Abstract Submitted
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Validation of MHD Models using MST RFP Plasmas[1] C.M. JACOBSON, B.E. CHAPMAN, D.J. DEN HARTOG, K.J. MCCOLLAM, J.S. SARFF, C.R. SOVINEC, University of Wisconsin-Madison — Rigorous validation of computational models used in fusion energy sciences over a large parameter space and across multiple magnetic configurations can increase confidence in their ability to predict the performance of future devices. MST is a well diagnosed reversed-field pinch (RFP) capable of operation with plasma current ranging from 60 kA to 500 kA. The resulting Lundquist number S, a key parameter in resistive magnetohydrodynamics (MHD), ranges from 4×10^4 to 8×10^6 for standard RFP plasmas and provides substantial overlap with MHD RFP simulations. MST RFP plasmas are simulated using both DEBS, a nonlinear single-fluid visco-resistive MHD code, and NIMROD, a nonlinear extended MHD code, with S ranging from 10^4 to 10^5 for single-fluid runs, and the magnetic Prandtl number $Pm = 1$. Validation metric comparisons are presented, focusing on how normalized magnetic fluctuations at the edge $\tilde{b}$ scale with S. Preliminary results for the dominant $n = 6$ mode are $\tilde{b} \sim S^{-0.20\pm0.02}$ for single-fluid NIMROD, $\tilde{b} \sim S^{-0.25\pm0.05}$ for DEBS, and $\tilde{b} \sim S^{-0.20\pm0.02}$ for experimental measurements, however there is a significant discrepancy in mode amplitudes. Preliminary two-fluid NIMROD results are also presented.

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