

UNIVERSITI TEKNOLOGI MARA

**PREDICTION OF WELD BEAD
GEOMETRY OF SMALL-WIRE
SUBMERGED ARC WELDING
IN 1G POSITION**

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ABSTRACT

Small-wire submerged arc welding is a welding process where the weld pool is submerged in granulates flux. It is different with the conventional SAW by the choice of filler wire which is 1.2mm. The most common problem encountered in small-wire SAW welding process is that the difficulty to determine the correct welding parameter for desired output bead geometry. The common approach is selection by trial and error can lead to waste of time, cost and energy. Therefore, in order to solve the problem a system was developed which can predict the weld bead geometry. The robotic welding ABB IRB 12400 was employed to perform small-wire SAW on mild carbon steel in 1G position. More than 204 samples, size 25mm x 500mm x 9mm thick were welded by the robot with welding current, voltage and travel speed in range 200-360 ampere, 22-36 volt and 4-18mm/s respectively but only 99 samples were accepted base on their good quality. Each sample was tagged with welding parameter, numbered, photographed on the profile, sectioned, polished and etched to observe the macrostructure. The weld bead geometry was measured and from the data the correlation between heat input and bead geometry was analysed based on the best the trend-line which is polynomial equation. It was found that when the data of welding samples were grouped according to bead penetration into 5 groups the accuracy of bead geometry prediction has Mean Absolute Deviation and maximum deviation that less than 1.0mm. Thus this experiment had produced an accurate system to predict the weld bead geometry and welding parameter, before welding, without trial and error, and experimentally verified by a large number of welded samples.

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