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Master Thesis Defense

Entitled

MINIMIZATION OF THE WELD DISTORTION BY WELD SEQUENCE OPTIMIZATION USING ARTIFICIAL INTELLIGENCE.

by

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Abstract:

The application of dissimilar metal welding processes is increasing nowadays in the automobile, aerospace, marine industry as they not only serve for joint welding for different metals but also assist in repairing and reworking in a simplified manner. Study on optimization of weld parameter to weld a structure is important to have control over the distortion, mass deposition, tensile strength, etc. The present research reports the development and implementation of the Genetic algorithm integrated Artificial Neural Network (GANN) based weld sequence optimization for reducing deformation of dissimilar metal joining using hot-encode technique. Gas Metal Arc Welding (GMAW) is used for the dissimilar metal welding of steel to aluminum. The plan is to divide the welding beads into various segments thus forming different weld sequences. The FEA software provided by MSC MARC Simufact will be used to simulate and analyze the distortion pattern of the welded joints. Simulation results will be validated through the experiments and further, the agreement will be validated with a fair percentage below 20% error to achieve accuracy in terms of studying deformation patterns. A training set of various sequences will be used to train the neural network to obtain a near-optimal sequence. The outcomes of this research are the selection of optimized process parameters for better joint characteristics such as tensile strength, hardness, bead geometry, etc. These optimized process parameters are used to weld the joint that is performed in a sequence. Finally, the sequences are optimized using GANN thereby reducing the distortion, improving the efficiency of the weldment. The sequences obtained are tested for minimum distortion criteria using both GMAW and Simufact welding software. The results exemplify that the proposed optimization model is suitable for any kind of weld design and optimization problem.

Keywords: Dissimilar Metal Welding; Gas Metal Arc Welding; Grey-based Taguchi Optimization; Weld Sequence Optimization; Artificial Neural Network (ANN); Genetic algorithm integrated ANN (GANN)