Stability analysis on magnetohydrodynamic flow of casson fluid over a shrinking sheet with homogeneous-heterogeneous reactions

ABSTRACT

Two-dimensional magnetohydrodynamic (MHD) stagnation point flow of incompressible Casson fluid over a shrinking sheet is studied. In the present study, homogeneous-heterogeneous reactions, suction and slip effects are considered. Similarity variables are introduced to transform the governing partial differential equations into non-linear ordinary differential equations. The transformed equations and boundary conditions are then solved using the bvp4c solver in MATLAB. The local skin friction coefficient is tabulated for different values of suction and shrinking parameters. The profiles for fluid velocity and concentration for various parameters are illustrated. It was found that two solutions were obtained at certain ranges of parameters. Then, the bvp4c solver was used to perform stability analysis on the dual solutions. Based on the results, the first solution was more stable and physically meaningful than the other solution. The skin friction coefficient increased when suction increased, but decreased when the magnitude of shrinking parameter increased. Meanwhile, the velocity and concentration profile increased in the presence of a magnetic field. It is also noted that the higher the strength of the homogeneous-heterogeneous reactions, the lower the concentration of reactants.

Keyword: Stability analysis; Homogeneous-heterogeneous; MHD; Shrinking sheet; Casson fluid