Multiaxial fatigue criterion considering the influence of out-of-phase failure and loading condition

C. Lu, J. Melendez, J.M. Martínez-Esnaola

PII: S0142-1123(18)30224-X
DOI: https://doi.org/10.1016/j.ijfatigue.2018.06.006
Reference: JIJF 4710

To appear in: *International Journal of Fatigue*

Received Date: 8 May 2018
Revised Date: 1 June 2018
Accepted Date: 5 June 2018

Please cite this article as: Lu, C., Melendez, J., Martínez-Esnaola, J.M., Multiaxial fatigue criterion considering the influence of out-of-phase failure and loading condition, *International Journal of Fatigue* (2018), doi: https://doi.org/10.1016/j.ijfatigue.2018.06.006

Multiaxial fatigue criterion considering the influence of out-of-phase failure and loading condition

C. Lu[a,b,*], J. Melendez[a,b], J.M. Martínez-Esnaola[a,b]

a) Ceit, Manuel Lardizabal 15, 20018 Donostia - San Sebastián, Spain

b) Universidad de Navarra, TECNUN, Manuel Lardizabal 13, 20018 Donostia - San Sebastián, Spain

2018.05

Abstract

A multiaxial fatigue criterion is proposed, which can be seen as a modification of a previous criterion presented by the authors. The influence of the unique material state can be taken into consideration, as well as the range and mean value of the variables involved in the fatigue parameter for depicting the influence of the loading condition. Definitions of the out-of-phase failure and out-of-phase failure angle are proposed, as well as an out-of-phase failure parameter that can be used to express the interdependent relationship with the out-of-phase failure, in both normal-type and shear-type failure. An explicit physical interpretation of different failure types is proposed. After validation and comparison with experimental results for different loading conditions and materials, it is concluded that the prediction ability of this modified multiaxial fatigue criterion is better than that of the original Lu's criterion, as well as than those of the other commonly used multiaxial fatigue criteria.

Keywords

Multiaxial fatigue; Failure mechanisms; Critical plane; Life prediction; Out-of-phase failure

Nomenclature

FP = fatigue parameter

γ_{max} = maximum shear strain amplitude

k = material-dependent constant

ε_n = normal strain

$\Delta\varepsilon_n$ = range of normal strain

ε_n^* = normal strain excursion

$\Delta\gamma_{max}$ = maximum range of shear strain

$\Delta\sigma_n$ = range of normal stress

$\Delta\tau$ = range of shear stress

$\Delta\gamma$ = range of shear strain

P_s = material state parameter

*Corresponding autor: C. Lu. Email: clu@ceit.es; se7en_luchun@163.com
Address: Parque Tecnológico de San Sebastián Paseo Mikeletegi, Nº 48 20009, Donostia - San Sebastián