Natural Convection in a Porous Medium Bounded by a Long Vertical Wavy Wall and a Parallel Flat Wall

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This paper presents natural convection in a porous medium bounded by a long vertical wavy wall and a parallel wall. The shape of the wavy wall is assumed to follow a profile of cosine curve. The wall is kept at a constant heat flux while the parallel wall is kept at a constant temperature. The governing systems of nonlinear partial differential equations in their non-dimensional form are linearised by using the perturbation method in terms of amplitude and the analytical solutions for velocity and temperature fields have been obtained in terms of various parameters occurring in the model. A numerical study of the analytical solution is performed with respect to the realistic fluid air in order to illustrate the interactive influences of governing parameters on the temperature and velocity fields as well as skin friction and Nusselt number. It is found that in the case of maximum waviness (positive and negative), the velocity component along the wall has a reverse trend near the flat wall. It is observed that the parallel flow through the channel at zero waviness is greater than at maximum waviness (positive and negative) while the same trend occurs for perpendicular flow in the opposite direction. Examination of the Nusselt number shows that in the presence and absence of a heat source, the heat flows from the porous region towards the walls but in the presence of a sink, the heat flows from the walls into the porous region.

Key words: Natural Convection; Porous Medium; Wavy Wall; Perturbation Method.
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