# UNIVERSITI TEKNOLOGI MARA

# THERMOS-PHYSICAL PROPERTIES AND HEAT TRANSFER CHARACTERISTICS OF WATER MWCNT-$FE_3O_4$ BASED HYBRID NANOFLUID AS A COOLANT FOR CAR RADIATOR

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Dissertation submitted in fulfillment
of the requirements for the degree of
**Master of Science in Mechanical Engineering**

**Faculty of Mechanical Engineering**

**July 2019**

# ABSTRACT

Energy management in a car radiator is important to ensure efficient operation of automobile engines. The cooling system of radiator traditionally use water and anti-freezing agent as the coolant fluid that passes through the engine block but they have some limitations due to the fact these medium exhibit relatively low thermal conductivity compared to nanofluid. Therefore, this study aims to analyze the thermo-physical properties of water MWCNT-$Fe_3O_4$ based hybrid nanofluid in car radiators and to study the effect of different operating parameter on the thermal characteristics of the coolant. A flattened tube was simulated in this study. The water based hybrid nanofluid MWCNT-$Fe_3O_4$ was used in this study and the concentrations of the nanofluid were varied at 0%, 0.3%, 0.5% and 0.7%. The ratio of the hybrid implemented was 90:10 of MWCNT and $Fe_3O_4$ respectively. The flow regime is laminar where the Reynold number ranges from 400 to 1000. The highest concentrations of water MWCNT-$Fe_3O_4$ hybrid nanofluid exhibits the most density, thermal conductivity and viscosity properties, meanwhile have the lowest specific heat capacity. Besides that, there were improvements in the heat transfer performance for the hybrid nanofluid compared to water. For example, at Reynold number 600 and inlet temperature 323K, the heat transfer coefficient for water was 1318.937W/$m^2$K while 0.7% concentration of nanofluid is 1324.258W/$m^2$K. The highest heat transfer performance was achieved when using 0.7% concentration of hybrid nanofluid.

# ACKNOWLEDGEMENT

I would like to thank Allah S.W.T for giving me the chance to take part in the Master programme and completing this long journey successfully. My appreciation and thanks go to my supervisor, Dr Ing. Alhassan Salami Tijani for the guidance and advises. His patient and determination in guiding me to succeed is very appreciated.

Special thanks for the Jabatan Perkhidmatan Awam (JPA) for the sponsor during my study because the fee for the MSc is not affordable by me. All the allowances were used for the study. Besides, my gratefulness goes to my colleagues and friends for the assistances to succeed in this project.

Lastly, this thesis is devoted to my beloved family, especially my husband and parents for supporting me through thick and thin. Although the journey of the research was very difficult and required a lot of sacrifice, I have been able to withstand and continue until the end because of them. The responsibility as a mother, wife and student had to be fulfilled at the same time. Alhamdulilah, this victory is achieved with all their help.

# TABLE OF CONTENTS


| | | Page |
|---|---|---|
| **CONFIRMATION BY PANEL OF EXAMINERS** | | **ii** |
| **AUTHOR'S DECLARATION** | | **iii** |
| **ABSTRACT** | | **iv** |
| **ACKNOWLEDGEMENT** | | **v** |
| **TABLE OF CONTENTS** | | **vi** |
| **LIST OF TABLES** | | **viii** |
| **LIST OF FIGURES** | | **ix** |
| **LIST OF SYMBOLS** | | **xi** |
| **LIST OF NOMENCLATURES** | | **xii** |
| **CHAPTER ONE: INTRODUCTION** | | **1** |
| 1.1 | Research Background | 1 |
| 1.2 | Problem Statement | 3 |
| 1.3 | Objectives | 4 |
| 1.4 | Significance of Study | 4 |
| 1.5 | Scope of Work | 5 |
| **CHAPTER TWO: LITERATURE REVIEW** | | **6** |
| 2.1 | Introduction | 6 |
| 2.2 | Car Radiator Studies | 7 |
| 2.3 | Nanofluid | 10 |
| 2.4 | Hybrid Nanofluid | 12 |
| **CHAPTER THREE: RESEARCH METHODOLOGY** | | **19** |
| 3.1 | Introduction | 19 |
| 3.2 | Justification of MWCNT- $Fe_3O_4$ Hybrid Nanofluid | 20 |
| 3.3 | Car Radiator Modelling and Drafting | 21 |
| 3.4 | Simulation | 22 |
| 3.5 | Model Equation for the Hybrid Nanofluid Physical Properties | 27 |

3.6 Model Equation for the Heat Transfer 28

**CHAPTER FOUR: RESULTS AND DISCUSSION ON THE THERMOPHYSICAL PROPERTIES AND HEAT TRANSFER CHARACTERISTICS OF THE HYBRID NANOFLUID 30**

4.1 Validation of Simulation 30

4.2 Grid Independence Test 31

4.3 Hybrid Nanofluid Thermophysical Properties 32

4.4 Heat Transfer Performance of Hybrid Nanofluid 33

4.5 Pressure Drop and Friction Factor of Hybrid in Coolant 37

4.6 Simulation Results 37

**CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS 40**

**REFERENCES 41**

**AUTHOR'S PROFILE 47**