

Preconditioning of Large-Scale Saddle Point Systems for Coupled Flow Problems

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In order to explore boundary feedback stabilization of coupled flow problems, we consider the Navier-Stokes equations that describe instationary, incompressible flows coupled with a diffusion convection equation. Using a standard finite element discretization, we get a differential-algebraic system of differential index two. We show how to reduce this index with a projection method to get a generalized state space system, where a linear quadratic control approach can be applied.

This leads to large-scale saddle point systems which have to be solved in a threefold nested iteration. For obtaining a fast iterative solution of those non-symmetric systems, we derive efficient preconditioners based on the approaches due to Wathen et al. [ELAMN/SILVESTER/WATHEN 2005, STOLL/WATHEN 2011]. Finally, we show recent numerical results regarding the arising nested iteration.