Numerical Design of Stabilizing Feedback Controllers for PDE Models

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Abstract: We consider static output feedback (SOF) control design problems, e. g. SOF–$\mathcal{H}_\infty$ synthesis, and focus the discussion on the numerical solution of SOF problems if the control system is described by partial differential equations (PDEs). The discretization of those problems leads to very large–scale non–convex and nonlinear semidefinite programs (NSDPs), e. g. the so–called $\mathcal{H}_\infty$–NSDP. We discuss some theoretical and practical difficulties which arise in the solution of such problems. Moreover, we consider some algorithmic strategies for solving the non–convex NSDPs and discuss some unstable PDE–based models which are currently implemented in $COMPl_eib$ 1.1: the COnstrained Matrix-optimization Problem library which contains more than 170 test examples drawn from a variety of control systems engineering applications. In particular, $COMPl_eib$ may serve as a useful benchmark tool for NSDP– (including BMI–) and other matrix optimization problem (including linear SDP) solvers. As a byproduct, $COMPl_eib$ can be used as a test environment for parts of control design procedures, e. g. model reduction algorithms and large–scale Riccati equation solvers.

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