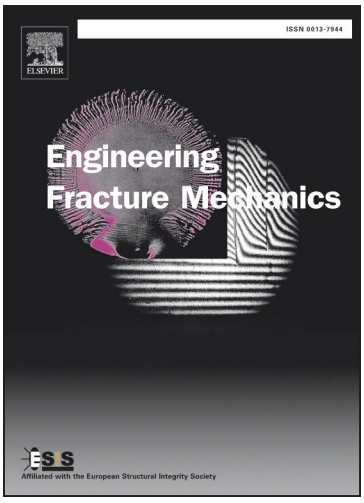

A non-local approach for probabilistic assessment of LCF life based on optimized effective-damage-parameter

Da Li, Dianyin Hu, Rongqiao Wang, Qihang Ma, Hui Liu

PII: S0013-7944(18)30216-9
DOI: https://doi.org/10.1016/j.engfracmech.2018.05.041
Reference: EFM 6015

To appear in: *Engineering Fracture Mechanics*

Received Date: 28 February 2018
Revised Date: 6 May 2018
Accepted Date: 26 May 2018

Please cite this article as: Li, D., Hu, D., Wang, R., Ma, Q., Liu, H., A non-local approach for probabilistic assessment of LCF life based on optimized effective-damage-parameter, *Engineering Fracture Mechanics* (2018), doi: https://doi.org/10.1016/j.engfracmech.2018.05.041

A non-local approach for probabilistic assessment of LCF life based on optimized effective-damage-parameter

Da Li[1], Dianyin Hu[2,3,4*], Rongqiao Wang[2,3,4], Qihang Ma[2], Hui Liu[2]

(1. Aero Engine Academy of China, Aero Engine Corporation of China, Beijing 101304, China;
2. School of Energy and Power Engineering, Beihang University, Beijing 100191, China;
3. Collaborative Innovation Center of Advanced Aero-Engine, Beijing 100191, China;
4. Beijing Key Laboratory of Aero-Engine Structure and Strength, Beijing 100191, China)

Abstract

The present paper includes two parts of low cycle fatigue (LCF) life analysis using the weakest-link method and a novel non-local approach respectively, which are both conducted based on previously published fatigue test results of TA19 notched specimens. The weakest-link method is applied to the prediction of strain fatigue life by introducing the Smith-Watson-Topper (SWT) parameter. The accuracy of the weakest-link method is found to be highly dependent on the values of Weibull parameters. The life scatter factor and the percentage for the data out of ±3σ scatter, which are introduced to evaluate the accuracy of deterministic and probabilistic life prediction respectively, have opposite tendency with the value of shape parameter for Weibull function. Accordingly, a non-local approach is proposed based on optimized effective-damage-parameter (OEDP). The optimization procedure for the effective damage parameter is established to ensure an optimum life scatter factor. Meanwhile, a probabilistic SWT model based on linear regression is developed to describe the dispersion of fatigue life. It is shown that a satisfactory accuracy of LCF life estimation can be achieved using the proposed method.

Keywords: stress concentration; size effect; low cycle fatigue; probabilistic fatigue life estimation; weakest-link method.

Nomenclature

Symbols

a_0	undetermined parameter in probabilistic life model	$N_{e,i}$	experimental fatigue life for the i^{th} data
b_0	undetermined parameter in probabilistic life model	ΔN	life scatter factor
b_N	Weibull shape parameter for fatigue	P_f	probability of component failure

* Corresponding author at: School of Energy and Power Engineering, Beihang University, Beijing 100191, China.
E–mail address: hdy@buaa.edu.cn (D.Y. Hu).