Effect on Tool Design and Heat Input of Some Welding Parameters in Friction Stir Welded Interstitial Free Steels

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Abstract

The friction stir welding process (FSW), a new solid state welding, are widely used in automobile and aerospace industries as compared to conventional fusion welding. The tool speed (rotational and translational), traverse speed, shoulder diameter and pin diameter are mainly responsible for the heat generation in FSW which are required to be optimized. The contribution of rotational tool speed is approximately three times higher than that of translational tool speed. This paper presents derivation for maximum heat generation to obtain best optimum tool geometry (tapered or cylindrical) in FSW through mathematical model using various parameters and necessary constraints. Two models namely genetic algorithm and regression model of response have been developed to compute optimum welding parameters. The genetic algorithm optimization technique has been employed for tapered and cylindrical FSW tool whereas the regression model has been employed for cylindrical FSW tool to obtain optimum tool geometry at constant welding speed. It has been found from genetic algorithm using MATLAB and regression modelling using MINITAB-17 that the optimum parameters for effective tool design are shoulder diameter as 12 mm, pin diameter as 4 mm and tool rotation speed as 250 rpm.

Keywords: friction stir welding, FSW, tool geometry, genetic algorithms, and regression modelling

References


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