Nonlinear time-varying fatigue reliability analysis based on improved toughness exhaustion model

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Abstract

The state function based on fatigue accumulation model has a great influence on accuracy of fatigue reliability analysis of components. A nonlinear fatigue accumulation model considering the interaction of loads is proposed in this paper. By introducing the square ratio of front and back loads as the new load interaction factor into the conventional toughness exhaustion model, thus it is improved to reflect the load sequence and interaction effect simultaneously. Moreover, the fatigue state function based on proposed model is constructed, which is analyzed by the probability density evolution method. The time-varying fatigue reliability curve is obtained by analyzing the generalized density evolution equation. The proposed model are verified using four experimental data, and results shows that the predication residual life fraction such obtained is more accurate. And accuracy and efficiency of the proposed time-varying fatigue reliability analysis method is validated using multi-level loading experimental data.

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