



Implication of Arrhenius Activation Energy and Temperature-Dependent Viscosity on Non-Newtonian Nanomaterial Bio-Convective Flow with Partial Slip

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Abstract

In the era of nano-engineering, the decomposition of nanoparticles with base liquids enhances the thermal performances of such base materials. Owing to the tremendous demand for high thermal performances in industries, the use of nanoparticles becomes more fascinating. In most nanofluid analyses, the thermal inspection of non-Newtonian is based on the assumption of constant viscosity. However, considering viscosity as a function of temperature is more beneficial to improve the transportation of mass and heat transfer phenomenon. This theoretical analysis addresses the narrative role of partial slip and temperature-dependent viscosity in the bioconvection assessment of Maxwell nanofluid confined by a stretched surface. The nonlinear thermal radiation and activation energy applications are encounter as a novel impact. The formulated set of coupled and nonlinear flow problems is numerically presented with proper execution of shooting algorithm. The comparative task for verifications is done against previous investigations with excellent confirmation claim. The graphical exploration because of flow parameters is reported for the nanofluid velocity, temperature, concentration, and microorganisms. The observations are summarized in the conclusion part.

Keywords Maxwell nanofluid · Temperature-dependent viscosity · Bioconvection flow · Activation energy · Numerical method

1 Introduction

Owing to the massive evolution in nano-sciences and thermal engineering, the research on nano-materials becomes a captivating research area, especially in current years. The attention of scientists for exposing the thermal characteristics of nanoparticles is due to their multidisciplinary use in various technological and industrial processes, health sciences, and thermal engineering systems. The essential novel dynamic of such nanoparticles is their extra-ordinary thermal features, which differ from base liquids. The nanoparticles with unique thermal mechanisms offer many applications in energy improvement, cooling of many engineering devices, heating processes, nuclear reactions, emission processes, fission and fusion chemical reactions, medical instruments, etc. The nano-size (1–100 nm), the nanoparticles play a significant role in enhancing the thermal performances in different

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