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Toroidal equilibria with flow and pressure anisotropy in high-beta reduced MHD models A. ITO, N. NAKAJIMA, National Institute for Fusion Science — Effects of flow, finite ion temperature and pressure anisotropy on equilibrium of high-beta toroidal plasmas are investigated based on reduced magnetohydrodynamic (MHD) models. A set of reduced equilibrium equations for high-beta tokamaks with toroidal and poloidal flow comparable to the poloidal sound velocity has been formulated from two-fluid MHD equations with ion finite Larmor radius (FLR) terms and pressure anisotropy. This set of equations has been solved analytically in the limit of single-fluid MHD. The solution shows that the magnetic structure is modified by the flow, the pressure isosurfaces depart from the magnetic flux surfaces due to the poloidal flow indicating transition from sub- to super-poloidal-sonic flow, and anisotropic pressure profiles are self-consistently determined in the presence of flow. We have solved the equilibrium equations for two-fluid equilibria numerically by using the finite element method. We have obtained the following feature of two-fluid equilibria both analytically and numerically: the isosurfaces of the magnetic flux, the pressure and the ion stream function do not coincide with each other.

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