附件二：内容介绍

Seminar #1:

Multi-Level Modeling for Complex Microwave/High-Speed Design

Professor Wolfgang J.R. Hoefer, University of Victoria

Complex communication and information systems operating in the Gigahertz range often combine multiple analog and digital functions. The design of such systems must capture all electromagnetic effects and interactions that impact their performance. However, it is impossible to model such systems globally at the field and device levels. Therefore, designers must take a hierarchical approach (top-down design) by which the system is conceived at a high level of abstraction and in behavioral terms. The specifications for its functional components are formulated at the network or circuit level. They, in turn, define a physical structure that requires frequency- or time-domain electromagnetic field analysis. Once the functional components have been realized, their actual physical behavior must be analyzed or measured, including possible parasitic interactions between them, and abstracted into realistic (as opposed to initially specified) behavioral models that accurately predict their impact on overall system performance (bottom-up verification). This methodology also addresses signal integrity, packaging, interconnects, electromagnetic compatibility (EMC), and thermal issues.

The purpose of this lecture is to familiarize our membership with evolving design approaches for systems of large technological and functional complexity, and to demonstrate how microwave modeling and design practices can be integrated into a wider flexible multi-level modeling environment. Techniques for interfacing models at the behavioral, network, circuit and field levels will be demonstrated. They range from order reduction of field models to the coupling of field- and circuit solvers, extraction of equivalent circuits from field solutions and measurements, behavioral representation by neural networks, and the linking of electromagnetic and thermal solvers. The key is to describe different parts of a complex structure by the most appropriate model of lowest possible order, while maintaining a two-way correspondence between functional behavior and physics across the modeling hierarchy.

Seminar #2:

TIME DOMAIN ELECTROMAGNETIC SIMULATIONS WITH MEFISTO-3D PRO

Wolfgang J. R. Hoefer
Faustus Scientific Corporation, 1256 Beach Drive, Victoria, BC, V8S 2N3, Canada

Abstract: This three-hour short course will provide an introduction to the modeling features and practical microwave power applications of the time domain electromagnetic simulator MEFiSTo-3D Pro. The purpose of this short course is to introduce practitioners who are mostly familiar with the classic frequency-domain approaches, to the possibilities and applications of this time-domain modeling tool. A free version, MEFiSTo-3D Nova, will be made available to participants to facilitate hands-on experimentation with the tool.

1. Executive Summary

The proliferation of computer tools for electromagnetic analysis, design and optimization is having a profound effect on the working environment of microwave engineers. While most practitioners are educated to work with frequency domain concepts and complex notation, they are less familiar with the time domain approach, its advantages and challenges. Yet, several time domain electromagnetic modeling tools have become available over the past ten years that can solve transient, wideband and nonlinear problems with ease and efficiency. The key to their effective use as engineering tools is to gain an in-depth understanding of what goes on inside these tools and how they solve electromagnetic fields.

The purpose of this short course is

a) to expose participants to the operating principles and capabilities of time-domain electromagnetic field solvers;

b) to illustrate the features by means of hands-on problem solving with MEFiSTo-3D Pro..

First, the characteristics of time domain simulators will be introduced in terms accessible to the practitioner, and the resulting performance profiles of such simulators will be demonstrated. This includes the pre- and post-processing steps that relate geometry and material data with field information and electromagnetic characteristics. Special emphasis will be on convergence, error control and validation using basic calibration elements. In this way, a solid foundation for user confidence and good technical judgment will be laid in a systematic manner.

The short course will be of benefit to

a) Microwave engineers experienced in frequency domain analysis and design who would like to learn more about time domain field solvers and their applications,

b) Experienced users of frequency-domain electromagnetic simulators who seek a better understanding of the theoretical and computational foundations of their time domain counterparts,

A number of real-time demonstrations and simulations will be presented during the short course, and participants are encouraged to bring their laptops on which they can install the **free 3D time-domain simulator program** (MEFiSTo-3D Nova by Faustus Scientific Corporation) that will allow them to gain hands-on experience in time domain field modeling and to practice problem solving.

