

Seminar

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Thursday, January 30, 2030
SN-4040, 2-3pm

Block preconditioning and multigrid methods for couples systems

Abstract:

Many preconditioning strategies are known for the solution of the saddle-point problems that arise from standard mixed finite-element discretizations of the incompressible Stokes or (linearized) Navier-Stokes equations. In particular, block-factorization preconditioners and monolithic multigrid methods have been thoroughly studied and shown to provide optimal performance in both serial and parallel environments. In this talk, we consider the extension of these approaches to more complex systems, where work is needed to ensure optimality of the resulting preconditioners. Two families of extensions will be discussed. For the Stokes equations, a nonconforming DG discretization, for which weak conservation of mass implies strong conservation, is considered. Generalizations of standard Braess-Sarazin and Vanka relaxation schemes are introduced for this problem and compared numerically. We also consider multiphysics systems, where mixed FEM discretization leads to larger block systems, such as in magnetohydrodynamics (MHD) and liquid crystals. Here, complexities in the operators and variations in physical parameters require adaptations to maintain robustness.