Heat Transfer Enhancement for Free Convection Flow of Nanofluids in a Vertical Rectangular Duct Using Darcy-Forchhiemer–Brinkman Model

J.C. Umavathi

Department of Mathematics, Gulbarga University, Gulbarga-585 106, Karnataka, I N D I A

Fax: 08472-253206 Email: jc_uma11@yahoo.com

Keywords Nanofluid, Finite Difference Method, Heat Transfer

Section: Natural and forced convection in porous media

ABSTRACT

In this paper, free convective heat transfer of nanofluids in a vertical rectangular duct filled with porous matrix are numerically investigated. The Darcy-Forchimmer-Brinkman model is used to represent the fluid transport within the porous medium. This investigation covers Grashof number in the range of $1 \le GR \le 25$, Brinknan number in the range of $0 \le BR \le 8$, and Darcy number $0.0001 \le Da \le 100$. Pure water and five different types of nanofluids such as Cu, Diamond, TiO_2, Ag and SiO_2 with a volume fraction range of $0\% \le \phi \le 0.9\%$ are used. The two-dimensional steady, laminar flow and heat transfer governing equations are solved using finite difference method of second order accuracy. It is found that the heat transfer is enhanced using a nanofluid. It is also found that an increase in the Darcy number, Grashof number, Brinkman number and aspect ratio increases the flow and heat transfer whereas inertial parameter and viscosity ratio reduces the flow and heat transfer