

**PRODUCT DEVELOPMENT USING  
REVERSE ENGINEERING (RE) APPROACH**

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**A report submitted in partial fulfillment of the requirement for the award of the  
Degree of Bachelor of Mechanical Engineering  
(Design and Innovation)**

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**March 2008**

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**I declare that this report entitled “PRODUCT DEVELOPMENT USING REVERSE ENGINEERING (RE) APPROACH” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.**

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## ACKNOWLEDGEMENT

First of all I would like thanks to ALLAH S.W.T because give me a chance to finish my report for Projek Sarjana Muda. Besides that, I also would like to take this opportunity to empress my regards to my supervisor, Mr. Hambali Bin Boejang, Faculty of Mechanical Engineering, UTeM, for his help, advice and guideline for me to understand the project and complete the report.

I want to thank to the technicians who had give information that help me to do the project. I also would like thanks to my colleagues especially to my housemate for their generosity in spending their time and providing me a lot of knowledge during my literature review and sharing their opinion and encouragement in my process of accomplished my Projek Sarjana Muda.

Besides that, I also want to thank to my parents because they always encourage me in what ever I do. Without them I cannot complete my study at this level. Last but not least, I would like to thank to the entire person who had involve directly or indirectly in my Projek Sarjana Muda.

## ABSTRACT

Reverse Engineering is a method that transverse from the ordinary of producing an existing product. Normally, the design process is start from drafting or sketching to produce the product. In contrary, the design process in Reverse Engineering is start by getting the data from the existing object. There are two systems that involve in Reverse Engineering (RE) method which are Computer Aided Design (CAD) and Rapid Prototyping (RP). The purpose of this project is to understand the application of Reverse Engineering, Computer Aided Design and Rapid Prototyping in product development using Reverse Engineering approached. It is the bottom-up approached that used in this project. The existing object that used in this project is motorcycle tail lamp. The existing object is scanned using 3D scanning machine which is non-contact method. The scanned data that gained from scanning process is CAD data. The CAD data is then converted to STL file format. Then the STL file is transferred to Rapid Prototyping machine to build the prototype. The completed prototype is then continuing to next process which is post processing. A study was carried out to compare the existing motorcycle tail lamp with prototype and to compare the RE CAD data with existing motorcycle tail lamp.

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**LIST OF ABBREVIATION**

2D	Two Dimensions
3D	Three Dimensions
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
FDM	Fused Deposition Modeling
NURBS	Non-Uniform Rational B-Spline
RE	Reverse Engineering
RP	Rapid Prototyping
SLA	Stereolithography Apparatus
STL	Standard Triangular Language

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction of the project

The engineering field is growth faster. The new product, new technology or new system has been introduced. In engineering field, Computer Aided Design (CAD) is familiar to engineers. CAD is making the design faster and effective. However, the manual drafting and sketching still been used by engineers.

There are new technologies that are now growth within time. Reverse Engineering (RE) and Rapid Prototyping (RP) are the new technologies that now all the engineers are learned. Reverse Engineering (RE), Computer Aided Design (CAD) and Rapid Prototyping (RP) are related together. These three technologies are making the engineering field easier to produce and analysis any part or product.

#### 1.2 Aim

The aim of this thesis is to understand the application of RE, CAD, and RP in product development using RE approach. The scanned object in this thesis is motorcycle tail lamp. The analysis in this thesis is part to part and CAD to part comparison. This product development involves the application of RE method to get the physical data of existing motorcycle tail lamp. The scanned data of the motorcycle tail lamp will be

manipulated to obtain the 3D CAD data. This 3D CAD data is then used in RP machine to make the prototype.

### **1.3 Objective**

The objective of this thesis is to apply a product development by using Reverse Engineering (RE) approach. In this thesis, motorcycle tail lamp is the product that will be developed by using Reverse Engineering (RE), Computer Aided Design (CAD) and Rapid Prototyping (RP) method.

