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Numerical Studies of Gyroviscous Effects Using High-Order Finite Elements NATHANIEL FERRARO, STEVE JARDIN, JOSHUA BRESLAU, Princeton Plasma Physics Laboratory, JESUS RAMOS, Massachusetts Institute of Technology — We have developed a technique for incorporating a general expression of the gyroviscous force[1] into an implicit solution algorithm for the two-fluid magnetohydrodynamic (MHD) equations. We present the results of numerical simulations of six-field extended-MHD equations in two dimensions, including Braginskii's gyroviscous stress tensor, using triangular finite elements with fifth-order accuracy and continuous first derivatives (C^1-continuity). Our model extends that used by Jardin and Breslau[2] by including the evolution of pressure and flow compressibility, in addition to the inclusion of the gyroviscous force. The use of C^1-continuous finite elements allows up to four differentiations of any field variable, thus enabling the inclusion of the full gyroviscous stress tensor. The effect of this term on wave propagation and Harris-equilibrium reconnection is demonstrated.

[1]J. J. Ramos, PSFC/JA-05-9, MIT (2005).
[2]S. C. Jardin and J. A. Breslau, Phys. Plasmas **12**, 56101 (2005).

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