Review and considerations on the fatigue assessment of welded joints using reference radii

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Abstract

The notch stress approach is a quite valuable tool for the fatigue assessment of welded joints. In historical view a huge number of variants have been investigated and FAT-values have been recommended. Up to now various different radii ($r = 1.0\ mm$, $r = 0.3\ mm$ and $r = 0.05\ mm$) are available for the assessment of thin, medium and thick welded sheets. In addition, effective stress approaches have been considered which rely also on the calculation of notch stresses. They do not use maximum stresses but evaluate the stress gradient in the notch ligament. These different variants of the notch stress approach and their relationship are analyzed in depth.

It is shown, that with the current recommended FAT values non-conservative results may occur if an assessment of weld toe failure is performed with notch stress approaches using maximum stresses and radii smaller $r = 1.0\ mm$. To overcome this limitation, FAT-values in relation to the notch radii and notch opening angle are proposed. Another possibility to overcome this discrepancy is the use of effective stresses. With this approach the stress gradients in the notch ligament are evaluated and only one FAT-class independent on the radius on opening angle is necessary.

Keywords: Welded joints, Fatigue assessment, Notch stress approach, Reference radii, Slope and knee point

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