

ARRAY

A PEER REVIEWED EDITED BOOK ON
MATHEMATICAL SCIENCE



Editors

Dulal Baruah

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A Numerical Study For Unsteady MHD Casson Fluid Flow Over a Permeable Stretching Sheet

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Abstract

The goal of this research is to investigate computationally the influence of a heat source and a heat sink on non-Newtonian fluids flowing in a porous medium through a stretching plate under an external magnetic field and viscous dissipation. In our study, Casson is used as a non-Newtonian fluid. Using correct similarity transformations, the governing equations are translated into non-dimensional forms. Furthermore, by using *bvp4c* in the MATLAB software, the numerical outcomes are found. The influence of different significant parameters on the fluid's velocity, temperature, and concentration profiles is analysed using graphical findings. The numerical findings of the rate of heat and mass transfer for various parameters are tabulated.

Keywords: Unsteady flow, Magnetic field, Porous Stretching plate, Casson fluid, Heat source/sink, Viscous dissipation.

1. Introduction

The study of heat and mass transfer through a stretching plate on non-Newtonian fluid has acquired the interest of numerous academics due to its importance in many industrial applications. Non-Newtonian fluids such as chemicals, cosmetics, pharmaceuticals are extensively used in factories. Due to their ampleness applications several engineers and scientists are working on them. This kind of fluid, however, cannot be characterized by a single constitutive relation. There are several non-Newtonian fluid models [1-7] that are proposed, among which Casson is the most popular.

The Casson fluid is a liquid that, at zero rate of shear, has infinite viscosity and has no viscosity at infinite rate of shear [8]. Some examples of Casson fluid include jelly, tomato sauce, and concentrated fruit juices. The human blood is also characterised as Casson fluid.

Casson [9] first proposed this model to predict the behaviour of suspensions of oil pigments in printing inks. Later on, this kind of fluid was studied by several researchers for numerous flow model. Mustafa *et al.* [10] investigated how a Casson fluid flows and transfers heat through a moving flat plate. By analysing the thermal and hydrodynamic slip conditions in a semi-infinite vertical plate, Rao *et al.* [11] investigated the heat transfer property of a Casson fluid past the plate. Qasim and Noreen [12] studied the flow of heat transfer of a Casson fluid past a permeable shrinking sheet by considering the viscous dissipation. The flow of a Casson fluid over a symmetric porous wedge was investigated by Mukhopadhyay and Mandal [13]. A few further Casson fluid efforts may also be found in [14-19]. Using generalized Fick's and Fourier's laws, Sheikh *et al.* [20] developed a fractional Casson fluid model with mass transfer and heat transfer.

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