Stability of swirling flows with heat transfer in a cylindrical enclosure with co/counter-rotating end disks under an axial magnetic field

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Description
In this article, a numerical study of swirling flows with heat transfer generated by two rotating end disks (co- and counter-rotating) inside a cylindrical enclosure having an aspect ratio equal to 2, filled with a liquid metal, and submitted to a vertical temperature gradient and an axial magnetic field is studied. The governing Navier-Stokes, energy, and potential equations along with appropriate boundary conditions are solved by using the finite-volume method. The flow and temperature fields are presented by stream function and isotherms, respectively. This flow is very unstable and reveals a great richness of structures. In an oscillatory regime, results are presented for various values of the Hartmann number, Ha = 5, 10, 20 and 30, and Richardson numbers, Ri = 0, 0.5, 1, 2 and 4, in order to see their effects on the value of the critical Reynolds number, Re_{cr}. Stability diagrams are established according to the numerical …