2. Outline and Structure of the Course

Introduction and Historical Perspective

1. Welcome and Introduction
2. The Task and General Field Solution Strategies

Frequency vs. Time Domain Electromagnetics

3. Classification of Electromagnetic Solution Methods
   3.1 Time-Harmonic Field Solutions
   3.2 Transient Field Solutions
4. Computational Burden
5. Relationships between Frequency and Time Domain Methods

Functional Characteristics of MEFiSTo-3D Pro

6. Geometrical input and discretization
7. Field excitation and time stepping
8. Signal output, processing and visualization
9. Field embedding of linear and nonlinear circuits
10. Field-based design and optimization
11. Validation and error correction

Demonstrations and Problem Solving Examples

Discussion, Summary and Conclusions.

Seminar #3:

Wolfgang J. R. Hoefer

Topic 1 Computer-Based Electromagnetic Research and Design Environment Incorporating Metamaterials with Negative Refractive Index

A computer based research and design environment for electromagnetic structures containing artificial materials with simultaneous negative permittivity and permeability will be presented and demonstrated. It employs a full-wave electrodynamic field modeling framework based on the Transmission Line Matrix (TLM) method that enables virtual prototyping and wideband characterization using realistic waveforms, topologies, and boundaries. The central innovative element for metamaterial modeling is a modified TLM cell that has the same properties as the elementary cell of actual realizable metamaterials. This modeling paradigm not only confirms previously published theoretical predictions and experiments, but also demonstrates the feasibility of novel microwave and optical components that defy conventional engineering notions. Several such unconventional components will be presented during the presentation.

Topic 2 Theory and Practice of Advanced Electromagnetic Field Modeling in the Time Domain (1 h Presentation)

Computer tools for electromagnetic analysis, design and optimization are central to the working environment of information technology engineers. While most practitioners are educated to work with frequency domain concepts and complex notation, many are less familiar with the time domain approach, its advantages and challenges. Yet, the majority of electromagnetic problems, particularly those that involve transient, wideband and nonlinear properties, are best treated in the time domain. The key to the effective use of time domain solvers is to gain an in-depth understanding of their particular modeling paradigms. This presentation will summarize essential features and capabilities of modern time domain solvers for electromagnetics, and demonstrate key concepts through live simulation examples.

Seminar #4:

THEORY AND PRACTICE OF TIME DOMAIN ELECTROMAGNETICS A FULL-DAY TUTORIAL

Poman P. M. So and Wolfgang J. R. Hoefer
ECE Department, POB 3055, University of Victoria, Victoria, BC, V8W 3P6, Canada
and Faustus Scientific Corporation, 1256 Beach Drive, Victoria, BC, V8S 2N3, Canada
(poman@ece.uvic.ca; : whoefer@ece.uvic.ca)
Abstract: This tutorial provides an introduction to the theoretical foundations, the operational characteristics and the practical engineering applications of time domain electromagnetic simulators. The purpose of this tutorial is to introduce practitioners who are mostly familiar with the classic frequency-domain approaches, to the concepts and operating principles of time-domain electromagnetic simulators, and to show how these translate into their special properties as engineering tools for high-frequency, signal integrity and EMC work.

1. Introduction

The proliferation of computer tools for electromagnetic analysis, design and optimization is having a profound effect on the working environment of EMC engineers. While most practitioners are educated to work with frequency domain concepts and complex notation, they are less familiar with the time domain approach, its advantages and challenges. Yet, an increasing number of electromagnetic modeling tools has become available over the past ten years that can solve transient, wideband and nonlinear problems with ease and efficiency. The key to their effective use as engineering tools is to gain an in-depth understanding of what goes on inside these tools and how they solve electromagnetic fields.

The purpose of this tutorial is

a) to provide insight into the operating principles of time-domain electromagnetic field solvers;

b) to show how these translate into their properties as engineering tools.

c) to illustrate their particular features by means of problem solving examples demonstrated live.

