
Bobby Philip
**Resistive Magnetohydrodynamics with Implicit Adaptive
Mesh Refinement**

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Implicit adaptive mesh refinement (AMR) is used to simulate a model resistive magnetohydrodynamics problem. This challenging multi-scale, multi-physics problem involves a wide range of length and time scales. AMR is employed to resolve extremely thin current sheets, essential for an accurate macroscopic description. Implicit time integration is used to step over fast Alfvén time scales. At each time step, large-scale systems of nonlinear equations are solved using Jacobian-free Newton-Krylov methods together with a physics-based preconditioner. The preconditioner is implemented using optimal multilevel solvers such as the Fast Adaptive Composite grid (FAC) method. We will describe our initial results highlighting various aspects of problem formulation, optimal preconditioning on AMR grids, and efforts towards achieving parallelism.

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