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ORIGINAL ARTICLE

Natural convection heat transfer in a nanofluid filled L-shaped enclosure with time-periodic temperature boundary and magnetic field

Khalid B. Saleem [a], **Alia H. Marafie** [b,*], **Khaled Al-Farhany** [c], **Wisam K. Hussam** [d], **Gregory J. Sheard** [e]

[a] *Department of Mechanical Engineering, College of Engineering, University of Basrah, Basrah, Iraq*
[b] *Mechanical Engineering Department, College of Engineering and Petroleum, Kuwait University Sabah Al Salem University City, Kuwait*
[c] *Department of Mechanical Engineering, University of Al-Qadisiyah, Al-Qadisiyah, Iraq*
[d] *School of Engineering, Australian University, Safat, Kuwait*
[e] *Department of Mechanical and Aerospace Engineering, Monash University, VIC 3800, Australia*

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Abstract The natural convective Cu-water nanofluid flow in L-shape cavity with an oscillating temperature profile is studied numerically. The cavity's lower horizontal and left vertical walls are heated sinusoidally with time about a high mean temperature ($\bar{T}_H$). In contrast, the cavity's right vertical wall and its nearby horizontal lower wall are kept cold at a temperature (T_c). The calculations have been performed over temperature oscillation amplitude ($0 \le A \le 2$), dimensionless temperature oscillation frequency ($0 \le f \le 100$), Rayleigh number ($10^3 \le Ra \le 10^8$), Hartmann number ($0 \le Ha \le 100$), the nanoparticles volume fraction ($0 \le \phi \le 0.2$), and enclosure aspect ratios ($0.2 \le AR \le 0.8$). Outcomes reveal that with $AR = 0.2$, heat transfer happens considerably through conduction at $Ra = 10^3$ –10^5, while the time average Nusselt number ($\bar{Nu}$) is independent of both Ha and Ra. Convection effects, on the other hand, become significant at high Ra. Additionally, as Ha ascends from 0 to 50, $\bar{Nu}$ increases linearly with increasing ϕ, while it remains steady at $Ha = 75$ and 100.

1. Introduction

In recent years, the steady/unsteady-state heat transport within various simple/complex shape cavities has been extensively studied. A new review of studies provides a complete overview

* Corresponding author.
E-mail addresses: khalid.saleem@uobasrah.edu.iq (K.B. Saleem), alia.marafie@ku.edu.kw (A.H. Marafie), khaled.alfarhany@qu.edu.iq (K. Al-Farhany), w.alsaadi@au.edu.kw (W.K. Hussam), Greg.Sheard@monash.edu (G.J. Sheard).
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