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Influence of Stress State on Crack-Tip Driving Force

Daniel Kujawski

Mechanical and Aeronautical Engineering, Western Michigan University, Kalamazoo, USA

In this paper, a two-parameter crack-tip driving force in terms of Kmax and DeltaK has been developed to account for load interaction effects on fatigue crack growth behaviour. The development is based on the premise that the load interaction effects depend upon the applied and residual stress state at the crack tip. Examples from the literature on crack growth behavior due to an overload application in air and vacuum are analysed. It is shown that a maximum retardation corresponds to the minimum value of Kmax at the crack-tip calculated due to the applied load and due to post-overload residual stresses. The results indicate that the post-overload behavior in air and vacuum is essentially the same. The observed quantitative variations are associated with the inherent differences in the fatigue crack growth in these environments. This approach shows explicitly how residual stresses induced by overload lead to delayed crack growth retardation.

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