DIRECT MODELLING CAD STUDY FOR PRODUCT DEVELOPMENT PROCESS

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DIRECT MODELLING CAD STUDY FOR PRODUCT DEVELOPMENT PROCESS

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Manufacturing Engineering Technology (Product Design) Hons.

by

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APPROVAL

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……

(Mohd Qadafie bin Ibrahim)

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ABSTRAK

Pemodelan langsung adalah sistem CAD yang membolehkan jurutera untuk bekerjasama secara langsung dengan geometri model yang bermakna mereka boleh mengawal ia dengan menolak, menarik, atau berpusing. Berbeza dengan model parametrik, di mana ia adalah hasil geometri ini perlu dibuat ke dalam langkah-langkah untuk menjana model akhir, pemodelan langsung membenarkan geometri ciri itu diubah tanpa perlu mengedit peringkat model interim. Ia juga merupakan teknologi yang memberi penekanan kepada untuk menggugurkan isu-isu kekangan dibuat oleh teknologi model parametrik. Oleh itu, kajian ini adalah kira-kira membandingkan hasil model parametrik dan model langsung dengan mengira klik butang tetikus untuk membuktikan kemudahan dan kelonggaran entiti model langsung manakala model parametrik menjadi penanda aras di seluruh kajian projek ini. Pemodelan langsung terbukti lebih baik daripada model parametrik yang dilengkapi dengan ciri pokok sejarah.

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ABSTRACT

Direct modelling is a CAD system that enables engineers to collaborate directly with the model geometry which means they can control it by pushing, pulling, or twisting. Contrasting with the parametric modelling, where the final geometry of the feature's has to be made into the steps that generate the final model, direct modelling permits the feature geometry to be altered without having to edit the interim model stages. It is also a technology that emphasis on to drop the constraint issues made by the parametric modelling technology. Therefore, the study is about comparing result of parametric modelling and direct modelling by counting clicking mouse button to prove the easiness and leniency of the direct modelling while parametric modelling becoming the benchmark throughout this project study. Direct modelling is proven to in advance apart from the parametric modelling that embedded with the history tree feature.

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DEDICATION

I love to bestow my dedication of this thesis for,
First and foremost,
My Lord, Allah S.W.T the Most Gracious and the Most Merciful,
Messenger of Allah S.W.T, Muhammad S.A.W,
My beloved parents, Abdul Mutalib and Norhayati,
Thoughtful siblings, Aishah and Amiruddin,
Supportive Supervisor, Mr Mohd Qadafie bin Ibrahim,
Respected lecturers of Faculty of Engineering Technology (FTK),
Fellow friends that lend hands and gave words of encouragement,
And the thesis reader.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CAD	-	Computer Aided Design
CAD/CAM	-	Computer Aided Design /Computer Aided Manufacturing
CPU	-	Central Processing Unit
PDD	-	Product Design and Development
I/O	-	Input Or Output
ALU	-	Arithmetic-Logic Unit
ICG	-	Interactive Computer Graphics
CRT	-	Cathode Ray Tube
BOM	-	Bill Of Material
3D	-	Three Dimensional
2D	-	Two Dimensional
MCAD	-	Mechanical Computer Aided Design
IGES	-	Initial Graphics Exchange Specification
CNC	-	Computer Numerical Control
BRep	-	Boundary Representation
CSG	-	Constructive Solid Geometry
NURBS	-	Non-Uniform Rational B-Spline
WYSIWYG	-	What You See Is What You Get
HD	-	High Definition

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

UI	-	User Interface
GUI	-	Graphical User Interface

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CHAPTER 1
INTRODUCTION

This chapter will clarified with brief on the basic understandings of the study which gives an overview of the parametric modelling CAD system and direct modelling CAD system. Essentially, it comprises of four main sections which are background, statement of purposes problem statements, objectives and work scopes where it portrays the whole process involved in this study.

1.1 Background

The application of Computer Aided Design (CAD) in the recent industry is not something brand-new to be heard about. This is because CAD software has been existed about five decades ago around year 1963. The history was guided by Ivan Sutherland with the development of Sketchpad which is also known as robot drafting was a ground-breaking computer program (Matthias, M. P., 2006). Referring to **Figure 1.1**, Sketchpad was handled with a light pen and a command button box which is located under the left hand. The four black knobs below the monitor screen functioning to control position and scaling part design.

