Parallel Iterative Solution Techniques for Integral Equation Methods

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Integral equation methods together with sub-cell algorithms have been an extremely useful tool in addressing many complicated, realistic problems. The solution process for integral equation methods result in the construction of a linear system of equation cast a matrix equation. The solution of this matrix equation can be done directly via LU decomposition using iterative techniques. When the iterative technique is chosen an appropriate method has to be used as well as a preconditioner. Alternatively, fast methods (such as FMM and AIM) require the use of iterative schemes since the entire matrix is not computed directly.

There is a large repository of parallel iterative solvers that are available but they are normally appropriate for real sparse matrices. By recasting the complex formulation into an equivalent real formulation real-valued parallel solvers can then be applied to the original complex problem. Depending on the equivalent real formulation the spectral properties will vary which will affect convergence. By using appropriate preconditioners this convergence will be accelerated. The solver package that is used is Trilinos, which an object –oriented solver package written in C++.

This presentation will examine preconditioner strategies that will be exercised on a number of different types of problems with different field formulations (EFIE, CFIE). The spectral properties of the matrix will be examined before and after preconditioning. In addition, different Krylov solvers will be used and the results compared to the direct solution method (LU decomposition). The parallel implications and efficiency will also be described and discussed.

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