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First Results of a Linear MHD Stability Code for Axisymmetric Plasmas with Arbitrary Equilibrium Flow L. GUAZZOTTO, R. BETTI, Laboratory for Laser Energetics, U. of Rochester, J.P. FREIDBERG, PSFC, MIT — Fast toroidal plasma flows are routinely induced by neutral beam injection in current tokamaks such as NSXT and DIII-D. Flow and flow shear stabilize external modes such as the resistive wall mode, suppress turbulence when the flow shear is large enough, and also have a significant influence on the stability and nonlinear evolution of the internal kink and ballooning modes. Equilibria with poloidal and toroidal arbitrary flows can now be generated with the University of Rochester code *FLOW*,[1] but the tools available to tackle the stability problem are quite limited. We have undertaken the development of a new finite-element linear stability code named *FLOS,* meant to investigate MHD stability with arbitrary flow. The code is based on a recent δW formulation in which the energy principle (including arbitrary flow) is reduced to an eigenvalue problem of the kind $(\omega\mathbf{A} - \mathbf{B})\boldsymbol{x} = 0$. Such a formulation is attractive because it allows a straightforward implementation of the finite element method. Presently, the code is limited to the analysis of internal modes. In the current work, we present the first results of the code relative to internal kink modes of tokamak plasmas in the presence of arbitrary flow. The implementation is also discussed in detail. This work was supported by the U.S. Department of Energy under Cooperative Agreement No. DE-FC52-92SF19460.

[1]L. Guazzotto *et al.*, Phys. Plasmas **11**, 604 (2004).

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