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Buoyancy induced model for the flow of 36nm alumina-water nanofluid along upper horizontal surface of a paraboloid of revolution with variable thermal conductivity and viscosity.

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Abstract

The motion of nanofluid (water and 36nm alumina nanoparticles) along upper horizontal surface of a paraboloid of revolution in the presence of nonlinear thermal radiation, Lorentz force and space dependent internal heat source within thin boundary layer is investigated theoretically. It is assumed that buoyancy induces the flow over this kind of of surface which is neither a horizontal/vertical nor cone/wedge, hence suitable buoyancy model for this case of fluid flow is presented. The viscosity and thermal conductivity are assumed to vary with volume fraction and suitable models for the case $0\% \leq \phi \leq 0.8\%$ are adopted. The transformed governing equations are solved numerically using Runge-Kutta fourth order along with shooting technique (RK4SM). Good agreement is obtained between the solutions of `RK4SM` and MATLAB `bvp5c` for limiting case. The influence of pertinent parameters are illustrated graphically and discussed. It is found that temperature and velocity functions are maximum at higher values of internal space dependent heat source. Local heat transfer rate is maximum at smaller values of internal space dependent heat source.

Keywords and phrases: Magnetohydrodynamics, Nanofluid, Paraboloid of revolution, Volume fraction, 36nm alumina particles, Variable viscosity, Variable thermal conductivity.

1. Introduction

Any particles in which the magnitude of its size is between 1 nanometer and 100 nanometer is known as nanoparticles. The earliest observation of thermal conductivity enhancement in liquid dispersions of submicronic solid particles (i.e. nanoparticles) was reported by Masuda et al. [1]. Scientifically, dispersions of such nanoparticles in the base fluids (i.e water) is called *nanofluid* by Choi [2]. Since then, the study of nanofluid has attracted the attention of many researchers in view of its various applications. It is now a