The characteristics of time domain simulators employing Finite Difference and Transmission Line Matrix (TLM) methods will be presented in terms accessible to the practitioner, and the resulting performance profiles of simulators based on these methods will be demonstrated. This includes the pre- and post-processing steps that relate geometry and material data with field information and electromagnetic characteristics. Special emphasis will be on convergence, error control and validation using basic calibration elements. By solving a number of canonical structures with accurately known properties, the key aspects of these time-domain tools will be demonstrated. In this way, a solid foundation for user confidence and good technical judgment will be laid in a systematic manner.

The tutorial will be of benefit to
a) EMC engineers familiar with linear and non-linear CAD in frequency domain who would like to learn more about time domain field solvers and their applications,
b) Experienced users of frequency-domain electromagnetic simulators who seek a better understanding of the theoretical and computational foundations of their time domain counterparts,
c) Researchers familiar with computational electromagnetics who would like to learn more about the requirements, concerns and methodology of practitioners.

A number of real-time demonstrations and simulations will be presented during the tutorial, and participants are encouraged to ask questions and make comments after each section. **Participants will receive a free 3D time-domain simulator program** (MEFiSTo-3D Nova by Faustus Scientific Corporation) that will allow them to gain hands-on experience in time domain field modeling and to practice problem solving.

2. Tentative Outline and Structure of the Tutorial

Speakers: Drs. Poman P. M. So and Wolfgang J. R. Hoefer

Introduction and Historical Perspective
1. Welcome and Introduction
2. History of Electromagnetic Modeling - Early Concepts
3. The Task and General Field Solution Strategies

Frequency vs. Time Domain Electromagnetics
4. Classification of Electromagnetic Solution Methods
   4.1 Time-Harmonic Field Solutions
   4.2 Transient Field Solutions
5. Computational Burden
6. Relationships between the Discrete Methods

Finite Difference Time Domain (FDTD) Simulators
7. Finite difference field formulations
8. Finite integration field formulations
9. Multiresolution (Wavelet) formulations
10. Stability, convergence, and error margins

Transmission Line Matrix (TLM) Simulators

11. TLM field formulations
12. Stability, convergence, and error margins
13. Relationships between FDTD and TLM

Functional Characteristics of Time Domain Simulators

14. Geometrical input and discretization
15. Field excitation and time stepping
16. Signal output, processing and visualization
17. Field embedding of linear and nonlinear circuits
18. Field-based design and optimization
19. Validation and error correction

Demonstrations

Discussion, Summary and Conclusions.

Seminar #5:

Towards Unifying Numerical Methods with the Method of Weighted Residuals (MWR)

Zhizhang (Daid) Chen

Abstract - The Method of the Weighted Residuals (MWR), sometimes known as the Method of Moments (MoM), has traditionally been applied in the frequency domain and has been shown to be effective and efficient especially in computing open electromagnetic structure problems. Although it has been extended to the time-domain in various forms, it is generally employed to solve the integral formulations derived from Maxwell's equations. Therefore, it is often considered as one type of numerical methods that is different from other numerical methods such as finite-difference methods. In this paper, however, we will show that the MWR, or MoM, is not just a method per se; it can in fact be a general framework or approach that can be used to unify or derive most of the numerical methods developed so far, either in frequency-domain or in time-domain. As the result, all the numerical methods can be fairly easy to understand and can be categorized into the same type of the method although their conventional derivations may still have their respective advantages. One potential application of the work presented here is that the hybridization of different numerical methods can now be done with a uniform framework. The seminar is intended for both the beginners and the experienced practitioners in the area of numerical electromagnetic modeling.

Seminar #6:

A DSP Based Retrodirective Array System For Duplex Digital Communications at 2.4 GHz

Professor Zhizhang (David) Chen

Abstract- Retrodirective arrays are unique phased array systems that are capable of sending signals back in the direction of a received source with no prior knowledge of the source's location. When compared to fully adaptive arrays that adapt their beam patterns to the signal environment based on the received spatial signature, retrodirective arrays do not require the computational burden for antenna pattern adaptation. Traditionally, retrodirective arrays have been designed around analog methods such as doubled local oscillator phase conjugation and heterodyning for use in line of sight non-fading channels. This presentation describes our recent work on a novel implementation of a retrodirective array for duplex digital communications and explains how retrodirective arrays can be used in complex wireless channels to increase system performance. Measurements of the antenna pattern for a retrodirective array using flexible uplink and downlink modulation schemes are presented and show that the designed system is capable of tracking a signal source accurately under duplex communications conditions.

