Boundary layer flow of a nanofluid and heat transfer over a stretching/shrinking sheet with suction

ABSTRACT

The solution to heat transfer problem due to a stretching/shrinking sheet and the steady two-dimensional boundary layer flow of a nanofluid is discussed thoroughly in this research. The governing partial differential equations are transformed into a system of ordinary differential equations by using a similarity transformation. The similarity equations are then solved numerically for nanoparticles, namely copper, alumina and titania in the base fluid of water with the Prandtl number Pr = 6.2 to investigate the effect of stretching/shrinking sheet parameter λ , nanoparticle volume fraction φ to the flow in nanofluid and heat transfer characteristics. Dual solutions for the temperature distributions and velocity are obtained. With increasing values of nanoparticles volume fraction, the skin friction and the heat transfer coefficient increase as well. It was found that the dual solutions exist in a certain range of the suction parameter for both stretching and shrinking cases and the critical values of viscous fluid ($\varphi = 0$), Sc = 1.999999. The nanoparticle volume fraction parameter φ and the types of nanoparticles play an important role to significantly determine the flow behavior whereby copper is proven to be the best heat transfer nanofluid in comparison to others.

Keyword: Boundary layer; Heat transfer; Nanofluid; Stretching/shrinking sheet; Dual solutions