



IEEE MTT Chapter Presentation

Neural Networks for RF and Microwave Design

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Significant advances continue in modeling and CAD to meet the challenges of next generation high-frequency electronic design. Increasing design complexity, coupled with tighter component tolerances and shorter design cycles, demand tools that are faster, more accurate and automated than possible today. It becomes important to achieve EM/physics-based design accuracies not only at the component level, but also at the circuit and system levels. Recent advances in the application of Artificial Neural Networks (ANN) to RF/microwave design created an exciting direction of computer-aided modeling for passive and active devices at component and circuit levels. It leads to substantial increase in modeling accuracy, speed, and flexibility. Applications are being made in modeling and design of microstrip and CPW circuits, multilayer interconnects, embedded passives, printed antennas, LTCC circuits, semiconductor devices, measurement standards, filters, amplifiers, mixers and so on. Knowledge based engineering concepts exploiting prior design knowledge are being introduced in microwave CAD such as knowledge-based neural networks, and knowledge-aided design. This leads to new level of CAD methodologies combining equivalent circuit/empirical models, EM/physics simulation and behavioral modeling with ANN and optimization algorithms for fast and accurate design of RF/microwave circuits and systems.

This talk presents a review of the state of the art in these emerging directions. The presentations highlight implementable methodologies for automated modeling and design of high-frequency electronic components, circuits and systems. The presentation covers fundamental concepts and methodologies, industrial applications, and future trends in R&D.

About the Speaker: Qi-jun Zhang received the B.Eng. degree from the East China Engineering Institute, Nanjing, China in 1982, and the Ph.D. Degree in Electrical Engineering from McMaster University, Hamilton, Canada, in 1987. He was with Optimization Systems Associates Inc. (acquired by HP in 1997), Dundas, Ontario, Canada during 1988-1990, developing advanced microwave optimization software. He joined the Department of Electronics, Carleton University, Ottawa, Canada in 1990 where he is presently a Professor.

His research interests are neural network and optimization methods for high-speed/high-frequency electronic design, and has over 170 publications in the area. He is an author of the

book *Neural Networks for RF and Microwave Design* (Boston: Artech House, 2000), a coeditor of *Modeling and Simulation of High-Speed VLSI Interconnects* (Boston: Kluwer, 1994), and a contributor to *Encyclopedia of RF and Microwave Engineering*, (New York: Wiley, 2005), *Fundamentals of Nonlinear Behavioral Modeling: Foundations and Applications*, (Boston: Artech House, 2005), and *Analog Methods for Computer-Aided Analysis and Diagnosis*, (New York: Marcel Dekker, 1988). He was twice a Guest Editor for the Special Issues on Applications of ANN to RF and Microwave Design for *the International Journal of RF and Microwave CAE* (New York: Wiley, 1999, 2002).

Dr. Zhang is a Fellow of the IEEE. He is on the editorial board of the IEEE Transactions on Microwave Theory and Techniques, the International Journal of RF and Microwave CAE, and the International Journal of Numerical Modeling. He is on the Technical Committee on CAD of the IEEE MTT Society, and the TPC of the IEEE MTT-S International Microwave Symposium.

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Time: 4:30 pm

Location: DC 1302

Invited by Prof. Raafat R. Mansour