



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

A STUDY ON 3D MODELING TECHNIQUE

Thesis submitted in accordance with the partial requirements of the Universiti
Teknikal Malaysia Melaka for the Bachelor of Manufacturing Engineering
(Manufacturing Design)

By

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APPROVAL

This thesis submitted to the senate UTeM and has been accepted as fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design). The members of supervisory committee are as follows:

.....

Supervisor

(Mr. Shajahan B. Maidin)

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ABSTRACT

Research that carried out inside this project is all about 3D modeling technique. This project is involving the research of numerous techniques that being used by student in order to produce 2D shape to 3D model. There are a lot of advantages of CAD (Computer Aided Design) discovered such as plan view, side view and front view can easily being generated. Beside that, the generated 3D model can also useful for other automated process such as CAM (Computer Aided Machining) as well as CAE (Computer Aided Engineering). This project is also important in finding factors that affected the 3D modeling skills of UTeM students. The weaknesses of the students have been discovered and the best method for producing the effective 3D modeling techniques has also being introduced. All the problems were identified by performing several tests and questionnaire to the students. The result obtained from this project has let us know the level of skills for the undergraduate students and some suggestion and recommendation for further improvements had been introduced.

ABSTRAK

Kajian yang dijalankan di dalam tesis ini adalah berkenaan teknik permodelan 3 dimensi. Projek ini melibatkan kajian terhadap teknik-teknik yang digunakan oleh para pelajar dalam menghasilkan bentuk-bentuk dari 2 dimensi sehinggalah ke bentuk 3 dimensi. Disini didapati bahawa terdapat banyak kelebihan dalam CAD dimana setiap pandangan pada sesuatu objek 3 dimensi dapat diperolehi serentak (pandangan atas, pandangan sisi dan pandangan hadapan). Disamping itu model 3 dimensi yang terhasil dapat digunakan terus untuk proses-proses lain seperti CAM (Permesinan terbantu computer) dan CAE (Analisis Kejuruteraan Terbantu Komputer). Projek ini adalah penting bagi mengkaji factor-faktor yang mempengaruhi teknik permodelan 3 dimensi bagi pelajar UTeM. Projek ini dapat mengenalpasti kelemahan-kelemahan pelajar dalam proses permodelan bentuk 3 dimensi dan seterusnya memperkenalkan kaedah terbaik bagi menghasilkan teknik permodelan yang efektif. Permasalahan-permasalahan ini telah dikenalpasti melalui ujian-ujian serta borang kaji selidik yang telah dijawab oleh para pelajar. Hasil yang diperolehi daripada projek ini telah mendedahkan tahap kemahiran pelajar dan cadangan untuk penambahbaikan telah diperkenalkan.

DEDICATION

For my beloved father, mother and family and also to my friends
especially to Mr. Mohd Izhar Bin Harun

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LIST OF ABBREVIATIONS

CAD	-	Computer Aided Design
CATIA	-	Computer Aided Three dimensional Interactive Application
2D	-	2 Dimensional
3D	-	3Dimensional
CAM	-	Computer Aided Manufacturing
CAE	-	Computer Aided Engineering
Pro-E	-	Pro/Engineer

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Manufacturing Engineering Faculty is one of the several faculties in UTeM. This faculty has five main programmed such as Manufacturing Design, Manufacturing Process and System, Robotic and Automation, Engineering Material and the last one is Manufacturing Management.

Manufacturing Design course focuses on design and manufacturing processes by using modern CAD tools as well as can. Students with strong manufacturing engineering background will be further exposed to techniques and approaches in design for manufacturing and assembly. The skills will help them in designing products and cost-effective system with high quality as well as environmentally safe. All student in this course had exposed to the design field since they are in year one. They had to take Graphic Engineering and CAD subject in year one then to improve their skill and the ability to be a creative person. UTeM also has offered several subjects that need student to create a new design or improve any existing design to fulfill the requirement for that subject.

CAD is a short form for Computer-Aided Design [1]. It is a technology concerned with the use of computer system to perform certain functions in design and production. This technology is moving in the direction of greater integration of design and manufacturing. Ultimately, CAD will provide the technology base for the computer-integrated factory in the future.