附件三：报告专家简介

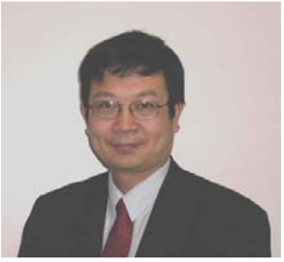
Professor Dr. Wolfgang J. R. Hoefer, Professor Emeritus, University of Victoria and CEO of Faustus Scientific Corporation

Wolfgang J. R. Hoefer received the Dipl.-Ing. degree in Electrical Engineering from the Technische Hochschule Aachen, Germany, in 1965, and the D. Ing. degree from the University of Grenoble, France, in 1968.

From 1968 to 1969, he was a Lecturer at the Institut Universitaire de Technologie de Grenoble and a Research Fellow at the Institut National Polytechnique de Grenoble, France. In 1969 he joined the faculty at the Department of Electrical Engineering, the University of Ottawa, Canada, where he was a Professor until March 1992. In April 1992 he was selected to hold the NSERC Industrial Research Chair in RF Engineering at the University of Victoria, Canada. He headed the Computational Electromagnetic Research Laboratory (CERL) in the Department of Electrical and Computer Engineering in Victoria until July 2006, when he became Professor Emeritus. He held visiting appointments with the Space Division of AEG-Telefunken in Backnang, Germany, the Electromagnetics Laboratory of the Institut National Polytechnique de Grenoble, France, the Space Electronics Directorate of the Communications Research Centre in Ottawa, Canada, the University of Rome "Tor Vergata", Italy, the University of Nice - Sophia Antipolis, France, The Ferdinand Braun Institute in Berlin and the Technical University of Munich, both in Germany, the Georgia Institute of Technology, Atlanta, USA, and the University of Perugia, Italy.

Dr. Hoefer was the Chair and Co-Chair of the MTT-15 Technical Committee on Field Theory from 1990 through 2004, and Associate Editor of the IEEE MTT Transactions from 1998 to 2000. He is the co-founder and managing editor of the International Journal of Numerical Modelling since 1988. He serves on the editorial and advisory boards of several other scientific journals and organizations. He is a Fellow of the IEEE, of the Advanced System Institute of British Columbia, and of the Royal Society (the Academies of Arts, Humanities and Sciences) of Canada. He is a distinguished Microwave Lecturer of the MTT Society (2005 to 2007), the recipient of the 2006 Distinguished Educator Award of the IEEE MTT Society, and the President of Faustus Scientific Corporation.

Professor Dr. Zhizhang Chen, Dalhousie University, Canada



Zhizhang Chen received a B.Eng. degree in Radio Engineering from Fuzhou University, Fujian, P.R. of China, in 1982, a M.A.Sc. degree in Radio Engineering from Southeast University (formerly Nanjing Institute of Technology), Nanjing, P. R. of China, in 1986 and a Ph.D. degree in Electrical Engineering from the University of Ottawa, Ottawa, Ontario, Canada, in 1992, respectively. He was the recipient of the Association of Professors University of Ottawa Student Award (1990), Ontario Graduate Student Scholarship (1991-1992), the Natural Sciences and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship (1993), and a Chinese National Natural Science Fund for Distinguished Young Scholars (oversea; 2006-2009). He was also the recipient of the Association of Professional Engineers of Nova Scotia (APENS) 2005 Engineering Award, the 2006 teaching excellence award in the category of Faculty of Graduate Studies from Dalhousie Student Union, the 2006 Professor of the Year in Electrical and Computer Engineering of Dalhousie University and the 2007 Dalhousie Faculty of Engineering Research Award.

