Cu-Al2O3/water hybrid nanofluid stagnation point flow past MHD stretching/shrinking sheet in presence of homogeneous-heterogeneous and convective boundary conditions

ABSTRACT

The intent of this research was to present numerical solutions to homogeneous–heterogeneous reactions of the magnetohydrodynamic (MHD) stagnation point flow of a Cu-Al2O3/water hybrid nanofluid induced by a stretching or shrinking sheet with a convective boundary condition. A proper similarity variable was applied to the system of partial differential equations (PDEs) and converted into a system of ordinary (similarity) differential equations (ODEs). These equations were solved using Matlab's in-built function (bvp4c) for various values of the governing parameters numerically. The present investigation considered the effects of homogeneous–heterogeneous reactions and magnetic field in the hybrid nanofluid flow. It was observed that dual solutions were visible for the shrinking sheet, and an analysis of stability was done to determine the physically realizable in the practice of these solutions. It was also concluded that hybrid nanofluid acts as a cooler for some increasing parameters. The magnetohydrodynamic parameter delayed the boundary layer separation; meanwhile, the nanoparticle volume fraction quickened the separation of the boundary layer that occurred. In addition, the first solution of hybrid nanofluid was found to be stable; meanwhile, the second solution was not stable. This study is therefore valuable for engineers and scientists to get acquainted with the properties of hybrid nanofluid flow, its behavior and the way to predict it.

Keyword: Hybrid nanofluid; Dual solutions; Magnetohydrodynamic; Stability analysis