High spatial resolution equilibrium reconstruction

Q. Ren[1,2], M.S. Chu, L. L. Lao, and R. Srinivasan[3]

[1]*Institute of Plasma Physics, Hefei, China*
[2]*Center for Magnetic Fusion Theory, Hefei, China*
[3]*Institute for Plasma Research, Bhat, Gandhinagar, India*

Abstract

The extension of the EFIT equilibrium reconstruction code to fine spatial-grid resolutions is discussed. The residue in the force-balance relation of the Grad-Shafranov (GS) equation and the convergence property of these fine spatial-grid EFIT equilibria are studied in detail. The results suggest that fine spatial-grid equilibria generally better satisfy the force-balance constraint described by the G-S equation. Finer spatial-grid equilibria have typically smaller average error in satisfying the force balance equation than coarse-grid equilibria and those extrapolated from coarse-grid results. Analysis of the equilibrium iteration algorithm employed in EFIT reveals that the iteration process is related to the spatial feedback stabilization of the plasma with flux control at various specified locations. Thus, for a converged equilibrium, axisymmetric stability is generally expected with feedback. The iteration error decreases self-similarly in the final stage of the iteration process and is related to the least-stable axisymmetric mode in the feedback-stabilized equilibrium.