# RECOGNITION OF INTERACTING PRISMATIC FEATURES FROM FEATURE BASED MODELS

**YU ZHENG**

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University Technology Malaysia

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# ABSTRACT

Automated feature recognition is considered as the bridge between the Computer-Aided Design (CAD) and Computer-Aided Process Planning (CAPP). The automation of process planning requires the recognition of the features by implementing the feature recognition procedure to execute the planning of process. Many methods have been proposed nowadays corresponding to the various kinds of features in different types of CAD software packages. Under such conditions, many researchers have been contributed to this area of research. In this method, the effort is focused on features with inner loops. The selected features are rectangular boss, pocket and hole related to the machining features of pocket, hole, step and slot in isolated form or interacting form. The proposed method is tested using Visual Basic for Application (VBA) programming, and implemented on the Solidworks solid models. The measured performances are the total recognition time, design feature document and machining feature document. The result proves the feasibility of the proposed method. With a simple programming language and easy to understand algorithm the proposed method shows its overwhelming advantages in recognition the features with inner loops.

# ABSTRAK

Pengakuan ciri automatik dianggap sebagai jambatan antara *Computer-Aided Design (CAD)* dan *Computer-Aided Proses Perencanaan (CAPP)*. Automasi proses perancangan menghendaki pengakuan ciri dengan menerapkan prosedur pengiktirafan ciri untuk menjalankan proses perancangan. Banyak kaedah telah dicadangkan sesuai dengan pelbagai kemudahan dalam pelbagai jenis pakej perisian CAD. Banyak penyelidik telah memberikan sumbangan dalam bidang penelitian itu. Usaha tersebut telah difokuskan pada ciri-ciri lingkaran dalaman dengan kaedah itu. Ciri-ciri yang terpilih adalah kotak segiempat tepat, poket dan lubang yang berkaitan dengan ciri-ciri mesin bagi poket, lubang, langkah dan slot dalam bentuk terpencil atau berinteraksi. Kaedah yang dicadangkan telah diuji dengan menggunakan *Visual Basic for Application (VBA)* pengaturcaraan, dan dilaksanakan pada model *SolidWorks*. Prestasi yang diukur adalah jumlah masa diketahui, rekaan ciri dokumen dan dokumen ciri pemesinan. Hasilnya telah membuktikan kelayakan kaedah yang dicadangkan. Dengan bahasa pengaturcaraan dan algoritma yang mudah difahami, kaedah yang dicadangkan dapat menunjukkan keunggulan yang luar biasa dalam pengakuan ciri dengan lingkaran dalaman.

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# INTRODUCTION

## 1.1 Background

Manufacturing organizations are always keen to find the ways to produce high-quality products at the lowest cost and shortest time. In order to achieve this objective manufactures are looking for an alternative ways to the traditional approaches to design, manufacturing, and management. Computer aided process planning (CAPP) is considered to be an effective way to adapt to the flexible manufacturing and reducing the planning time and increasing consistency and efficiency in modern industry.

However, parts' geometry information is stored in CAD system in the form of low-level entities such as faces, vertices, edges and so forth rather than the actual manufacturing information of holes, slots, pockets etc. which can be virtually used in the computer aided process planning (CAPP). The main problem is that features are not neutral formats to transfer the CAD data to computer-aided manufacturing (CAM) system. On the other hand, there is a lack of absolute common or standard structure of database which is used to store the information related to the design due to the different types of CAD packages. An urgent solution should be found to overcome the obstacles. This chapter consists of five parts: statement of problem, objective, scope, research stage and specification of this research.

## 1.2 Statement of Problem

There are two approaches to create feature models are design by features and feature recognition which are used to actualize the manufacturing process from the CAD system.

Design by features, also known as feature-based design (FBD) enables the feature structures to be achieved by certain operations or shaping which is related to manufacturing information. In a typical feature-based design, the shapes that can be used in design are limited to individual basic machining features. The designer may be forced to consider the geometry from the machining point of view without using functional considerations. (Yuan-jye Tseng, 1999) In addition the features used to design the part do not necessarily represent the best way to manufacture it. (Regli, 1995)

Feature recognition is the mechanisms which are developed to extract the high-level features from the CAD solid model to act as the interface between computer aided design (CAD) and CAPP. Various methods for feature recognition are introduced nowadays. These methods include pattern matching approach, hint-based approach, volumetric decomposition approach and neural-network-based approach. A general consensus is reached that the recognition of interacting feature is the most important and challenge issue in feature recognition.

Despite promising research, many problems in feature recognition remain unsolved. Current research is looking at various hybrid methods combining basic recognition algorithms with rules or constraints to improve the accuracy of recognition. (Mantyla, Nau, and Shah, 1996) The initial idea of this thesis is to obtain the prismatic feature information from the feature base models with interacting feature using a specific feature recognition algorithm.

This study will concentrated on the extraction of interacting prismatic features rectangular boss from feature based modeling with the presence of blind pocket and through pocket by feature recognition approach using Solidworks software.

## 1.3 Objective

The purpose of this project is to develop a system based on the algorithm structured by using VBA programming of Solidworks which is using Application Programming Interface (API) to achieve the recognition of the interacting features from the model which has been created on feature based modeling in the form of 3D.

## 1.4 Scopes

This project is conducted within the following:

i Involve the topology and geometrical data from solid modeling;

ii The algorithm that will be developed will recognize interacting features using the feature definition of the model;

iii The system developed will use this algorithm;

iv Facilities used are: Solidworks for representation of solid models and Application Programming Interface (API) to implement the algorithm.

## 1.5 Research Stage

The study will proceed in the following five stages, the tasks of each stage are listed below.

i. Literature Review

Survey the feature recognition development and methodology in CAD system on previous and current research.

ii. Development of a Suitable Method

Survey the utilization of Application Programming Interface in developing algorithm for feature recognition in order to develop a specific algorithm.

iii. Development of the Proposed Algorithm

Develop a specific algorithm for automatic feature recognition as listed in the scope according to the chosen method.

iv. Conducting test and experimentations on the Algorithm and Verify the Results

v. Evaluation

Evaluate the compatibility and efficiency of the method to determine its capabilities and limitations.

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