ESTIMATION IN SPOT WELDING PARAMETERS USING GENETIC ALGORITHM

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A report submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Engineering (Mechanical)

Faculty of Mechanical Engineering
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DECEMBER 2007

To my beloved mother,
for your love and courage.

This work is dedicated to my parents, Pauziah binti Awaludin, Lukman bin Shariff and my family members who love me and support me during my whole journey of education. Not to forget my fellow friends Apai, Burn, Be'ah, Noorsyam, Syafa, Bob, Karim and my fellow friends

Without you all who am I today!

ABSTRAK

Proses kimpalan rintangan titik merupakan suatu proses penyambungan yang penting terutamanya dalam industri automotif . Proses kimpalan titik menggunakan parameter yang perlu di tentukan oleh pengguna seperti arus electrik dan masa yang di ambil untuk melakukan satu proses dalam kimpalan titik. Kajian ini akan menganggarkan parameter kimpalan titik dengan menggunakan simulasi komputer. Pengenalpastian system merupakan satu bidang permodelan sebuah system melalui data dari ujikaji atau simulasi. Penggunaannya tersebar luas dalam bidang kejuruteraan dan kawalan. Algoritma genetik (GA) digunakan sebagai penganggar parameter untuk suatu struktur model. Dengan menggunakan (GA) parameter kimpalan titik akan dapat di anggarkan.

ABSTRACT

Spot welding is an important metal joining process mainly in the automotive industries. Spot welding process needed parameters define by user such as current and time to finish one cycle of spot welding process. In this study, parameter of spot welding estimate using computer simulation. System identification is the field of modeling a system from experiment or simulation data. The application has widespread in many areas especially in system and control engineering. Genetic algorithm (GA) used as parameter estimation method for a model structure. By using Genetic algorithm (GA) the spot welding parameters can be estimated.

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LIST OF ABBREVIATIONS

GA	-	Genetic Algorithm
JIS	-	Japanese Industrial Association
BS	-	British Standard
GAWCEM	-	Genetic Algorithm Welding Current Strength Estimation Model
GAWTCEM	-	Genetic Algorithm Welding Time Estimation Model
LSE	-	Least Square Estimate
SSE	-	Sum Square Error
MSE	-	Mean Square Error
EI	-	Error Index

CHAPTER I

INTRODUCTION

1.1 Introduction

Spot welding is an advance technique in welding field. Spot welding is used in an automotive industry to combine two or more plats in producing a car. Proton and Perodua are examples of local automotive industries using spot welding to fabricate their cars. Proton has a big factory at Tanjung Malim while Perodua at Rawang. The main advantage of using spot welding technique is the machine is applicable to robot arm so that, welding work can be done faster than other technique.

In the spot welding process, two or three overlapped or stacked stamped components are welded together due to the heat created by electrical resistance. This can be done by the work pieces as they are held together under pressure between two electrodes. Spot welding may be performed manually, using robots, or by a dedicated spot welding machine and the process takes only few seconds.

Spot welds are discrete weld locations that look like small circles on the assembled components. They are not continuous, linear welds. Low volumes of components are usually done manually, whereas high volumes can be achieved the best by using robots or dedicated weld equipment. In spot welding, there are number of variables involved such as current, pressure, time, human element, type of condition of welder, condition of electrodes and condition of surface. Some of the weld parameters are difficult to control and may cause weld problems. Others are easy to control such as the current, time and electrode pressure. Achieving good weld quality starts with a good process design that minimizes the variables during welding.

The genetic algorithm (GA) is useful as optimization techniques. GA can search the optimum parameter to produce the good quality of welding. In this study, the initial population of the genetic algorithm is created based on the range of spot welding parameter. The ranges can be estimated based on the standard were used in this study.

By using genetics algorithm, the parameters for spot welding can be optimized. Genetic algorithm can give the good parameter because it used probability concept for the optimization of welding.

1.2 The Problem Statement

Spot welding is a major bonding technique in the automotive industries Nowadays industries are using 30% of the total amount of spot weld to join a part of car. This is because difficult to the estimate welding parameters. The advantages of resistance spot welding are high speed and suitability for automation and inclusion in high production assembly lines with other fabricating operations. Spot welding is a very fast process and there are many factors that affect the quality of welds.

There are several variables to control in order to produce good quality weld like welding current (A), welding pressure (MPa) and time (Cycle). By automatic control of current, timing and electrode force, spot welds can be produced consistently at high production rates and low unit labor costs by unskilled operators.

