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Date : 11/5/09

STUDY AND ANALYSIS THE EFFECTIVENESS CAD/CAM SYSTEM IN MOLD DESIGN

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"I declared that this project report entitled "Study and Analysis the Effectiveness CAD/CAM System in Mold Design" is the result of my own research. This report was written by me and was my own effort except the ideas and summaries which I have clarified their resources"

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Date : MAY 2009

Specially dedicated to my beloved father, mother and other family members

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ABSTRACT

Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) are the use of computer technology to help in design especially in drafting the technical drawing and engineering drawing, of any parts or products. It includes the design of building and product in engineering. This technology is a combination that was very helpful and useful in engineering. One of CAD's technologies that used in engineering is CATIA V5R16's software. Most of this software is use for drawing a more detail of 3D and 2D models. Its also give the way to modification for drawing become easier and simple. This research is focused into two parts in this software name *core and cavity design* and *mold tooling design*. By using CATIA, it can help in identify problem on mold design, give a detail analyzed and produce more quality of a product.

ABSTRAK

Rekabentuk Berbantu Komputer (CAD) dan Pembuatan Berbantu Komputer (CAM) adalah penggunaan teknologi komputer untuk membantu dalam rekabentuk terutama dalam mendraf lukisan teknik dan lukisan kejuruteraan sesuatu bahagian atau produk. Ianya termasuk rekabentuk sesebuah bangunan dan komponen-komponen dalam kejuruteraan. Teknologi ini merupakan gabungan yang sangat berguna dan digunakan secara meluas di dalam kejuruteraan. Salah satu perisian CAD yang banyak digunakan di dalam kejuruteraan ialah perisian CATIA V5R16. Perisian ini sebahagian besarnya digunakan untuk lukisan yang lebih terperinci untuk model-model 3D dan lukisan 2D. Ianya juga memudahkan sesuatu pengubahsuaian dilakukan terhadap lukisan dengan lebih mudah dan ringkas. Penyelidikan ini tertumpu kepada dua bahagian di dalam perisian ini iaitu rekabentuk teras dan rongga *(core and cavity design) dan* rekabentuk acuan *(mold tooling design).* Dengan menggunakan CATIA, ianya dapat memudahkan dalam mengenalpasti masalah terhadap sesuatu rekabentuk acuan dan dapat dianalisis secara terperinci agar dapat menghasilkan sesuatu produk dengan lebih berkualiti.

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CHAPTER I

INTRODUCTION

In the field of engineering, manufacturing is the most important thing that helps in producing engineering products. For common product are components for vehicle. Vehicle is most important to human being because of the improvement in manufacturing technology. Its also produce the small part such as toys, kitchenware, part of computer, and etc.

In manufacturing engineering, there have one important field that is mold design manufacturing. Mold design is a manufacturing technique for making parts from both thermoplastic and thermosetting plastic materials in production. Molten plastic is injected at high pressure into a mold, which is the inverse of the product's shape. After a product is designed, usually by an industrial designer or an engineer, molds are made by a mold maker (or toolmaker) from metal, usually either steel or aluminium, and precision-machined to form the features of the desired part. Molding is widely used for manufacturing a variety of parts, from the smallest component to entire body panels of cars. Molding is the most common method of production, with some commonly made items including bottle caps and outdoor furniture.

There also many part of molding such as plastic molding, aluminium, composite, and steel molding. All of this part of molding was important in producing products in engineering. This field of engineering was helps us to be more productive and competitive especially to improve our daily life.

1.1 Background

The idea to propose this topic is because there was some problem occurs in manufacturing engineering. One of the problems is how to modify the product that already done to fulfill what the costumer needs. So, one of the solution is using CAD/CAM technology. Many of industries were already using this technology. This technology helps in modifying the design of product using computer. In industrial, time is one of the very important things. So, when any problem was occur, time for the engineer to make the solution is very important. Costumer needs is important for industrial because costumer will give their profit. Often designers in remote locations work together on the same model through networks or the Internet. The engineer discusses the design with the mold-maker across the country as they both mark-up features on the same model in real time. Usage of CAD/CAM technology is very new in Malaysia. For this reason, this project will tell us how far the effectiveness of CAD/CAM will help in industrial. Two and three-dimensional CAD/CAM drawings models contain all the equations for the geometry. Since CAD/CAM is a visual database the designer can query the database for any model information. Distance, coordinate geometry, volume, and mass properties are only a click away.

1.2 Objective

1. To study and analysis of CAD/CAM system application in mold design.
2. To design mold for an injection molded product.
3. To compare two different products using core and cavity design and mold tooling design.

1.3 Scope

This project will focus on:

- Advanced CATIA software using core and cavity design and mold tooling design.
- Study the effectiveness of CAD/CAM for complex part, which is neck joint wall fan and a simple part.
- CAD/CAM system used in injection molding.

