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Nonlinear Interchange Modes in 3D[1] JUPITER BAGAIPO, ADIL HASSAM, University of Maryland — We have shown previously that, in 2D, the ideal magnetohydrodynamic interchange mode stabilized by a constant transverse magnetic field is nonlinearly unstable if near marginal conditions. This study is extended to a 3D system where the mode is marginally stabilized by allowing for wavenumbers weakly transverse to an axial field. Two different boundary conditions are studied: periodic and line-tied in the axial direction. Periodic boundary conditions have applications in toroidal fusion devices while line-tied systems are common in the solar corona. We use reduced equations for a strong axial field to find an analytic solution as a function of the deviation from marginality. Using a systematic perturbation analysis we show that, to lowest order, there exists a secondary, quasistatic equilibrium with a critical field strength. Allowing for deviations from criticality yield a nonlinear time-evolution equation for the perturbation amplitude. The periodic case allows for two types of modes, and it is shown that the mode isomorphic to the earlier 2D problem is nonlinearly unstable, while the "sausage"-type mode is nonlinearly stable. These modes are modes along a rational surface and ballooning type modes, respectively. The line-tied case is shown to always be nonlinearly stable.

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