MAGNETOHYDRODYNAMIC (MHD) BOUNDARY LAYER FLOW PAST OVER A SHRINKING SHEET WITH HEAT TRANSFER

NURIN NATASHA BINTI ISMAIL

Thesis Submitted in Fulfilment of the Requirement for Bachelor of Science (Hons.) Computational Mathematics in the Faculty of Computer and Mathematical Sciences Universiti Teknologi MARA

July 2021

ABSTRACT

The study of shrinking surface with boundary layer theory has become important in recent years due to development in the industrial application. Magnetohydrodynamic boundary layer flow past over a shrinking sheet with heat transfer. The similarity transformation variables are used for transforming the partial differential equations to ordinary differential equation. The Maple software is used for shooting technique with Runge-Kutta-Fehlberg method to obtain the numerical solution. The effect of parameter which are Prandtl number and the magnetic field on the heat transfer characteristics are presented graphically and discussed in detail. At the surface, it is found that the increasing heat transfer rate increases the Prandtl number but decreases the magnetic parameter.

.

ACKNOWLEDGEMENT

First, I am very grateful to Allah SWT. With His grace and goodness, I was able to complete the Final Year Project.

Thank you to my supervisor, Madam Zanariah Binti Mohd Yusof for giving me so much attention, good advice, thoughtful ideas, and guiding me from the start until I can complete this project. I was able to learn new things that were quite challenging with the guidance and support from my supervisor. I was able to complete this project and understand the boundary layer problem which is important research in industrial development. I also appreciate and thank Dr. Nurhaslinda binti Zull Pakkal for her extensive guidance and assistance throughout the completion of the Year End Project.

Lastly, my deepest gratitude to my family who prayed for me and supported me in completing this project. Not forget my friend who helped and shared ideas and information.

TABLE OF CONTENTS

Page

DECLARATION BY THE SUPERVISOR ---------- i

DECLARATION BY THE CANDIDATE ---------- ii

ABSTRACT ---------- iii

ACKNOWLEDGEMENT ---------- iv

TABLE OF CONTENTS ---------- v

LIST OF TABLES ---------- viii

LIST OF FIGURES ---------- viii

LIST OF ABBVIATIONS AND SYMBOL ---------- ix

INTRODUCTION OF RESEARCH ---------- 1

1.1 Introduction ---------- 1

1.2 History of Research ---------- 1

1.3 Research Background ---------- 4

1.4 Problem Statement ---------- 4

1.5 Objectives ---------- 5

1.6 Significance of the Project ---------- 6

1.7 Scope of the Project ---------- 6

1.8 Important Parameter ---------- 6

1.8.1 The Prandtl Number (Pr) ---------- 6

1.8.2 The Reynolds Number (Re) ---------- 7

1.8.3 The Nusselt Number (Nu) ---------- 7

1.8.4 Skin Friction Coefficient (Cf) ---------- 8

1.9 Project Benefits ---------- 8

1.10 Definition of Terms and Concept ---------- 8

1.11 Organization of Report ---------- 9

LITERATURE REVIEW ---------- 10

2.1 Introduction ----------10
2.2 Literature Review----------10
2.2.1 Shrinking Surface ----------10
2.2.2 Heat Transfer----------11
2.2.3 Magnetic Field ----------12
2.3 Conclusion----------13
METHODOLGY----------14
3.1 Introduction ----------14
3.2 Research Step ----------15
3.2.1 Step 1: Topic Selection ----------16
3.2.2 Step 2: Understanding the related governing and boundary condition ----17
3.2.3 Step 3: Introducing New Parameter ----------18
3.2.4 Step 4: Transformations of Partial Differential Equations (PDE) and Ordinary Differential Equations (ODE) ----------18
3.2.5 Step 5: Numerical method----------19
3.2.6 Step 6: Plotting the Graph ----------19
3.2.7 Step 7: Analyse the Result----------21
3.3 Conclusion----------21
IMPLEMENTATION----------**22**
4.1 Introduction ----------22
4.2 Implementation of Method ----------23
4.2.1 Step 1: Topic Selection ----------23
4.2.2 Step 2: Understanding the related governing and boundary condition -----24
4.2.3 Step 3: Introducing New Parameter ----------25
4.2.4 Step 4: Transformations of Partial Differential Equations (PDE) and Ordinary Differential Equations (ODE) ----------27
4.2.4.1 Continuity equation ----------29
4.2.4.2 Momentum equation ----------30