Noniterative Magnetic Equilibrium Reconstruction in Axisymmetric, Large-Aspect-Ratio, Low-Beta Tokamak Plasmas

P. Rodrigues[1], J. P. S. Bizarro[1]

[1]*Associação Euratom-IST,*
Centro de Fusão Nuclear, Instituto Superior Técnico,
1049-001 Lisboa, Portugal

A new method for magnetic equilibrium reconstruction in axisymmetric, large-aspect-ratio, low-beta tokamak plasmas is proposed which takes as input the plasma pressure and the poloidal magnetic field profiles $p(r,\theta_p)$ and $B^\theta(r,\theta_B)$ measured along the chords $\theta=\theta_p$ and $\theta=\theta_B$ crossing the magnetic axis $r=0$, together with suitable boundary conditions. This departs from the usual specification of the plasma pressure $p(\psi)$, the poloidal current $2\pi F(\psi)/\mu_0$ or the safety factor $q(\psi)$ in terms of the poloidal magnetic field flux ψ, which is itself an unknown to the problem. While including information about the inner structure of the equilibrium under consideration in a quite natural fashion, the proposed method avoids the need to iteratively fit a set of free parameters to externally measured data, therefore reducing the computational cost of equilibria reconstruction.