UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Knowledge Based Expert System in Machining

Thesis submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka for the Degree of Bachelor of Engineering (Honours) Manufacturing (Manufacturing Design)

By

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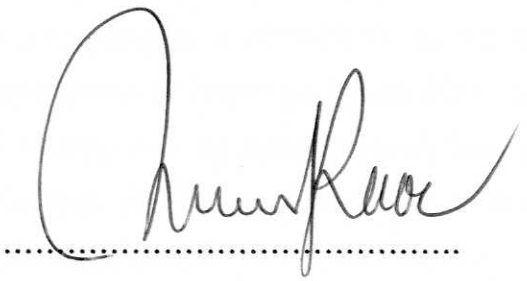
APPROVAL

This thesis submitted to the senate of Universiti Teknikal Malaysia Melaka (UTeM) and has been accepted as fulfillment of the requirement for the degree of Bachelor Manufacturing Engineering (Honours)(Manufacturing Design). The member of the supervisory committee are as follows:



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ABSTRACT

This research discuss about knowledge based expert system in machining using one type of Artificial Intelligence namely fuzzy logic. Fuzzy logic is a powerful problem-solving methodology with a myriad of applications in embedded control and information processing. Fuzzy provides a remarkably simple way to draw definite conclusions from vague, ambiguous or imprecise information. In a sense, fuzzy logic resembles human decision making with its ability to work from approximate data and find precise solutions. Fuzzy logic also has two types. First is Mamdani and the second is Sugeno. Fuzzy logics wide range has led into venture of many fields. E.g. prediction, optimization, forecasting, monitoring, control, approximation, evaluation, assessment, parameter selection and etc. This research carried out is basically to investigate the prediction machining process. So that a set of experimental parameters could be developed within the range of experimental value.

ABSTRAK

Kajian ini membincangkan tentang pengetahuan asas sistem pakar didalam pemesinan menggunakan salah satu jenis rekaan kebijaksanaan yang dinamakan sebagai lojik kabur. Lojik kabur adalah kaedah yang paling kuat di dalam menyelesaikan masalah dengan jumlah yang tidak terhitung dari aplikasi pada kawalan terancang dan pengolahan maklumat. Kabur menyediakan jalan keajaiban mudah untuk melukis kesimpulan tertentu dari kurang jelas, samar-samar atau penerangan yang tidak tepat. Di dalam akal, logic kabur menyerupai manusia membuat keputusan dengan kemampuan untuk bekerja dari jangkaan data dan mencari penyelesaian tepat. Logik kabur juga mempunyai dua jenis. Pertama ialah Mamdani dan yang kedua adalah Sugino. Logik kabur mempunyai banyak cabang untuk membuat sesuatu didalam pelbagai bidang. Contohnya, ramalan, optimism, meramalkan, pemantauan, mengawal, penghampiran, pernilaian, pengkajian, pemilihan parameter dan sebagainya. Kajian ini secara asasnya untuk menyelidik tentang ramalan proses pemesinan. Dengan itu, satu set eksperimental parameter perlulah dibangunkan di dalam lingkungan deretan nilai eksperimental.

DEDICATION

To my beloved father and mother:

Sayuti Bin Subari

Norsiah Binti Diron

This is a present for your sacrifice that not possibly required.

To my brothers and sister:

Saharuddin Bin Sayuti

Azhari Bin Sayuti

Norhayati Binti Sayuti

Zulkifli Bin Sayuti

You are the stimulus for this success.

To my younger sisters:

Siti Aminah Binti Sayuti

Nurul Azreen Binti Sayuti

Follow the success path for your journey still far

For your love, encouragement, and support during this project was absolutely invaluable.

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In the name of Allah, Most Gracious, Most Merciful.

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TABLE OF CONTENTS

LIST OF FIGURE

LIST OF TABLE

LIST OF GRAPH

LIST OF BAR CHART

CHAPTER 1

1. Introduction

An expert system which is also known as knowledge based system is a computer program that contains some of the subject-specific knowledge of one or more human experts. This class of program was first developed by researchers in artificial intelligence during the 1960s and 1970s and applied commercially throughout the 1980s. The most common form of expert systems is a program made up of a set of rules that analyze information (usually supplied by the user of the system) about a specific class of problems, as well as providing mathematical analysis of the problem and depending upon their design recommend a course of user action in order to implement corrections. It is a system that utilizes what appear to be reasoning capabilities to reach conclusions.

