Magnetohydrodynamic counter-rotating flow in a cylindrical cavity

Authors
Brahim Mahfoud, Rachid Bessaïh

Publication date
2016/2/1

Journal
International Journal of Heat and Mass Transfer

Volume
93

Pages
175-185

Publisher
Pergamon

Description
Three-dimensional steady combined free and forced convective magnetohydrodynamic (MHD) flow are simulated in a cylindrical cavity filled with a liquid metal and submitted to a vertical temperature gradient and an axial magnetic field. The forcing corresponds to a swirling flow produced by counter-rotation of the top and bottom disks. The governing Navier–Stokes, energy, and potential equations along with appropriate boundary conditions are solved by using the finite-volume method. Comparisons with previous results were performed and found to be in excellent agreement. The effects of magnetic field on flow and temperature fields are analysed. When the Reynolds number is increased, the axisymmetric basic state loses stability and different complex flow appear. Axisymmetric (m = 0) and asymmetric m = 1 and m = 2 azimuthal modes are observed. Azimuthal mode m = 3 are found when the Hartmann …