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The effects of differential flow between rational surfaces on toroidal resistive MHD modes[1] DYLAN BRENNAN, Princeton University, MICHAEL HALFMOON, University of Tulsa, DOV RHODES, ANDREW COLE, Columbia University, MICHIO OKABAYASHI, Princeton Plasma Physics Laboratory, CARLOS PAZ-SOLDAN, General Atomics, JOHN FINN, Tibbar Plasma Technologies Inc. — Differential flow between resonant surfaces can strongly affect the coupling and penetration of resonant components of resistive modes, and yet this mechanism is not yet fully understood. This study focuses on the evolution of tearing instabilities and the penetration of imposed resonant magnetic perturbations (RMPs) in tokamak configurations relevant to DIII-D and ITER, including equilibrium flow shear. It has been observed on DIII-D that the onset of tearing instabilities leading to disruption is often coincident with a loss of differential rotation between a higher m/n tearing surface (normally the 4/3 or 3/2) and a lower m/n tearing surface (normally the 2/1). Imposing RMPs can strongly affect this coupling and the torques between the modes. We apply the nonlinear 3-D resistive magnetohydrodynamic (MHD) code NIMROD to study the mechanisms by which these couplings occur. Reduced MHD analyses are applied to study the effects of differential flow between resonant surfaces in the simulations. Interaction between resonant modes can cause significant energy transfer between them, effectively stabilizing one mode while the other grows. The flow mitigates this transfer, but also affects the individual modes. The combination of these effects determines the nonlinear outcome.

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