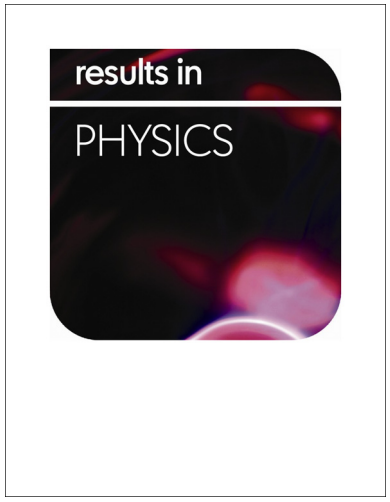

On steady two-dimensional Carreau fluid flow over a wedge in the presence of infinite shear rate viscosity

Masood Khan, Humara Sardar

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On steady two-dimensional Carreau fluid flow over a wedge in the presence of infinite shear rate viscosity

Masood Khan and Humara Sardar [1]
Department of Mathematics, Quaid-i-Azam University, Islamabad 44000, Pakistan

Abstract: This paper investigates the steady two-dimensional flow over a moving/static wedge in a Carreau viscosity model with infinite shear rate viscosity. Additionally, heat transfer analysis is performed. Using suitable transformations, nonlinear partial differential equations are transformed into ordinary differential equations and solved numerically using the Runge-Kutta Fehlberg method coupled with the shooting technique. The effects of various physical parameters on the velocity and temperature distributions are displayed graphically and discussed qualitatively. A comparison with the earlier reported results has been made with an excellent agreement. It is important to note that the increasing values of the wedge angle parameter enhance the fluid velocity while the opposite trend is observed for the temperature field for both shear thinning and thickening fluids. Generally, our results reveal that the velocity and temperature distributions are marginally influenced by the viscosity ratio parameter. Further, it is noted that augmented values of viscosity ratio parameter thin the momentum and thermal boundary layer thickness in shear thickening fluid and reverse is true for shear thinning fluid. Moreover, it is noticed that the velocity in case of moving wedge is higher than static wedge.

Keywords: Static/moving wedge, Carreau viscosity model, heat transfer analysis, numerical computations.

1 Introduction

Quite recently researchers have shown their keen interest in the study of fluid flow across the wedge formed figures. It has a vital importance in the fields of geothermal industries, aerodynamics, enhanced oil recovery, heat exchangers and geothermal systems, etc. Historically, a numerous literature on Falkner and Skan flow over a static wedge can be found in the books of Gersten and Schlichting[1] and Leal [2]. In the last few years, experts have taking much interest in the Falkner-Skan flow by considering the impacts of numerous parameters. The solutions and their dependence on β (the wedge angle) were latterly examined by Hartree [3] . He developed the solutions and velocity profile for different approximations of pressure gradient parameter.

The influence of suction/injection on forced convective wedge flow with uniform heat flux was examined by Yih [4]. His numerical study cast out that the flow separation only happens for the pressure gradient parameter $m = 0$. Ishaq *et al.* [5] discussed the steady 2D magnetohydrodynamic wedge flow of micropolar fluid in the presence of variable wall temperature. The boundary layer flows including variety of non-Newtonian fluids over stretching surfaces have received extensive attention in the literature. Some later works on the boundary layer flow of non-Newtonian fluids are offered in $[6-9]$. However, many fluids are non-Newtonian in their flow features and are suggested as rheological fluid models. Non-Newtonian fluids

[1]Corresponding author E-mail: humarasardar@gmail.com