Effect an Axial Magnetic Field in Co-rotating Flow Heated from Below

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Abstract : The effect of an axial magnetic field on the flow produced by co-rotation of the top and bottom disks in a vertical cylindrical heated from below is numerically analyzed. The governing Navier-Stokes, energy, and potential equations are solved by using the finite-volume method. It was observed that the Reynolds number is increased, the axisymmetric basic state loses stability to circular patterns of axisymmetric vortices and spiral waves. In mixed convection case the axisymmetric mode disappears giving an asymmetric mode $m=1$. It was also found that the primary thresholds Re_{cr} corresponding to the modes $m=1$ and 2, increase with increasing of the Hartmann number (Ha). Finally, stability diagrams have been established according to the numerical results of this investigation. These diagrams giving the evolution of the primary thresholds as a function of the Hartmann number for various values of the Richardson number.