# FORCED CONVECTION FLOW OF SECOND-GRADE HYBRID NANOFLUID PAST A STRETCHING SHEET WITH ALIGNED MAGNETIC FIELD

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# ABSTRACT

The composition of two or more nanoparticles amalgamated in a base fluid, termed hybrid nanofluid, offers greater thermophysical properties than single-nanoparticle-type nanofluid. Second-grade fluid, a subcategory of non-Newtonian fluid, has become an intriguing research topic due to its shear stress-alterable viscosity. The dispersion of $Al_2O_3$ and graphene nanoparticles into second-grade nanofluid substantially improves the thermophysical properties. Hence, this research focuses on forced convection flow of second-grade hybrid nanofluid past a stretching sheet with aligned magnetic field. The similarity transformation variables are used to convert the partial differential equations (PDEs) to ordinary differential equations (ODEs). The resulting ODEs obtained are encoded in the Maple software employing the Runge-Kutta-Fehlberg Fourth Fifth (RKF45) method. The acquired results are validated by comparison with the findings of prior related research. The outcomes are tabulated and graphically presented for skin friction coefficient, temperature profile, and velocity profile over pertinent parameters, namely second-grade, stretching, conjugate, magnetic field, aligned angle, nanoparticle volume fraction, and Prandtl number. The findings reveal that increased hybrid nanoparticle volume fraction, second-grade, magnetic field, and aligned angle parameters reduce velocity profiles and increase temperature profiles. Conversely, an increased stretching parameter raises the velocity profile and lowers the temperature profile. Additionally, larger $Al_2O_3$ and graphene volume fraction increases the skin friction coefficient, while higher second-grade and magnetic field parameters yield the opposite effect.

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