Abstract Submitted
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Validation of the Resistive and Hall MHD Models of the HIT-SI with the NIMROD Code CIHAN AKCAY, University of Washington, CHARSLON KIM, FAR-TECH Inc., BRIAN VICTOR, THOMAS JARBOE, University of Washington — NIMROD 3D pressureless Hall MHD (hMHD) simulations of the HIT-SI spheromak show excellent quantitative agreement with experimental measurements and resistive MHD (rMHD) shows qualitative agreement. New validation metrics are used for assessing the agreement based on biorthogonal decomposition (BD). In the absence of toroidal symmetry and a circular poloidal cross section, BD offers an effective alternative to Fourier decomposition for reducing large data sets to a few dominant spatio-temporal modes. HIT-SI uses two inductive helicity injectors to generate and sustain DC toroidal plasmas. Ratios of toroidal current to injector current up to 4 have been achieved. NIMROD is an initial value, 3D extended MHD code, which models the injectors as non-symmetric oscillating normal magnetic and parallel electric field boundary conditions on the toroidally symmetric spheromak boundary. The simulation output is compared to the formation time, plasma current, and internal and surface magnetic fields. hMHD reproduces the current amplification demonstrated by by HIT-SI with a similar formation time and matching internal magnetic fields. rMHD exhibits a lower current amplification and longer formation times. BD shows that hMHD captures the dominant spatio-temporal surface magnetic structures

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