Matrix Compression in the Method of Moments Code EIGER - Iterative Solver Accuracy and Parallel Efficiency

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The integral equations solved by the Method of Moments (MOM) are an invaluable tool to analyze and then predict the response of systems to electromagnetic environments. Since there is a memory limitation prohibiting the storage of the full matrix for problems large with respect to frequency, alternative techniques have been identified to circumvent this restriction. These alternative techniques are based on methods that use the reduction of the degrees of freedom for the far zone interactions to decrease the storage requirement. The method to be examined is matrix compression, a purely algebraic method, implemented in EIGER.

Since the full matrix is not stored an iterative approach is used to solve the matrix equation. In addition, the solution time and accuracy will depend on the tolerance of the compression algorithm, the choice of the iterative solver, and the tolerance of the iterative solver. Two different iterative solution methods have been incorporated in EIGER– Transpose-Free Quasi-Minimal Residual (TFQMR) and the Generalized Minimal Residual (GMRES) methods.

This talk will focus on a number of problem geometries including closed structures and those that have thin slots backed by cavities. Attention will be given to the parallel efficiency of the algorithm as well as the solution accuracy for the two different iterative solution methods.

A number of results will be described and discussed using the matrix compression algorithm in EIGER. Comparisons will be made with solutions obtained via the direct solve where these solutions are available. Tradeoffs between accuracy and solution time will be presented.

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