Counter-rotating flow in coaxial cylinders under an axial magnetic field

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Description
Numerical simulations are presented of swirling flow in vertical annuli filled with a liquid metal with counter-rotating end disks under an axial magnetic field. Two coaxial cylinders where a liquid metal was placed in the annular gap having an aspect ratio (height/radius) γ= 2 are considered. The bottom and top disks are assumed to rotate at the opposite (counter-rotating) angular velocities. Six annular gaps R= 0. 9, 0.8, 0.7, 0.6, 0.5 and 0.4 were studied. The governing Navier–Stokes and potential equations are solved by using the finite-volume method. The results show that different complex flow appears as the annular gap become larger. Asymmetric m= 2 and 3 azimuthal modes are observed. The presence of the magnetic field results to fluid deceleration and, thus, to flow stabilization. The stability diagram (Re cr–R) corresponding to the transition from axisymmetric to non-axisymmetric flow for increasing values of …