Exploration of Micropolar Fluid Stratification Flow Over Curved Stretching Sheet under Buoyancy Effect

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Abstract: The current article focuses on the effect of buoyancy on the bioconvective flow of micropolar fluid over a curved stretching sheet under the second-order slip boundary condition. Heat and mass transfer analysis has been produced using double stratification, linear heat sources, joule dissipation, and chemical reaction. The evaluation of entropy generation in the fluid flow is also illustrated. The flow equations are reduced from a system of partial differential equations to a system of ordinary differential equations using similarity transformations and then solved using the numerical technique of the Range-Kutta-Fehlberg fourth-fifth order method. The numerical values obtained are plotted on graphs for velocity, temperature, concentration, and bio-convection profiles with different parameters. The velocity profile exhibits consistent behavior near the buoyancy, with a decrease at the boundary followed by an increase. Notably, the velocity profile experiences a decrease under first-order slip conditions but grows when subjected to second-order slip. Micro-rotation intensifies as the material parameter increases. Conversely, temperature and concentration decline as the stratification parameter rises. Additionally, the concentration of motile microorganisms decreases with increasing Lewis number and Peclet number.

Keywords: Curved stretching sheet; magneto-hydrodynamics; micro-polar fluid; linear heat source; slip flow; bio-convection; buoyancy effect; double stratification; chemical reaction;