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Fatigue strength assessment of laser welded thin-walled joints made of mild and high strength steel

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Abstract

A database of fatigue tests taken from literature on thin-walled laser welded joints was created. Fatigue tests related to specimens made of different steel grades were considered, i.e. conventional and high strength steel, which is becoming of more concern in the automotive industry. For each specimen geometry in the database, the stress field in the notch ligament was obtained by means of finite element analysis, where the reference radius of $\rho_f = 0.05$ mm was modelled. The fatigue assessment was performed by using three representative stresses: the maximum notch stress as well as the stress according to the critical distance and the stress averaging approach. For each assessment approach a regression S-N curve with a dedicated scatter band (T_σ) was obtained. The scatter was taken as measure of the assessment reliability.

In addition to the assessment approach, also the effect of the base material on the fatigue strength is discussed.

Keywords: fatigue assessment, high strength steel, thin-walled specimens, laser beam welds, notch stress approach

1. Introduction

In the automotive industry there is a continuous trend to reduce the fuel consumption of vehicles. This development is driven on one hand by government regulations to limit the average output of carbon oxide. On the other hand, more and more customers consider the amount of fuel consumption in their purchase decision, but at the same time they do not want to relinquish driving dynamics and driving pleasure. To meet all demands, efforts are made in every directions. One of the many possibilities to meet those requirements is a reduction of the overall weight of the vehicles.

[☆]This document is a collaborative effort.

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