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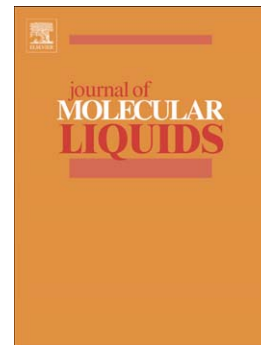
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A.K. Abdul Hakeem, S. Saranya, B. Ganga

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Comparative study on Newtonian/non-Newtonian base fluids with magnetic/non-magnetic nanoparticles over a flat plate with uniform heat flux

A.K. Abdul Hakeem ^{a,*}, S. Saranya ^a, B. Ganga ^b

^a Department of Mathematics, Sri Ramakrishna Mission Vidyalaya
College of Arts and Science, Coimbatore - 641 020, INDIA.

^b Department of Mathematics, Providence College For Women,
Coonoor - 643 104, INDIA.

* corresponding author Email:abdulhakeem6@gmail.com

Tel: +91 9442401998

Abstract

In this study comparison between the magnetohydrodynamic flow and heat transfer of Newtonian/non-Newtonian base fluids with magnetic/non-magnetic nanoparticles is investigated for the first time. To analysis the flow and heat transfer, velocity slip boundary conditions are considered. Water and Sodium alginate is considered as the Newtonian and non-Newtonian base fluids respectively and then magnetite and aluminium oxide as magnetic and non-magnetic nanoparticles are added to it. Similarity transformations are employed to transform the governing partial differential equations into a system of ordinary differential equations. The transformed equations are then solved numerically by means of robust Runge-Kutta method of fourth order with shooting technique. Graphs are presented to demonstrate the effect of several emerging parameters on velocity, temperature profiles along with the local skin friction coefficient and Nusselt number, which clearly describe the flow characteristics. Compared with non-magnetic nanoparticles, magnetic nanoparticles have an increased effect by magnetic field. It is also observed that non-Newtonian based nanofluids have higher skin friction and Nusselt numbers than Newtonian based nanofluids.

Keywords: Newtonian, Non-Newtonian, Magnetic, Non-magnetic, Uniform heat flux.

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