

UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

**NUMERICAL SOLUTION FOR UNSTEADY MICROPOLAR FLUID
OVER A PERMEABLE CURVED STRETCHING AND SHRINKING
SURFACE BY USING BVP4C**

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P44M23

**Report submitted in partial fulfillment of the requirement
for the degree of Bachelor of
Science (Hons.) (Mathematics)
College of Computing, Informatics and Media**

AUGUST 2023

ACKNOWLEDGEMENTS

We extend our sincere thanks and heartfelt gratitude to those who have provided unwavering support and guidance, and whose contributions have been instrumental in our success.

First and foremost, we would like to acknowledge the blessings of the Almighty, whose grace and mercy have given us the strength and perseverance to overcome challenges and achieve our goals.

We would also like to express our deepest appreciation to our families, friends, and loved ones, whose unwavering faith in our abilities has been a constant source of motivation and inspiration. Their love and encouragement have emboldened us to strive for greatness.

Our supervisor, Dr. Siti Hidayah binti Muhad Saleh, lecturers, and colleagues have played a pivotal role in shaping our journey. We offer our sincerest gratitude to them for their wisdom, guidance, and support, which has enabled us to navigate the complexities of our pursuits and develop the skills and knowledge necessary for success.

We are also grateful to the institutions, organizations, and benefactors who have provided us with the resources and opportunities to pursue our aspirations. Their generosity has been crucial in enabling us to achieve our goals and reach new heights of excellence.

Finally, we would like to thank all those who have contributed to our success in big or small ways. We remain indebted to each one of you for your support, encouragement, and unwavering commitment to our growth and development.

Once again, we express our deepest gratitude and appreciation to all those who have supported us along the way. Thank you.

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ABSTRACT

This study aimed to analyse the numerical solution for the unsteady flow of a micropolar fluid over a permeable curved surface that stretches and shrinks. The term unsteady denotes that the fluid flow undergoes time-dependent changes, while micropolar fluid refers to a type of fluid that considers microstructural rotations. A permeable curved stretching and shrinking surface refers to a solid boundary over which a fluid flows that allowing the fluid to pass through and having a curved shape with varying curvature, where some regions of the surface expand and others contract during the fluid flow process. The problem of this study is to investigate the behaviour of an unsteady micropolar fluid over a permeable curved stretching and shrinking surface by using BVP4C method. MATLAB was the software that was used to solve the problem. To use MATLAB software, the partial differential equation (PDE) needs to transform into an ordinary differential equation (ODE) using the similarity transformation approach. The resulting mathematical model is solved using MATLAB software with various parameter values. The objective of the study was to convert the governing boundary layer equations into nonlinear ordinary differential equations via similarity transform and BVP4C is used to analyse the numerical solution. The impacts of different parameters on the skin friction and couple stress on the fluid flow were investigated, and these effects were visually depicted through graphical illustrations. The results revealed the existence of dual solutions for different types of surfaces and concentration regimes. As a recommendation for future research, the report proposes investigating the dynamics of an unsteady micropolar fluid over a permeable curved stretching and shrinking surface using alternative methods such as BVP5C. This study discovered multiple solutions for different surface types and concentrations, which enhances the comprehension of the intricate dynamics of unsteady micropolar fluid flow over curved surfaces. Overall, our study provided insights into the complex behaviour of unsteady micropolar fluid flow over curved surfaces and could have practical applications in the design of microfluidic devices and other engineering contexts.