WELDING PROCESS OPTIMIZATION WITH ARTIFICIAL NEURAL NETWORK APPLICATIONS

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Abstract: Correct detection of input and output parameters of a welding process is significant for successful development of an automated welding operation. In welding process literature, we observe that output parameters are predicted according to given input parameters. As a new approach to previous efforts, this paper presents a new modeling approach on prediction and classification of welding parameters. 3 different models are developed on a critical welding process based on Artificial Neural Networks (ANNs) which are (i) Output parameter prediction, (ii) Input parameter prediction (reverse application of output prediction model) and (iii) Classification of products. In this study, firstly we use Pareto Analysis for determining uncontrollable input parameters of the welding process based on expert views. With the help of these analysis, 9 uncontrollable parameters are determined among 22 potential parameters. Then, the welding process of ammunition is modeled as a multi-input multi-output process with 9 input and 3 output parameters. 1st model predicts the values of output parameters according to given input values. 2nd model predicts the values of correct input parameter combination for a defect-free weld operation and 3rd model is used to classify the products whether defected or defect-free. 3rd model is also used for validation of results obtained by 1st and 2nd models. A high level of performance is attained by all the methods tested in this study. In addition, the product is a strategic ammunition in the armed forces inventory which is manufactured in a limited number of countries in the world. Before application of this study, the welding process of the product could not be carried out in a systematic way. The process was conducted by trial-and-error approach by changing input parameter values at each operation. This caused a lot of costs. With the help of this study, best parameter combination is found, tested, validated with ANNs and operation costs are minimized by 30%.

Key words: *Artificial neural networks, welding process control, weld operation*

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