

A Coupled Heat Transfer and Thermomechanical Analysis of multi-pass Welding in Thick Plates and Varying Joint Geometry

Gaurav Dak*, Vikram Kumar, Pratyush Jyoti Roy, Amitava De

Mechanical Engineering Department, Indian Institute of Technology Bombay, Mumbai, 400076, India

(*Corresponding author: 20004010@iitb.ac.in)

Abstract

Multi-pass welding of thick high-strength low-alloy steel plates involves layer-by-layer deposition of filler materials that experience repeated thermal cycles and a complex nature of thermomechanical stress and distortion. A quantitative understanding of the evolution of the thermal cycle and thermomechanical features is quite a challenging task by trial and error experiments. In contrast, numerical modeling of the multipass welding in thick sections is an efficient route for a fundamental understanding of the evolution of the coupled heat transfer and thermoemchanical phenomena. We present here an attempt to simulate multipass welding in thick plates with typical double-V groove geometry. The computed results of thermal cycles, weld joint cross-sections, and thermomechanical stress and distortion are validated with the corresponding experimentally measured results from the literature. Overall, the present work provides an efficient route to realize a quantitative insight into the evolution of temperature field, and thermomechanical stress and distortion in multipass welding of thick sections with complex joint geometry.

Keywords

Numerical simulation; Multipass welding; Temperature field, Residual stress; Distortion