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Development of a Fast Scalable Parallel Solver for the HiFi 3D Extended MHD Code A.H. GLASSER, University of Washington, V.S. LUKIN, Naval Research Laboratory — We report on the development of a fast parallel solver for the HiFi 3D extended MHD code. Previous work demonstrated scalable solution of 3D ideal MHD wave propagation on up to 32,768 cores of hopper.nersc.gov, a Cray XE6 parallel computer, using Physics-Based Preconditioning (PBP) and Algebraic Multigrid. We now apply these methods to a more realistic test problem, magnetic reconnection, with the new features of nonuniformity, nonlinearity, and dissipative terms. We have developed a method of Quiet Start for computing the most unstable eigenfunction of the equilibrium, using the SLEPc library to solve an associated complex generalized eigenvalue problem. Using this eigenfunction for initial conditions avoids the excitation of large-amplitude, short-wavelength, weakly damped waves, allowing for cleaner, faster, more understandable evolution. We have developed an improved approximate Schur complement for PBP which substantially improves the rate of Newton convergence. Scaling results of the new solver will be presented.

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