UNIVERSITI TEKNOLOGI MARA

PREDICTING THE WELDING PARAMETERS AND DEPOSITION GEOMETRY OF GAS METAL ARC WELDING PROCESS FOR T-FILLET

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Mechanical Engineering

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

A wide range of welding parameters and deposition geometry sizes of Gas Metal Arc Welding (GMAW) process are predicted. Recent studies focus on optimizing a weld bead size by using mathematical models and using costly welding software. A lot of studies were focused on downhand welding position, some in horizontal position and few in vertical and overhead positions. They were also studies in butt joint design and few in T-fillet joint design. The scope of this research focused on the predicting welding parameters and welding deposition geometry on a T-fillet joint with GMAW process utilizing articulated robot. 1.2mm diameter of ER70S-6 filler wire is used to produce fillet weld on 6mm thickness of low carbon steel base metal and shielded by 100% carbon dioxide gas. The T-fillet joint design is welded in 2F, 3F and 4F welding positions. A calculator is developed by Microsoft Excel software and the output will be a system that can predict the welding deposition geometry for the respective welding parameters. The results are validated by complying with American Welding Society (AWS D1.1) Codes and Standard and by using Mean Absolute Deviation (MAD). 5 sets of welding currents i.e. 100amp, 138amp,175amp,213amp and 250amp with respective arc voltages of 18volts, 21volts, 24volts, 27volts and 30volts; and with welding speeds of 2.5mm/second, 5mm/second, 7mm/second, 10mm/second, 12mm/second respectively are preset and 125 coupons are prepared for each position. Only quality weld beads are selected for macro etching tests and their actual geometrical data (results) are tabulated. All welding parameters and deposition geometry data are graphically plotted in 2D. Two calculators are produced based on actual and predicted data that are produced by those graphs. The welding parameters and deposition geometry results seemed accurately predicted within 1mm of Mean Absolute Deviation. The correlation graphs show that the higher the welding currents and voltages, the bigger the fillet weld size but it was otherwise for weld speeds. As a conclusion, the prediction calculators seemed successful to facilitate welding engineer in determining suitable welding parameters to be applied to produce the required fillet weld bead sizes. These calculators seemed could be utilized in industrial application.

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