Numerical investigation of heat transfer enhancement of nanofluids in an inclined lid-driven triangular enclosure.

ABSTRACT

The behavior of nanofluids is investigated numerically in an inclined lid-driven triangular enclosure to gain insight into convective recirculation and flow processes induced by a nanofluid. The present model is developed to examine the behavior of nanofluids taking into account the solid volume fraction δ. Fluid mechanics and conjugate heat transfer, described in terms of continuity, linear momentum and energy equations, were predicted by using the Galerkin finite element method. Comparisons with previously published work on the basis of special cases are performed and found to be in excellent agreement. Numerical results are obtained for a wide range of parameters such as the Richardson number, and solid volume fraction. Copper–water nanofluids are used with Prandtl number, Pr = 6.2 and solid volume fraction δ is varied as 0%, 4%, 8% and 10%. The streamlines, isotherm plots and the variation of the average Nusselt number at the hot surface as well as average fluid temperature in the enclosure are presented and discussed in detailed. It is observed that solid volume fraction strongly influenced the fluid flow and heat transfer in the enclosure at the three convective regimes. Moreover, the variation of the average Nusselt number and average fluid temperature in the cavity is linear with the solid volume fraction.

Keyword: Penalty finite element method; Nanofluid; Lid-driven triangular enclosure; Solid volume fraction.