

## Accepted Manuscript

Fatigue crack growth under large scale plasticity: A direct physical approach for single-valued correlation of fatigue crack growth data

K.S. Ravi Chandran

PII: S0142-1123(18)30352-9  
DOI: <https://doi.org/10.1016/j.ijfatigue.2018.08.010>  
Reference: JIJF 4806

To appear in: *International Journal of Fatigue*

Received Date: 16 May 2018  
Revised Date: 19 July 2018  
Accepted Date: 4 August 2018

Please cite this article as: Ravi Chandran, K.S., Fatigue crack growth under large scale plasticity: A direct physical approach for single-valued correlation of fatigue crack growth data, *International Journal of Fatigue* (2018), doi: <https://doi.org/10.1016/j.ijfatigue.2018.08.010>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## Fatigue crack growth under large scale plasticity: A direct physical approach for single-valued correlation of fatigue crack growth data

K. S. Ravi Chandran  
Department of Metallurgical Engineering  
The University of Utah, Salt Lake City, UT 84112, USA  
Email: [ravi.chandran@utah.edu](mailto:ravi.chandran@utah.edu)

### Abstract

The major challenge in the mechanics of elastic-plastic fatigue crack growth is to find a physically based driving force to correlate the crack growth rates under different loading conditions. Specifically, a parameter capable of providing a *single-valued* correlation of crack growth rate, regardless of applied fatigue stress/strain values, is needed. Approaches of the past used either cyclic strain (strain intensity factor) or nonlinear fracture mechanics based (cyclic J-integral,  $\Delta J$ ) parameter, to correlate fatigue crack growth. The latter, however, requires experimental load-deflection curve after every crack length increment and geometry correction factors, which are complex. In the present work, it is shown that a new and physically based approach, on the basis of the *cumulative change in the cyclic strain energy of the net-section*, is used to successfully correlate fatigue crack growth in a variety of loading situations. The change in the cyclic strain energy is determined analytically from elastic-plastic behavior of material and from the relative sizes of cracked and uncracked sections in the crack plane. Load-deflection measurements, geometric correction factors, or numerical methods of fracture mechanics are not needed in the present approach. Remarkably, excellent correlations of fatigue crack growth in a variety of specimen geometries and stress/strain levels have been found in both *stress- or strain-controlled fatigue* conditions. This work, in conjunction with the author's earlier works, validates that the change in net-section strain energy is a fundamental quantity in the mechanics of fatigue crack growth.

**Keywords:** Fatigue, Crack growth, Net-section, Elastic-plastic, Yielding, Strain energy, Stress intensity factor

Download English Version:

<https://daneshyari.com/en/article/11003925>

Download Persian Version:

<https://daneshyari.com/article/11003925>

[Daneshyari.com](https://daneshyari.com)