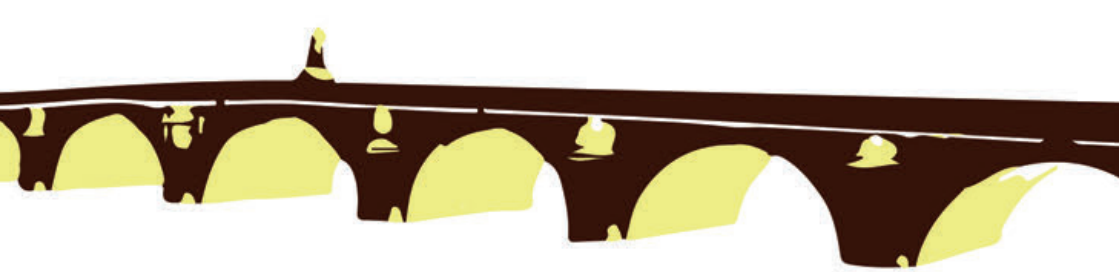

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P1_Tu: Poster Session 1
Time: 05/Sep/2017: 12:30pm-2:00pm • Location: Main Hall

Incorporation of MoM-based Waveguide Port Model into the Mixed Conducting and Dielectric Geometry

Faik Bogdanov[1,2], Irina Chochia[1], Lily Svanidze[1,3], Roman Jobava[1,3]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Georgian Technical University, Tbilisi, Georgia
[3]Tbilisi State University, Tbilisi, Georgia

In this paper, a general waveguide port problem is formulated in the case when the port is connected to arbitrary mixed conducting and dielectric geometry using the combination of equivalence principles for aperture coupling problem and for scattering problem on mixed geometry. The method of moments (MoM) is used to reduce the problem to algebraic equations in terms of both electric and magnetic currents. The obtained approach is verified on practical EMC problems for coaxial ports connected to microwave antenna and printed circuit board (PCB) geometries. A good agreement between the simulated and measured results is demonstrated.

O_We_A3: Computational Methods 1
Time: 06/Sep/2017: 9:00am-10:30am • Location: Amériques

Hybrid DGTD-MTL-MNA Method for Modelling of Transient Field Coupling into Cables

Iskander Badzagua[1,2], Lily Svanidze[1,2], Irina Oganezova[1,2], Zviadi Kutchadze[1], Roman Jobava[1,2]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Tbilisi State University, Tbilisi, Georgia

This paper presents an accurate and efficient time-domain approach for analyzing the coupling of transient electromagnetic fields into cable systems with arbitrary linear networks at terminations. Some nonlinear elements in termination circuits are also considered. The approach is based on hybridization of three different methods. First, the discontinuous Galerkin time domain (DGTD) method is used for calculating transient electromagnetic fields in a 3D environment. Second, the 1D finite difference time domain method is used to solve the transient response of a cable system. Finally, in order to incorporate circuit network at cable terminations, the equations of modified nodal analysis are integrated into the cable solver. The interaction of the mentioned methods is performed at each time step of calculation. The coupling of fields into cables is implemented without feedback into the field solver, while interaction between cable and circuit solvers is considered as bi-directional. The validation of the proposed hybrid approach is performed by comparisons with the lumped circuit transmission line (LCTL) approach. As an application, we demonstrate the investigation of coupling of transient electromagnetic fields into an LED lighting system located in the vehicle.

O_We_A3: Computational Methods 1
Time: 06/Sep/2017: 9:00am-10:30am • Location: Amériques

Novel VIE Solution for Low Frequency EM Fields Induced Inside Human Body Voxel Models

Giga Gabriadze[1,2], Giorgi Chiqovani[2], Ekaterina Yavolovskaya[1,2], Lili Svanidze[1,2], David Karkashadze[1,2], Roman Jobava[1,2]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Tbilisi State University, Tbilisi, Georgia

The novel Volume Integral Equation (VIE) method is developed for an accurate analysis of low frequency (LF) electromagnetic (EM) fields induced inside human body voxel model. To improve stability of LF solution, we introduce two sets of unknowns: electric voluminous currents and surface charges defined on interfaces between different materials. At low frequencies, efficient version of VIE is found by using only surface charges as unknowns. Adaptive Cross Approximation (ACA) is used to compress MoM matrix and speed up iterative solution based on Bi-Conjugate Gradient Stabilized (BicgStab) method. The efficiency of solution is demonstrated as for simple geometries, as well for real human body model. Developed approach is validated against literature data.

