A geometry-based welding distortion prediction tool

I. Granell Heredero; A. Ramos Calvo; A. Carnicero López

Abstract-

The prediction of welding distortion requires expertise in computer simulation programs, a clear definition of the nonlinear material properties, and mesh settings together with the nonlinear solution settings of a coupled thermal–structural analysis. The purpose of this paper is to present the validation of an automatic simulation tool implemented in Ansys using Python scripting. This tool allows users to automate the preparation of the simulation model with a reduced number of inputs. The goal was, based on some assumptions, to provide an automated simulation setup that enables users to predict accurate distortion during the welding manufacturing process. Any geometry prepared in a CAD software can be used as the input, which gave us much geometrical flexibility in the shapes and sizes to be modeled. A thermomechanical loosely coupled analysis approach together with element birth and death technology was used to predict the distortions. The automation of the setup enables both simulation and manufacturing engineers to perform welding-induced distortion prediction. The results showed that the method proposed predicts distortion with 80–98% accuracy.

Index Terms- Ansys; welding distortion; finite element method; thermoelastoplastic method; welding simulation