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Fast Physical Optics Algorithms for High Frequency Scattering

Speaker: **Prof. Amir Boag**
(School of Electrical Engineering, Tel Aviv University, Tel Aviv)

Date: 31 May 2017 @ 11:00 AM

Location: Room Ofek – Polo Scientifico F. Ferrari – Povo

Note: The seminar will be held in English

Contact: Prof. Paolo Rocca (paolo.rocca@unitn.it)

In this talk, we present two families of multilevel algorithms for the evaluation of scattering by electrically large and complex objects based on the Physical Optics (PO) approximation. The first type of algorithms is designed for the evaluation of the single- and double-bounce mono-static contributions to the PO scattering integrals, over a range of aspect angles, frequencies, and distances, including for near-field scenarios. Computational savings are achieved by directly evaluating the partial contributions due to very small subdomains on coarse grids at a very low computational cost, and then gradually interpolating and aggregating the contributions to obtain the backscattered fields due to large subdomains, in a hierarchical fashion. Such single- and double-bounce multilevel-PO algorithms achieve very significant reduction in the computational complexity. The second part of the talk is devoted to a fast iterative physical optics (IPO) algorithm for the analysis of scattering from large complex geometries involving multiple scattering and self-shadowing effects. The algorithm comprises two types of nested iterations: reflection ("bounce") iterations and self-shadowing iterations. Both types of iterations involve time consuming surface integrations carrying an O(N2) computational cost (N being the number of quadrature points). The nested iterative formulation is accelerated by using the multilevel non-uniform grid algorithm reducing the computational complexity to O(NlogN). The shadow radiation-IPO applicability to complex geometries and its numerical efficiency are demonstrated by comparison to a numerically exact method and to the conventional physical optics.

- **About the Speaker**

Amir Boag received the B.Sc. degree in electrical engineering and the B.A. degree in physics in 1983, both Summa Cum Laude, the M.Sc. degree in electrical engineering in 1985, and the Ph.D. degree in electrical engineering in 1991, all from Technion - Israel Institute of Technology, Haifa, Israel.
From 1991 to 1992 he was on the Faculty of the Department of Electrical Engineering at the Technion. From 1992 to 1994 he has been a Visiting Assistant Professor with the Electromagnetic Communication Laboratory of the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. In 1994, he joined Israel Aircraft Industries as a research engineer and became a manager of the Electromagnetics Department in 1997. Since 1999, he is with the Physical Electronics Department of the School of Electrical Engineering at Tel Aviv University, where he is currently a Professor.
Dr. Boag's interests are in computational electromagnetics, wave scattering, imaging, and design of antennas and optical devices. He has published over 100 journal articles and presented more than 200 conference papers on electromagnetics and acoustics. Prof. Boag is an Associate Editor for IEEE Transactions on Antennas and Propagation. He is a Fellow of the Electromagnetics Academy. In 2008, Amir Boag was named a Fellow of the IEEE for his contributions to integral equation based analysis, design, and imaging techniques.