Abstract Submitted
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Semi-Implicit Extended MHD Simulation[1] C.R. SOVINEC, H. TIAN, University of Wisconsin-Madison, D.D. SCHNACK, A.Y. PANKIN, Science Applications International Corporation, D.C. BARNES, University of Colorado-Boulder, NIMROD TEAM — A semi-implicit algorithm for non-ideal MHD is extended for two-fluid effects, including Hall, ∇p_e, gyroviscous, and thermal drift terms. The temporally staggered differencing of the flow velocity relative to magnetic field, number density, and temperatures is retained from the MHD algorithm [1] to reduce algebraic system sizes. Analysis of the complete advance for homogeneous equilibria with flow shows that an implicit Hall advance is necessary for stability. The advance is implemented in the NIMROD code and applied to several tests including the nonlinear GEM reconnection problem [2], linear tearing, internal kink, and edge localized modes. Performance is compared with a time-centered advance. We also report on a recent investigation of convergence properties for interchange modes and compare with an earlier numerical analysis [3] for non-ideal MHD.

[1] C. R. Sovinec et al., J. Comput. Phys. 195, 355 (2004).
[2] J. Birn et al., J. Geophys. Res. 106, 3715 (2001).
[3] H. Lutjens and J. F. Luciani, Comput. Phys. Commun. 95, 47 (1996).

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