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Nonlinear simulations of locking for finite β and favorable average curvature[1] CIHAN AKCAY, JOHN FINN, Tibbar Plasma Technologies, Inc., ANDREW COLE, Columbia University, DYLAN BRENNAN, Princeton University
— We present NIMROD simulations of error field locking in plasmas with weakly damped linear tearing modes (TM's) stabilized by pressure gradient and favorable curvature. Linear theory shows that the Glasser effect, the stabilization of TM's due to favorable average curvature and positive Δ', occurs in the visco-resistive as well as the resistive-inertial regime, and more generally, in any tearing regime having real frequencies. A periodic cylinder with a hollow pressure profile is used to model the favorable curvature. Linear simulations with rotation and an error field of magnitude ψ_w show the peak reconnected flux occurs near the TM phase velocity where the (quasilinear) Maxwell torque is zero. In nonlinear simulations, the real frequency and stabilization by favorable average curvature are masked by the pressure flattening near the mode rational surface due to sound wave propagation. This flattening can destabilize the mode, and the interaction of the field due to both ψ_w and the destabilized TM can lead to oscillations in the Maxwell torque and rotating islands. We describe the interplay of three effects on TM behavior: I) pressure flattening, II) nonlinear saturation due to current flattening, III) and locking by the Maxwell torque.

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Cihan Akcay
Tibbar Plasma Technologies, Inc

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