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Computational Study of the Grad–Shafranov Equation with Flow in Helical Symmetry[1] LORENZO SIDDI, Centre for Plasma Astrophysics, Departement Wiskunde, KU Leuven - Dipartimento di Matematica, Politecnico di Torino, Turin, Italy, LUCA GUAZZOTTO, University of Rochester, Rochester, NY, GIOVANNI LAPENTA, Centre for Plasma Astrophysics, Departement Wiskunde, KU Leuven, Leuven, Belgium, ROBERTO PACCAGNELLA, Consorzio RFX, Associazione ENEA - EURATOM sulla fusione, Padova, Italy — We present a numerical solution of the modified Grad–Shafranov equation in cylinder geometry and in the presence of macroscopic rotation. The main challenge is the full inclusion of helical symmetry, a problem relevant in a variety of scenarios. Cylindrical symmetry is often used as lowest-order approximation of the Grad–Shafranov equation in Tokamaks. However, in many other situations in astrophysical and laboratory plasmas, helical symmetry is a better assumption, in particular in Reversed Field Pinch (RFP) configurations in Single-Helicity states. The "Grad–Shafranov" equation is written in helical symmetry with a convective term expressed by toroidal and poloidal velocities. Two equations are obtained: a non-linear PDE for the magnetic flux $\Psi(r, u)$ and an algebraic equation for the density $\rho(r, u, \Psi)$ (u is the variable along the helix). Here, we report on our progress in the development of a numerical method and computational code to solve the coupled non-linear system. Examples of applications are described.

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