



Numerical Analysis of MHD Hybrid Nanofluid Flow a Porous Stretching Sheet with Thermal Radiation

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Abstract

The current investigation considers the two-dimensional time independent MHD flow and heat transfer of a water-based hybrid nanofluid induced by a stretching sheet of porous medium with first order boundary slip conditions. The Effects of thermal radiation, viscous dissipation, and Joule heating are taken into consideration. For investigation, hybrid nanoparticles of silver (Ag) and alumina (Al_2O_3) are considered along with water (H_2O) as base fluid. Following a suitable similarity transformation, the governing equations are reconstructed as a set of non-linear ordinary differential equations. The equations are solved using the Keller-box numerical technique. The influence of different parameters on the velocity profile and temperature profile are illustrated graphically, whereas its impact on skin-friction coefficient and local Nusselt number are tabulated. From this study, it is concluded that the thermal boundary layer thickness increases with an increase in the radiation and magnetic parameter. Furthermore, it is observed that the speed of the hybrid nanofluid can be controlled by applying a magnetic field, porous media, and enhancing the volume fraction of the nanoparticles. It is found that better results are shown by the use of hybrid nanofluid ($Ag - Al_2O_3/water$) compared to the nanofluids with single nanoparticles ($Ag/water$). An excellent comparison with previously published works is presented in the current article.

Keywords Thermal radiation · Viscous dissipation · Nanofluid · Joule heating · Stretching sheet · Slip effect

List of symbols

c	Constant
x, y	Cartesian coordinates along the surface and normal to it, respectively (m)
u, v	Velocity component along x -axis and y -axis respectively ($m\ s^{-1}$)

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