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NIMROD Extended MHD Simulations of Reversed-Field Pinch Relaxation Dynamics[1] JOSHUA SAUPPE, CARL SOVINEC, JOHN SARFF, JOSEPH TRIANA, University of Wisconsin-Madison — The nonlinear evolution and relaxation dynamics of an initially non-reversed two-fluid plasma in cylindrical geometry is investigated using the NIMROD code. The initial relaxation event brings the plasma to the characteristic reversed-field state. There is significant magnetic activity with MHD and Hall dynamos working together to relax the parallel current profile while the fluctuation-induced Lorentz force drives plasma flows. Subsequent events have considerably less magnetic activity and often have opposing MHD and Hall dynamos. The direction of the driven flows in these events differs from the initial event, and is consistent with experimental observations on the MST RFP. The nonlinear mode coupling during relaxation events is investigated, and the presence of the Hall dynamo is found to significantly alter the spectral power flow. Synthetic diagnostics are used to compare simulation results to experimental measurements of Hall dynamo mode structure with laser Faraday rotation and magnetic probes. At modest Lundquist number the time-scales of relaxation and drive are well-separated and the simulations are compared to two-fluid relaxation theories. Generalized two-fluid helicities are well-conserved relative to magnetic energy over the simulated relaxation events.

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