

DEVELOPMENT OF AN ITERATIVE METHOD FOR FINITE ELEMENT ANALYSIS OF HIGH FREQUENCY ELECTROMAGNETIC FIELDS

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This paper describes iterative methods for high frequency electromagnetic analysis using the finite element method of Maxwell equations including displacement current. For solving a complex symmetric system arising from the formulation of the E method, the conjugate orthogonal conjugate gradient method has been used. Moreover, to treat a large-scale system on a parallel computer efficiently, an iterative substructuring method has been used [1]. However, large-scale problems suffer from low convergence rate or no convergence. In here, for a magnetostatic problem, an iterative method based on the minimal residual method [2] is expected to show a stable convergence [3].

In this paper, to solve such a large-scale complex symmetric system, an iterative method like the minimal residual method is proposed. The proposed method shows a stable convergence behavior and a high convergence rate as compared to other iterative methods. Moreover, to treat a large-scale system, an iterative substructuring method based on the proposed method is also developed.

Figure 1 shows convergence histories of the proposed method and other iterative substructuring methods in solving a TEAM Workshop Problem 29 model with a 12 million complex degrees of freedom mesh. From this figure, the proposed method successfully improved convergence compared with other methods.

Parallel performances of strong scaling are shown in Fig.2. There is little difference in each iterative substructuring method, and the proposed method achieved 70% or more parallel performance.

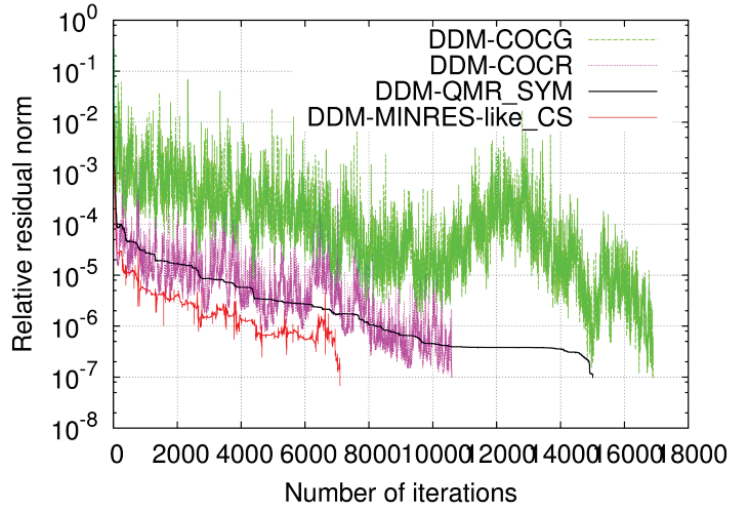


Fig.1 Convergence histories of a TEAM Workshop Problem 29 model with a 12 million complex degrees of freedom mesh

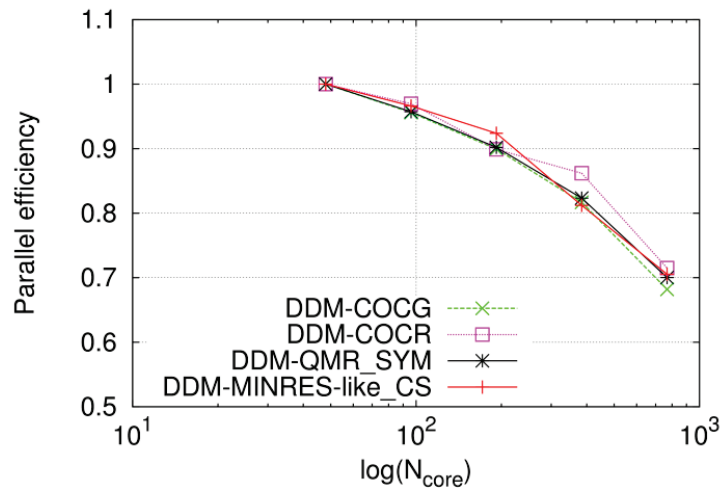


Fig.2 Parallel performances of the strong scaling

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