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FAST AND ACCURATE SOLUTIONS OF VERY LARGE ELECTROMAGNETICS PROBLEMS WITH THE PARALLEL MULTILEVEL FAST MULTIPOLE ALGORITHM

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The multilevel fast multipole algorithm (MLFMA) is a powerful method for the fast and efficient solution of scattering and radiation problems in electromagnetics. Real-life problems formulated with surface integral equations can be solved iteratively, where the required matrix-vector multiplications are performed efficiently by MLFMA. However, many real-life problems require discretizations with tens of millions of unknowns, which may not be handled easily with the sequential implementations of MLFMA running on a single processor. In order to achieve the solution of such large problems, MLFMA is parallelized on relatively inexpensive computing platforms with distributed-memory architectures. Unfortunately, parallelization of this algorithm is not trivial, and it can be difficult to obtain a sufficient parallelization efficiency, especially when the number of processors is large and problems involve complex objects. Recently, we developed a hierarchical partitioning strategy, which provides a higher parallelization efficiency than previous approaches. The resulting parallel implementation has been successfully used to solve very large electromagnetics problems involving more than **200 million unknowns.**

This talk will provide the details of the sophisticated simulation environment, which involves integral-equation formulations, iterative solvers, preconditioners, parallel computing, and a highly-efficient parallelization of MLFMA, developed at Bilkent University Computational Electromagnetics Research Center (BiLCEM).

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Özgür Ergül is a Ph.D. Student at Bilkent University Computational Electromagnetics Research Center (BiLCEM) directed by Prof. Levent Gürel (www.cem.bilkent.edu.tr). He is a recipient of the 2007 IEEE Antennas and Propagation Society Graduate Fellowship and the 2007 Leopold B. Felsen Award for Excellence in Electrodynamics. He is the coauthor of more than 100 journal and conference papers.