Numerical Revelations of Tangent Hyperbolic Nanofluid Flow Encompassed by Upright Microchannel

Abstract: The aim of this research is to analyse the non-Newtonian fluid behaviour and entropy by using tangent hyperbolic nanofluid with the effects of thermal radiation and the Hall effect in a vertical microchannel. In addition, tangent hyperbolic nanofluid flow is examined in relation to Brownian motion, thermophoresis, buoyancy, convective and slip conditions. The study has also attempted to investigate chemical reaction during the flow. A simplified set of governing equations is derived by employing appropriate non-dimensional variables. By applying the shooting methodology in conjunction with the Runge-Kutta-Fehlberg method, the solutions for velocity, temperature field, concentration field, and irreversibilities are found. Graphical representations are used to give in-depth explorations of the pertinent factors. The findings reveal that as the magnetic parameter rises, entropy decreases around the boundary while increases within it. Additionally, primary velocity declines, secondary velocity escalates, and the thermal profile rises. Similarly, with an increase in the radiational parameter, both entropy and the Bejan number rises, yet the trend reverses for the thermal profile.

Key Words: Hyperbolic tangent nanofluid; Hall effect; Thermophoresis and Brownian motion; Buoyancy Force; Vertical micro-channel; Magnetohydrodynamic.