Abstract Submitted
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NIMROD Modeling of Plasma Discharges in the Compact Toroidal Hybrid[1] J. HEBERT, J.D. HANSON, D.A. MAURER, Auburn University, M.G. SCHLUTT, C.R. SOVINEC, University of Wisconsin-Madison — The 3D extended MHD code NIMROD [1] has been modified to model plasma discharges in the Compact Toroidal Hybrid (CTH) torsatron. NIMROD has been used to reproduce CTH vacuum fields and has shown the formation of magnetic islands when a constant loop voltage is applied in a zero β simulation using constant conductivity [2]. To more accurately model CTH discharges, the NIMROD plasma model has been extended to include self-consistent ohmic heating using temperature dependent resistivity. Approximating the initial conditions for CTH discharges (flat temperature and density profiles with $T_e \sim 30$eV and $n_e \sim 1 \times 10^{18}\mathrm{m}^{-3}$) in NIMROD is done through the following process: (1) CTH vacuum fields are loaded into the NIMROD domain. (2) A uniform temperature of 30 eV is set across the domain. (3) NIMROD evolves the temperature with rapid parallel diffusion and a cold wall boundary condition to remove heat on open field lines. (4) The density is set as a multiple of the temperature. Simulations using this initial condition and the extensions to the plasma model with an experimental loop voltage reproduce the CTH current ramp rate.

[1] C.R. Sovinec et al. 2004 J. Comp. Phys., 195, 355 (2004).
[2] M.G. Schlutt et al. 2012 Nucl. Fusion 52 103023

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