All UTeM students will learn about basic CAD which is AutoCAD in year one. After that, for Design student they will continue to be taught advance CAD software which

is Solidworks in year two and lastly CATIA software in year four. AutoCAD is a 2D drawing and CATIA or Solidworks software is for 3D drawing. However nowadays AutoCAD software has been upgraded with 3D features.

2D or 2 Dimensional drawing is the drawing that only be drawn on top of a plane which is in 2 axis. 3D drawing is the drawing that exist in 3 axis and the fully object can be seen in 3D mode by using isometric view. The advantages of generating 3D drawing is students or designer can save their time in designing process where plan, front and side view can be obtained in the same time.

People that involve in designing will familiar with acquiring information from three-dimensional (3D) shape objects. This information will be transmitted more rapidly and more efficiently by using visual expression of the objects to be presented. In order to visualize some information in computer system, internal representation or in other word is modeling would be added to make it easily manipulated by computer.

Solid modeling is actually describing 3D geometry and topology of an object in computer system. This refers to an internal representation of an object in 3D space. The operating involved are insertion, deletion and modification on an object [19].

This project intends to use CAD system to access and discover student's 3D modeling technique so that improvement on their designing and modeling abilities can be addressed. An exercise will be provided and their modeling technique will be attained. It's also trying to identify any related issues that influenced the designing complexity and conclude the results in a contingency model which can be used by others students in designing.

1.2 PROBLEM STATEMENT

The area of this project is about the capability of the final year design student in designing by using CAD software. The ability of the students to respond quickly and effectively to design and technical changes rests on students being competent in the procedure of utilizing computer aided systems efficiently. Students exposed to the present day computer-based graphics are exercising various techniques and principles for solving 3D modeling or designing problems. This defiance in applying various basic principles and techniques of 3D mechanical modeling needs to be addressed. Better and systematic modeling strategies serve to reduce time of designing. The aim of this study was to investigate the extent to which Manufacturing Design Engineering program students acquire and retain 3D modeling strategy following a 3D modeling course. An exercise for designing a 3D model will be used and assessment on their modeling strategy will be made.

1.3 OBJECTIVE

1. To study and analyze the 3D modeling techniques and skill of students
2. To study and analyze the types of tools used in 3D modeling
3. To study factors that affected the modeling techniques
4. To develop and propose a contingency model for 3D modeling technique

1.4 SCOPE

This report entitled A Study On 3D Modeling Technique will use CAD software to accomplish this project. It focuses on 4th year design student in their skill in 3D modeling technique. This project is about how the student model part given by using CAD software. It starts with the sketching in 2D and then continues with the 3D parametric modeling. Then it will come out with the comparison on the design process, the method they used and also to propose a best way for modeling technique in design.

1.5 IMPORTANCE OF THE PROJECT

The importance or the key point of the project is about a 3D modeling technique for design students. This project needs to find out the capability of student in design and also their modeling skill. Identify which methods are easier for student to draw and also studied about the common method that use by student in designing process. All the data collected will be used for analysis to develop and propose the best method in designing. It may reduce design process time and also to improve the quality and productivity of design students.

1.6 ORGANISATION OF THE REPORT

In chapter one it will consist manufacturing engineering faculty background. The course provides and the focus in this chapter is on the Manufacturing Design course. In this chapter also have the explanation about the term of CAD/CAM, the problem statement of the research and the objective of this case study. To make it clearly it also contains the boarder or the limitation of the research and also the meaning of the research title.

Chapter two will cover the literature review of the report. It consist the previous research or article that relevant with this research. It also provides all the definition or function of the method that use in the research.

Chapter three is the methodology. This chapter will cover about the way that will chosen and use in the research. The other sides are the explanation of how to solve the problem and what method that use to help or to show the result.

Chapter four is the testing method. This chapter will cover about the testing that had used in this project. There are about two test and one questionnaire session that had been used to obtain the result.

Chapter five is the result from this project. This chapter will cover the analysis from testing method and questionnaire session.

Chapter six is the discussion. It will discuss the result and the analysis that had been obtained in the chapter five.

Chapter seven is the suggestion and recommendation to improve the findings of this project in the future. Chapter eight is the conclusion for the whole project.

Table 1.6.1 and table 1.6.2 below is the Gantt chart for the PSM 1 and PSM 2. Both Gantt chart are about the planning that will be done in the project, it also contain the aimed time to complete the plan.

