Analysis of heat source/sink in a Jeffrey hybrid nanofluid flow over a stretching sheet with an induced magnetic field

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ABSTRACT

Hybrid nanofluids have gained significant attention in advanced heat transfer technologies and heat exchangers due to their superior thermal conductivity and cost-effectiveness compared to monotype nanofluids. This study examines the heat and mass transfer in a Jeffrey hybrid nanofluid's unsteady boundary layer flow over a stretching surface, considering the effects of an induced magnetic field and a heat source/sink. The hybrid nanofluid comprises ethylene glycol (EG) as the base fluid, enriched with titanium dioxide $(\mathrm{TiO_2})$ and copper oxide (CuO) nanoparticles. The governing equations are transformed using similarity transformation into a set of non-linear ordinary differential equations, which are numerically solved using the shooting method combined with the fourth-order Runge-Kutta method. The numerical results for the hybrid nanofluid $(\mathrm{TiO_2} - CuO/EG)$ are presented graphically and thoroughly discussed to analyze the influence of various non-dimensional parameters. For instance, a higher heat source parameter indicates increased heat generation within the boundary layer, resulting in a higher temperature distribution. In contrast, the opposite effect is observed for the heat sink parameter.

Keywords: Heat source/sink, Induced magnetic field, Jeffrey fluid, Shooting method, Stretching sheet.

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