UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

MIXED CONVECTION STAGNATION POINT FLOW OVER AN EXPONENTIALLY STRETCHING OR SHRINKING VERTICAL SURFACE IN A HYBRID NANOFLUID WITH A SLIP EFFECT

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ABSTRACT

This study is interested in studying the hybrid nanofluid, which has grown significantly in recent years due to its presence in many technological and industrial applications. This study aims to observe the behavior of the governing parameters that contribute to the existence of dual solutions for the problem of mixed convection stagnation point flow over an exponentially stretching or shrinking vertical surface in a hybrid nanofluid with a slip effect towards the flow characteristic and heat transfer. The parameters refer to the nanoparticle volume fraction, slip parameter, mixed convection parameter, and stretching or shrinking parameter. This study focuses on two main phases: problem formulation and numerical analysis. The partial differential equations (PDEs) in governing equations are transformed into the nonlinear ordinary differential equations (ODEs) using similarity transformation due to PDE's complex character. Then, the reduced equations will be solved numerically using the bvp4c solver in the MATLAB software. The results obtained will be compared to the previous literature which is Waini et al. (2020) for validation purposes. The physical quantities of interest are the skin friction coefficient, heat transfer rate, velocity, and temperature profiles. The numerical results will be shown graphically and further discussed. The findings of this study are represented by four different figures which refer to the variation of skin friction coefficient and local Nusselt number with stretching or shrinking parameter for different values of nanoparticle volume fraction of Cu and velocity and temperature profiles for different values of nanoparticle volume fraction of Cu. It is found that by increasing the nanoparticle volume fraction, the skin friction coefficient and heat transfer rate at the surface are increased.

Keywords: Dual solutions, Hybrid nanofluid, Mixed convection, Stagnation point flow, Slip effect