Convergence and error analysis of a numerical method for the identification of matrix parameters in elliptic PDEs

FS: Discretization of optimal control problems

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In this talk we present and analyze a numerical method for solving the inverse problem of identifying the diffusion matrix in an elliptic PDE from distributed noisy measurements. We use a regularized least squares approach in which the state equations are given by a finite element discretization of the elliptic PDE. The unknown matrix parameters act as control variables and are handled with the help of variational discretization as introduced in [M. Hinze, A variational discretization concept in control constrained optimization: the linear-quadratic case, Comput. Optim. Appl. 30, 45–61 (2005)]. For a suitable coupling of Tikhonov regularization parameter, finite element grid size and noise level we are able to prove $L^2$–convergence of the discrete solutions to the unique norm–minimal solution of the identification problem; corresponding convergence rates can be obtained provided that a suitable projected source condition is fulfilled. Finally, we present a numerical experiment which supports our theoretical findings.

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