



20th International Zurich Symposium on Electromagnetic Compatibility

TU-1 on Monday, January 12

Title Tutorial	Modeling and Simulation Strategies in EMC Engineering: Problems, Challenges and Tools
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Abstract Electromagnetic Compatibility (EMC) engineering is multidisciplinary and extends from electrical, electronics and electromechanical to computer engineering, biomedical engineering to chemistry. This necessitates multiphysics modeling of electromagnetic fields as well as novel computer simulation approaches. This tutorial provides a brief introduction into modeling strategies and simulation scenarios pertaining to EMC engineering problems. First, basic concepts in electromagnetics, transmission lines, antenna theory, microstrip networks, waveguides, etc., will be reviewed from EMC engineers' point of view. Topics to be covered also include fundamental concepts such as accuracy, precision, resolution, physical problems and modeling, discrete environment, analytical models, numerical models, deterministic and stochastic modeling, simulation, validation, and verification. Then, numerical simulation approaches in EMC engineering will be discussed. Finally, virtual EMC tools (which have been introduced for educational, training, and design purposes) and characteristic examples will be presented.

The tutorial targets undergraduate and graduate level participants from EMC society. The tutorial will provide for the participants lecture notes and virtual EMC tools. The participants who bring their laptops may practice the virtual tools during the tutorial.

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LECTURE 1: Introduction

1. Engineers speak with numbers: Do we really know the meaning of the numbers we use?
2. Basic concepts, terms, definitions and keywords in EMC engineering.
3. Complex EMC Engineering environments, Fundamentals and model-based approaches
4. Validation, Verification, Accreditation and Calibration
5. Error/uncertainty analysis and EMC Test reporting

LECTURE 2: EMC and Numerical Simulation Approaches: Brief Review

1. The Finite-difference time-domain (FDTD) method
2. The Method of Moments (MoM) method
3. The Transmission Line Matrix (TLM) method
4. The Split-step parabolic Equation (SSPE) method

LECTURE 3: Virtual EM tools and DEMOS

1. Time-domain Reflectometer Tool: TDRMeter
2. Matlab-based Antenna Array Virtual Tool: ARRAY_GUI
3. FDTD- based Virtual Microstrip circuit Tool: MS-Filter
4. EM Wave – Metamaterial interactions virtual Tool: MTM-FDTD
5. 2D Parabolic Equation and MoM Radiowave Propagation Virtual Tool: GrMoMPE
6. Virtual RCS Tool: MGL-RCS

Speaker:

L. Sevgi (IEEE SM) has been involved with complex electromagnetic problems and systems for more than 20 years. After completing his PhD with Prof. Leopold B. Felsen in New York in 1990 he joined Istanbul Technical University (ITU). He was the Chair of the Electronic Systems Department in TUBITAK-MRC, Information Technologies Research Institute between 1999 and 2000. He was awarded a two-year fellowship at the Weber Research Institute/Polytechnic University in New York in 1988 and also worked with the Scientific Research Group of Raytheon Systems, Canada during 1998 - 1999. He was with the Center for Defense Studies, ITUV-SAM for the Turkish Integrated Maritime Surveillance System (Long Horizon) studies between 1993 -1997, and, for the Vessel Traffic System installation for Turkish Straits between 2000 and 2002. Since 2001, he has been with Dogus University of Istanbul and has been the Director of MODSIM (Modeling and Simulation) Centre at the University. His research has focused on propagation in complex environments, RCS prediction and reduction, EMC/BEM modeling and measurements, analytical and numerical methods in electromagnetics, signal processing techniques and radar systems.

He is the writer/editor of “*Testing ourselves*” Column in the IEEE Antennas and Propagation Magazine, member of the IEEE Antennas and Propagation Society Education Committee, the “*Scientific Literacy*” column writer of the IEEE Region 8 Newsletter, a member of the editorial board of the IEEE Antennas and Propagation Magazine, ELEKTRIK, Turkish Journal of Electrical Engineering and Computer Sciences, American Journal of Food Technology, IJAP, Int. Journal of Antennas and Propagation, (HINDAWI Publishing), Asian Journal of Management, (ACADEMIC Journals).

He is the author or co-author of seven books, nearly 90 journal and 70 international conference papers.