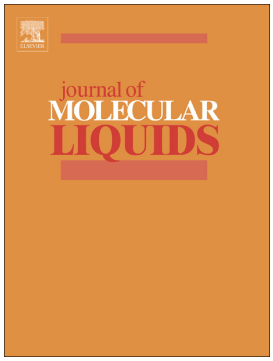

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Tariq Javed, Ziafat Mehmood, Muhammad Arshad Siddiqui, Ioan Pop

PII: S0167-7322(17)30454-3
DOI: doi: 10.1016/j.molliq.2017.05.104
Reference: MOLLIQ 7396

To appear in: *Journal of Molecular Liquids*

Received date: 1 February 2017
Revised date: 13 April 2017
Accepted date: 22 May 2017

Please cite this article as: Tariq Javed, Ziafat Mehmood, Muhammad Arshad Siddiqui, Ioan Pop , Study of heat transfer in water-Cu nanofluid saturated porous medium through two entrapped trapezoidal cavities under the influence of magnetic field, *Journal of Molecular Liquids* (2017), doi: 10.1016/j.molliq.2017.05.104

Study of heat transfer in Water-*Cu* nanofluid saturated porous medium through two entrapped trapezoidal cavities under the influence of magnetic field

Tariq Javed[a], Ziafat Mehmood[a,*], Muhammad Arshad Siddiqui[a] and Ioan Pop[b]

[a]Department of Mathematics and Statistics, FBAS
International Islamic University, Islamabad, 44000, Pakistan
[b]Department of Mathematics, Babeş-Bolyai University, 400084 Cluj-Napoca, Romania
[1]Phone: +92-51-9019511, [*]Email: rajaziafat@yahoo.comtariq_17pk@yahoo.com

Abstract: This manuscript contains numerical investigation of heat transfer by free convection through an enclosure of two trapezoidal cavities full of water-copper nanofluid saturated porous medium when horizontal upper and lower sides are provided uniform heat, inclined boundaries are assumed cold and central horizontal wall is considered insulated perfectly. The momentum equations governing the flow problem are first simplified by using penalty method to eliminate pressure terms using continuity equation and then the reduced momentum equations along with energy equation are solved by the Galerkin weighted residual technique of finite element method. Numerical computations are performed in terms of streamlines, isotherms, Nusselt number and average Nusselt number for various values of pertinent parameters governing the flow like Darcy number, Hartman number, Rayleigh number, Prandtl number, Porosity parameter and solid volume fraction.

It has been noticed that the stream line circulations gets stronger in the enclosure with increase in Rayleigh number and it appears more significantly in lower enclosure in comparison to top enclosure. Whereas isotherms are observed to be broken and distorted for large Rayleigh numbers showing the convection dominant effects in the enclosure. Isotherms deform largely for large value of Darcy number and strength of streamline circulations is noted to increase with increase in Darcy number. Furthermore, local Nusselt numbers for horizontal walls are seen to be maximum at edges and decreases while moving towards centre of the side from corners. Average Nusselt numbers are noted to be increasing function of porosity parameter however it increases along bottom wall and decreases along top wall with increase in Darcy number.

Keywords: Free convection; Finite element method; Cavity flow; Penalty method; Porous medium; Entrapped cavities.

Introduction: Heat transfer through convection has been area of prime interest for young researchers because of its various applications in modern technological devices, industrial processes and geological phenomenas like heat exchangers, condensers, food processing, solidification, melting processes, room ventilators and solar collectors etc.

Extensive work has been carried out in last few decades in the area of convective heat transfer in cavity flows by many researchers including Hossain and Alim [1] who studied free convection inside a trapezoidal cavity under the influence of magnetic field when bottom wall is heated either uniformly or non-uniformly. Considering upper wall insulated, they considered different