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Three-dimensional equilibria in axially symmetric tokamaks[1]
PAUL GARABEDIAN, Courant Institute-New York University — The NSTAB computer code was developed to study equilibrium and stability in fusion plasmas with three-dimensional (3D) geometry, and it is now being applied to calculate islands in tokamaks like ITER. The significance of 3D magnetohydrodynamic (MHD) equilibria in axially symmetric tokamaks is that they may contribute to the prompt loss of α particles or to disruptions, since they model neoclassical tearing modes and edge localized modes. The NSTAB code captures islands correctly despite a nested surface hypothesis because the MHD equations are in conservation form. This works well for islands whose widths are comparable to the mesh size. Convergence studies were made to check runs of NSTAB used to design quasiaxially symmetric stellarators. Residuals of 10^4 discrete equations can be reduced by 10^6 iterations of an accelerated method of steepest descent to the level 10^{-13} of round off error in double precision, showing that the 3D solutions are valid.

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