Technological advancements and our machine building abilities are the peer manifestation of our accepted world paradigm. However, as time evolves and our knowledge accumulates, difficulties and unexplainable observations become phenomena which demand reflection upon the existing paradigm. Such reflection often leads to the critical review of established principles and eventually to the proposition of new principles that will broaden our views, and hence will shape a new world paradigm.

It has been considered in recent years that a machining approach has provided a design philosophy under which manufacturing systems can be fully automated. The core ideas

in machining are both directly and indirectly linked with digital computers, i.e., by integrating digital computers into conventional manufacturing systems, so that human intelligence can be "transferred" to machines, and hence intelligent machines can then perform in an automated mode, without any further intervention by humans.

Mostly machines such as CNC, EDM and etc. have all been directly developed using digital computer technology. Techniques such as Expert Systems in Artificial Intelligence, Linear Programming in Operational Research and State-Space in Control Theory would not have been developed if the digital computer platform was not available. The invention of the digital computer was undertaken under the scientific principles of the time, with techniques and theories which have since been developed within that framework.

Digital computers, however, fall short of the capability to perform what can easily be performed by human intelligence, including (most notably) areas such as pattern recognition, natural language understanding, and decision making under fuzzy conditions; if these could be automated intelligently then they would have a great impact on our future manufacturing systems.

Fuzzy logic is the one type of Artificial Intelligence (1950s). Artificial intelligence (AI) is a branch of computer science that deals with intelligent behavior, learning, and adaptation in machines. Research in AI is concerned with producing machines to automate tasks requiring intelligent behavior. Examples include control, planning and scheduling, the ability to answer diagnostic and consumer questions, handwriting, speech, and facial recognition. As such, it has become an engineering discipline, focused on providing solutions to real life problems, software applications, traditional strategy games like computer chess and other video games. Artificial Intelligence (AI) has many types. Other type of Artificial Intelligence is Neural Network (NN), Hybrid, Adaptive Neuro-Fuzzy Inference System (ANFIS) and Genetic Algorithm (GA). Fuzzy logic systems can be applied to many applications such as pattern recognition/classification,

intelligent system controls, system identification, time series prediction, signature verification, image processing, machinery health monitoring, computer-assisted medical diagnosis, and etc. Fuzzy Logic was initiated in 1965 by Lotfi A. Zadeh, professor for computer science at the University of California in Berkeley. Fuzzy Logic also have two types, first is Mamdani and the second is Sugeno. Basically, Fuzzy Logic (FL) is a multivalued logic that allows intermediate values to be defined between conventional evaluations like true/false, yes/no, high/low, etc. Notions like rather tall or very fast can be formulated mathematically and processed by computers, in order to apply a more human−like way of thinking in the programming of computers.

In manufacturing, Fuzzy Logic is used in machine like drilling, turning, CNC, EDM and etc. Research on ways to do it better is of the utmost social interest and advanced techniques of machine intelligence have much to offer this agenda. So this volume's title generates great expectations. Readers deserve chapters outlining path-breaking research contributions in industrial-strength machine intelligence, and discussions of how existing AI techniques can be translated into the nitty-gritty domain of real-world application. Several articles in this volume of contributed essays do satisfy these expectations, but most fall short, either because they do not use computational techniques that one would recognize as "intelligent," apply established AI techniques to toy problems of little practical concern in industry, or both.

In medical, Fuzzy Logic used such as in the diagnosis. Medical diagnosis is the art of determining a person's pathological status from an available set of findings. It an art because it is a problem complicated by many and manifold factors, and its solution involves literally all of a human's abilities including intuition and the subconscious. If it is an art, is it at all susceptible to information processing. Although it appears to be among the most demanding problems ever to be approached by the information processing community, there is strong evidence that it is. It does, however, require an integration of results from most of the many sub disciplines of information processing and especially in artificial intelligence (AI).