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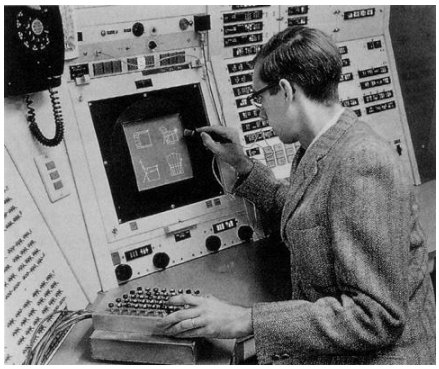

Figure 1.1: Sketchpad software console developed by Ivan Sutherland (1963)

According to Rao (2010), Computer Aided Design (CAD), use computer as a mechanism for all functions that are involved in the design process. Where the core purpose of the computer are that the layout design for comprehensive assembly, single component modelling, assembly modelling, interference and tolerance stack checking as well as engineering drawing.

Nowadays, CAD technology is a really high up issues because all the cost, time consumption as well as quality rely on it. Concerning technology development that changes rapidly, CAD technology is taking a few steps ahead to help designers create products that will marvel the customer as well as the end user. Up to this point, there are pile of CAD technologies accompanied the industry worldwide. This also includes the parametric modelling technology and direct modelling technology that will be the focus points of this study.

Parametric modelling technology is a modelling that has been applied globally. By applying the idea of parameter concept where the most significant subjects are the dimensions. As oppose to the 2D modelling and traditional 3D solid modelling, parametric modelling assign dimension that pilot the geometry. However, the constraints applied to make that part features are also attained in the model. In addition, parametric modelling is also embedded with history-based tree features which becoming the major problematic sources for the designer wherever there are changing of the design intents due to the constraint geometry. History-based modelling is said to be more structured in process, in-built parent/child relationship and the direct edits are well-arranged in tree form. In addition, the design intent was characterized by modelling process.

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On the other hand, the new kind of developed technology which is direct modelling technology emphasis on to make the product model that drop the constraint issues made by the parametric modelling technology despite do not keep the initial design intent. So, the designer can design their model at ease and more intuitive. Comparing with the parametric modelling, direct modelling has no history tree or being recognized as history-free modelling by Paul (2010). In different with parametric approaches, history-free technology more likely to be flexible modelling process, does not have parent/child relationship rather editing are typically direct where it just involving the change of geometry.

1.2 Statement of the Purposes

CAD/CAM work together in that the digital model generated in CAD is inputted to the CAM software package. The CAM software need to know the product physical shape which is CAD model before it can plan a proper set of fabrication instructions to a production machine.

This project will emphasis more on the design drawing process before it is transfer to CAM software. This project will steer on the current development of CAD technologies and aiming on the direct modelling technology research. In addition, this project also covers the comparison of the parametric modelling CAD and the direct modelling CAD. The comparisons also include the Product Design and Development (PDD) in a design flow process.

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1.3 Problem Statements

This study outlines two problems regarding parametric CAD system issues which are difficulties in learning curve and less flexibility in the design process. These kinds of problems lead to the lack of proficient worker that generate product with quality and dragging product development time consumption respectively.

Parametric CAD system is quite difficult to learn. Due to this, manufacturer or any company that utilized parametric CAD system need to send their worker for training which obviously raise the cost of the company on worker upgraded skill. Besides that, inflexibility of design process also contributes troubles to the worker especially when there are changes in drawing design.

1.4 Objectives

There are two objectives to be accomplished by the end of this study which are:

(a) To evaluate direct modelling in CAD technology

(b) To compare design process between parametric modelling and direct modelling

(c) To establish work flow for Product Design and Development (PDD) using direct modelling software

1.5 Work Scopes

This project consists of two work scopes. The first work scope is to make a comparison between parametric modeling CAD system and direct modeling CAD system. Parametric modeling is a primitive modelling involving the

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