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PREDICTING THE DEPOSITION GEOMETRY AND WELDING PARAMETER OF FLUX CORE ARC WELDING FOR WELDING BEAD ON PLATE WITH 1G POSITION

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ABSTRACT

Flux Core Arc Welding (FCAW) is a popular choice for metal fabrication. The process of FCAW used semi-automatic setup and consumable electrode (flux in the core of consumable wire), which can generate shielding gas to protect weld pool from atmosphere during welding. The most critical factor that determine the welding output is the correct choice of welding parameters. The quality of welding is considered acceptable when bead geometry or profile has the right sizes and has minimum defects. To determine the quality of the welding, the visually and the macrostructure characterization can be carried out. The welding operator in industry gets the size of bead geometry and the welding parameters by trial and error. This approach is costly, including the wastage of materials, powers and the labour costs. Research findings published so far were only valid for small sample sizes and involved tedious analysis in order to predict the bead geometry and welding parameter, except the bead geometry-heat input correlation method. In this work, large number of welded specimens were produced by Robotic FCAW process in 1G position. Only the bead geometry with good quality of samples were measured and tabulated. The heat input and weld bead geometry are plotted and the correlations of element of bead geometry were represented by the respective trend-line equations. These equations are used to predict the weld bead geometry and the welding parameters. The accuracy of the weld bead geometry was improved by grouping the data concerning the level of bead penetration that were collected from several experiments. The accuracy of prediction on bead geometry and welding parameters was found to be excellent, for more than 100 samples. The maximum deviation and the mean average deviation from experimental samples is less than 1mm.

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CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND

The Flux Core Arc Welding (FCAW) process has been widely used for welding on a wide range of material and thickness. In the welding process, the arc is located between the tip of electrode wire and the workpiece. It is the source of heat that created the molten pool on the workpiece. The electrode wire acts as filler wire or consumable to build up the deposition. For the protection of weld pool from atmospheric contaminations, additional shielding gas is supplied through a nozzle surrounding the wire. The FCAW is a high productivity semiautomatic process, which can be converted to mechanized or automatic equipment [1,2].

The applications of FCAW have exceeded the combined usage of all other arc welding processes. It is popular even among the small scale supporting industries. FCAW has the advantages of high deposition like Submerge Arc Welding (SAW) and Gas Metal Arc Welding (GMAW) plus the versatility of Shielded Metal Arc Welding (SMAW). It is believed that in the next decade, its usage would be a worldwide trend. The market for the machine, consumable and product of FCAW will be expected increased by many folds [3].

The semi-auto welding FCAW is very dependent on manual skill. Although the time to train a FCAW welder is less than SMAW welder, the cost of training a FCAW welder is more because the higher cost of consumable. Furthermore, most welders can maintain their skill qualification not more than five years. The shortage of skilled welder is an acute problem that faced by the fabrication industries. The cost of manual welding of FCAW is always on the increasing trend due to the increase of labour and consumable cost, while the profit margin is decreasing, leading to poor competitiveness among the fabricators [4].

The solution to overcome the problem of high labour cost, unavailability of skilled welder, the requirement to achieve high productivity, price competitiveness and generation of high income, lies in application of production automation. The market for automated and robotic system is growing rapidly. The cost of the automation machine