Faculty of Mechanical and Manufacturing Engineering Technology

STUDY CHAIR'S DESIGN OPTIMIZATION USING DESIGN FOR MANUFACTURE AND ASSEMBLY METHOD (DFMA)

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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Mechanical Engineering Technology with Honours.

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DEDICATION

For my beloved mother, Nor Liza Binti Isa and my father, Mat Daud Bin Deraman also to my big brother Muhammad Danial Aniq Bin Mat Daud.

ABSTRACT

The goal of this project is to show how Design Manufacture and Assembly (DFMA) may be used in the product development process. The study chair is the product chosen for use in the DFMA process in this project. The goal of this research is to minimise the number of study chair components while also examining the materials and techniques used in the manufacturing of the study chair. Furthermore, the DFMA approach was chosen because of its capacity to quantify the labour cost necessary in the manufacturing process. Boothroyd-Dewhurst DFMA software was utilised to make the analysis easier. This software was chosen because it is successful in reducing the number of components in a product and is easy to use for designers. In conclusion, the DFMA is utilised as the foundation for concurrent engineering studies to offer recommendations to product designers. In addition, using the form characteristic in the compatibility chart as a guide, Design for Manufacturing (DFM) was used to select the best method and material. Furthermore, the Design for Assembly (DFA) stage is an important tool for improving product design. Several suggestions have been made to improve the project, including a study of the possibility for geometry interface part or component data to be connected to the software.

ABSTRAK

Matlamat projek ini adalah untuk menunjukkan bagaimana Reka Bentuk Pembuatan dan Pemasangan (DFMA) boleh digunakan dalam proses pembangunan produk. Kerusi kajian adalah produk yang dipilih untuk digunakan dalam proses DFMA dalam projek ini. Matlamat penyelidikan ini adalah untuk meminimumkan bilangan komponen kerusi kajian sambil juga memeriksa bahan dan teknik yang digunakan dalam pembuatan kerusi kajian. Tambahan pula, pendekatan DFMA dipilih kerana keupayaannya untuk mengukur kos buruh yang diperlukan dalam proses pembuatan. Perisian Boothroyd-Dewhurst DFMA telah digunakan untuk menjadikan analisis lebih mudah. Perisian ini dipilih kerana berjaya mengurangkan bilangan komponen dalam produk dan mudah digunakan untuk pereka. Kesimpulannya, DFMA digunakan sebagai asas untuk kajian kejuruteraan serentak untuk menawarkan cadangan kepada pereka produk. Di samping itu, menggunakan ciri borang dalam carta keserasian sebagai panduan, Reka Bentuk untuk Pembuatan (DFM) digunakan untuk memilih kaedah dan bahan terbaik. Tambahan pula, peringkat Reka Bentuk untuk Perhimpunan (DFA) adalah alat penting untuk meningkatkan reka bentuk produk. Beberapa cadangan telah dibuat untuk memperbaiki projek, termasuk kajian kemungkinan bahagian antara muka geometri atau data komponen disambungkan ke perisian.

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Finally, I'd want to show my appreciation to anybody who directly or indirectly contributes to and aids me with my final year project. I'd want to express my gratitude to everyone for their excellent input and recommendations, which were critical to the study's success.

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B

Boothroyd Dewhurst, Inc
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C

cost
(DfC), 21

D

Design for Assembly
(DFA), 14
Design for Manufacture
(DFM), 14
Design for Manufacture and Assemble
(DFMA), 14

I

inspection
(DfI), 21

V

variability
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CHAPTER 1

INTRODUCTION

1.1 Background

DFMA stands for “Design for Manufacture / Manufacturing and Assembly”. DFMA is one of the main design approaches that focusses on ease of manufacture and efficiency of assemble product that meet the customers requirement and easily produce products. Its purpose is to reduce costs and minimum time by simplifying the design of a product it is possible to manufacture and assemble it more efficiently. DFMA combines two methodologies that are Design for Manufacture (DFM) and Design for Assembly (DFA).

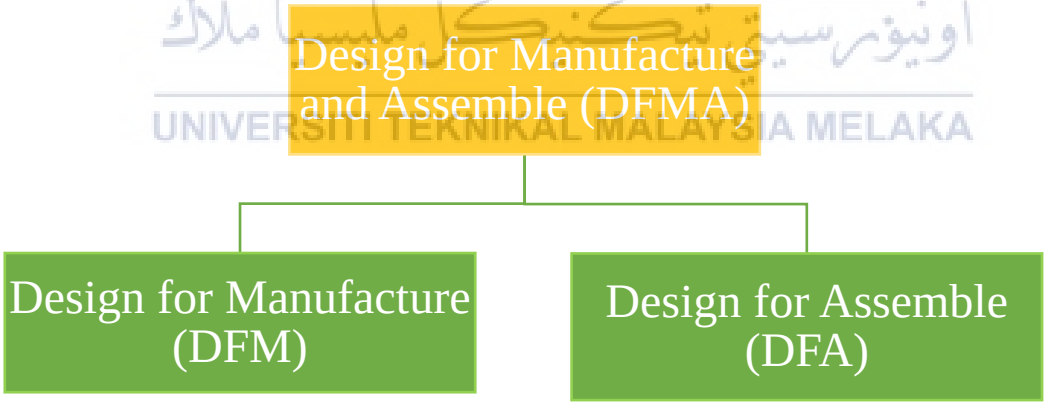


Figure 1.1: Type of DFMA method.

