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Probabilistic Analysis of Fatigue Crack Growth using Moment Method

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This paper presents a new incremental approach to estimate the path and the probabilistic distribution of the fatigue crack growth using the dual boundary element method. Paris-Erdogan law and maximum circumferential stress criterion are adopted to simulate the incremental growth. A new iterative scheme using a secant method is proposed to model curved crack growth. To predict the distribution and failure probability of fatigue crack, the second-order moment method using lognormal distribution is incorporated with the proposed incremental formulation. For each loading step, the distribution of crack length is approximated by those of the previous step. The failure probability is directly predicted from the distribution derived at each loading step. Proposed moment method produces a good approximation of the crack distribution compared with the results of the Monte Carlo simulation. For the calculation of the failure probability, moment method needs much less computational cost than the first-order reliability method.

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