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Nonlinear Gradient Preconditioning in Problems of Optimal Control and Estimation[1] BARTOSZ PROTAS, McMaster University — Optimal control and estimation of PDE systems usually results in ill–posed inverse problems which are typically solved using iterative methods of optimization. Their rate of convergence is determined by the conditioning of the problem which can be improved using suitable preconditioning techniques. In the case of optimization of PDE systems such preconditioners can be constructed by endowing the optimization space with an appropriate inner–product structure, and the preconditioned gradient is obtained by solving a linear boundary–value problem. In this study we investigate how this procedure can be extended to optimization in general Banach spaces without an inner–product structure. It is shown that such nonlinearly–preconditioned gradients can be obtained via solution of a nonlinear elliptic problem generalizing the familiar Laplace equation. To highlight the utility of such preconditioning techniques for solution of control and estimation problems for nonlinear PDEs we present computational examples obtained for the Kuramoto–Sivashinsky and Navier–Stokes equations.

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Bartosz Protas
McMaster University

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