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Stability of a two-volume MRxMHD model in slab geometry LI HUEY TUEN, MATTHEW HOLE, ROBERT DEWAR, GRAHAM DENNIS, Australian National University — Ideal MHD models are inadequate to describe various physical attributes of toroidal plasmas with no continuous symmetry, such as magnetic islands and stochastic regions. A new MHD formulation, MRxMHD [1], uses only a finite number of ideal-MHD flux surface interfaces, with relaxed plasma regions in between, thus allowing a stepped-pressure profile, magnetic islands, and stochastic regions. In toroidally asymmetric plasma, the existence of interfaces in MRxMHD is contingent on the field pitch, or rotational transform, of flux surfaces being irrational; a KAM [2] argument shows that some good equilibrium flux surfaces continue to exist for small perturbations to an integrable system (foliated by flux surfaces), provided that the rotational transforms on both sides of each interface are sufficiently irrational. Building upon the MRxMHD stability model by Hole [3], we study the effects of irrationality of the rotational transform at interfaces in MRxMHD on plasma stability. Investigating the plasma stability of a two-volume MRxMHD periodic-slab, we find that the 2D system stability conditions are dependent on the interface and resonance layer magnetic field pitch at minimised energy states. While tearing instabilities exist at low order rational resonances, investigating instability of high-order rationals requires study of pressure-driven instabilities.

[1] Hudson, S. R., et al. (2012), *Physics of Plasmas* **19**, 112502
[2] McGann, M. (2013), PhD thesis
[3] Hole, M.J. *et al,* (2007), *Nucl. Fusion* **47,** 746.

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