

Hydromagnetic Mixed Convection Flow of Nanofluid with Slip, Viscous Dissipation and Joule Heating Past an Inclined Plate

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Abstract

A numerical analysis is performed on the combined effects of Joule heating and viscous dissipation on a steady two-dimensional flow of an electrically conducting water-based nanofluid containing three different nanoparticles: copper (Cu), aluminium oxide (Al_2O_3) and Iron Oxide (Fe_3O_4) past an inclined plate comparing both suction and injection. Using a similarity transformation, the governing non-linear partial differential equations are converted into a system of coupled non-linear ordinary differential equations and then solved numerically using shooting technique with a fourth-order Runge-Kutta-Fehlberg integration scheme. Graphical results are presented and the effects of pertinent parameters on the dimensionless velocity and temperature quantitatively discussed. The numerical values of the rate of heat transfer $\theta'(0)$ and the shear stress $f'(0)$ presented in a table. The results show that there are significant effects of the controlling parameters on the flow fields.

Keywords: Hydromagnetic; Inclined Plate; Mixed Convection; Nanofluid; Slip Flow