



**Southeastern Michigan Section  
"Chapter IV" Speaker Series  
Wed, Apr. 22, 2009, 4:00 pm  
Appetizers and Networking at 3:30 pm  
Room #1005, EECS Bldg,  
North Campus, University of Michigan  
1301 Beal Ave, Ann Arbor, MI**



**A Novel, Highly Efficient Domain Decomposition Technique  
for the Finite Element Computation of Electromagnetic Fields:  
Application to Large-Scale Phased-Array Antennas  
and Photonic Crystal Problems**

**Jian-Ming Jin**

Professor, Department of Electrical and Computer Engineering  
Director, Center for Computational Electromagnetics  
University of Illinois at Urbana-Champaign, Urbana, IL 61801-2991

**Abstract:**

Numerical discretization of large-scale electromagnetic problems often results in a large system of linear equations involving millions or even billions of unknowns, whose solution is very challenging even with the most powerful computers available today. In this talk, we present a new computational technique for numerical analysis of such large-scale electromagnetic problems. This technique is based on the finite element method (FEM) combined with a highly robust nonoverlapping domain decomposition algorithm, which is referred to here as the electromagnetic dual-primal finite element tearing and interconnecting method (FETI-DPEM). In this method, a computational domain is first decomposed into many subdomains, and the field inside each subdomain is formulated using the FEM. The field continuity is enforced explicitly along the edges shared by more than two subdomains and implicitly at the interfaces between two subdomains through the use of Lagrange multipliers. The enforcement of the field continuity couples all the subdomain problems and forms a much smaller global interface problem. In this talk, we apply the FETI-DPEM method to the simulation of large finite arrays such as phased-array antennas and photonic crystals to demonstrate the efficiency and capability of the method.

**Speaker's Biography:**

Jian-Ming Jin is a Professor of Electrical and Computer Engineering and Director of the Electromagnetics Laboratory and Center for Computational Electromagnetics at the University of Illinois at Urbana-Champaign. He has authored and co-authored 200 papers in refereed journals and 18 book chapters. He has also authored *The Finite Element Method in Electromagnetics* (New York: Wiley, 1<sup>st</sup> edition 1993, 2<sup>nd</sup> edition 2002) and *Electromagnetic Analysis and Design in Magnetic Resonance Imaging* (Boca Raton, FL: CRC, 1998), co-authored *Computation of Special Functions* (New York: Wiley, 1996) and *Finite Element Analysis of Antennas and Arrays* (Hoboken, NJ: Wiley, 2008), and co-edited *Fast and Efficient Algorithms in Computational Electromagnetics* (Norwood, MA: Artech, 2001). His name often appears in the University of Illinois's *List of Excellent Instructors*. He was elected by ISI as one of the world's most cited authors in 2002. Dr. Jin is a Fellow of IEEE and a recipient of the 1994 National Science Foundation Young Investigator Award and the 1995 Office of Naval Research Young Investigator Award. He also received the 1997 Xerox Junior and the 2000 Xerox Senior Research Awards from the University of Illinois, and was appointed as the first Henry Magnuski Outstanding Young Scholar in 1998 and later as Sony Scholar in 2005. He was appointed as a Distinguished Visiting Professor in the Air Force Research Laboratory in 1999.

**Public Invited**

Appetizers and Networking at 3:30 pm