Influence of presence of inclined centered baffle and corrugation frequency on natural convection heat transfer flow of air inside a square enclosure with corrugated side walls

Original research article

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Abstract

The main objective of this study is to investigate the effect of presence of insulated inclined centered baffle and corrugation frequency on the steady natural convection in a sinusoidal corrugated enclosure. The present study is based on such a configuration where the two vertical sinusoidal walls are maintained at constant low temperature whereas a constant heat flux source whose length is 80% of the width of the enclosure is discretely embedded in the bottom wall. The remaining parts of the bottom wall and the top wall are adiabatic. The finite volume method has been used to solve the governing Navier–Stokes and the energy conservation equations of the fluid medium in the enclosure in order to investigate the effects of baffle inclination angles, corrugation frequencies and Grashof numbers on the fluid flow and heat transfer in the enclosure. The values of the governing parameters are the Grashof number Gr (103–106), the corrugation frequencies CF (1, 2 and 3), baffle inclination angles ($0° \le \Phi \le 150°$) and Prandtl number Pr (0.71). Results are presented in the form of streamline and isotherm plots. The results of this investigation are illustrated that the average Nusselt number increases with increase in both the Grashof number and corrugation frequency for different baffle inclination angles and the presence of inclined baffle and increasing the corrugation frequency have significant effects on the average Nusselt numbers, streamlines and isotherms inside the enclosure. The obtained numerical results have been compared with literature ones, and it gives a reliable agreement.