

THREE-DIMENSIONAL SWIRLING FLOWS WITH HEAT TRANSFER IN A CYLINDRICAL ENCLOSURE UNDER AXIAL MAGNETIC FIELD

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Description

The present work examine numerically the effect of axial magnetic field on mixed convection through a cylindrical cavity, filled with a liquid metal and having a rotating top and bottom disks. Effects of Richardson number ($Ri= 0, 0.5, 1$ and 2) and Hartman number ($Ha= 0, 5, 10$ and 20) on temperature and flow fields were analyzed. The basic state of this system is steady and axisymmetric, when the counter-rotation is sufficiently large, producing a free shear layer. This shear layer is unstable and different complex flows appear successively: steady states with an azimuthal wavenumber of 1; travelling waves and steady states with an azimuthal wavenumber of 2. Mixed modes and azimuthal wavenumber of 3 are also found with increasing Hartmann number. The stability diagram (Re cr- Ha) corresponding to the axisymmetric-three-dimensional transition for increasing values of the axial magnetic field is obtained.