World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:19, No:01, 2025

Analyzing Nonsimilar Convective Heat Transfer in Copper/Alumina Nanofluid with Magnetic Field and Thermal Radiations

Authors : Abdulmohsen Alruwaili

Abstract : A partial differential system featuring momentum and energy balance is often used to describe simulations of flow initiation and thermal shifting in boundary layers. The buoyancy force in terms of temperature is factored in the momentum balance equation. Buoyancy force causes the flow quantity to fluctuate along the streamwise direction ; therefore, the problem can be, to our best knowledge, analyzed through nonsimilar modeling. In this analysis, a nonsimilar model is evolved for radiative mixed convection of a magnetized power-law nanoliquid flow on top of a vertical plate installed in a stationary fluid. The upward linear stretching initiated the flow in the vertical direction. Assuming nanofluids are composite of copper (Cu) and alumina (Al_2O_3) nanoparticles, the viscous dissipation in this case is negligible. The nonsimilar system is dealt with analytically by local nonsimilarity (LNS) via numerical algorithm bvp4c. Surface temperature and flow field are shown visually in relation to factors like mixed convection, magnetic field strength, nanoparticle volume fraction, radiation parameters, and Prandtl number. The repercussions of magnetic and mixed convection parameters on the rate of energy transfer and friction coefficient are represented in tabular forms. The results obtained are compared to the published literature. It is found that the existence of nanoparticles significantly improves the temperature profile of considered nanoliquid. It is also observed that when the estimates of the magnetic parameter increase, the velocity profile decreases. Enhancement in nanoparticle concentration and mixed convection parameter improves the velocity profile.

Keywords : nanofluid, power law model, mixed convection, thermal radiation
Conference Title : ICAPDE 2025 : International Conference on Analysis and Partial Differential Equations
Conference Location : Tokyo, Japan
Conference Dates : January 09-10, 2025

Open Science Index, Mathematical and Computational Sciences Vol:19, No:01, 2025 publications.waset.org/abstracts/189314.pdf