UNIVERSITI TEKNIKAL MALAYSIA MELAKA

WELDING PATTERNS INFLUENCE ON THE JOINING STRENGTH OF MILD STEEL PLATE

This report is submitted in accordance with requirement of Universiti Teknikal Malaysia Melaka (UTeM) for Bachelor of Engineering Manufacturing Technology (Process and Technology)(Hons)

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow.

.....

(Project Supervisor)

ABSTRAK

Menghasilkan komponen dikimpal baik sentiasa mencabar dalam usaha untuk meningkatkan kualiti kimpalan terutamanya untuk kimpalan keluli lembut. keluli lembut mempunyai ciri-ciri kimpalan yang unik berbanding dengan bahan lain. Oleh itu, penyelidikan mengenai kimpalan pengaruh corak pada kekuatan menyertai kepinagn keluli lembut telah dijalankan dengan menggunakan analisis ujian-t. Ujian-t adalah analisis dua populasi bermakna melalui penggunaan peperiksaan statistik. Kajian ini telah dijalankan untuk mengkaji pengaruh dua kepingan keluli bersama dengan menggunakan ABB MIG gas robot arka logam kimpalan. Projek ini telah dimulakan oleh kajian pola kimpalan seperti zigzag, segi tiga dan garis lurus untuk kepinagn keluli lembut bersaiz 6mm ketebalan. Ujian tegangan dilakukan untuk mengetahui kekuatan masing-masing tegangan. Ini kekuatan tegangan adalah analisis dengan T-ujian hipotesis. Hasilnya, ia menunjukkan kimpalan corak tenunan zigzag adalah daya maksimum yang lebih tinggi daripada segi tiga dan garis lurus. Satu kekuatan terbaik corak tenunan kimpalan akan menilai dengan corak kimpalan menenun yang betul, jika dapat menghasilkan kekuatan cukup dinamik dan kualiti kimpalan terbaik, dipastikan. Secara keseluruhannya, keseluruhan objektif kajian yang disenaraikan berjaya dicapai daripada kajian awal ini.

ABSTRACT

Producing good welded components are continually challenged in order to improve the welding quality especially for mild steel welding. Mild steel has their unique welding characteristics compare with other material. Therefore, a research on welding pattern influence on the joining strength of mild steel plate was carried out by using T-test analysis. T-test is an analysis of two population means through the use of statistical examination. Experiments were carried out to study the influence of two plate butt joint by using the ABB MIG robotic gas metal arc welding. This project is been started by study the pattern welding such as zigzag, triangle and straight line for mild steel plate 6mm thickness. A tensile test was done to find out the respectively tensile strength. This tensile strength was analysis with T-test hypothesis. As a result, it shows the welding weave pattern zigzag is higher maximum force than triangle and straight line. A best strength of welding weave pattern will evaluate with the right welding weave pattern, if able to produce a sufficiently dynamic strength and best weld quality, was ensured. In overall, the entire listed research objective was successfully achieved from this preliminary research.

DEDICATION

For my beloved Father,

Abdul Kadir Bin Hj Amit

My beloved Mum,

Fatimah binti Hj Timbul

My Brothers,

Muhammad Khairul Abdul Kadir

Muhammad Khussairy Abdul Kadir

Muhammad Kamarul Azman Abdul Kadir

My Sisters,

Nurul Khairunnissa Abdul Kadir

Bibi Izzatul Ad'Wiyah Abdul Kadir

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Dear my mom and dad, Abdul Kadir Bin Hj Amit and Fatimah Binti Hj Timbul, truly from my heart. I love both of you a lot for your love and spirit that given to your second daughter. You mean everything to me.

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CHAPTER 1
INTRODUCTION

This chapter describes the introduction to the title of the project and briefly explains the problem faced for mild steel welding. In addition, the planning of completing final year project was discussing. It also covers the scope and importance of this project.

