



A COMPARATIVE ANALYSIS OF FUSED DEPOSITION MODELLING MACHINE PERFORMANCE



**BACHELOR OF MECHANICAL MANUFACTURING
ENGINEERING TECHNOLOGY (BMMD) WITH HONOURS**

2022



**Faculty of Mechanical and Manufacturing Engineering
Technology**



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**A COMPARATIVE ANALYSIS OF FUSED DEPOSITION
MODELLING MACHINE PERFORMANCE**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Cheong Yew Ching

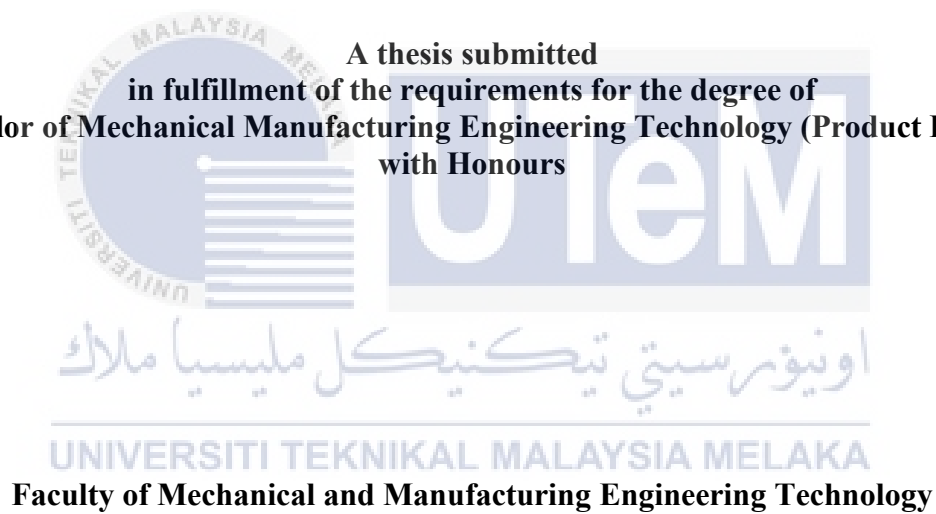
**Bachelor of Mechanical Manufacturing Engineering Technology (Product Design)
with Honours**

2022

**A COMPARATIVE ANALYSIS OF FUSED DEPOSITION MODELLING
MACHINE PERFORMANCE**

Cheong Yew Ching

**A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Mechanical Manufacturing Engineering Technology (Product Design)
with Honours**



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

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TAJUK: **A COMPARATIVE ANALYSIS OF FUSED DEPOSITION MODELLING MACHINE PERFORMANCE**

SESI PENGAJIAN: **2020/21 Semester 1**

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DEDICATION

To my beloved parents, Cheong Fook Choy and Woo Lai Hoe,

To my supervisor, Ts. Dr. Syahrul Azwan Bin Sundi,

To my co-supervisor, Ts. Dr. Hambali Bin Boejang,

To the assistant engineer, Tc. Kamaruddin Bin Abu Bakar,

To the assitant engineer, En Kamaruddin.



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ABSTRACT

The additive manufacturing is one of the technologies that can fabricate or build a part in more efficiency way and at lower costs. The main objective for this project is to repair, upgrade, enhance or modified the BFB 3D Printer by using engineering design (ED) approach. The BFB 3D Touch 3D Printer available in Lab Rapid Prototyping, JTKP, UTeM is currently down for 7 years. The cost to repair the similar type of machine three dimensional printer is high. Therefore, this study is carry out to overcome the challenges. The study is started with formulation by selecting the best design solution. Besides that, the the test model was printed for the analysis of dimensional accuracy and surface finish. The test model is referring from the previous study as a reference. The dimensional accuracy and the surface finish needed to be checked by printing a testing model of the 3D printer comparing to another 3D Printer. The result is not the best and the building time is not the same as actual time because the 3D Printer need more time for heating the nozzle. The BFB 3D Touch Printer is not suitable for doing prototype but suitable for doing studying and demonstration on the studies.



ABSTRAK

Pembuatan aditif adalah salah satu teknologi yang boleh mengarang atau membina bahagian dengan cara yang lebih cekap dan pada kos yang lebih rendah. Objektif utama projek ini adalah untuk membaiki, menaik taraf, meningkatkan atau mengubah suai Pencetak 3D BFB dengan menggunakan pendekatan reka bentuk kejuruteraan (ED). Pencetak 3D Sentuhan BFB 3D yang tersedia di Lab Rapid Prototyping, JTKP, UTeM kini tidak berfungsi selama 7 tahun. Kos untuk membaiki jenis mesin pencetak tiga dimensi yang serupa adalah tinggi. Oleh itu, kajian ini dijalankan untuk mengatasi cabaran tersebut. Kajian dimulakan dengan perumusan dengan memilih penyelesaian reka bentuk yang terbaik. Selain itu, model ujian telah dicetak untuk analisis ketepatan dimensi dan kemas permukaan. Model ujian merujuk daripada kajian lepas sebagai rujukan. Ketepatan dimensi dan kemas permukaan perlu diperiksa dengan mencetak model ujian pencetak 3D berbanding dengan Pencetak 3D yang lain. Hasilnya tidak terbaik dan masa pembinaan tidak sama dengan masa sebenar kerana Pencetak 3D memerlukan lebih masa untuk memanaskan muncung. Pencetak Sentuhan 3D BFB tidak sesuai untuk membuat prototaip tetapi sesuai untuk melakukan kajian dan demonstrasi terhadap kajian.

