

**PRECONDITIONED ITERATIVE METHODS FOR MULTIPLE
SADDLE-POINT SYSTEMS ARISING FROM
PDE-CONSTRAINED OPTIMIZATION**

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Optimization problems subject to PDE constraints form a mathematical tool that can be applied to a wide range of scientific processes, including fluid flow control, medical imaging, biological and chemical processes, and many others. These problems involve minimizing some function arising from a physical objective, while obeying a system of PDEs which describe the process. Of key interest is the numerical solution of the discretized linear systems arising from such problems, and in this talk we focus on preconditioned iterative methods for these systems.

In particular, we describe recent advances in the preconditioning of multiple saddle-point systems, focusing on positive definite preconditioners that can be applied within the MINRES algorithm, which may find considerable utility for solving these optimization problems as well as other applications. We discuss a promising structure of a preconditioner for multiple saddle-point systems, which may be applied within MINRES and lead to a guaranteed convergence rate, and often demonstrates superior convergence as opposed to widely-used block diagonal preconditioners.

Time-permitting, we will also discuss an inexact active-set method for large-scale nonlinear PDE-constrained optimization problems, coupled with block preconditioners for multiple saddle-point systems which utilize suitable approximations for the relevant Schur complements.

This is joint work with Andreas Potschka (TU Clausthal).

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