Finite life and propagating crack considerations for an extended interpretation of the Kitagawa-Takahashi diagram

Finite Life and Propagating Crack Considerations for an Extended Interpretation of the Kitagawa-Takahashi Diagram

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Keywords: Fatigue limit; Kitagawa-Takahashi diagram; El-Haddad equation; Probabilistic S-N curve.

ABSTRACT

Considerations resulting from S-N field analyses on the existence or non-existence of fatigue limit [1,2], besides being an everlasting topic of discussion in the fracture mechanics community, give rise to promote a more profound comprehension of some issues related to the Kitagawa-Takahashi (K-T) diagram, thus continuing former works of the authors [3,4]. To do this, arguments are provided to illustrate the necessity of revising some of the influencing concepts in the current conventional interpretation of the K-T diagram, such as the transcendence of considering probabilistic S-N field approaches avoiding arbitrary, deterministic bi- and trilinear S-N models (Fig. 1), which necessarily imply the K-T diagram to be referred to a defined finite lifetime, see [5], the contradictory definition of non-propagating cracks [6] and the necessary identification of the K-T with a particular fatigue mechanism. In this way, a probabilistic extension of the K-T diagram for finite life predictions is ensured even in the VHCF region with multiplicity of mechanisms (Fig. 2). It is hoped that this approach will enhance understanding, effectiveness and reliability of the K-T applications in practical component design.

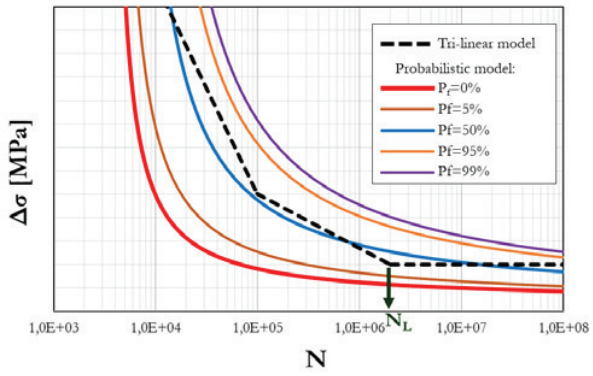

Fig. 1. Schematic representation of probabilistic S-N field, according to [2], and simplistic trilinear S-N field with definition of the kink point, N_L, as lifetime limit to which the K-T diagram is referred.

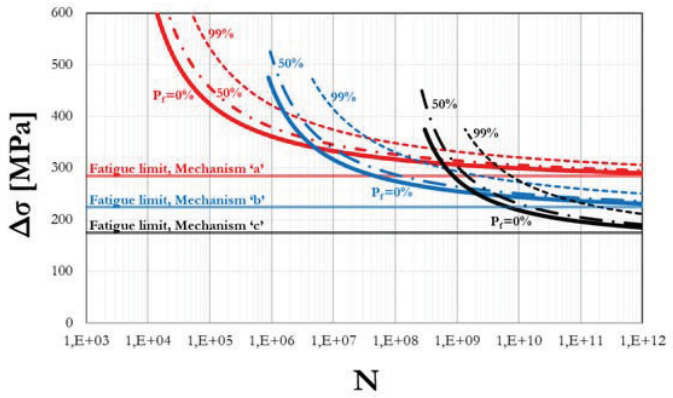

Fig. 2. Schematic probabilistic modelling of the S-N field, including hypothetical successive S-N fields as resulting from different failure mechanisms [1].

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