

NATURAL CONVECTION IN A RECTAGULAR ENCLOSURE WITH TWO HEATED SECTIONS ON THE LOWER SURFACE AND COOLED SIDE WALLS

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ABSTRACT The development of unsteady free convective flow in a rectangular enclosure has been numerically studied. The enclosure considered has rectangular horizontal lower and upper surfaces and vertical side surfaces. The horizontal width of enclosure is twice the vertical height of the enclosure while the longitudinal length of the enclosure is equal to the vertical height of the enclosure. There are two square, symmetrically placed isothermal heated sections on the lower surface, the rest of this surface being adiabatic. The vertical side-walls of the enclosure are kept at a uniform low temperature and the horizontal rectangular upper surface is adiabatic. The solution has been obtained by numerically solving the unsteady form of the governing equations. The unsteady, three-dimensional governing equations written in dimensionless form, have been solved using a iterative, semi-implicit finite-difference method. The solution was continued in dimensionless time until the time-averaged values of the flow variables ceased to change with time. The solution has the following parameters: the Rayleigh number, Ra , the Prandtl number, Pr , the dimensionless size, w_H , of the square heated sections and the dimensionless distance between the heated sections on the lower surface, w_S . Results have been obtained for a Prandtl number of 0.7. The conditions under which unsteady flow develops and the nature of the unsteady flow have been investigated and the variation of mean average Nusselt number with Rayleigh number and the effect of unsteadiness in the flow on this variation have been extensively explored.