EMCABS

EMC Abstracts
Osamu Fujiwara, Associate Editor

Following are abstracts of papers from previous EMC symposia, related conferences, meetings and publications.

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As the EMC Society becomes more international, we will be adding additional worldwide abstractors who will be reviewing articles and papers in many languages. We will continue to set up these informal cooperation networks to assist members in getting the information or contacting the author(s). We are particularly interested in symposium proceedings which have not been available for review in the past. Thank you for any assistance you can give to expand the EMCS knowledge base. **EMC**

EMCABS: 01-11-2008

MODELING INTERFERENCE COUPLING BETWEEN TWO ORTHOGONAL STRIP LINES ON ADJACENT LAYERS

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Proceedings of the 8th International Symposium on Electromagnetic Compatibility, Hamburg, Germany, September 8-12, 2008, pp. 61 - 66.
Abstract: In multi-layer circuit boards of modern electronic equipment, signal lines and power distribution traces can be set orthogonally and sandwiched between two reference layers. To evaluate interference between such an intersecting strip line geometry, a lumped mutual capacitance model is proposed. Determining the scalar potential due to an assumed line charge at the intersection of the orthogonal traces leads to the distributed mutual capacitance between two lines. The results show that for typical printed circuit board geometries, the mutual capacitance can be approximated as a lumped element at the intersection of the two orthogonal strip line geometries. The proposed model is verified by comparing the experimental and the computed results.
Index terms: Multi-layer circuit boards, orthogonal strip lines, interference coupling model, lumped mutual capacitance.

EMCABS: 02-11-2008

ANALYSIS OF A PCB-CHASSIS SYSTEM INCLUDING DIFFERENT SIZES OF MULTIPLE PLANES BASED ON SPICE

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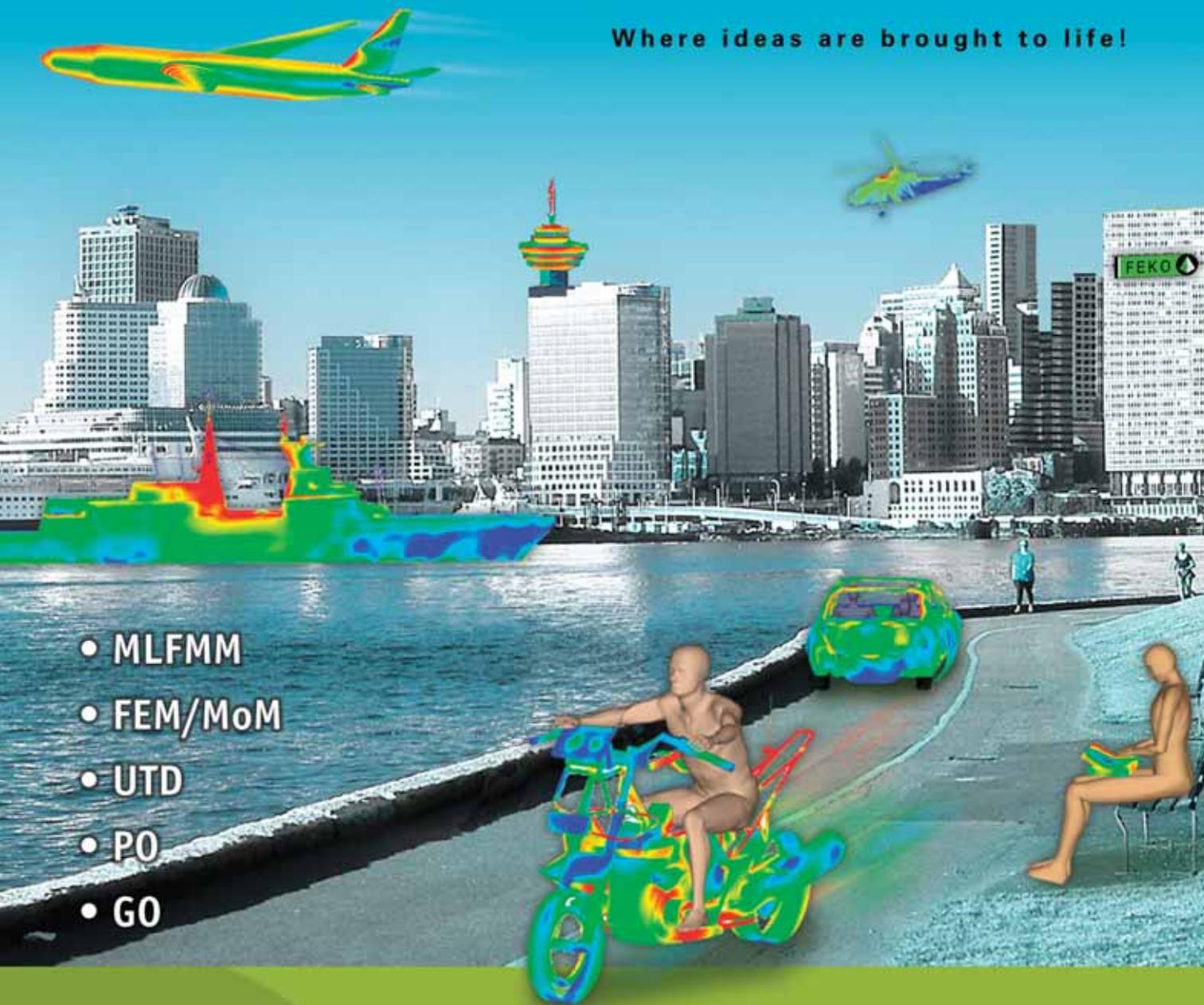n-kobayasi@aj.jp.nec.com, t-harada@bl.jp.nec.com, Hubing@CLEMSON.EDU
Proceedings of the 8th International Symposium on Electromagnetic Compatibility, Hamburg, Germany, September 8-12, 2008, pp. 97 - 102.

