"I admit that I have read this report and I found that it is suffice from the aspect of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design & Innovation)"

Signature : 

Supervisor : MR. SHAMSUL ANUAR BIN SHAMSUDIN

Date : 08 MAY 2007

DESIGN AUTOMATION OF ENGINEERING COMPONENT USING CAD 2D SOFTWARE

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A project report is submitted to the Faculty of Mechanical Engineering in partial fulfilment of the requirements for the award of the degree of Bachelor of Mechanical Engineering (Design & Innovation)

Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka

MAY 2007

"I admit this report is done all by myself except statement that I have already stated on each one of them"

Signature : _____

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Date : 08 MAY 2007

To all my family especially my parent,

Siti Marina and Abdul Rahim,

my brother and sister,

Muhd Ikram and Nur Izwa.

You all very important in my life...

Also to my project supervisor, all lecturers and all my friends.

This project success because of your support...

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ABSTRACT

This report describe about a project titled 'Design Automation of Engineering Component Using CAD 2D Software'. The purpose of this project is to draw an engineering component automatically as the user supply the input. Generally, this project will facilitate the user in designing the selected engineering component but at the same time this project will optimize the usage of selected CAD software. This report consists of seven chapters, where Chapter 1 is an introduction to this project, Chapter 2 describe about the literature review, Chapter 3 describe about the methodology, Chapter 4 describe about the development of this project, Chapter 5 describe about the results, Chapter 6 describe about the discussion while Chapter 7 is a project conclusion and recommendation. Selected CAD software for this project is AutoCAD 2002 and its customizing technique is explained in the Chapter 4. An AutoLISP Programming is used in this project and it is clearly explained in Chapter 4.

ABSTRAK

Laporan ini menerangkan tentang projek 'Pengautomasian Rekabentuk Komponen Kejuruteraan Menggunakan Perisian CAD 2D'. Projek ini dijalankan untuk melukis komponen kejuruteraan mekanikal secara automatik dengan hanya meminta masukan daripada pengguna. Secara amnya projek ini dapat membantu pengguna dalam melukis komponen kejuruteraan yang dipilih dan secara khususnya projek ini dapat mengoptimumkan penggunaan perisian CAD yang dipilih. Laporan ini mengandungi tujuh bab, dimana Bab 1 merupakan pengenalan kepada projek, Bab 2 menerangkan tentang kajian latar yang dilakukan, Bab 3 menerangkan tentang kaedah yang akan digunakan, Bab 4 menerangkan tentang cara projek ini dibangunkan, Bab 5 menerangkan hasil bagi program yang dijalankan, Bab 6 menerangkan tentang perbincangan manakala Bab 7 merupakan kesimpulan dan cadangan bagi projek ini. Perisian CAD yang dipilih untuk projek ini adalah AutoCAD 2002 dan cara-cara membuat pengubahsuaian di dalamnya diterangkan di dalam Bab 4. Siri aturan AutoLISP digunakan untuk projek ini dan ianya juga diterangkan secara terperinci di dalam Bab 4.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

The computer age has touched every aspect of our modern world. Computers control our energy, transportation, communication, manufacturing, agriculture, as well as our personal lives. They are used in every discipline of engineering from aerospace to civil and every phase from conception to final product output includes drawings, CNC code, and word processing. Therefore it is critical that the engineering professional become well versed in its control, as well as the usage of this modern tool, which includes the operation as well as the preparation of software. Although, software is becoming more versatile and readily available that will automate the many tedious and even complex task that are performed daily in today's engineering offices, there is still occasions in which specialized functions are still performed using just the basic system. Therefore, anyone who can write specialized programs can save a company many valuable hours of production time. [3]

Since computer-aided design (CAD) was introduced in early 1960's, software companies have continually developed packages related to design and engineering. Autodesk is one of the companies that develop CAD system and one of their products is AutoCAD. In Universiti Teknikal Malaysia Melaka (UTeM), the students

who learned mechanical engineering are exposed to use the CAD systems which begin with AutoCAD, followed by SolidWork, Catia V5 and other advanced CAD's software.

In order to optimize the usage of CAD system, this project is proposed to invent an automation program to facilitate the users in designing the simple mechanical component such as gears, spring, bolt, nut, and washer. For example, to produce a spur gear, the user supplies the number of tooth, as well as the diameter and a set of program will draw automatically the desired spur gear in 2D. Experimental work will be carried out to find the best method in order to achieve the objectives of this project.

