Comparisons of Linear and Nonlinear Plasma Response Models for Non-Axisymmetric Perturbations[1] A.D. TURNBULL, N.M. FERRARO, GA, V.A. IZZO, UCSD, M.J. LANCTOT, LLNL, L.L. LAO, GA, E.A. LAZARUS, ORNL, Y.Q. LIU, Culham Sci. Ctr, A. REIMAN, J.-K. PARK, PPPL — The plasma response to nonaxisymmetric field perturbations can be treated as an initial value (or dynamic) stability problem or from a nearby perturbed equilibrium approach. The approaches are quite different in principle and examples for specific DIII-D discharges are discussed in which representative codes, both linear and nonlinear, are used to validate the solutions. While the different approaches yield similar answers in some cases, in others they are significantly different. The plasma response can be large and linear models can break down even when the external field is small. In general, comparisons of the differences in the solutions between the approaches then provides improved understanding of the response and yields additional insights into some of the physics issues. For the nearby equilibrium approach, constraints need to be imposed on the profiles to obtain the physically accessible equilibrium solution. These can be informed using full nonlinear extended MHD calculations that include sufficient physics and experimentally realistic dissipation. Constraints on the pressure can be found from transport and a set of constraints on the current may be obtained from considering magnetic helicity, which has a physical interpretation in terms of field line linkage.

A.D. Turnbull
GA

Electronic form version 1.4