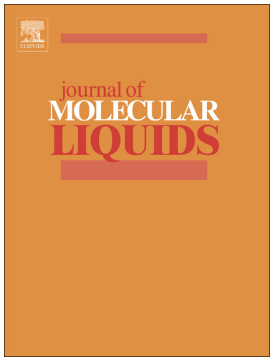


# Rheology of polymeric liquid with heat and mass transfer: Dual numerical solutions

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# Rheology of polymeric liquid with heat and mass transfer: Dual numerical solutions

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**Abstract:** This analysis presents the properties of chemical reaction and internal heat generation/absorption effects in a hydro-magnetic fluid flow. Dynamics of the polymeric type liquid (Maxwell model) are considered in the porous medium in order to analyze the absorbent effects. Energy and concentration equations are utilized to present the heat and mass transfer effects. Shrinking properties of the wall are considered to investigate the permeability and wall mass transfer effects. Mathematical formulations are presented and the set of derived partial differential equations (PDEs) are converted into coupled and nonlinear ordinary differential equations (ODEs) through suitable variables. The simplified mathematical equations are approximated numerically for the solution procedure. It is observed the dual numerical solutions exist for velocity, temperature and concentration profiles for the flow over a shrinking wall whereas only unique solutions exist for the stretching situations. Graphical illustrations are presented in order to show the rheological properties of Deborah number, wall mass transfer, heat generation/absorption, chemical reaction effects etc. Various tables are also constructed to present the dual nature of solutions for the skin friction, local Nusselt and Sherwood numbers.

**Keywords:** Deborah number, polymeric type liquid, chemical reaction, heat source/sink.

# Introduction

In view of academic curiosity and industrial applications, the rheology of non-Newtonian fluids has been given substantial attention is the recent times. The nonlinear relationship between stresses and deformation rate in the non-Newtonian fluid is nonlinear which give rise to more complex dynamical system. Apart from thickening and thinning behavior, various other rheological responses can be seen in the flow of non-Newtonian fluids including normal and tangential stresses, relaxation and retardation time etc. In view of

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