

Exact and Inexact BDDC algorithms for Saddle Point Problems

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BDDC (Balancing Domain Decomposition by Constraints) methods are nonoverlapping iterative substructuring domain decomposition methods for the solutions of large sparse linear algebraic systems arising from finite element discretization of elliptic boundary value problems. In this talk, the two-level BDDC methods are extended to the saddle point problems arising from mixed formulation of elliptic problems. In these two-level BDDC algorithms, all iterates are kept to be in the benign space, a special space in which the preconditioned operator is positive definite and the conjugate gradient methods can be used to accelerate the convergence. This requirement leads to much large coarse problems, which are generated and factored by a direct solver at the beginning of the computation. They can ultimately become a bottleneck. An additional level is introduced to solve the coarse problem approximately and to move this difficulty. This three-level BDDC algorithm can keep all iterates in the benign space and the conjugate gradient methods can still be used to accelerate the convergence. This inexact BDDC algorithm has also been tested for the incompressible Stokes.

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