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Critical toroidal rotation profile for resistive wall modes in tokamaks K.C. SHAING, University of Wisconsin, M. CHU, General Atomics, S.A. SABBAGH, Columbia Univeristy, M. PENG, Oak Ridge National Laboratory — A three-mode model including the effects of the toroidal coupling is developed for the resistive wall modes in tokamaks. The modes are basically toroidally coupled resistive wall tearing modes, and they have resonant surfaces inside the plasmas. In the vicinity of the resonant surfaces, the neoclassical effects are employed to describe the physics of the resistive layer. This leads to enhanced plasma inertia and dissipation. The dispersion relation that includes toroidal plasma rotation speed at the resonant surfaces and the mode frequency is derived from the determinant of a 6×6 matrix. The toroidal plasma rotation profile is calculated by solving the toroidal momentum diffusion equation with a momentum source in the regions between the magnetic axis and a resonant surface, between two resonant surfaces (there are two such regions in the model), and between a resonant surface and the plasma boundary. The boundary conditions are the toroidal rotation speeds at the magnetic axis, at the resonant surfaces, and at the plasma boundary. These coupled equations uniquely determine a critical toroidal rotation profile that stabilizes the resistive wall mode.

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