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Multigrid Smoothers for Magnetohydrodynamics

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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 thistalk, we consider a multigrid preconditioner for GMRES as a solver for these systems. We compare three potential smoothers for this system, two of which are motivated by well-known smoothers for the incompressible fluids system and the other is a new smoother that splits the physics into a magnetics-velocity operator and a Navier-Stokes operator. 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.