Neural network modeling for prediction of weld bead geometry in laser microwelding

ABSTRACT

Laser microwelding has been an essential tool with a reputation of rapidity and precision for joining miniaturized metal parts. In industrial applications, an accurate prediction of weld bead geometry is required in automation systems to enhance productivity of laser microwelding. The present work was conducted to establish an intelligent algorithm to build a simplified relationship between process parameters and weld bead geometry that can be easily used to predict the weld bead geometry with a wide range of process parameters through an artificial neural network (ANN) in laser microwelding of thin steel sheet. The backpropagation with the Levenberg-Marquardt training algorithm was used to train the neural network model. The accuracy of neural network model has been tested by comparing the simulated data with actual data from the laser microwelding experiments. The predictions of the neural network model showed excellent agreement with the experimental results, indicating that the neural network model is a viable means for predicting weld bead geometry. Furthermore, a comparison was made between the neural network and mathematical model. It was found that the developed neural network model has better prediction capability compared to the regression analysis model.

Keyword: Laser microwelding; Weld bead geometry; Artificial neural network (ANN)