

Hydrodynamic instabilities in swirling flow under axial magnetic field

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Description

The present paper investigates numerically the hydrodynamic instabilities occurring in a cylindrical container filled with a conducting viscous fluid and submitted to an axial magnetic field. The axisymmetric swirling flow produced by rotation of the bottom disk, in which a vortex breakdown bubble occurred on the axis of symmetry. This flow structure represents one of the most important instabilities. The governing Navier–Stokes and potential equations are solved by using the finite-volume method. For both steady-state and oscillatory regimes, various combinations of the top, bottom, and side walls conductivity are considered. The effects of the magnetic field and wall electrical conductivities on the position of vortex breakdown and his disappearance is developed. The results obtained showed that the vortex breakdown is suppressed beyond the magnitude of the magnetic field exceeds a critical value. The stability ...