Enhanced multiaxial fatigue criterion that considers stress gradient effects

Niels Saabye Ottosen, Matti Ristinmaa, Reijo Kouhia

PII: S0142-1123(18)30210-X
DOI: https://doi.org/10.1016/j.ijfatigue.2018.05.024
Reference: JIJF 4696

To appear in: *International Journal of Fatigue*

Received Date: 7 March 2018
Revised Date: 21 May 2018
Accepted Date: 23 May 2018

Please cite this article as: Ottosen, N.S., Ristinmaa, M., Kouhia, R., Enhanced multiaxial fatigue criterion that considers stress gradient effects, *International Journal of Fatigue* (2018), doi: https://doi.org/10.1016/j.ijfatigue.2018.05.024

Enhanced multiaxial fatigue criterion that considers stress gradient effects

Niels Saabye Ottosen*, Matti Ristinmaa* and Reijo Kouhia**

*Division of Solid Mechanics, Lund University,
SE-22100 Lund, Sweden

**Tampere University of Technology, Civil Engineering,
33720 Tampere, Finland

June 1, 2018

Abstract

Modification of a fatigue criterion valid for homogeneous multiaxial stress states to account for the beneficial effect of stress gradients is traditionally performed by modifying the stress terms in the fatigue criterion and thereby introducing new parameters that need to be calibrated. Here the stress terms are left unchanged and, instead, the parameters in the fatigue criterion are modified. This modification is performed, in principle, along the lines of Siebel and Stieler and it introduces Neuber's parameter as the only new parameter; however, as soon as the ultimate strength of the material is known, also Neuber's parameter is known. Therefore, the methodology introduced implies that no new calibration process is needed.

Here a specific fatigue criterion valid for homogeneous multiaxial stress states is enhanced by this procedure and predictions of this simple approach are compared with a broad range of experimental data and good accuracy is achieved. Moreover, the approach adopted can be applied to other fatigue criteria than the one considered here.

Introduction

Fatigue is a major source behind failures of mechanical structures, but despite significant developments since the pioneering work of Wöhler around 1860, the complexity of fatigue phenomena implies that a number of fundamental issues are still open for discussion; the historical development is presented e.g. by Schütz (1996) and Schijve (2003). For high-cycle fatigue, which is considered here, the