Investigation of the fatigue behaviour of notched specimens in the VHCF range using the StressLife fatigue life prediction method

The design of dynamically loaded metallic materials and components is based on the relationship between the stress amplitude and the number of cycles to failure, which is represented by a Wöhler curve. To ensure that the life assessment is as realistic as possible, the influence of geometry must be considered alongside material behaviour. Functional notches lead to increases in stress and can significantly influence fatigue behaviour. The investigation of notched specimens makes it possible to characterise the influence of the notch on the position and slope of the Wöhler curve, thereby providing important insights for the assessment of dynamically loaded components.
The aim of this work is to carry out stress-controlled fatigue tests on notched specimens using a resonant pulsator and to evaluate the test results using the StressLife fatigue life prediction method (LPV). By comparing the results with an existing database of fatigue tests on unnotched specimens, the aim is to investigate the influence of the notch on the stress amplitude and number of load cycles, as well as on the position and slope of the Wöhler curve. In addition, the material responses occurring during cyclic loading are recorded using sensors to measure internal energy (IETS). An infrared camera, digital image correlation (DIC) and electrical resistance measurement are used for this purpose.
The first step involves preparing the specimens for the fatigue tests. This includes geometrically mapping the notch, determining the surface roughness, and preparing the specimen surface for temperature measurement using an infrared camera and strain measurement using DIC. In addition, the test system is set up for the use of the intended measurement techniques. The fatigue tests are then carried out independently. Using the IETS, the temperature profile, the local strain distribution and the change in electrical resistance during cyclic loading are recorded. The focus here is on the material response in the notch field. The test results are then evaluated on the basis of the recorded material responses, and the Wöhler curve is determined using the LPM StressLife software. By comparing the results with the existing database of unnotched specimens, the influence of the notch on the position and slope of the Wöhler curve, as well as on the fatigue behaviour, is assessed.

Prerequisites:

- An interest in materials science, materials testing and fatigue
- (Basic) knowledge in the field of experimental testing and measurement technology

Type of opportunity:

- **Practical placement and Bachelor's thesis (30 ECTS) at the WWHK**
- **Research and development module (10, 20 or 30 ECTS) at the WWHK**
- **Master's thesis (30 ECTS) at the WWHK**

Duration and extent: in accordance with the study regulations and the nature of the student's work

Start date: immediately

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