Accepted Manuscript

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PII: S0045-7825(18)30274-3
DOI: https://doi.org/10.1016/j.cma.2018.05.030
Reference: CMA 11931

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date : 10 November 2017
Revised date : 23 May 2018
Accepted date : 24 May 2018

Please cite this article as: A. Mohammadipour, K. Willam, A numerical lattice method to characterize a contact fatigue crack growth and its paris coefficients using configurational forces and stress-life curves, *Comput. Methods Appl. Mech. Engrg.* (2018), https://doi.org/10.1016/j.cma.2018.05.030

A Numerical Lattice Method to Characterize a Contact Fatigue Crack Growth and its Paris Coefficients Using Configurational Forces and Stress-life Curves

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Abstract

Paris' law material constants have computationally been determined using the implications of Configurational Mechanics and total stress-life curves to characterize fatigue crack growth rate, which is a challenge in experimental programs for measuring these parameters. A 2D plane strain lattice approach with a brittle erosion algorithm was employed to characterize total fatigue life and fracture behavior of propagating cracks of a pad-substrate system under high-cycle fatigue loadings in the context of LEFM. The capability of the lattice in predicting the direction of crack tip extension was validated by comparing with the analytical results of a center inclined cracked domain under uniaxial direct tension and also the surface crack initiation angle of the contact fatigue pad-substrate system. The lattice not only does fairly predict the Paris' coefficients comparing to experimental measurements in literature, but also obtains total fatigue life by assuming a failure value for the crack length and demonstrates a curved fatigue

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Preprint submitted to Computer Methods in Applied Mechanics and Engineering May 23, 2018