Blasius and Sakiadis problems in nanofluids using Buongiorno model and thermophysical properties of nanoliquids

ABSTRACT

This study aims to investigate the classical problems of boundary layer flow and heat transfer characteristics past a semi-infinite static flat plate (Blasius problem) and past a moving semi-infinite flat plate (Sakiadis problem) in a water-based nanofluid with Prandtl number Pr = 6.2 which containing three different types of nanoparticles, namely Copper (Cu) , Alumina (Al 2O3), and Titania (TiO2). The model used for the nanofluid incorporates the effects of Brownian motion Nb, thermophoresis Nt and solid volume fraction ◖ parameters. The governing partial differential equations are transformed into a system nonlinear ordinary differential equations using a similarity transformation which is then solved numerically. Numerical results are presented in tables or graphs for the skin friction coefficients and local Nusselt number which represents the heat transfer rate at the surface as well as velocity, temperature and nanoparticle volume fraction profiles and the physical aspects are discussed in details. It is found that the Brownian motion, thermophoresis and solid volume fraction affects the fluid flow and heat transfer characteristics.

Keyword: Boundary layer; Heat transfer; Nanofluid; Brownian motion; Thermophoresis