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Thermal analysis of the friction stir welding process based on boundary conditions and operating parameters

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Abstract: Modelling of friction stir welding (FSW) remains a complicated task, as it is crucial to predict the mechanical properties of the final welded part. This research focuses on the numerical simulation aspect of the alloy material AA2195-T8. 3D transient thermal model was applied to simulate the heat transfer phenomena in the welding phase. In this model, the FSW tool is considered as a circular heat source moving in a rectangular plate having a cooling surface and subjected to non-uniform and non-homogeneous boundary conditions. To solve the thermal problem, the finite element method was used as part of a Lagrangian formulation. The obtained results allow us to determine the maximum value of the temperature in the Nugget zone of the welded joint. Sensitivity analysis of the operating parameters was also investigated to determine the thermal cycle and the temperature distribution during this welding process. Our results were successfully compared with the ones available in the literature with good agreement.

Keywords : Friction Stir Welding, Heat transfer, AA2195-T8, alloy material, parameter characterisation