Numerical tokamak equilibria with pressure anisotropy

G. Poulipoulis, G. N. Throumoulopoulos

Section of Astrogeophysics, Physics Department-University of Ioannina, Ioannina, Greece

Modern tokamaks rely on auxiliary heating methods which generate significant pressure anisotropy in the plasma[1, 2] which modifies the momentum conservation equation and therefore affects the equilibrium and stability properties. Therefore is of importance to include the pressure anisotropy for studies of equilibria in experiments with auxiliary heating. Pressure anisotropy can be expressed through the quantity $\sigma = \mu_0 (p_\parallel - p_\perp)/|B|^2$. This quantity can be positive or negative depending on the direction of the auxiliary heating. Under the assumption that $\sigma$ is uniform on magnetic surfaces a Generalised Grad-Shafranov equation can be obtained which along with a Bernoulli equation for the effective isotropic pressure defined as $\overline{p} = (p_\parallel + p_\perp)/2$ describe the equilibrium. The problem can be simplified via an integral transformation, depending on the quantity $\sigma$, which makes the Generalised Grad-Shafranov equation identical in form with the isotropic one[3]. In this contribution we have extended the code HELENA[4] to equilibria with pressure anisotropy. In this case the physical quantities are calculated by means of the aforementioned transformation in a manner similar to the extension of HELENA for plasma rotation parallel to the magnetic field[5]. The impact of pressure anisotropy, for positive and negative $\sigma$, on the equilibrium characteristics has also been examined.

References