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Automated Identification of MHD Mode Bifurcation and Locking in Tokamaks* J.D. RIQUEZES, S.A. SABBAGH, Y.S. PARK, Columbia U., R.E. BELL, PPPL, L.A. MORTON, ORAU — Disruption avoidance is critical in reactor-scale tokamaks such as ITER to maintain steady plasma operation and avoid damage to device components. A key physical event chain that leads to disruptions is the appearance of rotating MHD modes, their slowing by resonant field drag mechanisms, and their locking. An algorithm has been developed that automatically detects bifurcation of the mode toroidal rotation frequency due to loss of torque balance under resonant braking, and mode locking for a set of shots using spectral decomposition. The present research examines data from NSTX, NSTX-U and KSTAR plasmas which differ significantly in aspect ratio (ranging from A = 1.3 - 3.5). The research aims to examine and compare the effectiveness of different algorithms for toroidal mode number discrimination, such as phase matching and singular value decomposition approaches, and to examine potential differences related to machine aspect ratio (e.g. mode eigenfunction shape variation). Simple theoretical models will be compared to the dynamics found. Main goals are to detect or potentially forecast the event chain early during a discharge. This would serve as a cue to engage active mode control or a controlled plasma shutdown. *Supported by US DOE Contracts DE-SC0016614 and DE-AC02-09CH11466.

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