1.2 Project Aim

The aim of this project is to invent an automation program that facilitates the users in designing the simple mechanical component using the CAD 2D software. The program will simplifying multiple-step tasks into a routine that requires a single command to execute.

This involves the use of programming language to produce a program to draw automatically a simple mechanical component (gears, spring, bolt, nut, and washer) after the component's specification is entered.

As this project succeeds, it will be use by the Faculty of Mechanical in UTeM as a teaching aid.

1.3 Project Objectives:

1) To develop an automation program in Computer-aided Design (CAD).

2) To understand Computer-aided Design (CAD) system.

- ❖ Basic command to develop 2D drawing.
- ❖ Isometric/Orthographic views.
- ❖ Using the menus.
- ❖ Menus development which consist of button, screen and pull down menu.
- ❖ Using toolbars and icons.

3) To learn customizing the Computer-aided Design (CAD).

- ❖ Setting system variables.
- ❖ Customizing the menu.
  - Simple menus
  - Multiple menus
  - Linking menus
  - Loading menus
  - Partial menus

4) To familiarize basic engineering component.

- ❖ Function of gears, spring, bolt, nut, and washer.
- ❖ Application and usage of those engineering component.
- ❖ Type of those components.

1.4 Project Scope:

1) Choose the applicable CAD 2D software.

   - ❖ The applicable CAD 2D software will be defined as the experimental work is done.

2) Learn how to conduct programming in the selected CAD software.

   - ❖ Each of CAD software has its own programming method. To select the best CAD software with a simple programming language, an experimental work will be carried out.

3) Make an analysis or comparison with the exist component as a validation.

   - ❖ Research and experimental review will be done to recognize the component

CHAPTER 2

LITERATURE REVIEW

2.1 Mechanical Component

2.1.1 Introduction

A mechanical system is a synergistic collection of machine elements. It is synergistic because as a design it represents an idea or concept greater than the sum of the individual parts. For example, a wristwatch, although merely a collection of gears, springs, and cams, also represents the physical realization of a time-measuring device. Mechanical system design requires considerable flexibility and creativity to obtain good solutions. Creativity seems to be aided by familiarity with known successful designs, and mechanical systems are often collections of well-designed components from a finite number of proven classes.

Designing a mechanical system is a different type of problem than selecting a component. Often, the demands of the system make evident the functional requirements of a component. However, designing a large mechanical system, potentially comprising thousands or even millions of machine elements, is a much more open, unconstrained problem.

To design superior mechanical systems, an engineer must have a certain sophistication and experience regarding machine elements. Studying the design and selection of machine elements affords an appreciation for the strengths and limitations of classes of components. They can then be more easily and appropriately incorporated into a system. For example, a mechanical system cannot incorporate a worm gear or a Belleville spring if the designer does not realize that these devices exist. [1]

2.1.2 Gear

A gear may be thought of as a toothed wheel that when meshed with another smaller-in-diameter toothed wheel (the pinion) will transmit rotation from one shaft to another. The primary function of a gear is to transfer power from one shaft to another while maintaining a definite ratio between the velocities of the shaft rotations. The teeth of a driving gear mesh push on the driven gear teeth, exerting a force component perpendicular to the gear radius. Thus, a torque is transmitted, and because the gear is rotating, power is transferred. Gears are the most rugged and durable torque transmitters. Their power transmission efficiency is as high as 98%. On the other hand, gears are usually more costly than other torque transmitters, such as chain drives and belt drives. Gears are highly standardized as to tooth shape and size. The American Gear Manufacturers Association (AGMA) publishes standards for gear design (AGMA, 1990), manufacture (AGMA, 1988), and assembly (AGMA, 1989). [2]

