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Abstract

Based on the theory of critical distances (TCD), a new multiaxial notch fatigue life prediction method is proposed in this paper. Firstly, inspired by the means for determining the critical distance of fatigue limit shown in Kitagawa and Takahashi's diagram, a new measure is proposed to extend the means to the finite life interval. Then, by combining this new measure and the Sih *et al*. mixed mode fracture criterion, the relationship between axial and torsional notch fatigue lives can be established. Thus, torsional fatigue life can be calculated based on the axial data. Furthermore, on the basis of these obtained data and the modified wöhler curve method (MWCM), the multiaxial notch fatigue life can be estimated. As with the original TCD method, the present method preserves the advantage of effective computation through the so-called point method (PM) and linear elastic stress analysis. However, the new method can more fully takes into account the multiaxiality effect by considering both axial and torsional fatigue damage contribution, which is consistent with the thought of MWCM for plain fatigue assessment.

Keywords: The theory of critical distances; Notch fatigue finite life; Multiaxial loads.

NOMENCLATURE

A , B	material parameters in relationship of L_M vs. N_f
a_c	critical crack length
a_0	crack initial length
C , m , C_τ , m_τ	crack propagation parameters of Mode I and Mode III
F , F_{III}	geometric effect factors of Mode I and Mode III
G	shear modulus of elasticity
k , i	slope and intercept of *S*-*N* curve
K_c , K_{IIIc}	fracture toughness of Mode I and Mode III
K_{Ic}	plane-strain fracture toughness
k_t	stress concentration factor