Electromagnetic scattering from canonical and complicated objects

Researchers:

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Language Undefined

Description:

Fast and accurate solutions of electromagnetics problems are extremely important for realistic simulations of electromagnetic interactions between devices and their environments including living and no nliving objects.

Examples to real-life electromagnetics problems are radiation from antennas and their adverse effects on human health, indoor and outdoor propagation, optimizations of wireless systems, visualization via lens systems for microscopy, transmission through photonic crystals and metamaterials, detection with radar systems, light scattering from red blood cells to diagnose various diseases, and electromagnetic compatibility of novel electronic devices, to name a few.

Recently, we developed very efficient parallel implementations of the multilevel fast multipole algorithm (MLFMA) using novel parallelization strategies for high-performance computers. The developed implementations can be employed to a variety of problems in the aforementioned areas involving metallic and dielectric three-dimensional structures discretized with hundreds of millions of unknowns.

Objectives:

- Our purpose is to employ this powerful electromagnetics code to analyze large-scale canonical and complicated objects with unprecedented levels of accuracy and detail.
- These problems will have important uses both in real-life and also as a scientific demonstration of the solution of (hopefully) world's largest problems.
- The reason we are hopeful about this goal is the fact that we have already solved extremely large problems in the past.

Methodology:

We are using state-of-the-art fast solvers for electromagnetics problems, such as the multilevel fast multipole algorithm (MLFMA). These are extremely efficient solvers, however, quite difficult to parallelize.

We have devised original and ultimately useful parallelization schemes (such as the hierarchical parallelization scheme) for the parallelization of these difficult solvers.

Funding sources:

- Hierarchical parallelisation strategy for the multilevel fast multipole algorithm in computational electromagnetics.
- Efficient parallelization of the multilevel fast multipole algorithm for the solution of large-scale scattering problems.
- A hierarchical partitioning strategy for an efficient parallelization of the multilevel fast multipole algorithm.
- Parallelization of the multi-level fast multipole method for the solution of large electromagnetic scattering problems.
- Solution of large CEM problems with parallel multi-level fast multipole algorithm (MLFMA).
- Investigations of load balancing, communications, and scalability in parallel MLFMA.

Web:

- http://www.cem.bilkent.edu.tr [2]

Links

[1] http://www.cem.bilkent.edu.tr/ [2] http://www.cem.bilkent.edu.tr