The BDD-DIAG preconditioner in domain decomposition analysis for magnetostatic problems

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Abstract

An iterative domain decomposition method is proposed for numerical analysis of three-dimensional 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 (NN) preconditioner. Numerical results showed that the method was only effective for smaller problems. In this talk, we consider its improvement with the Balancing Domain Decomposition DIAGonal scaling (BDD-DIAG) preconditioner by the fourth author.

We proposed an approach for the construction of the coarse space (the $Z^{(i)}$ construction) in [1], which is a little improved in this talk. Tagami [2] gave a similar idea for the $Z^{(i)}$ construction with his successful numerical results. However, the original BDD [3] or NN preconditioners did not show effective results in our numerical experiments. BDD-DIAG only shows comparative results to the DIAG preconditioner which is used for a long time as the default option of ADVENTURE_Magnetic by the third author. Details will be mentioned in the conference with numerical results [4].

Keywords: Large-scale magnetostatic problems, HDDM, Preconditioning, Parallel computation

References

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