Proceedings of CHT-15
ICHMT International Symposium on Advances in Computational Heat Transfer

May 25-29, 2015, Rutgers University, Piscataway, USA

CHT-15-259

NATURAL CONVECTION FLOWS IN A POROUS NANOFLUID-FILLED TRIANGULAR ENCLOSURE WITH WAVY LEFT WALL

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ABSTRACT The present study numerically analyses the natural convection heat transfer and fluid flow behaviour having nano-fluids in a two-dimensional porous right-angled triangular enclosure having undulation on the left wall. The nano-fluids taken in this study are Cu-water and Al_2O_3-water. Darcy-Forchheimer model is used to simulate the momentum transfer in the porous medium. The stream function-vorticity equations are solved using finite-difference technique. The computations are done on a structured non-orthogonal body fitted mesh. The non-uniform heating of the enclosure has been considered for the study. The results are obtained to analyse the effect of Rayleigh number ($10^3 \leq Ra \leq 10^5$), Darcy number ($10^{-4} \leq Da \leq 10^{-2}$) on the heat transfer and fluid flow. Solid volume fraction parameter ϕ of nanofluids is taken in the range of $0 \leq \phi \leq 0.2$. The results are presented in the form of streamlines, isotherms, local Nusselt number and average Nusselt number. It is found that the effective thermal conductivity of the nanofluid plays a huge role in increasing the heat transfer rate inside the enclosure. It is also observed that the more heat transfer can be achieved by using high thermal conductivity nanoparticles in the base fluid with large solid volume fraction.