

Progress on Resistive MHD Code Verification Problems with M3D-C1

S. C. Jardin¹, N. Ferraro¹, J. Breslau¹, S. Hudson¹, D. Pfefferle¹, B. Tobias¹, M. Lanctot²

¹*Princeton Plasma Physics Laboratory, Princeton NJ 08543*

²*General Atomics, San Diego, CA*

We report on progress in using the M3D-C1 code to perform several resistive MHD code verification problems for comparison with analytic solutions and other codes. The first set of problems was proposed by the ITPA group on control, MHD, and disruptions and is known as Joint Activity 2, or simply JA-2. The intent is to study the interaction of several tearing modes in a torus. As a prelude to that, we have performed linear and non-linear analysis of two low-beta configurations that are unstable to one or more tearing modes. Configuration (1) has an analytic q-profile given (in cylindrical geometry) by: $q(r) = 1.15 \times (1 + (r^2/.6561))$ and is unstable to only the (2,1) mode. Configuration (2) has q-profile: $q(r) = 1.33 \times (1 + (r^2/.354)^4)^{1/4}$ (also in cylindrical geometry) and is unstable to both the (2,1) and (3,2) modes. For each of these configurations, we have also defined axisymmetric toroidal equilibrium that have the same $q(\psi)$ profiles (where ψ is the normalized poloidal flux) for comparison. The second set of problems came from discussions over the last year at both the “Transients in Tokamak Plasmas” and “Integrated Simulations” workshops. For these, besides the plasma region we include vacuum regions, resistive wall, and in some apply externally imposed “error fields” to study the evolution of tearing modes in the presence of more realistic and complex boundary conditions.