MULTIGRID SMOOTHERS FOR MAGNETOHYDRODYNAMICS

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Key words: *multigrid, saddle-point systems, magnetohydrodynamics*

Magnetohydrodynamic models are used to model a wide range of plasma physics applications. The system of partial differential equations that characterizes these models is nonlinear and strongly couples fluid interactions with electromagnetic interactions. As a result, the linear systems that arise from discretization and linearization of the nonlinear problem can be difficult to solve. In this talk, we consider a multigrid preconditioner for GMRES as a solver. We compare three potential smoothers for the MHD system, two of which (Vanka [3] and Braess-Sarazin [1]) are motivated by well-known smoothers for incompressible fluids system and another new smoother, which splits the physics into a magnetics-velocity operator and a Navier-Stokes block [2]. While we examine these smoothers in the context of geometric multigrid, they can be extended to relaxation schemes for algebraic multigrid. Results for a two-dimensional, steady-state test problem are shown.

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