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Advanced Digital Sciences Center

Distinguished Lecture Series

Fast Multipole Algorithm: Deep Insights

Thursday, 22 Nov 2012

3:00 p.m.

Fusionopolis, #17-01,
Connexis SOUTH
Charles Babbage Room

Weng Cho Chew

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Abstract

The fast multipole algorithm was heralded as one of the top ten algorithms by *IEEE Computational Science & Engineering* magazine in 2000. The fast multipole algorithm worked fabulously well for static physics problems with $O(N)$ complexity, but it was Professor Chew's research group at the University of Illinois that played an important role in creating the dynamic version of the algorithm, delivering $O(N \log N)$ complexity for the matrix-vector product of a dense matrix system. This breakthrough has enabled static dense matrix problems to be solved with 30 billion unknowns, as well as dynamic dense matrix problems with over 1 billion unknowns. Professor Chew's talk will highlight the history of the fast multipole algorithm and provide deeper insights into how it works.

About the Speaker

Weng Cho Chew is the first holder of the Y. T. Lo Chair in Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. Prof. Chew's current primary research interests lie in fast computational algorithms for solving electromagnetic scattering problems. His other areas of interest are in wave propagation, scattering, inverse scattering, inhomogeneous media for geophysical subsurface sensing and nondestructive testing applications and experiments. He has designed experiments with his graduate students to demonstrate the super-resolution phenomena of nonlinear inverse scattering. His research group has solved electromagnetic scattering problems of unprecedented sizes involving over 10 million unknowns, using fast algorithms and matrix-free methods. He is the originator of several fast algorithms for solving electromagnetics scattering and inverse problems, and has authored a book, *Waves and Fields in Inhomogeneous Media*, and coauthored a book, *Fast and Efficient Algorithms in Computational Electromagnetics*, in addition to more than 300 scientific journal articles and 400 conference papers, several patents, and book chapters.

Prof. Chew is an IEEE Fellow, an OSA Fellow, and was named an NSF Presidential Young Investigator in 1986. Previously, he was the director of the Center for Computational Electromagnetics and the Electromagnetics Laboratory. Prof. Chew has been named frequently to the Daily Illini's "Incomplete List of Excellent Instructors." He was also the winner of the IEEE Year 2000 Graduate Teaching Award, the UIUC Campus Award for Excellence in Graduate and Professional Teaching for 2001, a Founder Professor of the College of Engineering at the University of Illinois, and the co-winner of the Schelkunoff Best Paper Award for 2001. In 2002, ISI Citation elected him to the category of Most-Highly Cited Authors (top 0.01%). His work is cited by electromagneticists, geophysicists, mathematicians, and electro-chemists. Before joining the University of Illinois, Prof. Chew was a department manager and program leader at Schlumberger-Doll Research. He was on special leave to serve as the Dean of Engineering at The University of Hong Kong from 2007 to 2011.