Abstract: This paper describes the SPICE modeling of multiple plane structures where the inner layer planes have different shapes than the outer layer planes. These structures are often seen in a printed circuit board (PCB), or the space between a PCB and metal chassis. First, a SPICE model is proposed for these structures using two dimensional ladder networks and ideal transformers. Next, the model is expanded to structures including vertical connecting conductors, such as vias in a PCB and grounding posts connecting a PCB to a metal chassis. Coupling properties inside a PCB are calculated using the SPICE model and shown to be consistent with experimental data. Furthermore, radiated emissions from a PCB-chassis system are also calculated based on the SPICE and equivalent magnetic current source models. The results are consistent with experimental data to show the changes in radiated EMI due to the locations of grounding posts.

Index terms: SPICE models, multiple planes, two dimensional ladder network, ideal transformer, power bus resonance, chassis connections, grounding posts, equivalent magnetic current source, radiated EMI from PCBs.

USE OF REVERBERATION CHAMBER TO SIMULATE THE POWER DELAY PROFILE OF A WIRELESS ENVIRONMENT

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Abstract: Multipath propagation environment effects, such as frequency-selective fading, have a strong impact on the quality of a wireless channel. For example, multipath can impact bit error rate (BER) differently from Gaussian noise. For testing wireless devices/systems in these multipath environments it is imperative to have a reliable, controllable, and statistically repeatable measurement facility. The purpose of this paper is to illustrate how the reverberation chamber can be used to simulate different multipath propagation environments. Channel characteristics such as power-delay profile, RMS-delay spread, and the Rician K-factor are examined. Results for different chamber configurations (e.g., loading of the chamber, antenna positions, etc.) are compared and their effects discussed. Results achieved inside a chamber are compared with those obtained in an actual industrial environment.

Index terms: Delay spread, multipath propagation, power delay profile, reverberation chamber, Rician K-factor, wireless communications, wireless environment.

MAXIMUM RATES OF FREQUENCY SCANNING AND MECHANICAL OR ELECTRONIC STIRRING FOR DISTORTIONLESS SIGNAL GENERATION INSIDE ELECTROMAGNETIC REVERBERATION CHAMBERS

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Abstract: We present upper bounds for the rates of frequency scanning and mechanical or electronic stirring inside a reverberation chamber. The bounds are obtained by imposing quasi-stationary of the field to hold, allowing avoidance of nonlinear distortion of the analog or digital excitation (test) signal injected into the chamber. The interior field is represented as a dynamic stochastic process causing random hybrid modulation of the excitation field.

Index terms: EMC measurements, reverberation chambers, quasi-stationary, frequency scanning, mode stirring.

NUMERICAL ANALYSIS OF ELECTROMAGNETIC FIELD DISTRIBUTIONS IN A TYPICAL AIRCRAFT

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Abstract: The purpose of this study is to develop an accurate and reliable estimation method of electromagnetic field distributions in practical environments including passengers. However, comprehensive measurements in an actual environment are very costly and it is difficult to carry them out precisely. In this paper, large-scale numerical simulations are carried out to examine the electromagnetic fields excited by the 2.45 GHz wireless LAN terminal inside an aircraft. We used a typical aircraft model and employed the FDTD technique and a supercomputer to estimate the field distributions inside the whole area of the cabin. A large-scale parallel computing technique based upon several node partitions of a supercomputer was used because of its memory and speed capabilities. It is able to give us a good perspective within a reasonable computation time. Furthermore, a simplified histogram estimation method for electric field strength in the cabin was employed to deal with the complicated EMF distributions inside the cabin including passengers.

Index terms: Wireless LAN, aircraft, large-scale FDTD analysis, fields histogram estimation.

MULTIPOLAR EXPANSION SENSORS FOR NEAR FIELD CHARACTERIZATION

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Abstract: This paper introduces a new generation of magnetic field sensors, based on the spherical harmonics decomposition concept. The measurement principle is similar to a spatial filtering; according to the coil shape, the sensors are just sensitive to a specific component of the multipolar expansion. Five coil shapes are determined in order to account for the first two orders of the harmonic decomposition. The way of determining the coil shape is first explained, and a validation is proposed using finite element software.