Table 1.6.1: Gantt chart PSM 1

ACTIVITY	WEEK													
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
PSM Title find title choose title														
Find information - 3D modeling 3D part Software of 3D														
Object Find and choose object for the assessment														
Survey -Gather final year student to draw the object														
Documentation for draft report														
Submit the report														

Table 1.6.2: Gantt chart PSM 2

ACTIVITY	WEEK													
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Methodology - Discuss the new methodology														
- Work out with the drawing for 3D														
-Choose student to draw the object - use chart for the result														
-Do the questionnaire -produce graph for the result														
Documentation for report														
Submit the report														

CHAPTER 2

LITERATURE REVIEW

2.1 HISTORY OF CAD

In the late 1970s, the pressure to introduce product to the market in a faster way became more demanding and the desire to reduce lead times led to the discovery of Design for Manufacture (DFM). At the early stage of DFM implementation in manufacturing industry, Manufacturing Engineer were involve from the beginning in the design phase by giving suggestion to improve manufacturability, then it followed by the designer that was trained to have awareness on manufacturability aspects during the design process. A guideline was produced to assist designer in the design phase to produce design that can be manufactured without any manufacturability problems. When the computer technology became more advance, CAD tools was introduced into manufacturing industry to help designer to design product easily and this help to increase productivity and reduce time consuming in the design iteration itself [9].

Three-dimensional models are one of the terms in CAD. It is increasingly used in various areas of manufacturing, research and education. Mechanical parts represent an important fraction of various products widely used in our society. Fierce competition demands a permanent increase in productivity and faster response to design and technical change on products. This has led to widespread use of computer aided design software. Students exposed to the present day computer-based graphics modeling are exercising various techniques and principles for solving 3D mechanical modeling so better and systematic modeling strategies needs to be addressed to reduce time of designing [6].

2.2 INTRODUCTION TO MODELING TOOLS

25 years ago, nearly every drawing produced in the world was done with pencil or ink on paper. Minor changes meant erasing and redrawing while major changes often meant recreating the drawing from the scratch. If a change to one drawing affected other documents you were dependent upon having someone manually recognize the need to make the changes to the other drawings and to do so. CAD has fundamentally changed the way design is done [10].

CAD or computer-aided design is a combination system of hardware and software that enables engineers and architects to design everything from furniture to airplanes. In addition to the software, CAD systems require a high-quality graphics monitor; a mouse, keyboard, or digitizing tablet for drawing; and a special printer or plotter for printing design specifications [1].

CAD systems allow an engineer to view a design from any angle with the push of a button and to zoom in or out for close-ups and long-distance views. In addition, the computer keeps track of design dependencies so that when the engineer changes one value, all other values that depend on it are automatically changed accordingly.

Until the mid 1980s, all CAD systems were specially constructed computers [2]. In Computer Aided Design (CAD), Solid model of the product needs to be created. Parametric based solid model is an ideal basis for conducting design. The basic role of CAD is to precisely define the geometry of a design where it is critical to all subsequent activities in the product cycle development. Solid modeling has focused on modeling objects to capture their shape or geometry inclusive of related topological aspects. Solid modeling has been used in mechanical engineering, design analysis and manufacturing where the geometry information present in the solid models is utilized and processed for various proposes as an example to compute material characteristic and performance parameters in CAE application [8].

The rapid development of CAD has become the driving force for research and development in Concurrent Engineering is to develop an intelligent CAD system, the task is performed by Automated Manufacturability Analysis. Automated Manufacturability Analysis is a process which involves analyzing the design for potential manufacturability problems and assessing its manufacturing cost [9].

Listed below are the advantages of CAD [10].

- Precise
- 3D detailed drawing
- Computerized model to scale
- Test without having to produce it
- Drawings are device independent
- can resize easily by using calculation
- More economical and efficient
- Smaller files than bitmapped images
- Easier to see the characteristics
- can see the image in animation to get the feeling of it without having to build it

The different in CAD software is either it 2D or 3D. 3D Systems in any CAD software is a leading provider of 3-D Modeling, Rapid Prototyping and Manufacturing solutions. Its systems and materials reduce the time and cost of designing products and facilitate direct and indirect manufacturing by creating actual parts directly from digital input. These solutions are used for design communication and prototyping as well as for production of functional end-use parts [12]. Table 2.2.1 below is some of the typical CAD/CAM/CAE software. It contains the software and the system that use in CAD/CAM/CAE.