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AC loop voltages and MHD stability in RFP plasmas[1] K.J. MCCOLLAM, D.J. HOLLY, V.V. MIRNOV, J.S. SARFF, D.R. STONE, UW–Madison — Applied AC loop voltages provide a means to study and control the dynamics of MHD activity in RFP plasmas. In MST experiments with a new programmable power supply, applying a poloidal loop voltage oscillation of sufficient amplitude is observed to tightly entrain the ambient quasiperiodic sawtooth magnetic-relaxation cycle in the RFP, making it almost strictly periodic. The RFP's limit-cycle trajectory in (F, Θ) space, where F and Θ are the equilibrium reversal and pinch parameters, is drastically modified and suggests a fundamentally different relaxation regime. Applying both poloidal and toroidal AC loop voltages, as in oscillating-field current drive (OFCD), changes the limit cycle and can reduce MHD fluctuation amplitudes. The MHD response in OFCD experiments with varying source amplitudes and phase lags is examined in terms of linear stability and nonlinear mode coupling. Linear stability for MHD current-driven modes is calculated in cylindrical geometry, including the effect of conducting-wall proximity, and preliminary results indicate the presence of a stable region in (F, Θ) space, consistent with past results for the RFP. By using OFCD to control the RFP's positioning in (F, Θ) space, it might be possible to control or suppress MHD activity while driving steady-state plasma current.

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