

Solving large industrial problems in electromagnetics at CERFACS

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Abstract: The Parallel Algorithms Team has been working for some time with our colleagues in the Electromagnetism Team at CERFACS and collaborators in EADS and CERMICS/INRIA on the solution of large scale problems in electromagnetic scattering.

Both EFIE and CFIE are used and the equations are discretized using boundary element techniques giving rise to the need to solve very large sets of dense complex equations. The order of these systems will exceed one million in typical industrial applications.

Although a major expertise of the Parallel Algorithms Team is in the solution sparse equations, we show how essentially sparse techniques can be used in the solution of dense equations. We will solve the systems principally using preconditioned GMRES, where fast multipole methods are used both in the matrix-vector multiplications and in the preconditioner.

In this talk, we will concentrate on recent work in using a two-level preconditioner, either using a spectral lance or an inner-outer iteration with flexible GMRES. We will illustrate the power of these new ideas on realistic industrial test problems.

This talk is based on joint work with Luc Giraud, Bruno Carpentieri, Julien Langou and Emeric Martin of CERFACS, Guillaume Sylvand of CERMICS/INRIA, and Guillaume Alleon of EADS.