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Quasi-linear and nonlinear stabilization of the m=1 kink-tearing mode in cylindrical geometry KAI GERMASCHEWSKI, STEPHEN ABBOTT, University of New Hampshire, AMITAVA BHATTACHARJEE, Princeton University — The $m = 1$ kink-tearing mode is believed to play an important role in sawtooth crashes in tokamaks. Experimental data show that the sawtooth crash happens on time scales faster than what can be explained by resistive MHD reconnection models and a nonlinear impulsive growth phase is observed. Building on our prior computational study of the nonlinear evolution of the cylindrical $m = 1$ mode, we investigate in detail the nonlinear evolution of the mode in two regimes in an extended MHD model: (1) A nonlinear explosive growth phase mitigated by a shortening of the current sheet length for approximately force-free equilbrium configurations and (2) diamagnetic stabilization through a steepening pressure gradient that causes a poloidal separation of stagnation point of the flow and the magnetic X line as well as asymmetric flow in equilibria with initial pressure gradients. This work employs the Magnetic Reconnection Code (MRC), an extended MHD code that integrates Hall term and electron pressure gradient in a Generalized Ohm's Law. The code uses implicit time integration through the PETSc library and automatic code generation to create functions that evaluate the r.h.s. and sparse Jacobian.

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