### **1.4 Scope**

The scope of this thesis is to:

- I. Study on the Reverse Engineering (RE), Computer Aided Design (CAD) and Rapid Prototyping (RP).
- II. Manipulate the scanned data to obtain the CAD data for the motorcycle tail lamp.
- III. Create a prototype of the product using RP machine.
- IV. Compare the existing part to the prototype part.
- V. Compare RE CAD data to existing part

### 1.5 Flow Chart of PSM 1

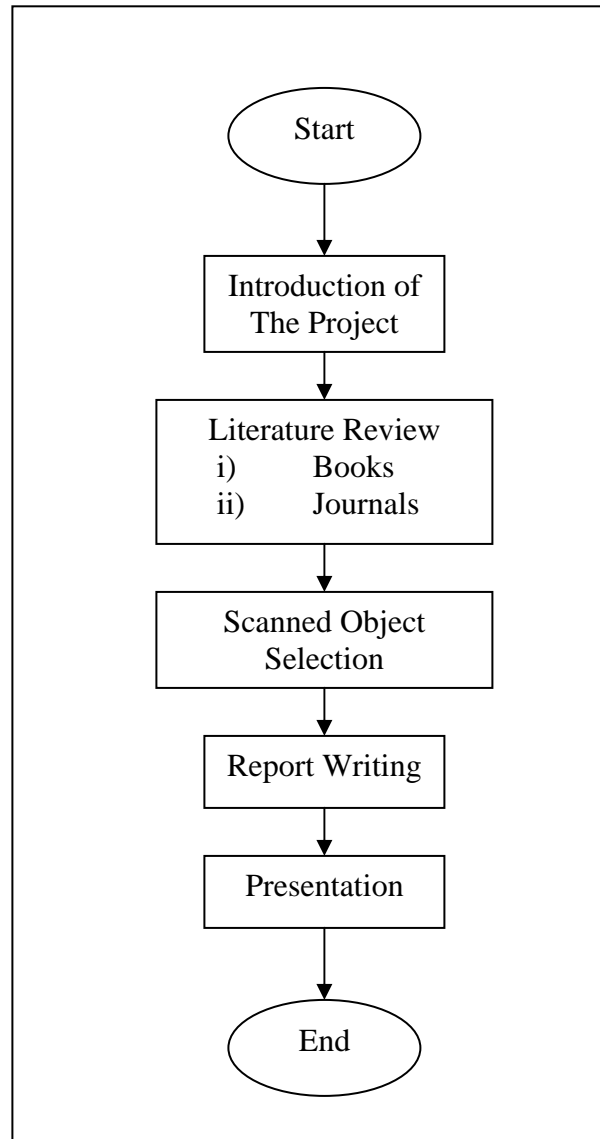


Figure 1.1: Flow Chart of PSM 1

## 1.6 Flow Chart of PSM 2

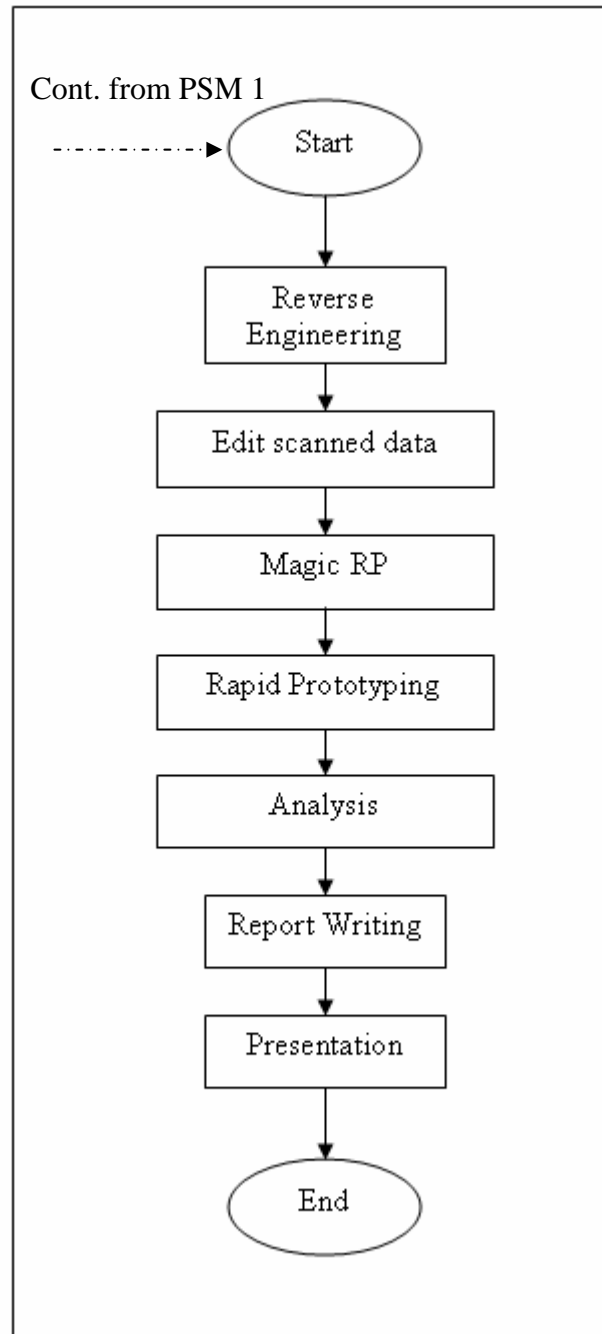


Figure 1.2: Flow Chart of PSM 2

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 REVERSE ENGINEERING (RE)

##### 2.1.1 Introduction of Reverse Engineering (RE)

Reverse Engineering (RE) is the process of capturing the 3 Dimension object form and transfer to a computer compatible representation. RE is also a process of creating engineering design data from the existing part. In some cases, RE is necessary only to extract 2 Dimension profile data from the model as the complete part may be efficiently modeled using these profiles and a surface or solid Computer Aided Design (CAD) / Computer Aided Manufacturing (CAM) system [1]. There are several methods that the object form can be captured for RE. The method chosen is depending on the object complexity and accuracies requirement from the digitization process [2]. The first step of RE in the process to produce the product is the physical model to CAD data. The next step of the RE is to convert the CAD data into a usable form.

##### 2.1.2 Common uses of Reverse Engineering

- As a learning tool.
- As a way to make new compatible product.
- For making software interoperate more effectively.
- To uncover the uncoordinated features or commercial products.

