MHD natural convection inside an inclined trapezoidal porous enclosure with internal heat generation or absorption subjected to isoflux heating

Abstract:

A steady laminar two-dimensional magneto-hydrodynamic natural convection flow in an inclined trapezoidal enclosure filled with a fluid-saturated porous medium is investigated numerically using a finite difference method. The left and right vertical sidewalls of the trapezoidal enclosure are maintained at a cold temperature. The horizontal top wall is considered adiabatic while the bottom wall is subjected to isoflux heating. A volumetric internal heat generation or absorption is embedded inside the trapezoidal enclosure while an external magnetic field is applied on the left sidewall of the enclosure. In the current work, the following parametric ranges of the non-dimensional groups are used: Hartmann number is varied as $0 = Ha = 50$, Darcy number is taken as $Da = 10 -3, 10 -4, and 8 × 10 -5, Rayleigh number is varied as $10 -3 = Ra = 10 -5, Prandtl number is considered constant at Pr = 0.7, the dimensionless internal heat generation or absorption parameter is varied as ? = -0.2, 0, 1, and 2.0, while the trapezoidal enclosure inclination angle is varied as 0°^ = ? = 90°. The results indicated a strong flow circulation occurs when the Darcy and the Rayleigh numbers are high. In addition, it is found that the Hartmann number, internal heat generation or absorption parameter and inclination angle have an important role on the flow and thermal characteristics. It is also found that when the enclosure inclination angle and Hartmann number increase the average Nusselt number along the hot bottom wall decreases.