Design for Manufacture (DFM) is considered as design for reduce manufacture process of the collection of parts that will form the product after assembly. Meanwhile, Design for Assembly (DFA) is all about reducing the cost and time to assemble of the parts into a finished product. Technically, DFMA is a systematic design procedure to analyze and quantify product design from the point of view of assembly and manufacture, minimize the cost and time of the production and fulfill customer's requirement.

1.2 Problem Statement

Nowadays, people are more wanting to have something that simple, easy and less costly in their daily requirement. Each study chair has a different design in terms of manufacturing and assembly which is related to the number of parts of a product. Some of study chair designs have many parts such as headrest some of it didn't have headrest. It consists of many a part and takes long time to assemble the product.

For this research the product study chair that has headrest will analyse to make it simple and reduce assemble time. In analyse the study chair, the most important things that need to be concerned is the existing design of the study chair. Besides that, some of the part for study chair can eliminate or reduce some components to make it minimize the assembly time of the study chair.

Therefore, research need to be carried out by using Design for Manufacture and Assemble (DFMA) method to identify the design efficiency of the product so that it could help manufacturer to improve the current study chair design. Manufacturer can improve the product by minimizing and simplifying some of the part and reduce assembly time to get maximum design efficiency of the product.

The DFMA method consists of Boothroyd Dewhurst method that could help to suggest the idle possible way to reduce the part of study chair, as well as the assembly time and the

cost of production. From that, the existing design of the study chair will improve in the after design (redesign) of the study chair.

Figure 1.2: Example type of study chairs.

1.3 Research Objective

The main aim of this research is to redesign the product by reduce the cost of product and time assemble product while maintaining product performance. Specifically, the objectives are as follows:

a) To investigate design of study chair using DFMA method.

b) To optimise study chair design using DFA method for original design and redesign product.

c) To identify the suitable material for redesign and reduce cost manufacturer using DFM method.

1.4 Scope of Research

The scope of this research are as follows:

- To analyze and compare the design efficiency for both current design of the product and the redesign of the study chair.
- To reduce the number of components or parts in the current study chair's using the DFMA procedure without altering their features.
- To estimate the manufacturing cost, it is necessary to give the cost of material, hourly rate for manufacturing and labor cost of study chair.

CHAPTER 2

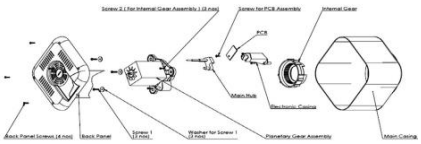
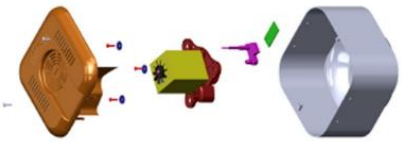
LITERATURE REVIEW

2.1 Introduction

According to research, a complete DFMA analysis assisted in providing a categorised approach to the costs to be infused with each division inside the company. This allows product designers to make the most use of all available resources. As a result, more efficient products at lower costs can be designed, increasing sales. According to Dewhurst et al, early cost estimation in product design is meant to serve as the foundation for design analysis for efficient manufacturing. By lowering the number of pieces in the product and redesigning some elements to minimise the amount of material needed, the DFMA technique may be utilised efficiently to reduce total manufacturing costs. Recent research has also shown that the material selection process might assist product designers in determining which elements of materials are important in their decision. A systematic way to evaluate how effectively a product is designed from an assembly standpoint is called Design for Assembly assessment. A research looks at a framework for automating the DFA assessment technique, which is an important step in creating a concurrent design environment. Assembly sequence creation, assembly features extraction, assembly code and other essential operations generation, data manipulation and computation, and re-design recommendation are the modules required for this. Recent DFMA research have focused on devices such as diesel engines, washing machines, and refrigerators, which have proven to be more successful due to their widespread use in daily life. Another

motivation to include consumer items in the DFMA technology is the large number of products available throughout the world.

2.2 Methodology for Design For Manufacturing and Assembly (DFMA)

Author	Product	Method	Result
• C. D. Naiju • Jayakrishnan Vinod • Pranaw. V. Warrier	Pedestal fan  Existing Pedestal Fan	DFMA for early cost estimation	 Redesigned Pedestal Fan
• Y Ngatillah	Emergency lamp  Product lamp early	DFMA for Product Development	 View of design lamp
• Akshay Harlalka • C. D. Naiju • Mukund Nilakantan Janardhanan • Izabela Nielsen	In-market food processor  Original product of the main processor machine.	DFMA for manufacturing cost reduction	 Redesign main processor machinr.

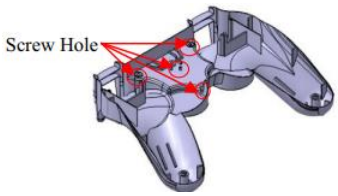
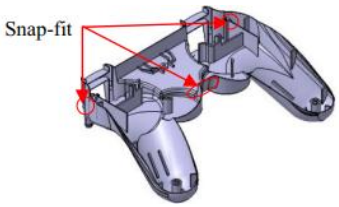
• Nor Nasyitah Mohammad	Joystick  Original joystick design	Compare the design efficiency	 Redesign joystick
• C. D. Naiju, • Pranav. V. Warrier • V. Jayakrishnan	Shopping cart  Existing shopping cart model	Cost reduction using DFMA	 Re-design shopping cart model
• G. F. Batalha	Fuel intake cover  Design before DFMA	Reducing number of parts	 Design after DFMA

Table 2.1: Comparison DFMA method for each product.