Seminars@Tech

IEEE DISTINGUISHED LECTURE IN ELECTROMAGNETICS: PROFESSOR LEVENT GÜREL

Location: MIRC Bldg. Room 102 A&B

Location Phone:

Fast Algorithms and Parallel Computing: Solution of Extremely Large Real-Life Problems in Electromagnetics

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Title: *Fast Algorithms and Parallel Computing: Solution of Extremely Large Real-Life Problems in Electromagnetics*

Abstract:

Accurate simulations of real-life electromagnetics problems with integral equations require the solution of dense matrix equations involving millions of unknowns. Solutions of these extremely large problems cannot be achieved easily, even when using the most powerful computers with state-of-the-art technology. Some of the world's largest integral-equation problems in computational electromagnetics have been solved at Bilkent University Computational Electromagnetics Research Center (BiLCEM). Most recently, we have achieved the solution of 1,000,000,000x1,000,000,000 (one billion!) dense system of matrix equations! This achievement is an outcome of a multidisciplinary study involving physical understanding of electromagnetics problems, novel parallelization strategies (computer science), constructing parallel clusters (computer architecture), advanced mathematical methods for integral equations, fast solvers, iterative methods, pre-conditioners, and linear algebra.

In this seminar, following a general introduction to our work in computational electromagnetics, I will present fast and accurate solutions of large-scale electromagnetic modeling problems involving three-dimensional geometries with arbitrary shapes using the multilevel fast multipole algorithm (MLFMA) and parallel MLFMA. Some complicated real-life problems, such as scattering from realistic aircraft, involve geometries that are larger than 1000 wavelengths. Accurate solutions of such problems can be used as reference data for high frequency techniques. Solutions of extremely large canonical benchmark problems involving sphere and NASA Almond geometries will be presented, in addition to the solution of complicated objects, such as metamaterial problems, red blood cells, and dielectric photonic crystals. Solving the world's largest computational electromagnetics problems has important implications in terms of obtaining the solution of previously intractable physical, real-life, and scientific problems in various areas, such as (subsurface) scattering, optics, bioelectromagnetics, metamaterials, nanotechnology, remote sensing, etc. For more information: www.cem.bilkent.edu.tr.

Speaker Bio:

Prof. Levent Gürel (Fellow of IEEE, ACES, and EMA) is the Director of the Computational Electromagnetics Research Center (BiLCEM) at Bilkent University, Ankara, Turkey. He received the M.S. and Ph.D. degrees from the University of Illinois at Urbana-Champaign (UIUC) in 1988 and 1991, respectively, in electrical and computer engineering. He joined the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, in 1991. Since 1994, he has been a faculty member in the Department of Electrical and Electronics Engineering of the Bilkent University, Ankara, where he is currently a professor, and a visiting/adjunct professor at UIUC since 2003. Among the recognitions of Prof. Gürel's accomplishments, the two prestigious awards from the Turkish Academy of Sciences (TUBA) in 2002 and the Scientific and Technological Research Council of Turkey (TUBITAK) in 2003 are the most notable. He is conferred the UIUC ECE Distinguished Alumni Award in 2013. Prof. Gürel is currently serving as an associate editor of Radio Science, IEEE Antennas and Wireless Propagation Letters (AWPL), JEMWA, PIER, and ACES Journals. He is named an IEEE Distinguished Lecturer for 2011-2013 and was invited to address the 2011 ACES Conference as a Plenary Speaker.

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Pizza available before the seminar from 12.00 PM to 12.30 PM