Viscous flow over a permeable stretching/shrinking surface in a nanofluid: a stability analysis

ABSTRACT

This study deals with the boundary layer flow and heat transfer near the stagnation point on a permeable stretching/shrinking surface in a nanofluid. The nanoparticles considered in this study are copper and silver. The governing nonlinear partial differential equations are transformed into a system of nonlinear ordinary differential equations using an appropriate similarity transformation which then solved numerically to study the effect of solid volume fraction or nanoparticle volume fraction parameter Φ of the nanofluid. Multiple solutions are found for a certain range of shrinking and suction parameters, therefore, a stability analysis is performed to determine which solution is stable and physically realizable. The effects of the governing parameters on the skin friction coefficient, the local Nusselt number and the velocity and temperature profiles were presented and discussed. It was found that the nanoparticle volume fraction substantially affects the fluid flow and heat transfer characteristics.

Keyword: Boundary layer; Nanofluid; Heat transfer; Stretching/shrinking surface; Dual solution; Stability analysis