1.4 Problem statement

Usage of CAD/CAM system especially in mold design is still new in Malaysian industry. Conventional methods of producing mold for injection molding is very slow due to trial and error process. In conventional method of injection molding, we are lack of expertise because of this method required are experienced workers in this field. However the developments of CAD/CAM system assist engineer in developing mold for injection molding process. This study concentrate on how develop of mold design process in injection molding can be improved by using CAD/CAM system.

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

Injection molding is a manufacturing process of large part manufacturing, rapid prototyping and fabrication of a product. Since the high cost of manufacturing using injection molding, development of CAD/CAM system are the main solution that generate prototype of costumer concepts, formulate part and mold designs, drawing and machining code. Using this technology, cost of manufacturing error can be reduce and help to lead time.

2.1 Integration of CAD and CAM

CAD is computer aided design, which is use to drawing, design and drafting a product using computer. Many of engineering drawing are design using CAD technology. CAD system using geometrical design parameter helps the designer to view product under a wide performance and test the product by simulation of real conditions. CAD also defined as a design that hundred percent automatically where designer just need to state the function of one part then computer are define the design. Thus, CAD is a program that transfer the manually process of product design to a computer aided process.

CAM is computer aided manufacturing, which a process to develop manufacturing or prototyping of a product model using computer program. In CAM technology, geometrical design data had been used to control an automatic machine. CAM system is familiar with numerical control (NC) system, due to the coded mechanically of geometrical data.

The integration of CAD and CAM is because of two types of interfaces. The geometrical design between CAD and CAM helps in data exchange of CAD with CAM. CAD consists of geometrical design parameter while CAM consists of geometrical design data. The second interface is communications between CAD and CAM. The earliest development of CAD/CAM technology is CNC machine. CNC machine is a manufacturing machine using programmed instructions from raw material until finish product.

2.2 Effectiveness of CAD

CAD software is a program to draw model of a product. This technology is an improvement in drawing of any model, hundred percent using computers. But CAD is more than just 2D drawing, it also consist of 3D solid and surface modelers that make CAD software as a versatile program. Some CAD software is also aided in strength and dynamic analysis. This application can make a data exchange, which shows that the one CAD software is related to other CAD software, for example data from CATIA software can be use in MAGICS and INSIDES software.

The computer application is transfers the manufacturing process from manual to computer-aided process. Using CAD is an advantage for companies in order to produce quick design and cheaply cost of manufacturing. It makes CAD software is able to help in business of the company. Although CAD software is software that help in analysis for development process of new product, Bauly (2000) defined that, this technology not widely use of many manufacturing companies. He also stated that CAD software are use to make a drafting of product.

2.3 Effectiveness of CAD/CAM System in Injection Molding

Plastic products are widely used nowadays. The common method of manufacturing plastic products is using injection molding. Injection molding is a process for the fabrication of plastic product using some mechanism. This process is very helpful in order to produce a high volume of the same products, which make it as a major advantage in using this method. Other advantages using injection molding are less cycle time, wide range of material can be used, minimal scarp losses and less process to complete parts after molding. But the major disadvantages of using injection molding are expensive equipment and high running cost. Besides, the parts are must be design with high molding consideration to ensure the product to be complete.

In injection molding, some granular material is fed into the hopper of the injection molding machine. The material is heat using heated barrel and melts. The melted material then inject into the mold with a constant pressure, until solidified. The mold then opens using some mechanism. In order to complete the process of injection molding in a good condition, design for mold base needs a high consideration.

Many of manufacturing design are using computer aided. Companies in the world are widely using the CAD/CAM software especially in injection molding process. This engineering analysis completely changes the manual process of injection molding into computer aided process. However the skill of using the software is important to minimize the possible error during design and manufacturing processes.

2.3.1 Company Using CAD/CAM in Production

Daeil Mold Co. which produce mold tool especially for home appliance, automotive industries and parts for client, is a Korean company that use the CAD/CAM system to increase the production. Korean Prime Minister awarded the company as a number of prizes for exporting of goods. The use of CAD/CAM system in the company enabled Daeil Mold to make the two different departments become one department. The decision for combination of the two departments reduced delivery time of parts from one department to another. Due to the company's experience, these CAD/CAM systems are proved to help in improvement of injection molding manufacturing.

Another company that uses the CAD/CAM system is RGE Engineering. This world class manufacturer of plastic injection molding use CAD software in their production process. This system enables the company to produce high volume of production and high quality parts. The whole processes of the production are automatically design and inspect by CAD/CAM system.

2.4 Current Research in CAD/CAM Technology

Using CAD/CAM technology, this process of design for mold base can help in reducing the running cost and time of completing the whole injection molding process. In injection molding of plastics and rubber, Kallien (1991) state that using new 3D simulation techniques the die fill, the curing process and the subsequent cooling of the