ABSTRACT

A significant problem faced by today’s welding engineer is the need to relate welding process parameters to the quality of the finished weld. This is usually achieved by experience and necessitates many experimental trials, eventually leading to optimal welding process parameters. In this study, the selection of process parameters for obtaining optimal weld bead geometry in the tungsten inert gas (TIG) welding of austenitic stainless steels is presented. Bead geometry (bead width and bead height) and penetration (depth of penetration and weld bead area) are important physical characteristics of a weldments known to influence the mechanical properties. Several welding parameters seem to affect the bead geometry and penetration. Welding current, welding voltage, torch speed, electrode vertex angle, shielding gas compositions influence the depth of penetration. The other factors that influence the penetration is heat conductivity, arc-length and arc-force.

Use of Artificial Neural Networks to model the TIG-welding process is explored in this study. Back propagation neural networks are used to associate the welding process variables with the features of the bead geometry and depth of penetration. These models have achieved good agreement with the training data and have good generalization. A neural network could be effectively implemented for estimating the weld bead geometry and depth of penetration. The results of these experiments show a small error percentage difference between the estimated and experimental values.

Keywords: Stainless Steels, GTAW, Process Parameters, Weld Bead Geometry, Artificial Neural Network, Modeling.