UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

MIXED CONVECTION FLOW OF CARBON NANOTUBES PAST A THIN NEEDLE WITH A CONVECTIVE BOUNDARY CONDITION USING A BVP4C SOLVER

P55S22

NURDINA AQLIMA BINTI YAHAYA (2021190179)

NURUL NAZIHA BINTI MOHD MILATU (2021102125)

RABIATUL ADAWIYAH BINTI MUSTAKIM (202111426)

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

FEBRUARY 2023

ACKNOWLEDGEMENTS

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

Firstly, I am grateful to Allah S.W.T. for giving us the strength to complete this project successfully. Throughout this process, we learned a great deal about ourselves on both an academic and a personality level. Sincere thanks to the holy Prophet Muhammad (Peace be upon him), whose style of life has been a constant source of inspiration for us. We want to express my gratitude to my supervisor, Dr. Siti Nur Alwani Binti Salleh, for her advice, patience, and most importantly, for giving us the motivation that we needed to accomplish this thesis. Having her as our supervisor has been a great joy and honors.

Our deepest gratitude goes to all our family members and to all our colleagues. Without their assistance, support, prayers, and encouragement throughout our academic career. It would not have been feasible to write this thesis. We genuinely appreciate all our dear friends for sticking by our side and supporting each other no matter what. Finally, we also want to thank our beloved lecturers for their help and support in the progress to finish this thesis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The problem of a steady laminar boundary layer flow past a continuously moving thin needle in carbon nanotubes with the presence of mixed convection and convective boundary condition is carried out in this study. Two kinds of base fluids namely, water and kerosene are considered in the flow problem. By adopting the similarity transformation, partial differential equations are transformed into ordinary differential equations. The resulting system of equation is then computed numerically via a bvp4c solver through MATLAB software. The bvp4c solver is one of the effective methods used to solve the boundary value problems in numerical study. The effect of the pertinent parameters namely, Biot number, mixed convection, velocity ratio, nanoparticle volume fraction, needle thickness, Prandtl number and carbon nanotubes on the characteristics of fluid flow and heat transfer are graphically presented and have been discussed further. The present study is validated by comparing the current results with those available in the literature, which are found to be in an excellent agreement. It is revealed from the study that the presence of the convective boundary condition tends to enhance the rate of heat transfer between the fluid and the needle surface. Besides, it is observed that the dual similarity solutions exist when the buoyancy force and the free stream flow are moving in opposite directions.