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Steady and Oscillatory States of Swirling Flows under an Axial Magnetic Field

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Abstract : In this paper, a numerical study of steady and oscillatory flows with heat transfer submitted to 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. The flow between counter-rotating end disks is very unstable and reveals a great richness of structures. The 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, Recr. Stability diagrams are established according to the numerical results of this investigation. These diagrams put in evidence the dependence of Recr with the increase of Ha for various values of Ri.

Keywords : swirling, counter-rotating end disks, magnetic field, oscillatory, cylinder
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