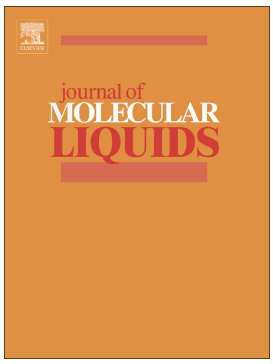

Effects of Lorentz force and induced electrical field on the thermal performance of a magnetic nanofluid-filled cubic cavity

Iman Jelodari, Amir H. Nikseresht

PII: S0167-7322(17)34781-5
DOI: https://doi.org/10.1016/j.molliq.2017.12.143
Reference: MOLLIQ 8439

To appear in: *Journal of Molecular Liquids*

Received date: 9 October 2017
Revised date: 21 December 2017
Accepted date: 28 December 2017

Please cite this article as: Iman Jelodari, Amir H. Nikseresht , Effects of Lorentz force and induced electrical field on the thermal performance of a magnetic nanofluid-filled cubic cavity. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Molliq(2017), https://doi.org/10.1016/j.molliq.2017.12.143

Effects of Lorentz Force and Induced Electrical Field on the Thermal Performance of a Magnetic Nanofluid-Filled Cubic Cavity

Iman Jelodari[1*] and Amir H. Nikseresht[2]

[1] Ph.D. Student, Mechanical and Aerospace Engineering Department, Shiraz University of Technology

[2] Associate Professor, Mechanical and Aerospace Engineering Department, Shiraz University of Technology

[*]Corresponding author, I.Jelodari@sutech.ac.ir

Abstract

In the present study, the effects of Lorentz force and magnetic field-based inductive electrical field on the thermal performance of a cubic cavity filled with a magnetic nanofluid are investigated. Both the three-dimensional governing equations of fluid flow and heat transfer and the governing equations of continuity of electric current density are solved. To validate the developed code and model, the results obtained from the numerical solutions are compared with the results of the relations that govern the magnetic fluid heat transfer and close agreement is found. The effects of other parameters such as the magnetic field imposing direction and power, nanoparticle volume fraction, and Rayleigh number on the Lorentz force are investigated as well. The results show that the imposing direction of the Lorentz force is vertical to the applied magnetic field and is opposite to the nanofluid velocity. The aforementioned force is considerably influenced by the volume fraction of nanoparticles,magnetic field power and nanofluid velocity. The obtained results show that the Lorentz force has no significant effect on the base fluid thermal performance.

Keyword: free convection, magnetic field, Lorentz force, nanofluid, cubic cavity, Nusselt number