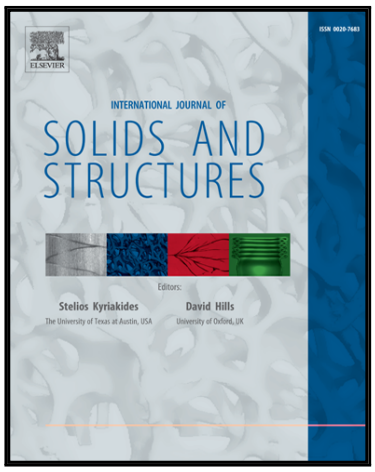

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The Influence of Welding Procedure and Plate Geometry on Residual Stresses in Thick Components

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Abstract

This study compares the residual stress profiles generated by two different welding techniques (multi-pass and single pass welding) in 80 mm thick ferritic steel welds. As residual stresses in such thick welded steel specimens that are representative of important industrial processes are to be determined, the contour method as a practical choice is employed. The results show that the residual stress distribution is sensitive to the details of the welding process, with the maximum tensile residual stress being located in the weld for the multi-pass weld and in the heat-affected zone for the single pass weld. However, the results obtained from the contour method are only valid at the cut plane. In order to predict residual stress variations along the depth of the welded specimens from the free surface, the inverse eigenstrain technique is extended. The eigenstrain-based approach allows us to evaluate the minimum specimen length required for the accurate estimate of residual stresses in large-scale engineering structures. This technique also allows predicting the correct magnitude of residual stresses in the full length specimen even if a shorter specimen is used for experiments. Finally, multiple cut contour measurements are made on the multi pass specimen in order to compare the distributions of residual stress in the longitudinal and transverse directions.