

Abstract Submitted
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Implementation and Verification of Two-fluid Modeling in NIMROD¹ C. R. SOVINEC, H. TIAN, University of Wisconsin-Madison, D. C. BARNES, University of Colorado at Boulder, A. Y. PANKIN, D. D. SCHNACK, SAIC-San Diego — A second-order time advance for the two-fluid plasma model with equilibrium flow and drift has been developed and implemented in the NIMROD fusion MHD code. The algorithm retains the leapfrog character of the MHD algorithm [JCP 195, p. 355 (2004)] but solves separate implicit advances for each field. Analysis shows that this approach is numerically stable at arbitrarily large time-step when advection and drift terms, including gyroviscosity, are time-centered in each segment of the leapfrog. Implementation relies on Krylov methods with sparse approximate matrices solved directly for preconditioning and with matrix-free computations in the Krylov-space iterations. The implementation is tested on linear wave, interchange, and magnetic reconnection problems where analytic results are readily available.

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