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Fully implicit adaptive mesh refinement solver for 2D MHD[1] B. PHILIP, LANL, L. CHACON, ORNL, LANL, M. PERNICE, INL — Application of implicit adaptive mesh refinement (AMR) to simulate resistive magnetohydrodynamics is described.[2] Solving this challenging multi-scale, multi-physics problem can improve understanding of reconnection in magnetically-confined plasmas. AMR is employed to resolve extremely thin current sheets, essential for an accurate macroscopic description. Implicit time stepping allows us to accurately follow the dynamical time scale of the developing magnetic field, without being restricted by fast Alfven time scales. At each time step, the large-scale system of nonlinear equations is solved by a Jacobian-free Newton-Krylov method together with a physics-based preconditioner. Each block within the preconditioner is solved optimally using the Fast Adaptive Composite grid method, which can be considered as a multiplicative Schwarz method on AMR grids. We will demonstrate the excellent accuracy and efficiency properties of the method with several challenging reduced MHD applications, including tearing, island coalescence, and tilt instabilities.

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[2]B. Philip, L. Chacón, M. Pernice, *J. Comput. Phys.*, in press (2008)

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