Dual solutions on boundary-layer flow over a moving surface in a flowing nanofluid with second-order slip

ABSTRACT

The steady boundary-layer flow of a nanofluid past a moving semi-infinite flat plate in a uniform free stream in the presence of second order slip is studied using a second order slip flow model. The governing PDE are transformed into non-linear ODE by using appropriate similarity transformations, which are then solved numerically using bvp4c solver for different values of selected parameters. We found that the solutions existed for dual in a certain range of velocity ratio parameter. Therefore, a stability analysis has been analyzed to show which solutions are stable. The effects of velocity ratio parameter, Lewis number, Prandtl number, Brownian motion parameter, thermopherosis parameter, mass suction, first order slip parameter, and second order slip parameter on the skin friction coefficient, heat transfer coefficient, dimensionless velocity, temperature as well as nanoparticle volume fraction profiles are figured out graphically and discussed. These results reveals that the slip parameters expand the range of the solutions obtained. The increment of slip parameters lead to decrease the skin friction coefficient while increase the heat transfer coefficient. In addition, the value of Lewis nmber, Prandtl number, Brownian motion parameter, and thermopherosis parameter are significantly affected the heat transfer coefficient. Lastly, the first solution is stable and physically relevant, while the second solution is not.

Keyword: Stability solution; Moving surface; Nanofluid; Second-order slip; Bvp4c; Brownian motion; Thermophoresis; Lewis number; Prandtl number