Fatigue reliability assessment of load-carrying cruciform welded joints with undercuts and misalignments

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July 13, 2023

Abstract

Due to the additional local stress concentration caused by undercut and misaligned defects, welded joints own less fatigue strength. This work uses probabilistic technique and fracture mechanics theory to quantitatively investigate the impacts of undercuts and misalignments on fatigue performance and reliability of Load-carrying Cruciform Welded Joint (LCWJ). Firstly, the geometrical characteristics summary of the size and type of undercuts and misalignments are provided from researches and experiments. Subsequently. Evaluations of the stress levels are combined with the nominal loadings in LCWJs, probabilistic distributions of material fracture properties, and various configurations of geometries and flaws. Meanwhile, the estimations of fatigue strengths are conducted by the probabilistic reliability theory by taking into account the distributions of the actual fatigue data. The findings reveal a clear disparity between the base metal and weldment test results. Different reliability levels for various defect types and sizes and in LCWJs are caused by the tolerance limits.

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