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Constaint Preconditioning and Schilders Factorization for Saddle-Point Systems

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Saddle-point systems arise widely because they generally result from any problem with constraints. Hence in Fluid Mechanics incompressibility is a constraint on the Navier-Stokes equations, in Optimization algebraic and/or bound constraints are often applied and in PDE constrained optimization the PDEs themselves provide the constraints.

This talk is about preconditioned iterative approaches to the solution of large-scale saddle-point problems based on preconditioners which preserve the constraints: so-called constraint preconditioners. We will briefly review the attractive feature of such preconditioners and then explain how these preconditioners can effectively be realized through a block factorization due to Wil Schilders. This reveals a range of possible approaches where the balance between faster convergence though better preconditioning and the cost of the preconditioner varies.

This is joint work with Sue Dollar, Nick Gould and Wil Schilders