Impact of heat generation/absorption on the unsteady magnetohydrodynamic stagnation point flow and heat transfer of nanofluids

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ABSTRACT

Purpose: The purpose of this study is to describe the unsteady three-dimensional magnetohydrodynamic stagnation point flow of nanofluids with heat generation/absorption. Design/methodology/approach: The comprehensive numerical simulations in this study accommodate a physical insight into the heat transfer and flow problem. The use of finite difference method through the bvp4c function in Matlab provides the numerical results and graphical illustrations for the heat transfer rate and shear stress. Findings: Dual solutions are discovered in this study. Thus, stability analysis is implemented and the first solution complies the stability behavior. Silver nanoparticles dominate the highest thermal conductivity. Accretion of the rate of heat transfer is obtained with an increment in the magnitude of heat absorption, suction parameter and nanoparticle volume fraction. A stronger magnetic field and larger unsteadiness parameter contribute to the increase of the surface shear stress. Practical implications: Many practical fluid mechanics problems involve the time-dependent element. Practically, an unsteady flow of nanofluid can be implemented in the micro-manufacturing, periodic heat exchanges process, nano drug delivery system and nuclear reactors. Originality/value: In spite of numerous studies on the unsteady flow, none of the researchers combined the effect of heat generation/absorption and magnetic field in the nanofluid model. The behavior of the flow and heat transfer have been analyzed thoroughly with the variations in the unsteadiness parameter, heat source/sink and nanoparticle volume fraction. Moreover, the discovery of dual solutions in this model strengthens the novelty of this study. Subsequently, the implementation of stability analysis leads to a remarkable revelation where the first solution is found to be stable.

KEYWORDS

Heat generation/absorption; Magnetohydrodynamic; Nanofluid; Stability analysis; Stagnation point flow; Unsteady

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