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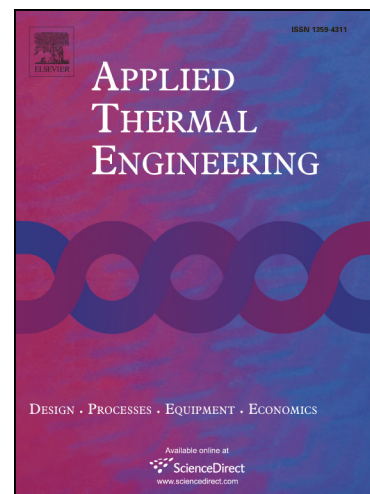
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# Effects of temperature-dependent properties on natural convection of nanofluids in a partially heated cubic enclosure

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## 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 cubic cavity is a water-based nanofluid containing  $\text{Al}_2\text{O}_3$  nanoparticles. The effects of thermal Rayleigh number ( $10^4 \leq Ra_f \leq 10^6$ ), diameter of nanoparticle ( $25 \text{ nm} \leq d_s \leq 100 \text{ nm}$ ), nanoparticle volume fraction ( $0.0 \leq \phi \leq 0.04$ ), temperature of the cooled side-wall ( $315 \text{ K} \leq T_c \leq 335 \text{ K}$ ), temperature difference between the sidewalls ( $10 \text{ K} \leq \Delta T \leq 50 \text{ K}$ ), 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  $\phi_{max}$  at which the maximum heat transfer enhancement is obtained, and the value of  $\phi_{max}$  is found to increase slightly with decreasing the nanoparticle diameter, and to increase remarkably with increasing the temperature of  $T_c$  or  $\Delta T$ . Moreover, we also find that the average Nusselt number and the heat

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