Index terms: Coils electromagnetic sensors, near field measurements, multipolar expansion, radiated EMC, radiated electromagnetic sources characterization.

EMCABS: 07-11-2008

CLASSIFICATION OF ELECTROMAGNETIC EFFECTS AT SYSTEM LEVEL

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Abstract: High-Power Electromagnetic (HPEM) environments are capable of causing effects like malfunctions, performance degradation, interferences, and destructions in electronic and electrical systems. Due to the large plurality of effects, a scientific and systematic discussion requires classifications, which abstract the essential information. This paper presents a systematic classification of electromagnetic (EM) effects. The presented system enables an assessment and comparison of EM effects at system level.

Index terms: High-power electromagnetics, effects, susceptibility, intentional electromagnetic interference, classification.

EMCABS: 08-11-2008

MOM-BASED ANALYSIS OF THE IMMUNITY OF MARINE EQUIPMENT IN A CONTROL CABINET OF CRUISE AND CONTAINER VESSELS AGAINST 2.4-GHZ WLAN APPLICATION

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Abstract: In this contribution, a typical control panel is investigated. The structure is assembled on bridges of modern ships. Numerical results are presented for the excitation by means of a WLAN antenna. The applied technique was the method of moments based upon a combination of the adaptive-cross approximation and singular value decomposition (ACA/SVD) solver to deal with the exhaustive computational requirements due to the large extension of the panel in terms of wavelength.

Index terms: Method of Moments, MoM, fast solver, ACA, SVD, wireless LAN, WLAN, IEC 60945.

EMCABS: 09-11-2008

EFFECTS OF SHIELDING ENCLOSURES ON THE BREAKDOWN FAILURE RATE OF ELECTRONIC EQUIPMENT

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Abstract: As a criterion of quality of a shield regarding its ability to protect electronic equipment against electromagnetic pulses, the breakdown failure rate of operating test equipment with and without the shield can be compared. In this contribution, the shielding behavior of cubical shields with varying rectangular slots against ultra wideband pulses of double exponential wave form is studied. It is found that applying the shield may have the effect that electronic equipment becomes even more vulnerable to pulses due to resonance effects inside the enclosure. The results of these examinations in time domain are compared to results in frequency domain which can be found in publications.

Index terms: UWB-pulses, shielding effectiveness, rectangular enclosure with rectangular aperture.

EMCABS: 10-11-2008

GENERALIZED PEEC METHOD BASED ON DYADIC GREEN'S FUNCTIONS IN TIME AND FREQUENCY DOMAIN

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Abstract: This paper presents a novel concept for time- and frequency-domain modeling with the PEEC method (DGF-PEEC), which is based on the mixed potential integral equation (MPIE) with dyadic Green's functions. Such models provide exact full-wave semi-analytical solutions for an arbitrary interconnection system; on the other hand, they are represented in a circuit form and, thus, can be implemented in common circuit simulators. The paper derives a general DGF-PEEC formulation that can be applied to all types of MPIE with dyadic Green's functions. Based on this concept, the PEEC model for interconnections in layered media is developed and verified with the help of a MoM code and by measurements as well.

Index terms: PEEC, dyadic Green's functions, time domain analysis, striplines.

EMCABS: 11-11-2008

BAND-LIMITATION EFFECT ON STATISTICAL PROPERTIES OF CLASS-A INTERFERENCE

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Abstract: The effect of band limitation on the statistical properties of Middleton's Class A noise model is investigated. It is found that a uniformly weighted sum of statistically independent and identically distributed Class A random variables becomes a new Class A random variable with reduced impulsiveness. It is also found that band limited noise becomes Class A noise if the impulse response of the filter has a rectangular envelope waveform. Since matched filters employed by DS-SS (direct sequence spread spectrum) or OFDM (orthogonal frequency division multiplex) systems usually satisfy the above condition, the results can be widely applied to the evaluation of the error probability of signal detection in such communication systems subjected to Class A interference.

Index terms: Electromagnetic interference, nongaussian noise, amplitude probability distribution, Class A.

EMCABS: 12-11-2008

EVALUATION OF SENSITIVITY OF DIGITAL TV RECEIVER SUBJECTED TO INTRASYSTEM INTERFERENCE

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Abstract: This study demonstrates that the sensitivity of the orthogonal frequency division multiplexing (OFDM) digital television (DTV) receiver particularly for mobile reception subjected to intra-system interference is possible to be estimated from the amplitude probability distributions (APDs) of the interfering noise measured with the subcarrier bandwidth of the DTV receiver. It was found that the bit error probability (BEP) after error correcting of victim DTV receiver is approximately estimated from APD of interfering noise by using the coding effect in the presence of Gaussian interference. The experimental result showed that the coded BEP performance was highly correlated with the sensitivity of the mobile DTV receiver.

Index terms: Component, digital broadcasting, one-segment broadcasting, ISDB-T, reception sensitivity, amplitude probability distribution. **EMC**