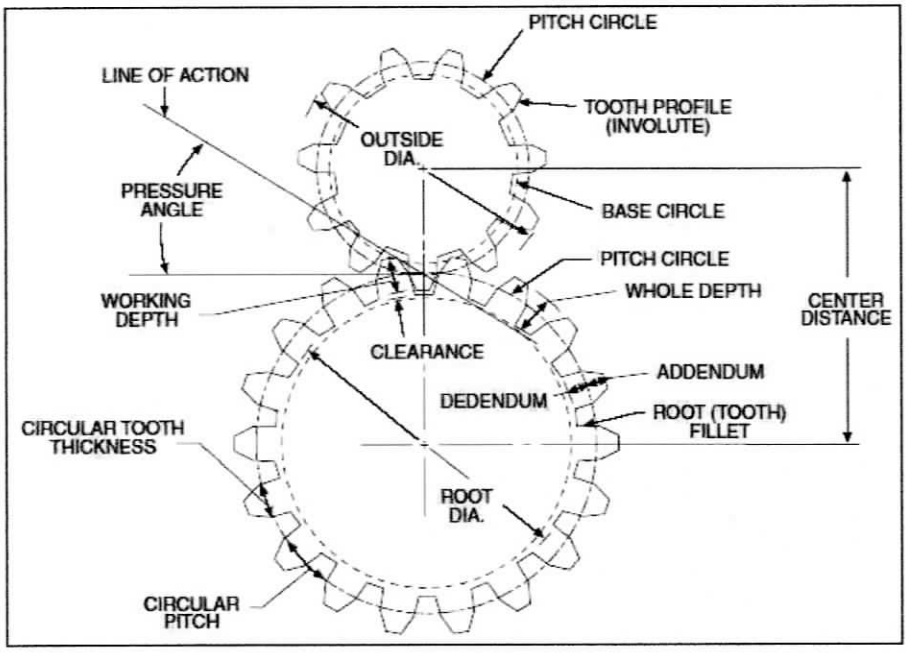

Figure 2.1: Basic gear geometry

Type of Gear

Gears can be divided into three major classes:-

1) Parallel-Axis Gears
   i) Spur Gear
   ii) Helical Gear
2) Nonparallel-Coplanar Gears
   i) Bevel Gear
   ii) Straight Gear
   iii) Zerol Gear
   iv) Spiral Gear
3) Nonparallel-Noncoplanar Gears
   i) Worm Gear

1) Parallel-Axis Gears

This type of gears is the simplest and most popular type of gear. They connect parallel shafts and can transfer large amounts of power with high efficiency. Spur and helical gears are two of the primary gears in this classification. [2]

i) Spur Gears

Figure 2.2 shows a spur gear drive with teeth on the outside of a cylinder and parallel to the cylinder axis. Spur gears are the simplest and the most common type of gear.

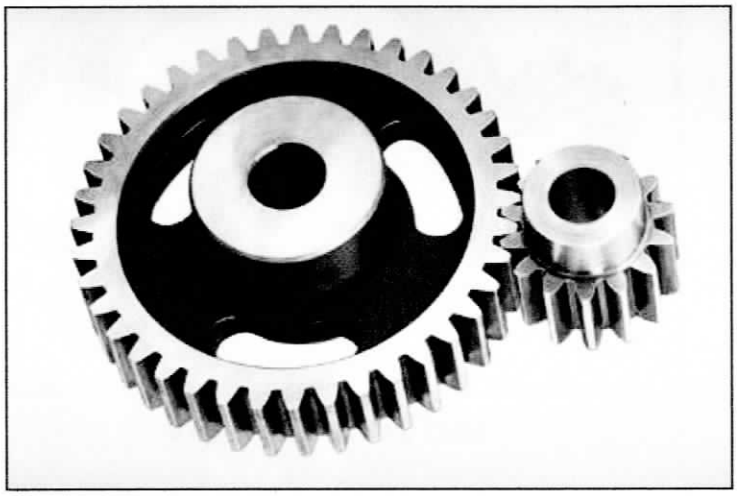

Figure 2.2: Spur Gear

ii) Helical Gears

Figure 2.3 shows a helical gear drive, with gear teeth cut on a spiral that wraps around a cylinder. Helical teeth enter the meshing zone progressively and have a smoother action than spur gear teeth. Helical gears also tend to be quieter. Another positive feature of helical gears is that the transmitted load is larger, thus implying that helical gear life will be longer for the same load. A smaller helical gear can transmit the same load as a larger spur gear.

A disadvantage of helical gears is that they produce an additional end thrust along the shaft. This end thrust may require an additional component, such as a thrust collar, ball bearings, or tapered-roller bearings. Another disadvantage is that helical gears have slightly lower efficiency than equivalent spur gears. Efficiency depends on total normal tooth load, which is higher for spur gears. Although the total load-