Significance of Viscous Dissipation on Electrically MHD Eyring-Powell Nanofluid Flow over an Inclined Plate

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1. INTRODUCTION

Nanofluids possess the stable nature and is obtained by adding nanometer sized particles called nanoparticles to the base fluid. These types of fluids have higher thermal conductivity when relatively compared with the base fluid.

Magnetohydrodynamic (MHD) study deals with the fluids that are electrically conducting. Many studies have been made in accordance with this MHD effect. But the present study focuses primarily on electrically MHD fluid flow of Eyring Powell nanofluid. Also, the viscous dissipation effects are taken into consideration. Further Brownian motion and thermophoresis effect were accounted for the present study.

Most of the existing research have considered the flow of Eyring-Powell nanofluids on different geometries as well as with MHD effects, but the inclined plate geometry and electrically MHD have not been considered as of our knowledge. The main focus of the current study is to analyse the impact of the electrically MHD along with the viscous dissipation effect. In the available literature on Eyring Powell nanofluid, Fatunmbi et al. [1] investigated entropy generation on Eyring Powell nanoliquid over a magnetized riga plate with non-linear radiation. Kumar et al. [2] considered heat source/sink in the MHD flow of Eyring Powell fluid and found that there is a converse relationship between velocity and fluid material parameter. Gopal et al.[3] investigated electrically MHD nanofluid flow with higher order chemical reaction and viscous dissipation effect.

2. MATHEMATICAL MODELING

The present work focuses based on the following assumptions.

- The governing equations of electrically MHD Eyring Powell nanofluid flow over an inclined plate with viscous dissipation effect is considered.
- Then, the governing dimensional differential equations are transformed into non-dimensional form. The physical quantity of interests for heat and mass transfer studies was also derived in non-dimensional form.
- Finally, the transformed non dimensional ODE will be solved using the software MATLAB.

3. RESULTS AND HIGHLIGHTS

The fluid flow profiles and heat transfer rate will be obtained using the inbuilt MATLAB function. The results will be discussed by plotting graphs for different pertinent parameters. Some of the findings through this study listed here.

- The influence of Hartmann number in the velocity gradient and temperature gradient shows the effect of conductive heat transfer with the fluid flow velocity.
- An increase in Hartmann number shows that the slowing down of flow induces the heat transfer rate.
- The velocity field shows a steady decrement rate when the fluid parameter is uniformly increased.

The Eyring-Powell nanofluid has wider scope of applications when compared to other nanofluids such as Maxwell, Oldroyd-B and other nanofluids. Due to its vast engineering application, it will be more influential in industries.

REFERENCE

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