A Grad-Shafranov Refiner Using High Order Spectral Elements[1]

ALAN H. GLASSER, Los Alamos National Laboratory — Numerical computation of the outer region matching data for resistive and other singular MHD modes of axisymmetric toroidal plasmas is much more sensitive to errors in the equilibrium solution of the Grad-Shafranov Equation (GSE) than corresponding ideal MHD stability analysis. While many direct and inverse GSE solvers are capable of producing sufficiently accurate solutions for ideal analysis, most have difficulty achieving adequate resolution and iterative convergence for resistive analysis. We have developed a Grad-Shafranov refiner using high-order spectral elements to improve on the accuracy of such solutions. The inverse form of the GSE and the equation for the Jacobian of the straight-fieldline coordinate system are solved iteratively, starting from an inaccurate initial solution to obtain a highly accurate final solution in inverse form, most suitable for stability analysis. Results will be presented for numerically challenging NSTX equilibria with small aspect ratio, large vertical elongation, and high beta.

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