

Computational investigation of crack behavior in friction stir welding

ABSTRACT

The aim of the present work is to predict the fatigue life of a friction stir welded (FSW) joint in the 2024-T351 aluminum alloy using the finite element method in the framework of Fracture Analysis Code for Two Dimensions (FRANC2D/L). The simulation is conducted using linear elastic fracture mechanics based on Paris' model, and the maximum tensile stress and displacement correlation methods are applied to calculate the crack direction and stress intensity factor, respectively. Several strategies are applied in order to predict the crack propagations through various welded zones regarding the corresponding parameters and Paris constants for each zone. The entire crack growth process is investigated step by step through all of the FSW zones, and the fatigue lifetimes of the FSW joint under various loading conditions are predicted by implementing the same procedure. The numerical results are validated with experimental and analytical work.

Keyword: Simulation; Finite element method; Fatigue crack growth; Paris model; Friction stir welding