ASPECT RATIO EFFECT ON ENTROPY GENERATION AT NATURAL CONVECTION IN A CAVITY SUBMITTED TO A MAGNETIC FIELD

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Abstract

Natural convection in a cavity filled with air and submitted to an oriented magnetic field is numerically investigated. The cavity is heated and cooled along the active walls whereas the two other walls of the cavity are adiabatic and insulated. Entropy generation due to heat transfer, fluid friction and magnetic effect has been determined in transient state for laminar flow by solving numerically the continuity, momentum and energy balance equations, using a Control Volume Finite—Element Method. The structure of the studied flows depends on four dimensionless parameters which are: The thermal Grashof number, the aspect ratio, the Bejan number and the Hartman number. At high values of thermal Grashof number (i.e., $Ra=10^5$), results show that the aspect ratio of the cavity and the presence of a magnetic field affect considerably the convection in the core of the enclosure. The entropy generation increases in function of the aspect ratio. The lower the Hartmann number the higher the influence of the aspect ratio on Bejan number. The magnetic force tends to accelerate the fluid motion inside the cavity; the core vortex is elongated vertically until to be multiplied at Hartmann stronger. The effect of the magnetic field is to reduce the convective heat transfer inside the cavity.