichkeit einer signifikanten Reduktion von Entwicklungs- und Absicherungszeit.

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Modelling of CISPR 25 Antenna Measurements on High Voltage Supply Cables for Electrical Vehicles Combining the Method of Moments with VHDL-AMS
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Conventional combustion engines will be more and more replaced by electrical motors. EVs contain an electrical motor for propulsion and often a high-voltage battery. In many cases the electric motor works also as a generator to charge the battery. The energy is pro-

vided to the electric motor by shielded high voltage supply cables (HV-cables) and a DC/AC-converter with implemented pulse with modulation. Pulses created by fast switching transistors are propagated over the HV-cable harness to the battery and the electrical motor [1]. Cable shields should avoid EMI-problems, but several effects like uncompensated shield currents due to unbalanced inner conductors in combination with shield imperfection and direct field penetration through the cable shield lead to significant emissions through the cable [2]. Sophisticated models have to be found to calculate the EMI behaviour of the HV-cables adequately to find out critical operation points by simulation.
This paper deals with the modelling of the antenna coupling behaviour of HV-cables in a typical automotive EMC setup according to CISPR-25 [3] using VHDL-AMS. As for the solution of partial differential equations, to represent the coupling behaviour, VHDL-AMS alone is not suited, 3D field solvers with the MoM (Method of Moments) are necessary. Methods of model order reduction like Vectfit [4] were applied to combine the different simulation methods. The resulting common mode currents on the shielded HV-cable and the resulting antenna levels were calculated and compared to measurements.
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Superconducting Nanoelectronic Devices
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Superconducting nanoelectronic devices exhibit a considerable potential for application in future high frequency electronics. The superconducting ground state is described by a macroscopic matter wave function. This yields high ac conductivity, low fluctuations, excellent energy efficiency and also macroscopic quantum effects.
Josephson devices exhibit extremely small size and low energy consumption.
The Josephson effect allows generation, detection, mixing, and parametric amplification of high frequency signals up into the THz region. Josephson devices also allow the generating two-photon coherent states and entangled states and will open the door for future applications in quantum information processing and quantum computing.
In this presentation the fundamentals of superconducting nanoelectronic devices, their application in classical microwave technology as well as for quantum signal processing will be discussed.

KH2010-C-1578
Modelling Automotive FlexRay Transceivers for Signal Integrity and EMC Simulations
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Automotive bus systems are used to connect control units, intelligent sensors and actors in vehicles. From economical point of view extended cable networks are desirable. Systems are often operated close to their specification limits. To provide safety critical applications under these circumstances or electromagnetic disturbances, the functionality of a bus system must be ensured with sophisticated methods.
An approach to detect problematic behaviour and its causes is the computational investigation of the transmitted signal quality (signal integrity) of the physical layer of the bus system. Models for any component of a bus system have to be developed. Accuracy of models and methods has to be qualified by measurements with realistic systems.
To ensure a high immunity against electromagnetic disturbances, the transceivers should be qualified with special RF immunity tests. EMC simulations may help to investigate possibly critical cases. Therefore accurate EMC behavioural models are needed [2].
This paper shows the possibilities of bus system signal integrity and EMC simulation and focuses on modelling of the transceiver device. SI transceiver models mainly deal with output characteristics [1] while EMC models reflect the input behaviour of a device. However, intersections between those two fields exist and can be used to create a transceiver model to reflect both behaviours. As result the combined model is able to reflect the signal integrity behaviour of a real transceiver device in a wide range of input voltage and under electromagnetic disturbances and considers operation thresholds which limit normal operation ranges.
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Methods for Radiating Transmission Line Simulation Model Creation Based on Measurements
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The emission level of automotive electronic systems is often governed by the cable harness. In many cases it is the dominant radiating structure and determines the position of resonances. Standardized component field measurement methods, like the ALSE antenna method provided in CISPR 25 [1] for evaluation of electromagnetic emissions from automotive systems, suffer from the need of large and expensive anechoic chambers. Also a single field strength value is often not sufficient to characterize the EMI behavior of a complex system. Furthermore it is not possible to use the measurement data for behavioral model creation for simulation. Having simulation models, a statement about the radiating electromagnetic fields can already be made in early phases of development.
In this paper methods to create simulation model of a radiating cable bundle from near-field measurements are presented and compared. Measurements are done in frequency and time domain in order to get phase information, to reduce measurement time, and to correlate different measurement data sets [2]. The electromagnetic field is measured at several points near the cable bundle. The first approach applies field data to approximate the electromagnetic field with a simulation model consisting of electric dipoles [3]. Another approach is to compute an equivalent current distribution on the line and to calculate with linear antenna approaches the field emission [4]. The methods are presented and tested on representative structures. In conclusion advantages and disadvantages of the approaches are given and compared with each other.
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KH2010-C-1580
In Memoriam Sir Ian Axford und Henry Rishbeth
J. Röttger, M. Förster

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does not exist.

KH2010-B-1582
Interferenzminimierung bei automobiler Radarsensorik
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Radarsensoren sind eine Schlüsselkomponente zunehmend und in verschiedenen Fahrzeugklassen zum Einsatz kommender automobiler Sicherheitsfunktionen. Eine hohe Störfestigkeit insbesondere auch gegen Emissionen anderer im Betrieb befindlicher Radars ist unerlässlich. Der Beitrag informiert über die Motivation, die Randbedingungen sowie einschlägige Aktivitäten im Rahmen laufender öffentlich geförderter Vorhaben. Laufende und geplante Aktivitäten zur Untersuchung von DBF/Adaptive Beamforming als erfolgversprechende Maßnahme zur Störunterdrückung werden dargestellt.