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Research highlights

A 2D numerical model of multipass welding was developed which takes into account all physical, thermo-metallurgical and mechanical phenomena
A comparison was made between singlepass and multipass welding in terms of fusion zone and heat affected zone dimensions and residual stress distributions near the weld toe
The higher the number of weld passes, the higher the magnitude of the residual asymptotic stress field near the weld toe
According to a previous model published in literature, with increase in the number of welding passes a decrease in the high cycle fatigue strength is expected.

Abstract

In the high cycle fatigue (HCF) regime, the fatigue strength of welded joints is influenced by residual stresses (RS) induced during welding processes. If the weld toe is modelled via a sharp V-notch, the distribution of weld toe residual stress can be shown to be asymptotic with a singularity which follows either the linear-elastic or elastic-plastic solution depending on parameters that range across material properties, specimen clamping conditions, and the welding process. For thicker plates, multipass welding is used instead of single-pass welding to reduce the heat input and hence