

DESIGN AND FABRICATE VISE USING CAD/CAM SYSTEM

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**Thesis Submitted to the Faculty of Mechanical Engineering, Universiti
Teknikal Malaysia Melaka in Partial Fulfillment for the Degree of Mechanical
Engineering (Design and Innovation)**

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APRIL 2007


"I confess that I have read this report and from my observation this report fulfill the term of scope and quality in Fulfillment for the Degree of Mechanical Engineering (Design and Innovation)

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ACKNOWLEDGEMENTS

A great thankful to Allah s.w.t for giving me an opportunity to finish my PSM project as scheduled. I also would like to thank to Universiti Teknikal Malaysia Melaka (UTeM) especially to Faculty of Mechanical Engineering for giving me thrust and opportunity to conduct my PSM research.

I would like to sincerely convey my greatest appreciation to En. Mohd Rizal bin Alkahari as my degree project supervisor for all the coaching and guidance through this year. I pray to Allah for your healthy and happiness in your life. A lot thank is also dedicated to all FKM lecturers especially lecturers from Department of Design and Innovation for their understanding and assistance throughout this project.

Not forgetting heartiest appreciation to my family, especially my beloved parents. Lastly I would like dedicate my thanks to all persons who involve in this research either direct or indirect such as my friends, FKM workshop technicians and others.

ABSTRACT

This project is to improve the vise design by reducing the material used. This project presents an optimization approach as a method to reduce the material used in this design. Factor of Safety is being considered in order to improve this design. In order to analyze the design structure, the Finite Element Analysis (FEA) is used. The Factor of Safety is checked for every design improvement. The standard of Factor of Safety is 3 and above. Because of that, the design size are changed with reduction of material is made and repeated until the Factor of Safety of this design close with the standard Factor of Safety. Other than that, in order to ensure effective clamping of the vise, the material is left at least 5mm from internal diameter of the vise. The improved design is fabricated using CAM system. The CNC program and simulation process are automatically generated and transferred into CNC milling machine in order to produce the final design into real product.

ABSTRAK

Projek ini adalah bertujuan untuk mengubahsuai rekabentuk ragum dengan mengurangkan penggunaan bahan yang digunakan. Projek ini menggunakan pendekatan optimisasi sebagai kaedah untuk mengurangkan bahan yang digunakan dalam rekabentuk ragum ini. Dalam mengubahsuai rekabentuk ragum ini, faktor yang dipertimbangkan ialah 'Factor of Safety'. 'Finite Element Analysis' pula digunakan untuk menganalisis struktur rekabentuk ragum ini. Rekabentuk ragum ini akan diubahsuai berulang kali dan setiap kali diubahsuai, 'Factor of Safety' untuk setiap rekabentuk akan diuji. 'Factor of Safety' yang standard untuk sesuatu rekabentuk produk ialah tiga dan ke atas. Disebabkan itu, saiz rekabentuk ragum ini akan diubah dengan mengurangkan bahan yang digunakan dan ia akan diubah berulang-ulang kali sehingga 'Factor of Safety' menghampiri nilai minimum 'Factor of Safety' yang standard. Selain daripada itu, untuk memastikan keberkesanan ragum yang dihasilkan, lebih saiz atau bahan sebagai toleransi ditinggalkan sekurang-kurangnya 5mm daripada diameter dalaman ragum. Rekabentuk ragum yang telah diubahsuai akan dihasil dengan menggunakan sistem CAM. CNC program dan simulasi akan dihasilkan secara automatik oleh sistem CAM dan akan dipindahkan ke mesin miling CNC untuk menghasilkan produk yang sebenar.

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LIST OF ABBREVIATIONS**SUBSCRIPT****DEFINITION**

CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CNC	Computer Numerical Control
PDS	Product Design Specification
FEA	Finite Element Analysis
1-D	1 dimensional
2-D	2 dimensional
3-D	3 dimensional

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CHAPTER 1

INTRODUCTION

1.0 Introduction of Study

Jig and fixture are important in both traditional manufacturing and modern flexible manufacturing system, which directly affect machining quality, productivity, and cost of the product. The jig or vise are widely used in manufacturing operations to locate and hold a part firmly in position so that the required manufacturing processes can be carried out according to specifications of the design.

In the Faculty of Mechanical Engineering workshop, a simple vise is used to hold the cutter holder when there is a need to change a cutting tool. The current size of this vise is quite big and directly disturbs the technician to running the machine. The size of the existing vise design can be reduced to avoid the problem that occurs on the technician. The other reason to reduce this design size is to reduced material used. The cost of material that used in this design is very expensive. Because of that reason, the project concentrates on redesigning this vise with the material being reduced.

1.1 Objective of Study

There are many objectives of this study. The main objectives of this study are

1. To design the vise using CAD System.
2. To analyze the design structure using Finite Element Analysis (FEA) to reduce size and material.
3. To improve the design with reduce the size and material.
4. To fabricate the improved design using CAM System.

1.2 Study Scope

This research is about to improve the vise and propose a new vise based on existing design. In order to improve this vise, the main factor that considered is material used. The size of the vise was reduced in order to reduce the material used. The analysis on the existing design using Finite Element Analysis will be applied because to know the Factor of Safety of this design.

Result from this analysis is used to reduce the size and material on this vise design. The CAD/CAM system will be used to design, analyze and simulate the design change. The CNC program will be generated used CAM system and this design will fabricate using CNC machine.

1.3 Problem Definition

During redesign new vise, the main factor must to be considered is material selection. This is because the jig must be hard enough to locate and hold a cutter holder firmly in position when changing a cutting tool. To fabricate this vise, the selected material is mild steel. The problem is the cost for the mild steel is increase today. Because of that in redesign this vise, the material that used to fabricate it must be reduced.

1.4 Purpose of Study

This research is to improve the vise that used to hold the cutter holder .This research is also about to fabricate the improved design using CAM system. The consideration factor in improving this design is the material used because of the increasing on the material cost and price. From this study, student can learn about how to use the CAD software, how to optimize the design to reduce the material and how to fabricate the design using CAM system.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Design is the process to create a product or service that fulfills the customer or the marketplace needs. In process to design a product, there are five process must following to get a good final result and meet the satisfying of market and customer. The processes are design brief, product design specification, concept design, detail design, manufacturing and testing and the last process is sales (Paul Hudson n.d.).

There are three main phase stages are involved in the step to design a product. A first stage is design the product. Design stages included recognition of costumer need, definition of problem and data collection. From the result of first stage, the design can came out with some method like sketch, drawing and dimensional drawing using Computer Aided Drawing (CAD).

Second stage in designing product is to analyze the design .The analysis is very useful to know the performance of the product or design. Another benefit of analysis is implementation of optimization can be applied at the design to get a maximum performance of the design. The methods that can use to apply the analysis are finite element analysis, finite different analysis and other method.