

Surface Crack Analysis Under Cyclic Loads Using Probabilistic S-Version Finite Element Model

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ABSTRACT

The failure in engineering structures has always become a norm for the engineers to encounter. Thus, it is very important to improve the quantification of uncertainty in fatigue analysis. The main objective of this paper is to examine the effect to the uncertainties parameter in numerical calculations for multiple surface crack problems. A finite thickness plate with surface cracks subjected to random loads with constant-amplitude loading is considered in the fatigue crack growth analysis using a newly developed probabilistic S-version finite element model (ProbS-FEM). The virtual crack closure method was used to calculate the stress intensity factor, whilst the Latin hypercube sampling was employed in ProbS-FEM to determine the probabilistic distribution. Specimens with a multiple notch were prepared and analysed in the fatigue tests. The crack grown both in experimental and numerical simulations were verified. The results from the newly developed ProbS-FEM agreed with the experimental findings. The newly developed approach is demonstrated on a complex cracked structure.

KEYWORDS: Crack growth; Finite element model; Probabilistic; Stress intensity factor; Surface crack

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