1.1 Background of Project

The recent manufacturing technology development has enabled the manufacturing to make components and parts. Robot welding with high degree of automation, high power and high production are extremely advantage in automotive application the welding industrial industry. Best robot welding system able to decrease the welding cost and production time for a product. Robot welding is important in the welding industry and consistent or much better job than manual welding. There are several advantages in using robots instead of human being to carry out any task. For example, robots can increase repeatability consistency, safety and quality by reducing the failure or error. The major's components of MIG robot welding are the controller or the mechanical unit and the controller, which goes about as the robot mind. Quality of welding does not only affected by the welder but there also cause by other's factors such as room temperature of robot welding. This study is conducted at UTEM's Laboratory which provides facilities and machines for student's learning and research that involves in process MIG robot welding. Other than that, this study is about the welding patterns is influence on the joining strength

of mild steel plate using MIG robot welding. In MIG robot welding at UTeM laboratory have a basic patterns such a straight line, other beside that in MIG robot welding have is three welding weaving pattern is zig-zag-shaped and triangular the weaving programme for robot welding is more difficulties then straight line and have difference toughness of the welding. This study is to identification and analysis of current patterns of MIG robot welding, then proposing the best patterns MIG robot welding that can prove welding patterns is one of the methods to give good quality of welding and can reduce of using too much electrode.

1.2 Problem Statement

Welding process is commonly used to joint mild steel plates together. In order to get the best quality welding strength, factors that need to be considered include the welding weave patterns, besides thickness of workpiece also can affect. Basically, methods of the joint using different weave patterns are still lacking. Besides, the problem regarding in the MIG robot welding, there have different welding weave patterns. So, a final year project with title is “welding patterns influence on the joining strength of mild steel plate” will be carried out determine the best weave pattern using the tensile test.

1.3 Scopes of Project

This study was carried out at the robot welding Laboratory, Faculty of Engineering in UTeM to propose the welding patterns influence on the joining strength of mild steel plate. The requirement in choosing patterns only focused and covered the workpiece. In this study, there are using mild steel plate AISI 1010 with dimensions (100mmx50mmx6mm) and the welding process MIG ABB robot welding (use mild steel wire 1.0mm mix argon, 80% 20co2 mix argon gas). Joint types which will be performed are the butt joint weld; once a joint is been weld appropriately utilizing the ABB robot welding. The welding patterns will do is tringle, zig-zag and straight

line. Therefore, material must be dividing into five parts of each welding patterns using milling machine with 6mm end mill and then tensile test is use Shimadzu 100kn tensile machine are used to get the result strength of welding. The limitation for this project is nozzle, gas, parameter of the robot welding and jig for welding processes.

1.4 Objectives

There are a few goals that should be file in this venture. These targets are:

1. To analyze the strength of three welding patterns on mild steel plate
2. To conduct statistical analysis using T-Test
3. To determine the best welding pattern of ABB MIG robot welding

1.5 Thesis Overview

This year final report is discussed in general about welding patterns influence on the joining strength of mild steel plate. The report is divided into three chapters covering all matters to be discussed in the development of this project.

This first chapter of this report is the introduction. In the introduction, you will have a sub-study including background, objectives, approach to the problem, the project's scope and methodology. In the background of the project, it will discuss the project processes. Meanwhile, the problem statement in the problem getting resistance welding quality will be explained. So the purpose of this project, some scope of work has been determined and clearly described in the sub theme of the work areas.

Chapter two review of the literature covered. It is the study of the processes that promote participation in this project. In addition to that, literature review also covered the theory of the project and the case study of the previous study.

The next chapter is the methodology. This chapter will discuss about some of the guidelines for this project and also clearly mentioned steps to be taken for this project. This step is clearly explained in order to achieve the objective of this project. Chapter four is about the result and discussion of the project. Besides that, the performance and analysis of the result obtained is also included in chapter four.

The last chapter of this report is conclusion. In this chapter, the achievement of the project objectives will be concluded. Some recommendation will be suggested for future improvement.

CHAPTER 2

LITERRATURE REVIEW

This section contains the literature review on hypothetical ideas connected in this project. It contains the data social occasion of the project with a specific end goal to finish the entire task.