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ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I would like to thank and praise Allah the Almighty, my Creator, my Sustainer, for everything I received since the beginning of my life. I would like to extend my appreciation to the and Universiti Teknikal Malaysia Melaka (UTeM) for providing the research platform. Thank you also to the Malaysian Ministry of Higher Education (MOHE) for the financial assistance.

My biggest thanks go to my supervisor Ts. Dr. Syahrul Azwan Bin Sundi @ Suandi and my co-supervisor Ts Dr Hambali Bin Boejang, Faculty of Manufacturing and Mechanical Engineering, Universiti Teknikal Malaysia Melaka (UTeM) for all of your support, advice and inspiration. Your constant patience in maintaining and providing invaluable information will be remembered forever. My special thanks go to Assoc Prof. Dr. Lau Kok Tee and Ts. Dr. Norfariza Binti Ab Wahab for all the help and support I have received from them.

Last but not least, I would like to wholeheartedly go to my dear parents, Cheong Fook Choy and Woo Lai Hoe for tour encouragement and for being the pillar of strength in all my endeavors, your patience and understanding have brought me a lot, after all I thank all the people who gave me their help, support and given me inspiration to embark myself the study.

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LIST OF SYMBOLS AND ABBREVIATIONS

D,d	-	Diameter
mm	-	Milimeter
cm	-	Centimeter
°	-	Degree
RP	-	Rapid Prototyping
AM	-	Additive Manufacturing
3D	-	Three-dimensional
2D	-	Two-dimensional
CAD	-	Computer-Aided Design
FDM	-	Fused Deposition Modelling
JTKP	-	Jabatan Teknologi Kejuruteraan Pembuatan
ASCII	-	American Standard Code For Information Interchange
ISO	-	International Organization For Standardization
UV	-	Ultraviolet
STL	-	Standard Triangle Language
CAM	-	Computer-Aided Manufacturing
STEP	-	Standard For The Exchange Of Product Model Data
DDM	-	Direct Digital Manufacturing
PLA	-	Polylactic Acid Or Polylactide
SLA	-	Stereolithography
SLM	-	Selection Laser Melting
SLS	-	Selection Laser Sintering
LOM	-	Laminated Object Manufacturing
FFF	-	Fused Filament Fabrication
ALM	-	Additive Layer Manufacturing
ED	-	Engineering Design
PLA	-	Polylactic Acid
ABS	-	Acrylonitrile Butadiene Styrene
SFF	-	Solid Freedom Fabrication

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter clearly explains about the introduction of the topic. The background explains about the additive manufacturing (AM) and the problem statement is the problem of the 3D Printer that face. Therefore, the objective has been to solve the problem statement. The scope of research is carried out to overcome the objective.

1.2 Background



Additive manufacturing (AM) is the industrial production name for 3D printing, a computer-controlled process that creates three dimensional objects by depositing materials in layers. Additive manufacturing (AM) differs from traditional manufacturing technologies. Rapid prototyping is the technique of fabricating a prototype model from a CAD file. In other words, additive manufacturing is the process, and rapid prototyping is the end result. The development of the technology of rapid prototyping (RP) which uses 3D printing technology makes the design or the product development process become faster. RP functions not only looking the prototype of the product but also looking for the dimensional of the product is fit to a part and how to approved the part. RP is a technique that can be used to create a data computer aided design (CAD) into 3D objects with additive manufacturing or 3D printing technology. There are many types of RP technologies, such as Stereolithography (SLA),

Fused Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Selective Laser Sintering (SLS), and others. Figure 1.1 shows the work of additive manufacturing.



Figure 1.1: The work of additive manufacturing (anonymous, 2022)

1.3 Problem Statement

BFB 3D Touch Printer is a historical printer and it has some problems appear in the machine. There is one Fused Deposition Modelling (FDM) machine in Rapid Prototyping Laboratory, Jabatan Teknologi Kejuruteraan Pembuatan (JTKP), Fakulti Teknologi Kejuruteraan Machanical Pembuatan (FTKMP), UTeM. This machine is not functioning specifically the motion of the platform in z direction is jam and the temperature cannot be heated and its temperature cannot be read. As such, the cost for service is expensive and very difficult to find the spare parts for enhance the 3D printer. The service fee is around RM2000 until RM3000. Therefore, this study is carried out to overcome the challenge in order to reduce the cost for avoiding the purchasing a new machine. For the performance of the 3D printer, the dimensional accuracy and surface finish need to carry out for doing the analysis.

1.4 Research Objective

The objective that needs to be achieved in this case study are:

- To repair, upgrade, enhance or modified the BFB 3D Touch Printer by using the engineering design approach.
- To analyze the dimensional accuracy and surface finish of printed test model.

1.5 Scope of Research

The main scope of this research are as follows:

1. To understand the concept and process of BFB 3D Touch Printer
2. To apply engineering design (ED) process to solve the problem of the BFB 3D Touch Printer.
3. To design the supporter nozzle of the BFB 3D Touch Printer
4. To solve the problem of the z-axis of the BFB 3D Touch Printer
5. To fabricate a test model.
6. To analyze the dimensional accuracy and surface finish.