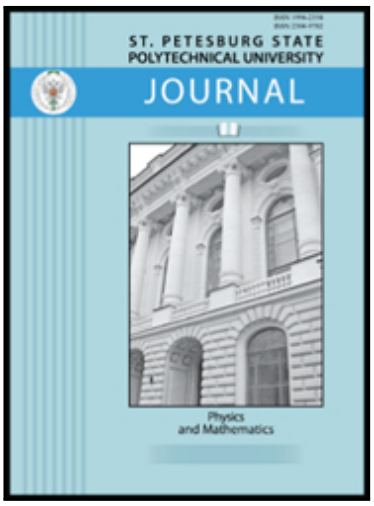

Chemical reaction and thermal radiation effects on boundary layer flow of nanofluid over a wedge with viscous and Ohmic dissipation

Alok Kumar Pandey , Manoj Kumar

PII: S2405-7223(17)30024-5
DOI: 10.1016/j.spjpm.2017.10.008
Reference: SPJPM 165

To appear in: *St. Petersburg Polytechnical University Journal: Physics and Mathematics*

Received date: 9 March 2017
Revised date: 29 July 2017
Accepted date: 10 October 2017

Please cite this article as: Alok Kumar Pandey , Manoj Kumar , Chemical reaction and thermal radiation effects on boundary layer flow of nanofluid over a wedge with viscous and Ohmic dissipation, *St. Petersburg Polytechnical University Journal: Physics and Mathematics* (2017), doi: 10.1016/j.spjpm.2017.10.008

Chemical reaction and thermal radiation effects on boundary layer flow of nanofluid over a wedge with viscous and Ohmic dissipation

Alok Kumar Pandey[a,b,*], Manoj Kumar[b]

[a] Roorkee Institute of Technology, Roorkee, Uttarakhand, 247667, India
[b] G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, 263145, India
Email: mr.alokpandey1@gmail.com, mnj_kumar2004@yahoo.com

Abstract: In this article the influence of thermal radiation on magnetohydrodynamic (MHD) flow of Cu-water nanofluid past a wedge in the occurrence of viscous-Ohmic dissipation and chemical reaction analyzed. The non-linearity numerical approach called RKF 4-5th order have been used with shooting technique to find the results of velocity, temperature and concentration field for several points of employing parameters. The skin friction coefficient, Nusselt number and Sherwood number are examined in details and results are depicted by graphically and tabular way. The outcomes declared that concentration boundary layer width diminishes on escalating the values of chemical reaction parameter and velocity profiles increases as increase in magnetic field parameter.

Keywords: Chemical reaction; Nanofluid; Ohmic dissipation; Thermal radiation; Viscous dissipation.

1. Introduction

Due to the low thermal conductivity, the conventional fluids like as water, ethylene glycol and oil have a restricted cooling performance. Choi [1] illustrated that this restricted cooling performance can be determined by the addition of small amount of high heat transfer performance of nano-solid particles to the traditional fluid to form so-known as nanofluids. Typically, the particles in such nanofluids have dimensions ranging from 1 to 100 nm and take the form of metals, oxides, carbides, nitrides or non-metals. There are several engineering and physical application of heat transfer in nanofluid are such as engine cooling, refrigerator, chiller, microelectronics, fuel cells etc.

Magnetic nanofluid is a magnetic colloidal suspension of carrier liquid and magnetic nanoparticles. The assistance of the magnetic nanofluid is that fluid flow and heat transfer can be managed with the aid of external source, which builds it pertinent to several areas like as aerospace, electronic packing and thermal engineering. In other word, flow behavior sturdily affected due to intensity and orientation of the applied magnetic field. The applied magnetic field influences the suspended particles and reshuffles their concentration within the fluid which convincingly alters the flow characteristics of heat transfer. Alternatively, the study of MHD flow for an electrically conducting fluid flow over a heated wedge surface has lot of significant applications in engineering fields like as nuclear reactors cooling, magnetohydrodynamic power generators, studies of plasma and petroleum engineering. Moreover, magnetohydrodynamic is also obliging to manage the metallurgical processes and boundary layer flow. In few investigations, the influences of MHD flow past a wedge surface due to nanofluid have been analyzed.

Ariel [2] premeditated the magnetic field influence on laminar flow of two dimensional incompressible glutinous fluid impinging normal to the plane. The author analyzed that on increasing the values of Hartmann number, the shear stress rate raises. The effect of suction/injection on two dimensional steady nanofluid MHD flow due to a vertical wedge in the existence of mixed convection and chemical reaction was studied by Ganapathirao et