2.1 Introductions

In the last 20 years, the advancement of science and modern welding technology has been extraordinary. Global, welding is a technology for manufacturing a trillion dollars largely used in the building and bridges and aircraft, aerospace, shipbuilding, energy, automotive and electronic industries. Since it may be because welding is a construction technique, it is seen by many as the basic science (Ranjeet Agarwala, 2000) said.

The accent of the welding process in the current technology can properly be cheeks, considering the great application absorbing metal bonding by heat treatment. The other tests can be used to add towards the welder or welding to meet its assent code requirements (ASME SEC IX QW Article II). All standard WPS are suitable to achieve high level created the need for automation of the welding process, as this provides conditions of preparation and administrable welding and ensure product of high and consistent quality of the products manufactured and estimating high production appropriate for modern industry.

Ranjeet Agarwala 1999, said arc welding is recommended is the best manual promise features bright robot. This circumstance first axis of underproduction manual mass

due to severe ambient environment medium arises from the extreme warmth and exhaust achieve the welding procedure, second, curve welding is the kind of work third largest behind collecting furthermore, machining in the metal creation industry. The robotization of the welding procedure begins a real testing zone of analysis in the range for example, mechanical technology industry sensor, control system and artificial brightness. Automation or automation industry modern technology (computer) to control industrial machinery and processes, replacing human operators. It is a part of the stage of mechanization, where human operators are added with machinery to assist them in their jobs. The most visible part of automation could say almost one industrial robotics. A little benefit is repetition, close quality control, waste reduction, and integration with the business system, improving productivity and reducing labor. (Shariman Abdullah, 2005) said automation can be perpetual with one or mount movable with automation gear or transfer adequate for adjustment to various employments controllable pitch.

Welding automation in simple terms means that the welding work is done without by human intercession. After all, in better operation of the automatic control, be that as it may, not important to always screen the welding operation. Programmed welding requires a point by point plan of the developments and consequtive operations. Coordination of the different parts of the welding apparatus, such as wire feeders, the movement of the torch and the power source is needed. Robot play an important role in automating processes precise welding the welding arc GMAW like. They are widely used in specific industries such as automobile manufacturing. A small device specific electromechanical automatic welding such as seam comes next and video monitoring apparatus.

2.2 Arc welding

Arc welding is a technique joining material where two or more melt surface by exposure to intense heat of an electric are created between an electrode and the workpiece to be welded. The technique used and the type of electrode vary depending on the selected welding process (Moore, 1985)

2.2.1 Welding Gas Metal Arc

Bowditchetal, (2005) highlights the welding gas metal arc welding (GMAW) is a welding process in which metals are joined by warming them with a solder are between a constant consumable anode and the base metal. A gas or gas mixture is used protective atmosphere to prevent contamination of the weld. Moreover, welding using gas metal arc as a wire electrode. A welding arc is truck between the terminal and the base metal. The terminal is melted as is fed continuously to keep the welding arc.

Weglowski et al, (2008) indicate that the greater the increasingly gas metal arc welding (GMAW) used for manufacturing industries (Figure 2.1). This process is very flexible because it can be connected to welding position. It can be effectively coordinated into robotic creation gallops. Furthermore, this process an externally supplied shielding gas without applying pressure is used. MIG welding alludes to the utilization of dormant gas while welding metal active gas (MAG) includes the utilization of dynamic gas (i.e., carbon dioxide and oxygen). A variation of the GMAW procedure utilizes a metal powder filled tubular electrode to compensate for most of the core materials (core metal electrode). Typically, economically critical metals, for example, carbon steel, low alloy steel of high strength, mild steel, aluminum and copper, titanium and nickel alloys can be welded at all over positions with the GMAW process by picking shielding gas suitable welding electrode and variables

