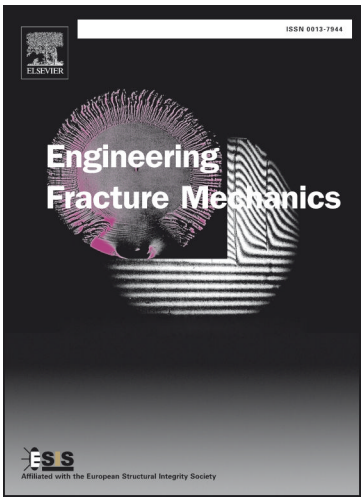

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A methodology for fretting fatigue life estimation using strain-based fracture mechanics

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Abstract: This work presents a methodology to estimate the lifetime of components under fretting fatigue using strain-based fracture mechanics (SBFM). The latter was originally designed to model small crack behavior in notches, where the behavior of materials is non-linear, i.e. outside of the linear elastic fracture mechanics (LEFM) domain. The SBFM model is basically a LEFM model modified to consider the effects of material nonlinearity and does not require two stages (initiation and propagation) to model fatigue life. To obtain these solutions, 2D finite element model simulations were performed and later adjusted by a 3D correction factor to consider a 3D elliptical crack propagation. The plasticity property of the material was considered by using the Ramberg-Osgood curve in association with Neuber's rule. The simulations estimated the fatigue life of 7050-T7451 Al and 2024-T351 Al components for several stress levels and the results were then compared to experimental data. The methodology was able to predict short and long crack behaviors, as well as crack arrests, and the results show that the method can satisfactorily predict fretting fatigue lives.

Keywords: Fretting fatigue; crack propagation; FEM; weight function.

1 – Introduction

Fretting fatigue occurs whenever mechanical components that are in contact with each other experience relative oscillatory movements at the contacting surfaces owing to cyclic loading. The repeated tangential slip between the contact surfaces causes a reduction in the fatigue life/limit and

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