UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

THREE-DIMENSIONAL FLOW OF NANOFLUID OVER A NON-LINEARLY PERMEABLE SHRINKING SHEET BY USING BVP4C METHOD

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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ABSTRACT

This study examines the three-dimensional flow of nanofluids over a non-linear, permeable, shrinking sheet. The goal of this study is to understand the mathematical model, including its parameters, boundary conditions, and equation. First, the governing equation is modelled, and then the similarity transformation approach is used to change the equation from a partial differential equation (PDE) to an ordinary differential equation (ODE). The obtained similarity equations are numerically solved. MATLAB software with the bvp4c approach is used to solve the resulting mathematical model with different values of parameters. The results are displayed as tables and graphs to highlight the impact of the physical parameters. The table was used for comparing with the previous study by Saleh et al. (2020) that used shooting methods, while the graph was used for visualising the research. It has been discussed how the governing parameters affect the local Reynolds numbers in the x and y directions, the velocity profiles, temperature profile, and heat transfer. As a result of the study the skin friction, $f''(0)$ increase and skin friction, $g''(0)$ decrease as linearity constant, β decrease. Furthermore, the velocity profiles of $f'(\eta)$ increase as Prandtl number (Pr) increase. It shows that the boundary layer thickness, η is increase, the graph of velocity profiles, $f'(\eta)$ decrease. The study also resulted that the existent of duality solution for $f'(\eta)$ at $\gamma = -1.0$.

Keywords: Three-dimensional flow, nonlinear, permeable, shrinking sheet, Nanofluids, Similarity equation, partial differential equation (PDE), ordinary differential equations (ODE), bvp4c, dual solution.