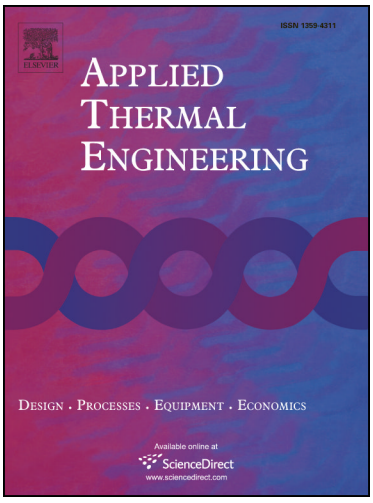

Effects of temperature-dependent properties on natural convection of nanofluids in a partially heated cubic enclosure

Lei Wang, Baochang Shi, Zhenhua Chai

PII: S1359-4311(17)34162-5
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.09.006
Reference: ATE 11063

To appear in: *Applied Thermal Engineering*

Received Date: 20 June 2017
Accepted Date: 2 September 2017

Please cite this article as: L. Wang, B. Shi, Z. Chai, Effects of temperature-dependent properties on natural convection of nanofluids in a partially heated cubic enclosure, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.09.006

Effects of temperature-dependent properties on natural convection of nanofluids in a partially heated cubic enclosure

Lei Wang[a], Baochang Shi[a,b], Zhenhua Chai[a,b,*]

[a] *School of Mathematics and Statistics, Huazhong University of Science and Technology, Wuhan 430074, China*
[b] *Hubei Key Laboratory of Engineering Modeling and Scientific Computing, Huazhong University of Science and Technology, Wuhan 430074, China*

Abstract

In this paper, the effects of temperature-dependent properties on natural convection of nanofluids in a partially heated cubic enclosure are investigated in detail with lattice Boltzmann method. To improve the computational efficiency, all simulations are performed on the Graphics Processing Unit (GPU) using NVIDIA's CUDA. The fluid in the cuibc cavity is a water-based nanofluid containing Al_2O_3 nanoparticles. The effects of thermal Rayleigh number ($10^4 \leq Ra_f \leq 10^6$), diameter of nanoparticle ($25\ nm \leq d_s \leq 100\ nm$), nanoparticle volume fraction ($0.0 \leq \phi \leq 0.04$), temperature of the cooled sidewall ($315\ K \leq T_c \leq 335\ K$), temperature difference between the sidewalls ($10\ K \leq \Delta T \leq 50\ K$), aspect ratio ($0.50 \leq AR \leq 1.00$) and heating location on temperature field and fluid flows are investigated. The results reveal that the average Nusselt number is decreased with the increase of nanoparticle volume fraction. In addition, it is also observed that there is an optimal volume fraction ϕ_{max} at which the maximum heat transfer enhancement is obtained, and the value of ϕ_{max} is found to increase slightly with decreasing the nanoparticle diameter, and to increase remarkably with increasing the temperature of T_c or ΔT. Moreover, we also find that the average Nusselt number and the heat

*Corresponding author
Email address: hustczh@hust.edu.cn (Zhenhua Chai)