

Abstract

Process parameters modeling have always been one of the key aspects in development of an adaptive control of arc welding process. The welding process parameters are inherently nonlinear, time-delayed, and interdependent, and their on-time adjustment highly influences a sound weld bead formation and process monitoring. During the welding process, parameters control is the primary goal to leads a quality welding. Moreover, the final weld joint behavior, i.e., residual stress, welding strength, and micro-crack formation are generally observed after cooling of the weld product. Thus, it has always been a difficult task to control mechanical properties of a final weld joint. To obtain the best mechanical properties, the final weld joint characteristics needed to be controlled and predicted during the process itself by precise adjustment of the process parameters. The paper presents a neuro-fuzzy modeling approach to provide adaptive control for the automatic process parameter adjustment. Three input parameters wire feed speed, welding gap, and torch speed are modeled with welding current output, providing control over weld bead formation during the welding. The same input process parameters are also modeled to predict final weld joint characteristics, i.e., dilution ratio, hardness of weld bead, hardness of fused zone, and bead width. In order to ascertain the effectiveness of the neuro-fuzzy modeling approach, multiple regression models were also developed to compare the performances.

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