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ABSTARCT

This work illustrates the steady state, two dimensional natural convective flow and heat transfer features in square enclosure containing heated hexagonal block maintained either at constant wall temperature (*CWT*) or uniform heat flux (*UHF*) thermal conditions. Governing equations (mass, momentum and energy) are solved by using finite volume method (FVM) with 3rd order accurate QUICK discretization scheme and *SIMPLE* algorithm for range of field pertinent parameters such as, Grashof number ($10^3 \leq Gr \leq 10^6$), Prandtl number ($1 \leq Pr \leq 100$) and power law index ($0.5 \leq n \leq 1.5$). The analysis of momentum and heat transfer characteristics are delineated by evolution of streamlines, isotherms, variation of average Nusselt number value and Colburn factor for natural convection (j_{nH}). A remarkable change is observed on fluid flow and thermal distribution pattern in cavity for both thermal conditions. Nusselt number shows linear variation with Grashof and Prandtl numbers; while rate of heat transfer by convection decreases for power law index value. Higher heat transfer rate can be achieved by using uniform heat flux condition. A Nusselt number correlation is developed for possible utilization in engineering/scientific design purpose.

Keywords: Square cavity; Heated block; Grashof number; Natural convection; Power law index

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