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[**x**] Theory [ ] Experiment

Implementation of a new Algorithm for Linear Resistive MHD Stability,* S.A. Galkin, A.D. Turnbull, M.S. Chu, J.M. Greene, *GA*, D.P. Brennan, *ORISE* – A method for evaluating linear resistive MHD stability based on transforming solutions of differential equations with regular singularities into finite solutions [1] has been implemented for the 2D toroidal case in the TWIST-R code. In 1D, the algorithm was previously shown to be accurate, with good convergence, even for irregular singularities [2]. Challenging numerical issues arise in 2D due to coupling of the additional regular solution components; these need to be treated properly across the singular layer. Also, singularities in several coefficients need to be cancelled exactly, and coordinate singularities at the magnetic axis need to be handled properly. Using an analytic Solovev equilibrium to systematically check and benchmark the code, all the major numerical issues have been resolved and physically meaningful solutions and asymptotic matching data are obtained. Convergence in most cases is near quadratic for a range of values of the Mercier index $\mu = \sqrt{-D_I}$ well beyond that possible for previous asymptotic methods. Benchmarks for the Solovev case and numerically generated equilibria will be discussed.

[1] S.A. Galkin, et al., Phys. Plasmas **7**, 4070 (2000).
[2] S.A. Galkin, et al., Phys. Plasmas **9**, 3969 (2002).

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