UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

UNSTEADY MIXED CONVECTION STAGNATION POINT FLOW OVER A PLATE MOVING ALONG THE DIRECTION OF FLOW IMPINGEMENT USING BVP4C

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ABSTRACT

The study focuses on unsteady mixed convection stagnation point flow over a plate moving along the direction of flow impingement. The purposes of this study are to apply similarity transformation to transform the nonlinear partial differential equation (PDE) into an ordinary differential equation (ODE) and to solve and analyse numerically the unsteady mixed convection stagnation point flow over a plate moving in the flow impingement direction by using the BVP4C method in the MATLAB software. The order of the PDE was chosen by the highest derivative. The methodology was divided into two phases, with the first focused on the examination of unsteady mixed convection flow and the second on numerical analysis utilizing the BVP4C method. The impacts of numerous parameters on heat transfer characteristics such as parameters associated with unsteadiness parameter A, parameter for mixed convection λ, parameter for the plane flow ($m=0$) and axisymmetric flow ($m=1$), Prandtl number $\Pr$, and heat exchange are examined. Similarity transformations are applied to convert the governing nonlinear PDE to an ODE system and solve numerically using the BVP4C approach. The results are then compared with those from previous research to enable the BVP4C technique. The utilization of the BVP4C technique is an effective tool to obtain accurate results and solutions for this research. It highlights the significance of unstable boundary layer flow in engineering and applied science, especially in the industrial sector. In summary, this research provides a comprehensive investigation by employing the BVP4C method. The governing equations are solved numerically, and the effect of multiple variables or parameters is investigated. The graphical findings showed the changes in the heat transfer rate $-\theta'(0)$ and the skin friction coefficient $f''(0)$. The impacts of Prandtl number, $\Pr$ and unsteadiness parameter, A were examined for plane flow ($m=0$) and axisymmetric flow ($m=1$). The analysis revealed the existence of dual solutions for both opposing flow and assisting flow cases.