Water resource systems (WRS) can be viewed as management systems subject to continuous operations broken by discrete events when new goals must be defined on the short-term either to guarantee an efficient use of the upstream water reserves or to enforce security. Fuzzy Logic is used in each instance of the recurrent optimization problem to express accurately the demand constraints and the level of the terminal stock constraints, and then a Linear Programming solution is developed. The proposed approach is illustrated by its application to a water resource system of medium complexity.

Actually, Fuzzy Logic is also can used in many applications. It's not limited only in machining such as CNC, drilling, turning and etc. The function of Fuzzy Logic is universal. But in this research is focus only in machining.

1.1 What is Knowledge based or expert system?

A knowledge based system usually called an expert system. The field of automatic control has for a long time focused on the development of algorithm. With the availability of inexpensive digital computers attempts are now being made to add other elements such logic, reasoning, sequencing and heuristics. Knowledge based control is the one alternative for obtaining controller with improved functional features.

Knowledge based control system are based on the operators heuristics knowledge of the system to be controlled. The main objective is to extend the range of conventional control algorithm by encoding knowledge and heuristics about identification and adaptation in a supervisory expert system. An ideal expert control system should have the following objectives:

- It should be able to control in a satisfactory manner a large class of process that may be time-varying and subject to a variety of disturbance.
- It should require minimal a priory knowledge about the process.
- It should be able to make intelligent use of all available prior knowledge.
- It should improve the control performance as it gathers more knowledge about the system.
- It should allow the user performance specifications in simple qualitative terms like small overshoot and as fast as possible.
- It should monitor the performance of the system and detect problems with sensors, actuators and other components.
- It should be possible for the user to get information about process dynamics, control performance and the factors that limit the performance in an easy manner.

1.2.1 Objectives

The main objective in this research is about the knowledge based on expert system in machining. Beside that, other specific objectives include:-

i. To give information to readers about Fuzzy logic basically mean.
ii. To study the function of the Fuzzy Logic.
iii. To apply fuzzy logic into machining application in prediction.
iv. To evaluate the effectiveness of fuzzy application in the area of research.
v. To develop a set of recommended experimental data for machining process.

1.3 Scope of study

In this research, its concentrate on one type of the Artificial Intelligence (AI) techniques and it is Fuzzy Logic. From this research, FL is also having 2 types. First is Mamdani and the second one is Sugeno. FL also categorize as an expert system. Fuzzy logics wide range has used of many fields, e.g. prediction, optimization, forecasting, monitoring, control, approximation, evaluation, assessment, parameter selection and etc. But in this research, its focus on the prediction only. To run this experiment, software will be used to get the result. The software that will be used for this research is FLOP (Fuzzy Logic Operating Program). Because of that, to run this experimental its not use higher cost. So from this experimental using software, finally try to get the result.

1.4 Problem statement

When using the Fuzzy Logic, its more practical compare to the traditional method like mathematically and experimental. Fuzzy Logic not has limitation when it used. For example, fuzzy logic can be used to check prediction of a process, such as, when cutting a plate with 10mm width. Now we only have the data to cut only 6mm. By using fuzzy logic, we can estimate the prediction of the result that we will get although the process has not been done yet.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Introduction

Fuzzy Logic is well known and applied in most of the rules which covert rules base and knowledge based prediction optimization, forecasting, monitoring, control, approximation, evaluation, assessment, parameter selection and etc. The output is based on the input from an experiment in the related field.

Many researches her conducted this research successfully by incompletely knowledge based rules in to the system. The system is a unique design, machining, management, medical and etc. Actually, fuzzy Logic also has two types. First, in 1975 is Mamdani and the second is Sugeno. Mamdani types are user-friendly in that they are very intuitive and well-suited to human input. It is the most commonly seen fuzzy methodology. While, the Sugeno or Takagi-Sugeno-Kang method of fuzzy inference was first introduced in 1985, and is very similar to Mamdani. The main difference between the two is that the output membership functions are restricted to being only linear or constant for Sugeno-type fuzzy inference. This results in a more computationally efficient Fuzzy System, resulting in Sugeno being the Fuzzy model of choice for adaptive techniques of fuzzy model creation. These adaptive techniques can be used to customize the membership functions so that the fuzzy system best models the data.