Thermal analysis of non-Newtonian fluid flow past a permeable shrinking wedge with magnetohydrodynamic effects: Reiner–Philippoff model

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ABSTRACT

This paper aims to examine the MHD effects on Reiner–Philippoff fluid flow over a permeable shrinking wedge. The partial derivatives of multivariable differential equations are transformed into similarity equations by adopting appropriate similarity transformations. The resulting equations are solved in MATLAB using the bvp4c technique. The findings reveal that the existence of the magnetic field is proven to improve the friction factor and heat transfer performance. Similar effects are observed with the rise of the suction strength. However, increasing the Reiner–Philippoff fluid parameter lowers the heat transfer rate but increases the friction factor. Moreover, the Lorentz force created by the magnetic field essentially slows the fluid motion, thereby delaying the separation of the boundary layer. The dual solutions are established, leading to the stability analysis that supports the first solution's validity.

KEYWORDS

Reiner–Philippoff fluid · MHD · Shrinking wedge · Boundary layer flow · Heat transfer · Dual solutions

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