Hybrid carbon nanotube flow near the stagnation region over a permeable vertical plate with heat generation/absorption

ABSTRACT

This research explored the mixed convection flow past a vertical plate immersed in a hybrid carbon nanotube near the stagnation point. The hybrid carbon nanotube was synthesized by the mixture of two nanoparticles, namely multi-wall (MWCNT) and single-wall (SWCNT) carbon nanotubes immersed in water (base fluid). In addition, attractive aspects of suction/injection and heat generation/absorption effects were incorporated. Similarity variables were used to convert the partial differential equations describing the fluid into ordinary (similarity) differential equations before being solved numerically using Matlab software. The simultaneous impact of several parameters on velocity and temperature profiles, skin friction coefficient, and local Nusselt number were represented with graphs. Dual solutions were observed for some pertinent parameters, which led to stability analysis. This analysis interpreted that merely the first numerical solution is stable. In addition, hybrid nanoparticle, injection effect, and heat-generation parameters led to a decreased range of solutions, whilst the suction effect and heat-absorption parameters acted in the opposite manner. Besides, it is noted that the rate of heat transfer for hybrid carbon nanotube was higher when compared with carbon nanotube and ordinary fluid. Additionally, the heat absorption and buoyancy-assisting flow parameters magnified the heat transfer rate.

Keyword: Hybrid carbon nanotube; Heat generation/absorption; Suction/injection; Dual solution; Stability analysis