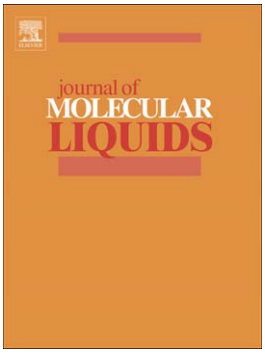

Hydromagnetic peristalsis of water based nanofluids with temperature dependent viscosity: a comparative study

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Hydromagnetic peristalsis of water based nanofluids with temperature dependent viscosity: a comparative study

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Abstract: Variation in effective viscosity of nanofluids with temperature is well admitted now. Peristalsis of nanofluid with temperature dependent viscosity is investigated here. Distinct nanoparticles i.e. Copper (Cu), Silver (Ag), Gold (Au) and iron oxide (Fe_2O_3) along with two models for effective thermal conductivity of nanofluids are used in the analysis. Effects of the Hall and Ohmic heating are also accounted. Resulting nonlinear equations are solved numerically. Physical interpretation of the results is presented. Comparison of results is made for constant and variable viscosity, for different thermal conductivity models and for various nanoparticles. It is reported that the values of velocity, temperature and heat transfer rate reported through Maxwell's model are large when compared with the Hamilton-Crosser's thermal conductivity model. Results indicate that enhanced values of variable viscosity parameter decrease the effective viscosity of nanofluid and hence fluid flows freely. Velocity and temperature of nanofluid increases when variable viscosity parameter is allocated larger values. Further, heat transfer rate at the boundary is large when nanofluid is composed of gold nanoparticles.

Keywords: Peristalsis; nanoparticles; variable viscosity; thermal conductivity models; mixed convection.

1 Introduction

Nanofluids are innovatively engineered materials having countless applications in industry, medicine and technology. These fluids are actually suspensions of nanometer sized metallic particles in orthodox liquids. Suspension of such particles enhances the thermophysical properties (e.g. thermal conductivity, viscosity, density and specific heat) of base fluids [1]. Due to unique chemical and mechanical properties, such fluids are readily being adopted in various industries to facilitate heat transfer process. Nanofluids have applications in biomedical engineering, industrial and domestic cooling, nuclear reactors, automobile and IT industry etc [2, 3]. Subject to such wide utility of nanofluids, various investigators have analyzed such flows under different aspects [4-9]. It is well established fact that viscosity of fluids in