### **2.1.3 Type of Reverse Engineering**

The simple models can be measured with vernier calipers and recreated in the CAD system based on measurements. However, for the complex model, there are two type of RE which is contact and non-contact.

#### **2.1.3.1 Contact Method**

Co-ordinate Measuring Machine (CMM) is the contact method. CMM provides higher accuracy in the micron range but it is subject to slow the data sampling times. CMM takes the data by a touch probe. It touches the part surface using the probe at a certain point. The surface scanning CMM can take the sample at one point per second. The less sophisticated CMM has much lower data collection rates. CMM is more high accuracy than the 3D Vision System. The disadvantage of CMM is it touches the scanned object. Thus, the act of scanning the object might modify or damage it. This contact method is very significant when scanning valuable objects such as historical artifacts. The other disadvantage of CMMs is that they are relatively slow compared to the other scanning methods. Physically moving the arm that the probe is mounted on can be very slow and the fastest CMMs can only operate on a few hundred hertz [3].

#### **2.1.3.2 Non-Contact Method**

3D Vision System is one of the non-contact methods. The 3D Vision System has the ability to take the sample at higher rates but it loses to CMM in accuracy specifications. The 3D Vision System has no touch probe and it capable to measure the 3D point on a surface. The 3D Vision System can increase the speed of the RE process. Compare to the touch probe, 3D Vision System have the advantages of high data collection speed, up to 10 000 per second depending on the type of sensor employed and non-contact measurement [4]. The non-contact method is much faster collecting data than contact method.