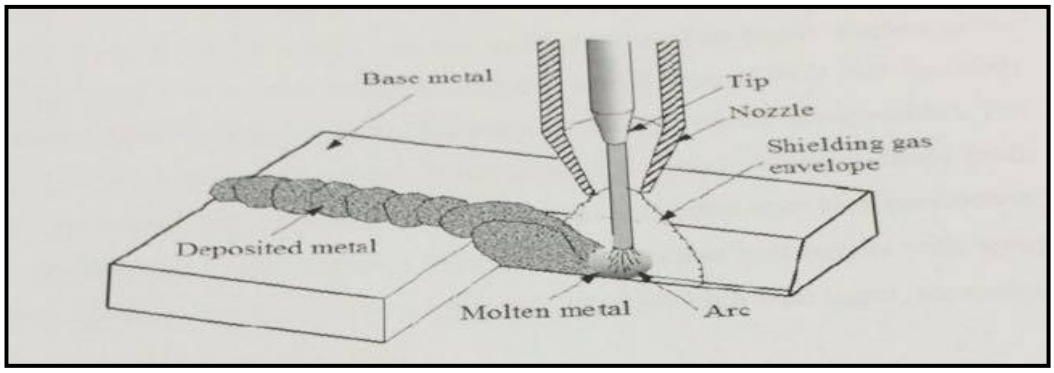

Figure 2.1: GMAW process (Weglowski et al, 2008)

2.2.2 Advantages GMAW

The main advantages of welding gas metal arc are; you can be removed and removal slang flow, and reduce smoke and gases. Low level of skill in semiautomatic welding method application is possible. (Helzer.C. 1999)

The metal arc welding can be used for most metals. Carbon dioxide is limited to welding steel. The electrodes were observed in base metals. The process can also be used for melting and for accumulating use of special metal surface to support surface and corrosion resistance. Metals from 01.3 inches up you can weld thickness. The variation of short cut and variation pulsed arc welding are used to the thinner material in all positions.

MIG welding offers a poor welding controlled welding thin material at any position. A smooth weld and minimal spatter occurs and has become very popular. The main advantages of gas metal arc welding are highly operator factor, high deposition rates, high use of filler metal, and slag removal and defluxing. In addition, other advantages are reduction in smoke and gases, the lower level of skill in a semi-automated method of application required for shielded metal arc welding and possible automation (Cary and Helzer, 2004) manual.

2.2.3 Limitation of welding gas metal arc

The GMAW procedure, similar to any other welding process has certain constraints that limit their use. First, the welding gear is more unpredictable, typically all the more expensive and less. Then, the GMAW procedure is harder to apply in difficult to achieve places because the welding gun is bigger than the small holder and should be kept near the joint within 10 to 19 mm. Finally, the shielding gas limits outdoor applications unless protection (Ferjutz one Davis, 1993).

2.2.4 Welding metal transfer

Weglowski e.t ll. (2008) defines GMAW metal transfer process as a material of the welding wire transfer as molten liquid droplets to the workpiece (Figure 2.2). According Ferjuts and Davis (1993) optimal transfer mode depends partly on the thickness of the base metal being welded. For example, very thin sections (in all positions) require short-circuit mode (with low current levels and Appraise adjustments voltage and other operating parameters, including the shielding gas composition. Thicker sections show better results spray or transfer screaming. These transfer input modes also produce high temperature, high penetration and high deposition rate.

Metal transfer plays an important role in determining the stability of the process and the quality of the weld. Depending on the welding conditions, metal transfer can take place in a main modes; globular, spray, and shorts (Figure 2.3). Mass transfer where the droplet diameter is larger than the diameter of the wire occurs at relatively low currents. Since often accompanied by large spatters, globular transfer is typically used in parts having relatively loose requirements of welding quality. Spray transfer, where in the droplet diameter is smaller than the diameter of the wire, it occurs at high currents and a half. It is a very stable and efficient process, and is widely used in the welding of thick steel plates and aluminum parts. Short circuiting transfer is a transfer mode in which special drop melts the wire tip makes contact with the workpiece or weld pool surface. It is characterized by repeated intermittent are extinction and re-ignition. It requires low heat input is commonly used in the welding of thin sheets (Weglowski et al., 2008)