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Internal Current-Driven Kink Modes in Line Tied Screw Pinch.[1]

V.V. MIRNOV, C.B. FOREST, C.C. HEGNA, University of Wisconsin and Center of Magnetic Self-Organization in Lab and Astrophysical Plasmas — In recent theoretical studies of external kink mode stability in line-tied geometry, a current channel was assumed to be isolated from a cylindrical conducting wall by a vacuum gap [1,2]. In a more general model [3], the current channel was surrounded by a low density external plasma yielding the no-wall marginal stability condition q_b=1 where b is the radius of the external plasma. Recent experimental results from the Rotating Wall Machine (RWM) show that during the initial ramp-up period of the plasma current, the m=1 mode becomes unstable before q_b falls below unity at the plasma boundary. The instability has an internal character corresponding to the appearance of the resonance surface $q(r_s) = 1$ in the plasma region. Theoretical analysis based on an energy principle calculation for internal kink modes in line-tied geometry show that the line tying effects are strong enough to stabilize the ideal internal kink mode. This discrepancy motivates our interest in studying non-ideal effects in line tied geometry and non-MHD sheath mechanisms that can reduce line-tying stabilization and explain the experimental observations. [1] D.D.Ryutov, R.H.Cohen, L.D.Pearlstein, Phys. Plasmas, v.11, No 10, 4740 (2004). [2] C.C.Hegna, Phys. Plasmas, v.11, No 9, 4230 (2004).[3] V.V.Mirnov, C.B.Forest, C.C.Hegna, Bull. of the APS, v.49, No 8, p.231 (2004).

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