Stagnation-point flow past a shrinking sheet in a nanofluid.

ABSTRACT

In this paper, the stagnation-point flow and heat transfer towards a shrinking sheet in a nanofluid is considered. The nonlinear system of coupled partial differential equations was transformed and reduced to a nonlinear system of coupled ordinary differential equations, which was solved numerically using the shooting method. Numerical results were obtained for the skin friction coefficient, the local Nusselt number as well as the velocity and temperature profiles for some values of the governing parameters, namely the nanoparticle volume fraction φ, the shrinking parameter $\lambda$and the Prandtl number Pr. Three different types of nanoparticles are considered, namely Cu, Al2O3 and TiO2. It was found that nanoparticles of low thermal conductivity, TiO2, have better enhancement on heat transfer compared to nanoparticles Al2O3 and Cu. For a particular nanoparticle, increasing the volume fraction φ results in an increase of the skin friction coefficient and the heat transfer rate at the surface. It is also found that solutions do not exist for larger shrinking rates and dual solutions exist when $\lambda < -1.0$.

Keyword: Boundary layer, Nanofluid; stagnation-point flow; Shrinking sheet; Dual solutions.