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Nonlinearly unstable interchange modes in transverse magnetic field JUPITER BAGAIPO, PARVEZ GUZDAR, ADIL HASSAM — We study the ideal interchange instability in a plasma immersed in a constant transverse field near marginal stability. Using reduced equations for a strong axial field, we investigate the tradeoff between the deviation from marginality and residual convection. We calculate a method to predict $|\vec{B}_\perp - \vec{B}_{crit}|$, the deviation of the field from marginality, as a function of residual convective flux. Such a formulation would find application in assessing the B-field tolerances in stellarator coil design. We use an expansion in small perturbations in the field amplitude about marginality to find nonlinear analytic solutions. The lowest order expansion yields an eigenvalue equation for the critical field for marginal stability, $\vec{B}_{crit}$. A time-evolution equation for the amplitude is found from the third order expansion. Simplifying this result for $kL \gg 1$, we find that the system is nonlinearly unstable for perturbations larger than a critical value proportional to the square root of the deviation. Nonlinear numerical simulations of this system in dissipative MHD have verified the result in our calculations. Our results and method are also compared with previous works by Beklemishev, Cowley, and Waelbroeck. Work supported by the USDOE.

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