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Foreword Advanced Emc Numerical Modeling

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Foreword
Advanced EMC Numerical Modeling

THE INCREASING need in recent years for computer-based design and analysis techniques in all fields of engineering has resulted in the development of sophisticated models and simulation tools. In the field of electromagnetic compatibility (EMC), major advances have been made, brought about by the unique aspects of EMC design, which makes it different from other fields of electromagnetic design. These features include the presence of widely different time and space scales in the same physical problem, the use of various materials with widely varying and frequency-dependent parameters, the need to characterize systems well beyond their normal operating frequency range, the statistical nature of many of the electrical parameters, and finally extreme complexity.

A whole array of models have been devised to cover aspects of complex EMC problems such as, lumped-circuit models, distributed models, and full-field models. Yet, major developments are still needed to enhance and integrate these models so that practical EMC problems can be solved.

The purpose of this Special Issue on "Advanced EMC Numerical Modeling" is to highlight major areas of advancement in EMC simulation where the creative skills of modelers have introduced innovative approaches that are revolutionizing EMC numerical modeling and simulation. The following papers cover the state of the art and point to future trends in five important areas. The first three papers by Staker *et al.*, Ruehli *et al.*, and Rubinstein *et al.* illustrate how major generic modeling techniques are being extended and improved to increase efficiency or to exploit developments in computer technology. This is a continuing effort since any enhancements in the efficiency of the basic full-field modeling techniques is highly desirable as new and more complex problems are tackled. A permanent problem in the simulation for EMC is the treatment of boundaries, either to terminate open-boundary problems, or to avoid detailed modeling of particular features. The papers by Berenger and by H. Wang *et al.* address this particular issue of boundaries.

Notwithstanding any improvements in the main full-field modeling techniques, it is difficult to envisage that electrically large practical EMC problems could be tackled without incorporating special models which describe more efficiently particular electrically small features such wires, apertures etc. This combination of techniques, in the same simulation, to tackle multiscale problems appears to be an essentially pre-requisite to full scale simulation of practical problems. The next two papers address the modeling of thin wires. The paper by Sewell *et al.*uses modal expansion techniques to interface the global mesh to local wire solutions and the paper by Ala *et al.* employs wavelets. A similarly challenging application is the simulation of coupling through shields with apertures. The paper by Martin *et al.*uses semi-empirical techniques to describe apertures, while the papers by Paul *et al.* and *Siah et al.* employ a digital filter interface and fast multipole method respectively to model coupling.

The last two papers by K. Wang *et al.* and Fan *et al.*give two examples of a large simulation of a practical EMC problem.

Finally, we wish to thank all the authors of the papers which appear in this issue, for their valuable contributions, and also those whose papers could not be included and will appear in forthcoming regular issues of the transactions. We also express our appreciation to Prof. M. Koledintseva who helped us with the handling of the submitted papers.

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Dr. Christopoulos has received the Electronics Letters and the Snell Premiums from the Institute of Electrical Engineers and several conference Best Paper awards. He is a Member of the Institute of Electrical Engineers (IEE), U.K., and IoP. He is the Executive Team Chairman of the IEE Professional Network in EMC, member of the CIGRE Working Group 36.04 on EMC and Associate Editor of the IEEE TRANSACTIONS ON ELECTROMAGNETIC COMPATIBILITY.

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