P2_We: Poster Session 2
Time: 06/Sep/2017: 12:30pm-2:00pm • Location: Main Hall

Investigation of the Impact of Parasitic Parameters on PCB Performance by Hybridization of 3D Quasistatic Field Solvers and MNA

Alexander Demurov[1,2], Giga Gabriadze[1,2], Badri Khvitia[1], Zviad Kutchadze[1], Anna Gheonjian[1,2], Roman Jobava[1,2], Ilona Danelyan[1]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Tbilisi State University, Tbilisi, Georgia

This paper presents a hybrid approach to investigation of performance of printed circuit board (PCB) by examining the impact of parasitic parameters of the board design on the efficiency of a device. Firstly, parasitic parameters are extracted from board layout by 3D quasistatic field solvers. Secondly, the corresponding equivalent circuit is constructed. Thirdly, the extracted parasitic circuits are incorporated into functional circuit model. Finally, Modified Nodal Analysis (MNA) is used to examine complete network. The hybridization makes it possible to vary circuit parameters and layout independently to achieve maximum system performance. Validation of the proposed method is performed by comparison of simulation results with measurements of GSM band signal amplifier.

P2_We: Poster Session 2
Time: 06/Sep/2017: 12:30pm-2:00pm • Location: Main Hall

Hybrid MoM-MTL Solution for LF Susceptibility and Radiation Problems

Giorgi Chiqovani[1], Iskander Badzagua[1,2], David Karkashadze[1,2], Giga Gabriadze[1,2], Roman Jobava[1,2]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Tbilisi State University, Tbilisi, Georgia

This paper presents hybridization of multi-conductor transmission line (MTL) approach and Method of Moments (MoM) for solving automotive low-frequency (LF) EMC radiation and susceptibility problems. Special boundary conditions are applied for thin 3D sheets, characterized by both, electric and magnetic material parameters. Loop-star basis functions are used for low frequency MoM solution of Surface Integral Equations (SIE). For modeling of multi conductor cable systems, efficient circuit model was implemented, considering shielding and any type of losses. Hybrid solution is validated using full-wave MoM solution. Applicability of described approach is demonstrated using magnetic fields generated by a shielded cable inside a car and electro-magnetic coupling from inductive charger to this shielded cable.

O_We_D3: Exposure to EM Fields
Time: 06/Sep/2017: 4:00pm-5:30pm • Location: Amériques

Low Frequency Human Exposure Analysis for Automotive Applications

Ekaterina Yavolovskaya[1,2], Benjamin Willmann[3,4], Giga Gabriadze[1,2], Giorgi Chiqovani[1], Zurab Sukhiashvili[1], Sophia Iosava[1], Lily Svanidze[1,2], Roman Jobava[1,2]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Tbilisi State University, Tbilisi, Georgia; [3]VOLKSWAGEN AG, Wolfsburg, Germany; [4]University of Magdeburg, Magdeburg, Germany

This paper presents a simulation methodology for efficient investigation of human exposure to low-frequency (1 Hz to 10 MHz) electromagnetic fields generated by automotive electrical systems such as wireless power transfer (WPT) systems. The main stages of the modeling process are discussed. A simulation approach based on the combination of computationally efficient methods such as surface integral equation (SIE) to handle 3D environment and volume integral equation (VIE) to simulate fields inside the human body model is used. TARO-based human body model is considered. For analysis of human exposure in different, realistic scenarios, human posing methodology is developed. Human exposure due to low-frequency magnetic fields of WPT systems is investigated. Inner body induced electrical fields are calculated and compared to ICNIRP basic restrictions.

Automotive EMC Workshop

WT_Fr_A1: Workshop 4A - Automotive EMC
Time: 08/Sep/2017: 10:00am-10:30am • Location: Jeanneteau

Analysis of the Radiated Emission from Shielded HV-Cables

Anna Gheonjian[1,2], Oussama Sassi[3], Badri Khvitia[1,2], Zviad Kutchadze[1], Diana Eremyan[1], Giorgi Kapanadze[1,2], Roman Jobava[1,2]

[1]EMCoS Ltd., Tbilisi, Georgia; [2]Tbilisi State University, Tbilisi, Georgia; [3]VOLKSWAGEN AG, Wolfsburg, Germany

Improvement of EMC performance of power-train system in electric vehicles requires radiates emission analysis. Radiated emission depends on several factors such as characteristics of switching power electronics components, quality of shielding and impedance of complex grounding paths.
Simulation approach for radiated emission analysis, presented in this work, was validated using automotive component test setup with CISPR 25 rod antenna method. Side effects of antenna cable positioning that disturbs reproducibility of radiated emission test results were also analyzed and discussed.
In order to focus on shielding and grounding path aspects signal generator with a stable wide-band spectrum and built-in power supply was developed. Generator is powerful enough to perform radiated emission tests for fully shielded systems in the 0.15 MHz - 30 MHz frequency range.
Presented simulation methodology can be applied at system level for analysis of shielding performance and resonant effects associated with complex grounding path of electric power-train system installed in the vehicle.

Georgian Wines Degustation

Time: 06/Sep/2017: 3:30pm-4:00pm
Location: EMCoS booth #1

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