

Title: Non-linear radiative second-grade nano fluid with sinusoidal magnetic force and arrhenius activation energy: A computational exploration

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Abstract: The goal of this work is to further improve our knowledge of the nonlinear radiative second-grade nano fluid flow boundary layer phenomena which is associated with an Arrhenius activation energy, a sinusoidal magnetic field, and a stretched peripheral with a heat source. The unsteady governing equations are transformed into a proper dimensionless arrangement, and then the explicit finite difference (EFD) method is applied to numerically calculate the equations. However, precise stability and convergence criteria have been developed to make the solution convergent. Along with the typical profile of other flow fields, the oscillatory forms of the velocity are shown. Tabular research has even demonstrated a relationship between the Nusselt number and other parameters, and graphical depiction has been used for regression and data prediction. The novel conclusions drawn from this research indicate that, in comparison to linear patterns, nonlinear radiative heat flux significantly raises (30.35 %) flow profiles with second-grade characteristics. Moreover, the heat transfer rates of second-grade Nano fluids are seen to be significantly influenced (35.14 %) by the sinusoidal magnetic component. When considering nonlinear thermal radiation, activation energy principles cause a major change (34.19 % more) in mass transmission, as high-temperature processes become an essential part of chemical reactions.

Keywords: Second-grade fluid, Periodic magnetohydrodynamics (MHD), Nano fluid, Nonlinear radiation, Heat and mass transfer, Arrhenius activation energy

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