Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Initial application of the M3D-C^1 code to the study of non-ideal modes in NSTX S.C. JARDIN, J. BRESLAU, J. CHEN, S. GERHARDT, PPPL, N. FERRARO, General Atomics, X. LUO, K. JANSEN, M. SHEPHARD, SCOREC Center, RPI — The M3D-C^1 code is a two-fluid toroidal magnetohydrodynamic code based on high-order, compact finite elements with C^1 continuity on an unstructured adaptive triangle-based grid. The code is built upon and extends many of the favorable features of the M3D approach to solving the MHD equations in a highly magnetized toroidal plasma. The vector fields use a physics-based decomposition that explicitly conserves energy and which allows for two energy-conserving subsets of the full equations (reduced MHD). The efficient split-implicit time advance is closely related to the ideal MHD energy principle, and allows time steps several orders of magnitude in excess of the Courant condition based on the Alfven or whistler waves. The present application is to apply the linearized code to study the onset of non-ideal instabilities in NSTX. The computational model has a physically based resistivity profile such that the Lundquist number S varies from 10^8 in the plasma center to $\sim 10^0$ in the surrounding 'vacuum' region. Special adaptive meshing algorithms have been utilized to allow high resolution both in the regions where the resistivity transitions rapidly and around mode rational surfaces. We also illustrate the differences in stability boundaries and growth rates for an ideal and non-ideal description of the plasma for different plasma profiles.

S.C. Jardin
PPPL

Date submitted: 20 Jul 2009 Electronic form version 1.4