UNIVERSITI TEKNOLOGI MARA

THE PREDICTION OF FLUX CORED ARC WELDING (FCAW) FILLET GEOMETRY AND WELDING PARAMETERS FOR HORIZONTAL POSITION (2F)

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ABSTRACT

The robotic and mechanized welding system can perform productively only when it is programmed with the correct welding parameter before the start of welding. The welding parameter that produces quality deposition with specific value of bead penetration will be even more difficult to select than just getting a weld-able parameter. Unless the robot operator has record of preset welding parameter, selection of welding parameter by trial and error will be unproductive and unreliable. A reliable prediction system need to be developed and tested that can guide the operator to select welding parameter that assure the correct bead geometry and bead penetration. This project will focus on Flux-cored arc welding (FCAW) process, creation of an accurate prediction formula that can generate the welding parameter for quality fillet deposition with specific bead geometry. A welding robot was employed to weld fillet joint on carbon steel in horizontal position (2F). The effect of heat input on fillet bead geometry was studied by performing welding at a range of current, voltage and travel speed. The effect of heat input on root penetration of fillet bead can only be observed from the macro-structure of the fillet cross-section. Trend-Line Fitting analysis was applied to predict the bead geometry. The trend-line was obtained from the correlations of heat input, current, voltage, and speed with the fillet bead leg size. The trend-line formula was applied in the prediction of FCAW fillet bead in 2F position. The accuracy of the prediction of fillet bead geometry including the fillet root penetration was improved by selecting only quality samples, grouping the samples according to the depth of root penetration, and combining the data obtained from different experiment conducted by different operators, locations and welding power sources. The prediction of the fillet bead geometry for FCAW in 2F position when given any weld able parameter, leg size, throat size and root penetration was successfully achieved with good accuracy, maximum deviation of less than 1mm. Finally a calculator chart was developed at the end of this experiment. In industrial practice, error of 1mm in weld fillet bead geometry is generally acceptable. By applying the calculator chart, a wide range of welding parameters for quality deposition can be generated with desired fillet leg size and root penetration in one try.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Manufacturing is a process of transferring input (raw materials) into an output which is the product. The terms input in manufacturing refers to a combination of materials, labor, machines, tooling, and also the formulation. Welding is one of the manufacturing processes involved in production of a product [1].

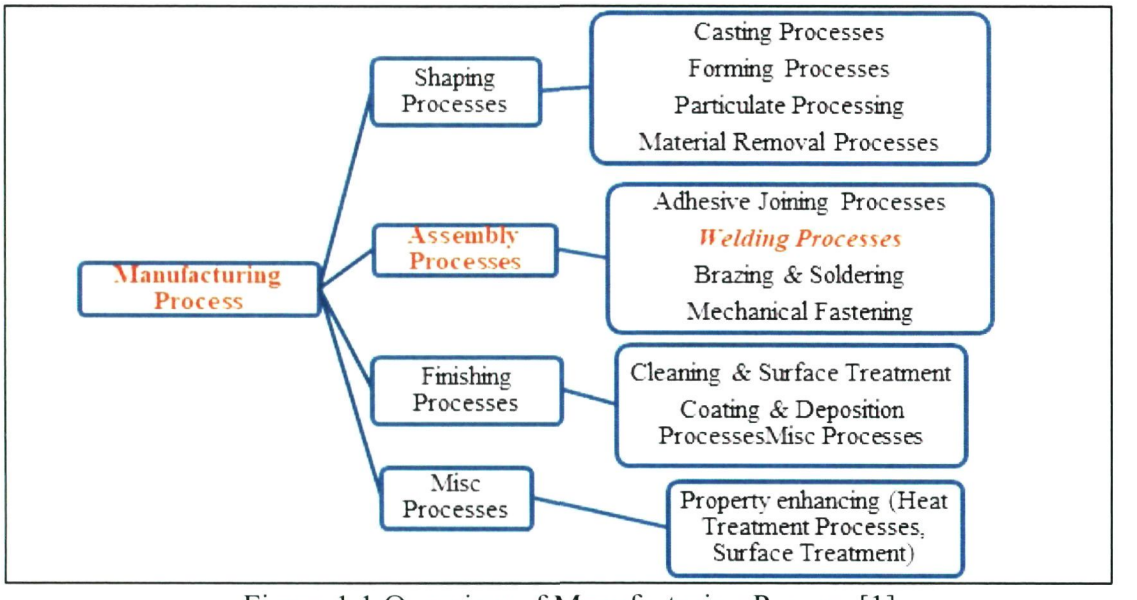

Figure 1.1 Overview of Manufacturing Process [1]

According to the American Welding Society (AWS) [2], welding is a joining process that produces coalescence of materials with or without the application of pressure, heat and the use of filler metal [2]. On the other basic definition, welding is a process of creating homogenous fusion in a metal.

Fusion welding processes are widely used for joining metal structures and applied for fabrication or maintenance, such as pipes, ships, and cars [3]. The advancement of welding technology has contributed toward the development of industries to produce aircraft, oil drilling platform, piping system, tanks and boilers. In general, these joining processes offer a very good compromise between reliability,