

Simulation et optimisation du transfert thermique lors du soudage par friction malaxage FSW d'un métal

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Abstract: The Friction Stir Welding (FSW) is an assembling process of parts in the solid phase, without melting the material and without added metal. The basic concept of the FSW process is simple and consists of using a non-consumable rotational tool with a pin and shoulder shaped to provide required weld properties, where the thermal energy is generated by friction among the rotating the different. The aim of this thesis is to propose an optimization strategy using the SQP algorithm (Quadratic Sequential Programming) coupled with 3D transient heat transfer computation were used to improve the FSW process parameters. An optimization method was applied to improve the FSW welding parameters of an AA2195-T8 aluminum-lithium alloy plate. The numerical procedure proposed is based on the optimization of the spatial parameters related to the tool, ie the welding speed, the speed of rotation of the tool, the radius of the shoulder of the tool and the vertical force applied. This study aims to investigate three criteria: the control of the maximum temperature during FSW; the minimization of the HAZ length and finally the reduction of the total welding energy. The numerical study showed good agreement between the results obtained and the existing experimental data. This good agreement between the results of the two approaches would make it possible to use the proposed numerical model to predict the thermal field and the maximum value of the temperature. The optimization process has demonstrated its robustness and the main results obtained are: The optimal operating conditions allow a gain about 38% of consumed energy by FSW and a reduction of 11 % in the welding time; Applying the optimal parameters permits until a 70% decrease in the length of the Heat Affected Zone (HAZ) at every position on the weld line.

Keywords : Friction Stir Welding (FSW), Heat transfer, finite volume method, SQP algorithm optimization method.