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# Stability Analysis of Stagnation-Point Flow past a Shrinking Sheet in a Nanofluid

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**Abstract :** In this paper, a numerical and theoretical study has been performed for the stagnation-point boundary layer flow and heat transfer towards a shrinking sheet in a nanofluid. The mathematical nanofluid model in which the effect of the nanoparticle volume fraction is taken into account is considered. The governing nonlinear partial differential equations are transformed into a system of nonlinear ordinary differential equations using a similarity transformation which is then solved numerically using the function bvp4c from Matlab. Numerical results are 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 $\Phi$, the shrinking parameter $\lambda$ and the Prandtl number Pr. Three different types of nanoparticles are considered, namely Cu, $Al_2O_3$ and $TiO_2$. It is found that solutions do not exist for larger shrinking rates and dual (upper and lower branch) solutions exist when $\lambda < -1.0$. A stability analysis has been performed to show which branch solutions are stable and physically realizable. It is also found that the upper branch solutions are stable while the lower branch solutions are unstable.

**Keywords :** heat transfer, nanofluid, shrinking sheet, stability analysis, stagnation-point flow
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