

A numerical solution using EFDM for unsteady MHD radiative Casson nanofluid flow over a porous stretching sheet with stability analysis

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Abstract

The present study deals with the heat and mass transfer of the unsteady two-dimensional magneto-hydrodynamics Casson nanofluid flow over a non-linearly stretched porous sheet associated with viscous dissipation, chemical reaction, heat generation, and thermal radiation. After nondimensionalizing the boundary layer governing equations, an explicit finite difference scheme is implemented to solve the equations. To make the numerical approach more reliable, a stability analysis is carried out to establish the efficient convergence criteria ($Le \geq 0.25$ and $Pr \geq 0.373$). The velocity, temperature, and nanoparticle concentration profiles are plotted to investigate the influence of different flow parameters. It is found that the nanofluid motion hastens with the increase in both the Grashof number and the modified Grashof number. It is also noteworthy to observe that increasing thermal radiation enhances the nanofluid temperature, whereas increasing chemical reaction leads to a decrease in nanofluid concentration. The current research shows that there are some important industrial applications for magnetic nanoparticle processing and cooling in the industry. The study finds its importance with the view to increasing the heat and mass transfer efficiency