Fully Coupled Multilevel Domain Decomposition Methods for Inverse Elliptic Problems

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In this talk we discuss some parallel multilevel Lagrange-Newton-Krylov-Schwarz (LNKSz) algorithms for solving the nonlinear system of equations arising from the discretization of inverse elliptic problems. In LNKSz, a Lagrangian functional is first formed according to the inverse elliptic problem with a proper regularization, and then differentiated to obtain an optimality system of nonlinear equations. Inexact Newton's method with line search is then applied directly to the fully coupled nonlinear optimality system and at each Newton's iteration the Jacobian system is solved with a Krylov subspace method preconditioned with a multilevel overlapping Schwarz method. We apply LNKSz to some parameter identification problems described as minimization problems constrained by elliptic partial differential equations. We report some results of a PETSc based parallel implementation of LNKSz for several different types of inverse problems.

This is a joint work with Si Liu and Jun Zou.