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Numerical study of pressure-gradient driven dynamics in a cylindrical pinch[1] URVASHI GUPTA, CARL SOVINEC, University of Wisconsin - Madison — Computational modeling of Reversed-Field Pinch (RFP) dynamics is a challenging multi-scale problem. Most past efforts towards modeling RFPs have focused on studying macro-scale evolution of fluctuations and dynamo effects, without pressure-gradient driven dynamics. Recent NIMROD studies on RFPs with uniform background pressure have, however, shown that thermal effects play a significant role in RFP relaxation dynamics. We therefore seek to understand how thermal transport develops self-consistently with pressure-gradient dynamics and magnetic relaxation. In order to account for the absence of micro-scale effects in NIMROD, we initiate our model with a cylindrical Z-pinch equilibrium with a strong guide field, centrally peaked pressure and uniform temperature. Such a configuration forms a symmetric Ohmic steady state that is in classical particle-transport balance while being highly unstable to interchange. Nonlinear 3D evolution from this state develops tearing and interchange dynamics, where energy transport in quasi-steady state involves fluctuating parallel conduction and convection. Future goals include studying the dynamics of how this steady state is sustained self-consistently by the interplay between tearing, interchange and thermal transport.

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