IEEE KITCHENER-WATERLOO

IEEE MTT-Chapter Presentation

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"CHARACTERISTIC BASIS FUNCTION METHOD—A GENERAL-PURPOSE TECHNIQUE FOR FAST SIMULATION OF RF/MICROWAVE CIRCUITS AND ANTENNAS"

Abstract:

Virtual prototyping of RF, wireless, and microwave circuits—as well as integrated antennas for these systems—plays an important role in the cost-effective and timely development of new products. However, this task may be very time-consuming because these circuits typically contain a large number of linear and non-linear components, and the procedures for the circuit simulation and optimization can be very computer-intensive.

Commercial Field Solvers that simulate planar microwave structures are often based on the Method of Moments (MoM). As is well known, the conventional MoM using the sub-sectional basis functions, and a $\lambda/10$ or $\lambda/20$ discretization (frequently even smaller in many applications), can become highly computer-intensive when the number of unknowns and, hence, the matrix size, exceed beyond what can be accommodated in the RAM. This situation is frequently encountered in the process of simulating practical configurations, be they planar circuits or arrays, not only because their dimensions may be large in terms of the wavelength, but also because the discretization size may have to be very small to accurately model the fine features of a circuit component. Since the operation counts increase as $O(N^2)$ and $O(N^3)$ for matrix generation and solution, respectively, where N is the number of unknowns, this places a heavy burden on the CPU in terms of both memory and time. Furthermore, the solution process needs to be repeated at each frequency in the range of interest, often with a very fine discretization step, to capture the nuances of the S-parameters of the circuit which may exhibit rapid variations owing to the presence of resonances.

The objective of this talk is to present an approach, called the Characteristic Basis Function Method (CBFM), which has been designed to alleviate the problem of large solution times alluded to above. The method, introduced relatively recently by the authors and their colleagues, has evolved during the last two years and is currently in the process of being implemented in a CAD package. If attacks the problem of large simulation times in a 3-pronged manner: by reducing the time to generate the matrix elements; using special high-level basis functions; and, finally employing efficient techniques for spanning the frequency range.

Numerous examples will be presented in the talk to illustrate the application of the CBFM to problems of practical interest.

Biography:

Raj Mittra is Professor in the Electrical Engineering department of the Pennsylvania State University. He is also the Director of the Electromagnetic Communication Laboratory, which is affiliated with the Communication and Space Sciences Laboratory of the EE department. Prior to joining Penn State he was a Professor in Electrical and Computer Engineering at the University of Illinois in Urbana Champaign. He is a Life Fellow of the IEEE, a Past-President of AP-S, and he has served as the Editor of the Transactions of the Antennas and Propagation Society. He won the Guggenheim Fellowship Award in 1965, the IEEE Centennial Medal in 1984, the IEEE Millennium medal in 2000, and the AP Distinguished Achievement award in 2002. He has been a Visiting Professor at Oxford University, Oxford, England, and at the Technical University of Denmark, Lyngby, Denmark.
He is the President of RM Associates, which is a consulting organization that provides services to industrial and governmental organizations, both in the U. S. and abroad.

All are Welcome
Refreshments will be served

DATE: **Thursday April 1, 2004**

TIME: **3:00 pm**

LOCATION: **EIT 3151, University of Waterloo**

Invited by Prof.Safavi-Naeini IEEE-MTT Chapter