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Generation of rotational flows in toroidally confined visco-resistive magnetohydrodynamics JORGE MORALES, CRPP, EPFL, Switzerland, WOUTER BOS, LMFA, CNRS, Ecole Centrale de Lyon, Ecully, France, KAI SCHNEIDER, M2P2-CNRS & CMI, Aix-Marseille University, Marseille, France, DAVID MONTGOMERY, Department of Physics and Astronomy, Dartmouth College, Hanover, New Hampshire 03755, USA — We investigate by numerical simulation the generation of rotational flows in a toroid confining a conducting magnetofluid. A current is driven by the application of externally supported electric and magnetic fields. We show how the properties and intensity of the rotations are regulated by dimensionless numbers (Lundquist and viscous Lundquist) that contain the resistivity and viscosity of the magnetofluid. At the magnetohydrodynamic level (uniform mass density and incompressible magnetofluids), rotational flows appear in toroidal, driven MHD. The evolution of these flows with the transport coefficients, geometry, and safety factor are described. Two different toroidal geometries are considered, one with an up-down symmetric and the other with an asymmetric cross section. We show that there exists a fundamental difference between both studied cases: the volume-averaged angular momentum is zero for the symmetric case, while for the asymmetric cross section a finite volume-averaged angular momentum appears. We observe a breaking in the up-down symmetry of the flow and a toroidal preferred direction emerges. Ref.: J. Morales, W.J.T. Bos, K. Schneider and D.C. Montgomery. Magnetohydrodynamically generated velocities in confined plasma. Phys. Plasmas, 22, 042515, 2015.

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