The Accuracy and Efficiency of Parallel Matrix Compression in the Method of Moments code EIGER

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The integral equations solved by the Method of Moments (MOM) have become invaluable tool to analyze the response to systems in an electromagnetic environment. Since there is a memory limitation prohibiting the storage of the full matrix, alternative techniques have been implemented to circumvent this restriction. These alternative techniques are based on methods that decrease the rank of the far zone interactions of the elementary scatterers and thereby decrease the storage requirement. Two well-known techniques include the fast multipole method and matrix compression.

In both of these techniques the full matrix is never computed thus alleviating the storage problem. However, matrix compression based on the Adaptive Cross Approximation (Bebendorf, 2000; Zhao et. al, 2005) is a purely algebraic method. Since the full matrix is not stored an iterative approach is used to solve this matrix equation. The solution time and accuracy will depend on the tolerance of the compression algorithm as well as the tolerance of the iterative solver. Previously this algorithm has been implemented for use on parallel platforms in the method of moments code EIGER. Preliminary results were described and discussed.

This talk will expand the class of problems previously considered using this technique. These will include dielectric bodies as well as objects with thin slots backed by cavities. Attention will be given to the parallel efficiency of the algorithm as well as the solution accuracy.

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. Finally, these results will show the usefulness of these techniques in solving a variety of electromagnetic problems.

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