DESIGN VALIDATION AND DEVELOPMENT OF PLASTIC INJECTION MOULD CAVITY FOR CONTAINER PLASTIC PRODUCT

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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Faculty of Manufacturing Engineering
May 2008
DECLARATION

I hereby, declare this thesis entitled “Design Validation and Development of Plastic Injection Mould Cavity for Container Plastic Product” is the results of my own research except as cited in the reference.

Signature : .................................................................

Author’s Name : CHIN KAT MENG

Date : 10TH MAY 2008
The thesis submitted to the senate of UTeM has been accepted as partial fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design). The members of the supervisory committee are as follows:

Main Supervisor: Mr. Hassan Attan
Date : .....................
Stamp : .....................
ABSTRACT

Plastic Injection Moulding is one of the popular commercial manufacturing in plastic industry, it has the ability to produce any complex design product. This project, aims to validate design of the plastic container to be manufactured by using plastic injection molding. The design of the product needs to convert into cavity and core of the mould and the form of mould cavity is done by using several advanced manufacturing processes to fabricate the product.

This project begins with the validation of the dimension of the mould by measuring the existing mould using CMM machine. The procedures of handling mould and the method to measure the mould dimension will be state out. The next step is modeled process using CAD/CAM software to construct the 3D model. The CAD/CAM software used in this modeling process is CATIA, because it has wide flexibility and capabilities in the 3D modeling. After the modeling, a process plan is generated and the mould fabrication processes will be carried out using various type of manufacturing process. The design feature and process parameter is analyzed and verified.

The project is concluded with a discussion of the manufacturing process in general, including some of the future developments, and some of the recommendations.
‘Plastic Injection Moulding’ adalah salah satu proses pembuatan komersial yang popular dalam perindustrian plastik, ia dapat menghasilkan pelbagai jenis produk rekabentuk kompleks. Projek ini, bertujuan untuk mengesahkan rekebentuk kotak plastik yang digunakan dalam mesin suntikan plastik. Rekabentuk plastik produk itu perlu ditukar dalam bentuk acuan dengan menggunakan beberapa jenis proses pembuatan termaju untuk menghasilkan produk ini.

Projek ini dimulakan dengan mengesahkan ukuran acuan dengan menggunakan mesin CMM. Seterusnya ialah menunjukkan langkan-langkah untuk menguruskan acuan dan cara-cara untuk mengukur ukuran acuan itu. Permodelan 3D akan menggunakan perisian CAD / CAM sebagai satu alat mod el untuk membina 3D model. Perisian CAD / CAM yang akan digunakan dalam proses permodelan 3D adalah CATIA, kerana ia mempunyai fleksibiliti yang luas dalam permodelan 3D. Selepas permodelan 3D, menghasilkan suatu proses rancangan dan proses fabrikasi acuan akan mengikut rancangan yang ditentukan. Fabrikasi acuan akan dijalankan dengan menggunakan berbeza jenis mesin dan proses.

Projek ini ditamatkan dengan satu penbincangan berkaitan dengan proses pembuatan, serta termasuk beberapa cadangan untuk masa hadapan.
ACKNOWLEDGEMENT

First and foremost, I would like to express my thousand of thanks to my honorable supervisor, Mr. Hassan Attan, for this endless support and help throughout this project. Through his invaluable guidance and advice, this project has become a reality.
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List of Abbreviations

LDPE = Low Density Polyethylene
HDPE = High Density Polyethylene
PP = Polypropylene
PMP = Polymethylpentene
PVC = Polyvinylchloride
PC = Polycarbonate
PS = Polystyrene
SAN = Styrene Acrylonitrile
ABS = Acrylonitrile Butadiene Styrene
RP = Rapid
CAD = Computer-Aided-Design
CAM = Computer-Aided-Manufacture
CMM = Coordinate Measuring Machine
RT = Rapid Tooling
CHAPTER 1
INTRODUCTION

This project is to design and develop a cavity insert of mould for the container plastic product by using CAD/CAM software and advanced manufacturing process. Develop a mould cavity is require combination of several stages until to the final product and is aimed to the mould are able to function as well. In the design and develop of a mould which needed many of the computer-aided design or manufacturing software and machine to complete the design and development of a mould. Listings below show the stages of design and development of a cavity mould:

