1998 International Sherwood Fusion Theory Conference
March 23–25, 1997, Atlanta, Georgia

Investigation of Inner Layer Models Using Resistive Energy Principle Approach

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We apply the recently developed linear MHD eigenvalue TWIST-R code to study resistive MHD plasma stability using a variety of different inner layer models. The TWIST-R code is based on the fully toroidal resistive energy principle [1]. The code uses two projections of the plasma displacement (radial and tangential) [2] and can treat 2D toroidal plasma configurations surrounded by a vacuum region and an ideal conducting wall. Different inner layer models, either analytical or numerical, can be easily incorporated in the code, including models which couple different projections of the displacement, plasma rotation near resonance surfaces, etc. The code solves a nonlinear eigenvalue problem and the full structure of the resistive (and ideal) eigenfunctions simultaneously with corresponding eigenvalues can be obtained numerically.

Benchmark calculations were carried out between the TWIST-R code and the published benchmark case with the MARS and PEST-3 codes [3]. The benchmark comparison with PEST-3 code against pressureless and finite pressure plasma configurations was done using the classic Glasser-Greene-Johnson (GGJ) inner layer model [4]. We also compare the Greene and Miller inner layer model behavior [5] with the GGJ model. The inner layer ideal parity solutions and their effects on the sensitivity of dispersion relations were studied and the influence of the plasma parameters such as pressure, plasma shape, etc., on resistive modes is also discussed.

The immediate future plans include exploring of inner layer effects with compressibility, plasma rotation, magnetic well and the role of the ideal parity solutions.

This is a report of research sponsored in part by the U.S. Department of Energy under Grant No. DE-FG03-95ER54309.

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