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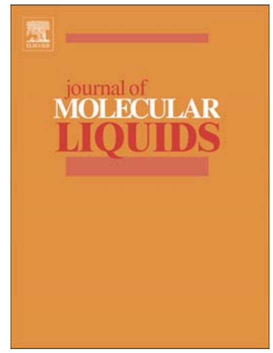

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Axisymmetric flow and heat transfer over an unsteady stretching sheet in power law fluid

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Abstract: An analysis is presented for the unsteady boundary layer flow and heat transfer of power law fluid model over a radially stretching sheet. A uniform magnetic field is applied perpendicular to the direction of the flow. With the aid of new similarity transformations, the governing time dependent nonlinear boundary layer equations are converted into nonlinear ordinary differential equations. The transformed coupled ordinary differential equations are then solved analytically by homotopy analysis method (HAM) and numerically by shooting method. The influence of different parameters like, power law index n, magnetic parameter M, unsteadiness A, suction/injection S, and generalized Prandtl number Pr on velocity and temperature profiles are presented graphically and discussed. It is found that the velocity and the thermal boundary layer thickness are the decreasing function of unsteadiness parameter. The impact of the local skin friction coefficient and local Nusselt number is presented in tabular form.

Keywords: Axisymmetric flow; Power law fluid; Unsteady stretching

1. Introduction

Researchers have extended their studies towards the regime of non-Newtonian fluids and their heat transfer characteristic due to the fact that most non-Newtonian fluids have more profuse industrial and technological applications rather than Newtonian fluids. A number of mathematical models have been proposed to explain the rheological behavior of non-Newtonian fluids. Among these models a model which has been most widely used in chemical engineering process is the power law model. Although this model is merely an empirical relationship between the stress and velocity gradient, it has successfully applied to non-Newtonian fluids experimentally.

Extensive research has been conducted over the past few years on flow and heat transfer of non-Newtonian fluids upon a stretching surfaces due to its tremendous industrial utilization. Rao et al. [1] studied the injection/suction at a moving wall in power law fluid. Degan et al. [2] studied the transient natural convection of non-Newtonian fluids about a vertical surfaces embedded in an anisotropic porous medium. Abel et al. [3] analyzed the flow and heat transfer to a power law fluid over a stretching sheet by considering variable thermal conductivity and heat source. Chen [4] considered the magnetohydrodynamic mixed convection flow and heat transfer of an electrically conducting power law fluid past over a stretching surface in the presence of heat generation/absorption and thermal radiation. Hayat et al. [5] considered the

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