

**UNIVERSITI TEKNOLOGI MARA**

**MATHEMATICAL MODELLING ON  
MHD FLOW OF A NANOFUID OVER  
A STRETCHING/SHRINKING WALL  
USING BVP4C (P33S23)**

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Report submitted in partial fulfillment  
of the requirements for the degree of  
**Bachelor of Science (Hons.)**  
**(Mathematics)**

**Faculty of Computer and Mathematical Sciences**

**January 2024**

## ABSTRACT

Magnetohydrodynamics (MHD) combined electrostatics and fluid dynamics, introducing fundamental ideas in fluid dynamics such as boundary layer and stagnation point flow. This study was initiated due to an insufficient number of investigations focusing on how MHD flows on nanofluids are affected by stretching/shrinking walls. Additionally, most studies concentrated on hybrid nanofluids in general and did not utilize the BVP4C method to solve the problems in their studies. The objectives of this study were to determine the mathematical model for MHD flow of nanofluids driven by stretching/shrinking walls, to compare the results using BVP4C, and to analyze the obtained numerical solution. To derive the mathematical model, the partial differential equation was transformed into an ordinary differential equation for problem-solving. Numerical results were obtained using BVP4C in MATLAB software. Then, the results of the velocity profile  $f'(\eta)$ , temperature profile  $\theta(\eta)$ , nanofluid concentration profile  $\phi(\eta)$ , skin friction coefficient  $f''(0)$ , heat flux  $-\theta'(0)$  and mass flux  $-\phi'(0)$  were interpreted and discussed. The result shows that as magnetic parameter  $M$  increased,  $f'(\eta)$  also increases. In addition,  $\theta(\eta)$  and  $\phi(\eta)$  increased when thermophoresis parameter  $Nt$  increased. Furthermore,  $f''(0)$ ,  $-\theta'(0)$  and  $-\phi'(0)$  were also increase as constant mass flux  $s$ , Biot number  $Bi$  and Brownian motion parameter  $Nb$  increased respectively. A few recommendations could be implemented for future studies, such as using BVP5C an alternative solver and apply the model for hybrid nanofluid. Future studies could also try to identify the second solution for the problem of this study. In conclusion, BVP4C method produced the same result as shooting method. These affirms the reliability and efficacy of this numerical approach in solving complex problems that were associated with MHD flows of the nanofluid. All in all, it can be concluded that the main objective of the study have been achieved.

## **ACKNOWLEDGEMENT**

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

Firstly, we are grateful to Allah S.W.T for giving us the strength to complete this research successfully.

We would like to express our gratitude to Dr. Siti Hidayah Muhad Saleh for giving us guidance and helping to supervise our work during the year of completion. Also, we would like to thank our MSP660 lecturer, Sir Mohd Azdi Maasar for giving his advice, suggestions, and his willingness to teach us this course.

Not only that, we also would like to express our gratitude to the group members who have been fully committed to taking on their responsibilities and sacrificing their leisure time to make sure the assignment could be completed in time. The project was only possible with the group members' hard work. Finally, a special thank you to our family and friends who gave us unconditional support, motivation, and encouragement throughout our journey in completing the research.

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