1.3 Objectives

The main objective of this research is to estimated parameters. The study starts with investigating the spot weld and implementing the genetic algorithm to determine the parameter. In general, the objectives of the study are:-

(i) To study spot welding and factors affecting a good spot welding.
(ii) Using Genetic Algorithm to estimate good parameter of the welding variables. The welding variables are current and time.
(iii) Validate the model.

1.4 Scope and Limitation

The research is subjected to the following scope and limitation:

(i) The study is limited to resistance spot welding.
(ii) The material of specimen is mild steel and galvanized
(iii) The thickness of material is 2mm for mild steel and 1mm for galvanized.
(iv) The machine used is spot welding machine (VX-100K)

The research has a few assumptions:

(i) Others variables such as human element, type of machine, material and surfaces are neglected.
(ii) The machine system used is assumed stable. (Spot welding machine need air pressure to move the electrode, but the compressor does provide enough pressure needed for the machine)

1.5 Methodology

The methodology for this study is based on System Identification procedure as shown in flow chart shown in Figure 1.1 below:-

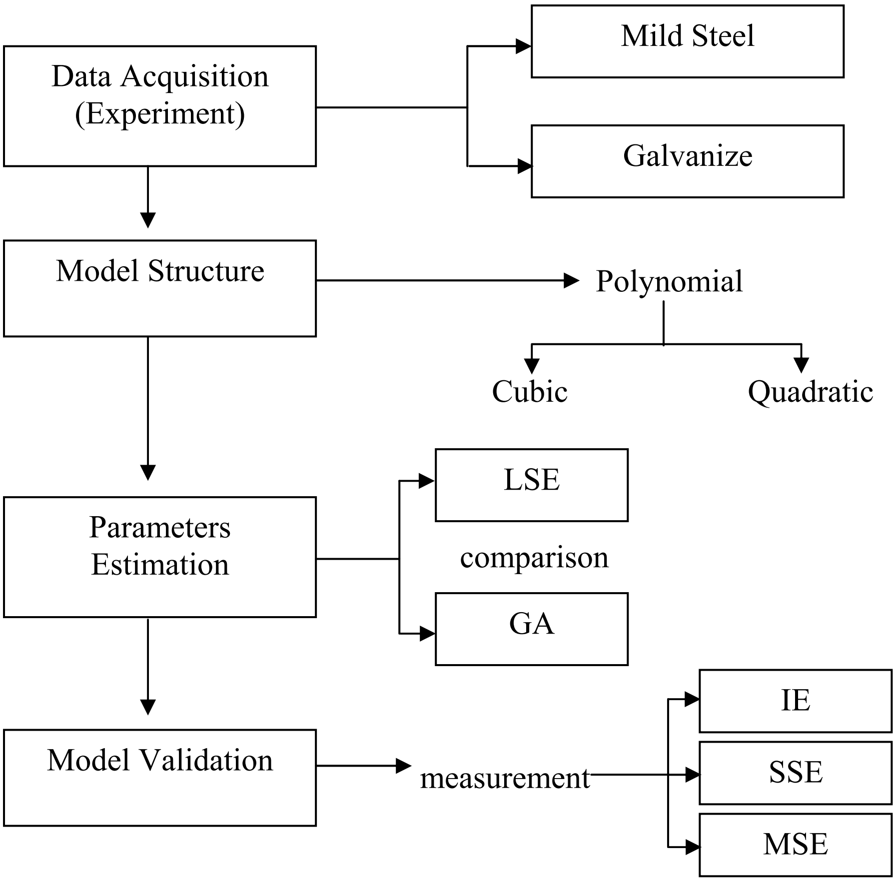

Figure 1.1 Project Methodology

Mild steel and galvanize are material used in this study. For the model structure, polynomial model was used. There are two type of polynomials model such as cubic and quadratic. LSE and GA were used for the parameters estimation. To measure the performance of the model used Error Index, Sum Square Error and Mean Square Error was used as a model validation tests.

1.6 Organization of the Thesis

This report consists of six chapters. Chapter 1 gives brief introduction about the project including objective and scope of the project.

Chapter 2 discusses about spot welding and system identification. Spot welding is several types of resistance welds, resistance welding process and spot welding parameters. In system identification there are several steps should involved as data acquisition, model structure, parameter estimation and model validation.

Chapter 3 discusses about data acquisition and describes the steps on how to collecting the data. This chapter discusses about operational framework, step in specimen preparation, spot welding process and steps to make tensile shear test.

Chapter 4 describes the methodology used in these projects which are system identification procedure and genetic algorithm (GA) procedure as the parameters estimation techniques. This chapter also discuss about the model structure used.

Chapter 5 presents the result of the simulation studies and validating GA algorithm in spot welding parameters estimation technique.

Finally, chapter 6 consists of the conclusion and the recommendation of the project for future work of this project.