A preconditioner construction for magnetostatic problems

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An iterative domain decomposition method is applied to numerical analysis of 3-Dimensional (3D) linear magnetostatic problems, taking the magnetic vector potential as an unknown function. The iterative domain decomposition method is combined with the Preconditioned Conjugate Gradient (PCG) procedure and the Hierarchical Domain Decomposition Method (HDDM) which is adopted in parallel computing. Our previously employed preconditioner was the Neumann-Neumann preconditioner. Numerical results showed that the method was only effective for smaller problems. In this paper, we consider its improvement with the Balancing Domain Decomposition (BDD) preconditioner. Here, we concentrate our attention on a perturbed problem of the original linear magnetostatic problem for simplicity. The perturbed problem approaches to the original problem when the perturbation parameter becomes zero and it produces a positive definite coefficient matrix in the approximation process. Therefore, the well-known theory of Mandel (1993) can easily be applied to the perturbed problem.

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