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High-beta equilibria in circular, elliptical and D-shape large aspect ratio axisymmetric configurations with poloidal and toroidal flows OMAR LOPEZ ORTIZ, LUCA GUAZZOTTO, Auburn Univ — The Grad-Shafranov-Bernoulli system of equations is a single fluid magnetohydrodynamical description of axisymmetric equilibria with mass flows. Using a variational perturbative approach [1], analytic approximations for high-beta equilibria in circular, elliptical and D-shape cross sections in the high aspect ratio limit are found, which include finite toroidal and poloidal flows. Assuming a polynomial dependence of the free functions on the poloidal flux, the equilibrium problem is reduced to a modified Helmholtz PDE subject to homogeneous Dirichlet conditions. An application of the Green's function method leads to a closed form for the circular solution and to a series solution in terms of Mathieu functions for the elliptical case, which is valid for arbitrary elongations. To extend the elliptical solution to a D-shape domain, a boundary perturbation in terms of the triangularity is used. A comparison with the code FLOW [2] is presented for relevant scenarios.

[1] Eliezer Hameiri, *Phys. Plasmas*, **20**, 024504 (2013).
[2] L. Guazzotto *et al.*, *Phys. Plasmas*, **11**, 604 (2004).

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