- Design and determination on specification and dimension of the product
- Technical Drawing Generation in 2D and 3D with full scale of dimension
- Study the structure of the mould, characteristics
- Modeling the mould cavity for the product
- Mould fabrication and construct
- Select the appropriate process for fabrication and planning the process sequences
1.1 Background of the Problem

This project is continuous of previous study. Previous study is focus on the analysis and design the mould for Container Plastic Product. While in this project will concentrate on the validate the previous design’s dimension and plan a process to develop the mould for container plastic product. The development process of the mould is generally a critical way for the newcomer in the mould industry. Mould development require years of experience and knowledge or either the effort or money are sacrificed will just waste it without any return rate. So it is very difficult for a new comer in this field to develop a mould without years of experience.

1.2 Statement of the Problem

The most efficient way to improve the knowledge in the mould development is research on the existed mould development procedure in the market. Apply these methods or the systems into the mould development process. From the development process try to analysis all the failure and successful factor and sure its all these result and study will be the best experience and knowledge base for the next mould development process. Below is the list of the problems statement:

- Unsure dimension accuracy provided by the previous study.
- Process selection and process planning for mould development
1.3 Objectives

In this final project objective is to study on design and develop cavity of a mould, the objectives are listing below:

1.3.1 Learn to use CAD/CAM software to design a mould
1.3.2 Understanding the Mould Structure and its function especially in the cavity side of the mould.
1.3.3 Learn to choose most appropriate manufacturing process for the mould construction.
1.3.4 Aims to obtain tolerance of the mould dimension become as precise as possible

1.4 Scope

The scope of this final project is listing below:

1.4.1 Study, verify the dimensions of container plastic product. Confirmation on the dimension is precise and suitable for fabricated.
1.4.2 Study function of the components and configuration of the mould. These include understand all the components in the mould and its each function.
1.4.3 Developed cavity of the mould by using most suitable manufacturing process.
1.4.4 Planning the whole process for the mould fabrication, the process planning include tools and process used in the fabrication and methods of removal material.
1.5 Importance of the Project

This project enable to widen the knowledge in the injection moulding process including design and development of a mould. Form this project surely will improve the understanding the whole mould structure, components, features and its components function. Beside that, through this project can gain more understanding in the mould design and mould development process. All these knowledge are very useful when involve in the mold making industrial.

1.6 Organization of the Report

Chapter 1: Introduction

In this chapter, will explain the objective and the scope of this project. Beside, in the introduction has been stated out the problems statement of the se project and the importance of this project for the future study.

Chapter 2: Literature Review

Literature review will study on all the research and study has been done and relevant to this project. The literatures are providing very useful information and knowledge to important to finish project.

Chapter 3: Methodology

In the methodology, will explain the all the procedure and progress to finish this project including release mould, assembly and disassembly mould procedure, measuring process by using the CMM, and the manufacturing process involved during the machining job.
Chapter 4: Development of Cavity mould and Dies

In this chapter, will explain the process plan to machining the mould cavity and dies by using several manufacturing process.

Chapter 5: Result

Finished mould cavity and the dies will be show at this chapter.

Chapter 6: Discussion

In this chapter, will discuss on the adjustment and few considerations should be concerns of. These factors will help to improve the quality and the accuracy of the mould.

Chapter 7: Conclusion and Recommendation

Conclude what has been gained during the whole progressing of this project. Beside that, recommend some opinion to improve the process planning quality.
1.7 Flow Chart of the Project

![Flow Chart of the Project](image)

Figure 1.1: Flow chart of the project

1.8 Schedule of the project

Figure 1.2 below show the plan of schedule for the first part of the project:

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Figure 1.2: Schedule of project
Figure 1.3 below show the plan of schedule for the second part of the project:

![Figure 1.3: Schedule for the second part of the project](image)

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1.9 Summary

Overall in this project will more concentrate on the mould design, material selection for product and the mould base, analysis and modeling the cavity mould, measure the existing mould by using CMM, study the injection moulding machine function and selection development process for the mould fabrication.