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NUMERICAL SOLUTION OF UNSTEADY MICROPOLAR NANOFLUID MODEL OVER EXPONENTIALLY CURVED SURFACE WITH CHEMICAL REACTION USING BVP4C

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ABSTRACT

The purposes of the present study are to investigate the unsteady behaviour caused by a chemical reaction in micropolar nanofluids flowing over exponentially curved surfaces. Micropolar nanofluids exhibit microstructural properties and enhanced thermal characteristics due to the presence of suspended nanoparticles, which promises advantages in industrial heat transfer applications. Based on similarity transformations, the governing partial differential equations (PDEs) for momentum, micropolar, energy, and concentration are derived and reduced into a system of nonlinear ordinary differential equations (ODEs). These ODEs are numerically solved using bvp4c solver in MATLAB, a collocation method for boundary value problems. The output is compared with the results in articles using the shooting method for validation of those obtained with bvp4c. After validating the method, the study would be directed towards evaluating the effect of various physical parameters such as curvature k, unsteadiness β, micropolar K, Prandtl Pr and Schimdt Sc number. The effect of parameters is studied on all four profiles: velocity $f'(\eta)$, micropolar $h(\eta)$, temperature $\theta(\eta)$ and concentration $\phi(\eta)$ profiles. It is found that $f'(\eta)$ increases as the k and K increase, while $h(\eta)$ enhances when β increases but diminishes for K. Curvature parameter k also enhances both $\theta(\eta)$ and $\phi(\eta)$. Pr increases $\theta(\eta)$, however Sc decreases $\phi(\eta)$.

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