From January to August 1993, Dr. Chen was a NSERC postdoctoral fellow under the supervision of Professor Peter P. Silvester with the Department of Electrical and Computer Engineering, McGill University, Montreal, Quebec, Canada. Since September of 1993, he has been with the Department of Electrical and Computer Engineering at Dalhousie University, Halifax, Nova Scotia, where he is presently a full professor. He has been appointed as a Killam Chair Professor in Wireless Technology at Dalhousie University (2005-2010). He has also been appointed as the Member of NSERC (Natural Sciences and Engineering Research Council of Canada) Strategic Project Selection Panel – Information and Communication Technology (2004-2007).

Dr. Chen has been active in both teaching and research. Since his first term with Dalhousie University, he has been teaching various undergraduate and graduate courses in the areas of RF/Microwave communication electronics/systems, antennas and electromagnetics, and has maintained good student evaluations. He has authored or co-authored over 140 journal/conference papers and 20 industrial reports in the areas of computational electromagnetics and RF/microwave circuit and system design (they have been cited extensively in SCI literatures). Dr. Chen was one of the key originators in developing new numerical algorithms (including the highly cited and commercialized alternating-direction-implicit finite-difference time-domain (ADI-FDTD) method) and in designing a new class of compact RF front-end circuits for wireless communications.

Dr. Chen has been an invited speaker, session chair and organizer for a number of international conferences, workshops and seminars, and has served as an editorial board member for the IEEE Transactions on Microwave Theory and Techniques and International Journal of Numerical Modeling by John Wiley. He is also an invited reviewer for various international journals and research grant agencies. Dr. Chen is a senior member of IEEE, a registered professional engineer and has served as a consultant for a number of local companies.

Dr. Chen's general research area is in RF/Microwave Engineering and Computational Electromagnetics. His current teaching and research involvements are in the areas of **computational electromagnetics** and **wireless technologies** that include **generic electromagnetic time-domain modeling, intelligent RF/microwave transceiving systems, smart antennas, ultrawide-band technology, high-frequency electronics as well as software-defined radios**.

Professor Dr. Poman So, University of Victoria, Canada

Poman P. M. So received his B.Sc. degree in Computer Science and Physics from the University of Toronto, Canada, in 1985. He received his degrees in Electrical Engineering from the University of Ottawa (B.A.Sc. and M.A.Sc.) and the University of Victoria (Ph.D.) in 1985, 1987 and 1996, respectively. Dr. So joined the Department of Electrical and Computer Engineering at the University of Victoria as an Assistant Professor in July 2005.

Dr. So is a Senior Member of IEEE and a registered Professional Engineer in the Province of British Columbia, Canada. He has more than twenty years of research and industrial experience in object-oriented computational electromagnetics and microwave engineering. Dr. So servers regularly as a reviewer for the IEEE Transactions of Microwave Theory and Techniques, IEEE Microwave and Wireless Components Letters, and International Journal of Numerical Modeling – Electronic Networks, Devices and Fields by John Wiley and Sons. He is also a member of the Editorial Advisory Board for the International Journal of Numerical Modeling.

Dr. So visited the Technische Universität München (TUM), München, Germany, in September 2007 for four months as a research scientist and made significant contribution to an open source TLM simulator project. In October 1993, he visited the Ferdinand-Braun-Institut für Höchstfrequenztechnik Berlin, Berlin, Germany, as a research scientist. From August 1990 to February 1991, he was a visiting researcher at the University of Rome in Italy and the Laboratoire d'Electronique in Sophia Antipolis, France. During his time in the three universities, he developed a number of electromagnetic wave simulators for the Digital MPP and Connection Machine CM2 massively parallel computers. Since 1988, Dr. So has published over ninety refereed journal and conference papers. He is the co-author of The Electromagnetic Wave Simulator— A Dynamic Visual Electromagnetics Laboratory Based on the Two-dimensional TLM Method, by John Wiley and Sons Inc.

On the industrial side, from April 1997 to June 1998, Dr. So was a senior antenna engineer at MDA Space Missions, formerly known as SPAR Aerospace Ltd.; his work included high frequency (10 to 40 GHz) antennas and feed components design for commercial satellite systems and Ka-band active antenna CAD software development. Dr. So is a co-founder of the Faustus Scientific Corporation and is the creator of MEFiSTo — a time-domain electromagnetic field simulator based on the TLM method.