

**FEATURE RECOGNITION USING RULE BASE TECHNIQUES FOR
FEATURE WITH INTERSECTION**

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ABSTRACT

Automated feature recognition is considered a critical component for the integration of Computer Aided Design (CAD) and Computer Aided Process Planning (CAPP). In feature recognition most current systems have difficulties in recognizing interacting features because of the destruction of characteristic adjacency relationships in the feature boundaries when interaction occur. Therefore in response to the problem, the application of rule based method is outlined in this research for the implementation to specific features with and without intersection. This need to be extended to thin wall parts, to support design for manufacture for injection molding and casting process which have some commonly used feature to be recognized especially feature with intersect. The proposed method is implemented to the feature with and without intersection such as through hole, cylinder boss, blind hole and other six cylinder boss with specific intersecting features. Three selected plastic parts with several common molding features also has been used for the case study. The proposed method is tested using Graphics Interactive Programming (GRIP), and implemented on the Unigraphics solid modelers. The results show that the proposed method is successful in recognizing the selected features with and without intersection especially for cylindrical feature.

ABSTRAK

Pengecaman sifat automatik adalah bahagian terpenting untuk persepaduan atau integrasi antara Rekabentuk Berbantu Komputer dan Proses Perancangan menggunakan Komputer. Pelbagai kaedah telah dibangunkan untuk mengautomasi pengecaman sifat tetapi kebanyakannya sulit untuk mengenal pasti sifat-sifat pada sesuatu komponen apabila interaksi antara sifat-sifat terjadi. Oleh itu berdasarkan kepada masalah tersebut, kajian tesis ini tertumpu kepada *rule-based* untuk pengecaman sifat-sifat tertentu yang berinteraksi dan tidak berinteraksi. Perkara ini perlu diperluaskan lagi untuk barangan dinding nipis untuk membantu rekabentuk pembuatan dalam suntikan acuan plastik dan logam yang mana mempunyai sifat yang berinteraksi untuk di buat pengecaman. Kaedah pengecaman sifat dilaksanakan kepada sifat-sifat dengan interaksi dan tanpa interaksi seperti *through hole*, *cylinder boss*, *blind hole* dan enam jenis bos yang berlainan sifat dengan interaksi. Tiga jenis barangan plastik yang mengandungi sifat dengan dan tanpa interaksi juga telah digunakan untuk tujuan kajian kes dalam projek ini. Kaedah pengecaman sifat telah diuji dengan menggunakan *Graphics Interactive Programming (GRIP)* pada pemodel padu *Unigraphics*. Hasil keputusan menunjukkan kaedah ini mampu mengecam semua sifat terpilih yang dibangunkan dengan dan tanpa interaksi terutamanya kepada sifat yang berbentuk silinder.

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CHAPTER 1

INTRODUCTION

This chapter will discuss the objective, scope, methodology and benefit of this project.

1.1 Introduction

Feature recognition provides a communication medium between CAD and manufacturing application and it is a basic component of tool for design analysis and feedback. Various methodologies have been developed to recognize features. Few approaches have demonstrated the ability to recognize both single feature and intersecting feature by using various algorithms but the basic limitation among both (single feature and intersecting feature) of their method is limited only for certain feature.

One of the main problem in the feature recognition areas is that most current system have difficulties in recognizing interacting features because boundaries of the destruction of characteristic adjacency relationships in the features boundaries when interaction occur. Rule base technique need to be extended for feature with intersection.

1.2 Problem Background

Feature recognition is the basic component of tools for design analysis and feedback, as well as for systems that automatically generate process plan and drive manufacturing process. Recognizing features from a design means providing design understanding to manufacturing software system.

In feature recognition most current systems have difficulties in recognizing interacting features because of the destruction of characteristic adjacency relationships in the feature boundaries when interaction occur. The difficulties of recognizing interacting features stem from the fact that intersecting destroys part or the entire characteristic of pre-defined basic features.

Since feature recognition is an important stage in CAD/CAM integration, this shortcoming may cause bottlenecks in automating the process. Hence it is necessary to recognize the intersecting feature and identify the design and manufacturing features. This need to be extended for thin wall parts, to support design for manufacture for injection molding and casting process which have some commonly used feature to be recognized especially feature with intersect. Feature recognition using rule based is outline in this research for the implementation to features with intersection.

1.3 Objective of the Project

- i. To develop rule base technique approach for feature recognition with intersection for selected feature
- ii. To develop a feature recognition approach for molded part by using rule based technique.

1.4 Scope of the Project

- a) The development of specific algorithm for feature recognition with and without intersection.
- b) The selected features covered are of solid models in thin wall injection molding and thin wall cast parts. These are
 - i) Through hole, cylinder boss and blind hole
 - ii) Blind hole intersect with cylinder boss. (BOSS1, BOSS2, BOSS3, BOSS4, BOSS5 and BOSS6)

- c) Facilities used are: Unigraphics solid modelers for the representation of solid models and Graphics Interactive Programming (GRIP) for implementation of the algorithms.

1.5 Research Methodology

i. Phase 1

Focuses on literature review. Survey on current research in the area of CAD, CAPP and CAM. Survey on research in feature recognition approach, thin wall injection molding and die cast.

ii. Phase 2

Identification of software and hardware. A suitable CAD/CAM software and compatible programming language need to be selected.

iii. Phase 3

Development of specific algorithm for automatic feature recognition as per scope of research.

iv. Phase 4

Experiment on a case study and verification of the algorithm.

v. Phase 5

Evaluation of the capabilities of the method which includes the advantages and limitations of the method.

1.6 Significance and benefit of proposed research

- a) Can be implemented as part of a manufacturing advisor to identify features that may be expensive and difficult to manufacture.
- b) Feature recognition approach for thin walled parts to support design for manufacture for injection molding and thin wall casting.
- c) Reason for selected feature:
 - i. Expensive or difficult to manufacture early in the design process.
 - ii. Have the major impact on manufacturability of the part and usually used in injection molding and casting part.

- iii. This feature need to use another type of process especially rib (thin wall) need to use EDM process. (expensive and difficult to manufacture)
- d) Assist inexperienced designers in the design of products for injection molding or other near net shape manufacturing processes.
- e) A basic development for commercial reason and industrial purpose in CAD/CAPP/CAM.

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