

**Universiti Teknologi MARA**

**Impact of Nanoparticle Shape on  
Aligned MHD Free Convection Flow of  
Hybrid Nanofluid over a Vertical Plate**

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## **STUDENT'S DECLARATION**

I certify that this report and the research to which it refers are the product of my own work and that any ideas or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline.



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## ABSTRACT

Hybrid nanofluid has been known as having a better thermal property in enhancing the heat transfer rate among researchers. In this present study, the impact of nanoparticle shape on free convection flow of hybrid nanofluid with base fluid of water, Copper (Cu) and Aluminium oxide ( $\text{Al}_2\text{O}_3$ ) as the nanoparticles that move through a static vertical plate was investigated and had been solved numerically using Fourth Order Runge Kutta Method via Maple software. The dimensionless ordinary differential equation was derived by reducing the dimensional partial differential equation with similarity transformations. The behaviour of hybrid nanofluid was examined by considering different values of governing parameters which are the shape factor, inclination angle of magnetic field, magnetic interaction, volume fraction of nanoparticles and Grashof number. The effect on velocity and temperature profiles were plotted and analysed, and the numerical value of skin friction and Nusselt number were presented in tabulated form. It was observed that nanoparticle shape factor has a significant impact on hybrid nanofluid. Blade shaped nanoparticle in Cu- $\text{Al}_2\text{O}_3$ /Water hybrid nanofluid produced the maximum velocity and temperature compared to platelets, cylindrical and bricks. The spherical shaped of nanoparticle in Cu- $\text{Al}_2\text{O}_3$ /Water hybrid nanofluid computed the lowest temperature and followed by  $\text{Al}_2\text{O}_3$ /Water nanofluid with spherical shaped nanoparticle. Furthermore, it was found that the skin friction and Nusselt number for Cu- $\text{Al}_2\text{O}_3$ /Water hybrid nanofluid is increased whenever the varied value of governing parameter increased. From this study, it is portrayed that hybrid nanofluid and nanofluid is a good heat transfer and thermal conductivity but with a good selection of nanoparticle shape, an enhancement of hybrid nanofluid can be produced.

**Keywords:** Hybrid nanofluid, Nanoparticle shape factor, Free convection, Vertical plate, Numerical method

## TABLE OF CONTENTS

CONTENTS	PAGE
<b>SUPERVISOR'S APPROVAL</b>	ii
<b>STUDENT'S DECLARATION</b>	iii
<b>ACKNOWLEDGEMENTS</b>	iv
<b>ABSTRACT</b>	v
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF FIGURES</b>	viii
<b>LIST OF TABLES</b>	x
<b>LIST OF ABBREVIATIONS</b>	xi
<b>CHAPTER ONE: INTRODUCTION</b>	
1.1 Background of the Study	1
1.2 Problem Statement	5
1.3 The Objective of the Study	5
1.4 Scope of the Study	6
1.5 Significance of the Study	7
<b>CHAPTER TWO: LITERATURE REVIEW</b>	
2.1 Nanoparticle Shape	8
2.2 Aligned MHD	10
2.3 Free Convection	10
2.4 Hybrid Nanofluid	11
2.5 Numerical Method	12
2.6 Summary	14
<b>CHAPTER THREE: RESEARCH METHODOLOGY</b>	

3.1	Research Methodology Framework	15
3.2	Formulation of Mathematical Model	16
3.2.1	Governing Equation for Fluid Dynamics	17
3.2.2	Dimensionless Governing Equation	20
3.2.3	Skin Friction Coefficient	42
3.2.4	Nusselt Number	44
3.3	Numerical Method	45
3.4	Summary	49

## **CHAPTER FOUR: RESULTS AND DISCUSSIONS**

4.1	Results Analysis	50
4.2	Effect of nanoparticles and hybrid nanoparticles on velocity and temperature profiles with its physical interpretation on skin friction coefficient and Nusselt number	52
4.3	Effect of dimensionless parameters on velocity and temperature profiles with its physical interpretation on skin friction coefficient and Nusselt number	57
4.3.1	Nanoparticle shape factor	58
4.3.2	Inclination angle of magnetic field	62
4.3.3	Interaction of magnetic parameter	65
4.3.4	Volume fraction of nanoparticles	68
4.3.5	Grashof number	71
4.4	Overall Analysis	74

## **CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS**

5.1	Conclusions	76
5.2	Recommendations	79

<b>REFERENCES</b>	<b>80</b>
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