Numerical Illustration of Diffusive Flow of Blood-Based Tri-Hybrid Nanofluid generated by Curved Stretching Sheet using Law of Porosity

Abstract

This study explores the effect of trihybrid nanoparticles on the flow characteristics near the stagnation point over a curved stretching surface. The analysis incorporates the Darcy-Forchheimer flow, including Cattaneo-Christov heat flux model, chemical reaction, linear heat source, slip flow, and convective heat as well as mass boundary conditions. The hybrid nanofluids consist of a mixture of titanium dioxide, iron oxide, and silica nanoparticles are mixed with base fluid (blood) to generate TiO_2-Fe_3O_4-SiO_2/blood hybrid nanofluids. The analysis of partial differential equations (PDE) involves employing similarity variables to transform them into simpler ordinary differential equations (ODE). For solving the investigated problem, the Range-Kutta-Fehlberg 4^{th}-5^{th} order technique, a robust numerical technique, was employed to obtain mathematical solutions. Throughout the numerical process, all parameters, except those under examination, were kept at their default values. Additionally, various plots were generated based on numerical results to illustrate the obtained data. The findings indicate that an enhances the Forchheimer number leads to a reduce in the velocity profile. Moreover, the velocity, temperature, and concentration profiles decline with rise in slip flow. The presence of the Forchheimer effect and a magnetic field reduces the friction factor. Furthermore, the Nusselt number is enhanced by higher Brinkman and Prandtl numbers.

Keywords: Curved Stretching Sheet; Trihybrid nanofluids; Cattaneo-Christov heat flux; Chemical reaction; Darcy-Forchheimer law of Porosity; Slip Flow; Convective heat and mass flux.