Submission Summary

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Paper Title

Enhancement of Convective Heat Transfer in Moving Porous Semi-Spherical Fins using Hybrid Nanofluids with Shape-Optimized Nanoparticles in Ethylene Glycol-Water Base Fluid

Abstract

This study investigates the potential of ethylene glycol-water (50%) based hybrid nanofluid with shape-optimized nanoparticles for enhancing convective heat transfer in moving porous semi-spherical fins. In this study, we investigate the impact of nanoparticle structures on thermal performance by incorporating graphene oxide and silver nanoparticles into the base fluid. This departure from traditional hybrid nanofluids introduces new geometries (spherical, blade, and laminar), leading to enhanced thermal conductivity and unique interfacial characteristics. Darcy's model is implemented to analyze the flow and thermal behaviour of the nanofluid within the fin, incorporating temperature-dependent internal heat generation, natural convection, and radiation effects. Governing equations are extracted and transformed into non-linear ordinary differential equations (ODEs) using similarity solution. Numerical solutions are obtained via the 3-stage Lobatto - **III**a formula, enabling systematic investigation of various influential parameters such as thermal conductivity, emissivity, and heat transfer coefficients. Our findings shows that through comprehensive graphical analysis, there are significant improvements in dimensionless temperature facilitated by our unique hybrid nanofluid, showcasing the enhanced efficiency and effectiveness of ethylene glycol-water based hybrid nanofluid. Furthermore, the specific structures of the nanoparticles plays a crucial role, with graphene oxide and silver demonstrating superior thermal performance due to their high aspect ratios and synergistic effects. This study contributes novel insights on the effectiveness of non-conventional base fluids and optimized nanoparticle shapes for improving convective heat transfer in porous fins. The findings hold significant implications for various thermal management applications in various industries, including electronics, energy, and aerospace.

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