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Ideal Kink Modes In a Line-Tied Screw Pinch With Finite Plasma Pressure* V.V. MIRNOV, Center for Magnetic Self-Organization, University of Wisconsin-Madison, V.A. SVIDZINSKI, H. LI, Los Alamos National Laboratory — A new method for computing ideal magnetohydrodynamic linear eigenmodes in a cylindrical screw pinch with line-tying boundary conditions is presented. In this method, plasma volume is reflected over one of the end plates, and equations and field components are continued on the extended volume with the continuation rules prescribed by the line-tying boundary conditions. Field components in the combined volume are expanded in Fourier series in the axial coordinate. The resulting set of coupled differential equations is solved numerically in the radial coordinate yielding growth rates and eigenmodes for the system. Example of an m=1 (m is poloidal mode number) internal kink instability in force-free plasma equilibrium with uniform pressure is considered. In contrast to a periodic screw pinch, marginally stable perturbations are essentially compressible in line-tied geometry. Finite compressibility makes the mode more stable in addition to usual line-tying stabilization in zero pressure plasma. The critical length corresponding to marginal stability increases with the increase of plasma beta. A universal axial dependence for marginally stable density perturbations ρ(r, z) = ρ(r) exp(- i z / q(r)) is predicted analytically and confirmed numerically (q = r B_z/B_θ). *The work was supported by the U.S. D.O.E. and N.S.F.

Vladimir Mirnov
University of Wisconsin - Madison

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