Statistical Distribution for Prediction of Stress Intensity Factor Using Bootstrap S-version Finite Element Model

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Abstract:
Stress intensity factor (SIF) is one of the most fundamental and useful parameters in all of fracture mechanics. The SIF describes the stress state at a crack tip, is related to the rate of crack growth, and used to establish failure criteria due to fracture. The SIF is determined to define whether the crack will grow or not. The aims of this paper is to examine the best sampling statistical distributions in SIF analysis along the crack front of a structure. Box-Muller transformation is used to generate the statistical distributions which is in normal and lognormal distributions. This method transformed from the random number of the variables within range zero and one. The SIFs are computed using the virtual crack-closure method (VCCM) in bootstrap S-version finite element model (BootstrapS-FEM). The normal and lognormal distributions are represented in 95% of confidence bounds from the one hundred of random samples. The prediction of SIFs are verified with Newman-Raju solution and deterministic S-FEM in 95% of confidence bounds. The prediction of SIFs by BootstrapS-FEM in different statistical distribution are accepted because of the Newman-Raju solution is located in between the 95% confidence bounds. Thus, the lognormal distribution for SIFs prediction is more acceptable between normal distributions.

Keywords : Stress intensity factor; Statistical distributions; Box-Muller transformation; Random samples; Regression analysis

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