A Balancing Domain Decomposition Method with a Multigrid Strategy of Magnetostatic Problems

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An iterative domain decomposition method (DDM) is considered for numerical computations of magnetostatic problems based on mixed formulations. Introducing mixed formulations has some mathematical advantages. However, the number of iterative steps is larger as the scale of computational models is larger. Therefore, it is required to introduce an efficient preconditioner of the iterative DDM.

In this paper, a balancing domain decomposition (BDD) method is introduced. The BDD method is originally proposed by Mandel (1993). The null space of a coefficient matrix of resultant linear systems plays an important role in BDD method. However, in case of magnetostatic problems, the dimension of null space is large, which causes some difficulties. To overcome such difficulties, a kind of multigrid strategy is introduced. Then, BDD method enables us to keep the number of iterations of the iterative DDM even if the number of subdomains increases.

Keywords: balancing domain decomposition method, multigrid method, preconditioner, magnetostatic problem.