Studies of Nonlinear Two Fluid Tearing Modes In Cylindrical Reversed Field Pinches

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Oscillatory character of two-fluid tearing instability in cylindrical RFP was analytically predicted in [1]. The NIMROD code is used to run 3D two fluid computations in cylindrical geometry. Profiles similar to the Madison Symmetric Torus RFP are used with a reduced aspect ratio to limit the number of modes. The structure and dynamo effects of single helicity non-reversed states are examined and compared with a single fluid model. Consistent with [1], NIMROD linear results show rotation of the two fluid tearing instability due to the relatively strong field line curvature in the RFP configuration. The effect is absent in force free slab model with straight field lines. Previous results in 2D slab geometry have shown the linear Hall dynamo is present in a narrow region around the rational surface, but it is broadened and exhibits a fine structure along the separatrix in the nonlinearly saturated state. This fine structure is a challenge to model in 3D, and resolution requirements are investigated. The sensitivity of the nonlinear Hall dynamo to the relative size of the ion sound gyroradius and the resistive scale is investigated. Studies of reversed states allow for the examination of both the stable and unstable resonant modes and their nonlinear coupling.

[1] V.V. Mirnov, et al., Proc. of 21st IAEA Fusion Energy Conf, TH/P3-18 (2006).