



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Analysis of Plastic Flow in Two Plate Injection Mould

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

By

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BORANG PENGESAHAN STATUS TESIS*
JUDUL: ANALYSIS OF PLASTIC FLOW IN TWO PLATE INJECTION MOULD
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DECLARATION

I hereby, declare this thesis entitled
“Analysis of Plastic Flow in Two Plate Injection Mould” is the result of my own
research except as cited in the references.

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ABSTRACT

This thesis is focused on the analysis of plastic flow in two plate injection mould. Compact Disc Cases (top and bottom) are designed with two cavities as the plastic part in the two plate injection mould. Solidworks software is used to design the plastic part and Rhinoceros is used for meshing the surfaces of plastic part. Meanwhile at the stage of analysis, Moldex Software is used to perform the analysis of filling and packing. This thesis will discuss the flow of molten plastics inside the injection mould. The analysis begins at the origin of the flow and includes all major flow channels such as barrel, nozzle, sprue, runners and gates, until the two cavities are completely filled. In the analysis, plastic flow behaviour is studied together with parameters setting in plastic injection moulding. Based on this analysis, improvement has been made to the part design and feed system in the mould. This includes the location of gate at the part design, size of sprue, runners and gates. From the analysis also, Moldex Software helps to determine the part defect that might occurred during plastic injection moulding process such as short shot, unequal filling, over filling, welding line and others. From that, the optimum parameters setting are selected in order to get a quality plastic part. So, this thesis will explain the plastic flow analysis clearly.

ABSTRAK

Tesis ini adalah tertumpu kepada penganalisaan proses pengaliran plastik di dalam dua plat acuan suntikan. Bekas simpanan Cakera Padat (atas dan bawah) di rekabentuk dengan 2 rongga acuan sebagai produk plastik dalam dua plat acuan suntikan. Perisian Solidwork digunakan untuk merekabentuk produk plastik dan Rhinoceros digunakan untuk mesh permukaan produk plastik. Manakala di peringkat analisa, perisian Moldex digunakan untuk membuat analisa pengisian dan pemadatan. Tesis ini akan membincangkan pengaliran bahan plastik cair di dalam acuan suntikan. Analisis bermula dari permulaan proses pengaliran plastik dan merangkumi keseluruhan saluran pengaliran proses di mesin sehinggalah masuk sepenuhnya ke dalam dua rongga acuan. Dalam analisa itu, sifat-sifat pengaliran plastik dikaji bersama-sama dengan penetapan parameter-parameter dalam pengacuanan suntikan plastik. Berdasarkan analisa ini, pembaikan dibuat kepada rekabentuk produk dan sistem masukan bahan dalam acuan. Ini termasuk kedudukan laluan masuk pada rekabentuk produk, saiz penghantar, dan saiz laluan masuk. Daripada analisa ini juga, perisian Moldex membantu mengenalpasti kecacatan produk yang mungkin berlaku dalam proses pengacuanan suntikan plastik seperti suntikan tidak lengkap, pengisian tidak sekata, lebih pengisian, garisan kimpal dan lain-lain. Lanjutan dari itu, penetapan parameter optimum dipilih untuk mendapatkan produk plastik yang berkualiti. Oleh itu, tesis ini akan menerangkan analisa pengaliran plastik tersebut dengan jelas.

DEDICATION

Especially dedicated to my beloved family especially to;

My Mother (Norizan Binti Hussain),

My Father (Omar Bin Shafii)

and

My Sister (Normazira Binti Omar)

whose very concern, understanding, supporting and patient. Also to special person;

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LIST OF ABBREVIATIONS

ABS	-	Acrylonitrile Butadiene Styrene
CAD	-	Computer Aided Design
CAE	-	Computer Aided Engineering
CAM	-	Computer Aided Manufacturing
CAS	-	Computer Aided System
CD	-	Compact Disc
Dc	-	Dimension of cavity
Dp	-	Moulded part dimension
GPPS	-	General Purpose Polystyrene
HDPE	-	High Density Polyethylene
LDPE	-	Low density Polyethylene
Max	-	Maximum
RHINO	-	Rhinoceros
RPM	-	Rotation per Minutes
PA6.6	-	Polyamide
PBT	-	Polybutyleneterephthalate
PC	-	Polycarbonate
PE	-	Polyethylene
PES	-	Polyethelensesepionate
PMMA	-	Polyoxymethylene
PP	-	Polypropylene
PS	-	Polystyrene
PSM	-	Projek Sarjana Muda
SAN	-	Styreneacetalnitrat
sec	-	Second
3D	-	Three dimensional
2D	-	Two dimensional

LIST OF UNIT

°C	-	Degree of Celsius
cc	-	Centimetre cubic
cc/sec	-	Centimetre cubic per second
g	-	Gram
g/cc	-	Gram per centimetre cubic
KN	-	Kilo Newton
mm	-	Millimetres
MPa	-	Mega Pascal
S	-	Shrinkage value
s	-	Second
%	-	Percent

CHAPTER 1

INTRODUCTION

1.1 Project Background

This thesis is base to determine the plastic process flow. Plastic is a material that can produce many shapes that can be used by human in routine life. All of plastic products are produce from various type of operation or process. All of product produces with different type of plastic material depend to needed. Plastics are divided into two distinct groups: thermoplastics and thermosets.

Plastics can be moulded into various forms and hardened for commercial use. Plastic is perfect for this modern age. It is light, strong, easily moulded and durable. Although plastics are thought of as a modern invention, there have always been "natural polymers" such as amber, tortoise shells and animal horns. These materials behaved very much like today's manufactured plastics and were often used similar to the way manufactured plastics are currently applied. ^[1]

The plastic product can make from the several processes like injection moulding, blow moulding, compression moulding, film insert moulding, gas assist moulding, rotational moulding, structural foam moulding, extrusion and thermoforming. This thesis will explain and study more about injection moulding. Injection moulding is a process in which the plastic material is injected into a mould forming a plastic product. Injection moulding is a manufacturing technique for making parts from thermoplastic material. The solid plastic material is fed into an injection moulding machine, heated and then pressed into the mould. In injection

moulding, plastic pellets or granules are fed from a hopper into a heating chamber. A plunger or screw pushes the plastic through the heating chamber, where the material is softened into a fluid state. At the end of this chamber, the resin is forced into a cooled, closed mould. Once the plastic cools to a solid state, the mould opens and the finished part is ejected. ^[1]

Injection moulding is very widely used for manufacturing a variety of parts, from the smallest component to entire body panel. It is the most common method of production, with some commonly made items including bottle caps and outdoor furniture. Plastic moulding products can be seen everywhere such as plastic tubes, grips, toys, bottles, cases, accessories, kitchen utensils and a lot more. The mould is made by a mould maker from tool steel, usually either steel or aluminium, and precision-machined to form the features of the desired part. Mould is used to produce desire product that we needed. Many elements are involved in mould such as feeding, cooling and injector system. In modern technology, CAD software can be used to design mould and after that perfume machining raw material to produce complete mould. Feeding system is important element for plastic flow in injection mould. All of this will be explain detail inside this project. In this thesis, the analysis is concentrate for plastic flow in two plate injection mould.