Thermal and Concentration Boundary Layer Analysis of Sisko Hybrid Nanofluids on Exponentially Curved Riga Surfaces

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ABSTRACT

This study investigates the heat and mass transfer characteristics of a Sisko hybrid nanofluid composed of iron oxide (Fe_3O_4) and cobalt ferrite ($CoFe_2O_4$) nanoparticles dispersed in a sodium alginate base fluid. The fluid flows over a exponentially curved Riga plate embedded in a porous medium, considering influences such as a heat source/sink and chemical reaction. By transforming the governing partial differential equations into a set of ordinary differential equations through appropriate similarity transformations, the study examines the impact of Biot numbers on temperature and concentration fields. These numbers are crucial for understanding the internal resistance to heat and mass transfer at the interface between the fluid and the curved plate. Numerical solutions are derived using a shooting method and the MATLAB function bvp4c, and the impact of various parameters on velocity, temperature, and concentration fields is thoroughly analysed with the help of graphs. The outcomes underscore the importance of thermal and chemical reaction parameters, as well as the permeability of the porous medium. The present work has significant implications in engineering and industrial fields.

KEYWORD: Sisko fluid; Porous medium; Riga plate; Heat source/sink; Chemical reaction.