

## 含多裂纹结构的断裂可靠性分析

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### 摘要

基于随机有限元法和可靠性设计理论, 建立了一种含多裂纹结构的断裂可靠性分析模型。首先, 根据最小二乘法建立应力强度因子的表达式, 然后将影响结构断裂的不确定因素视为随机变量, 通过一阶二次矩法和随机有限元法求出每条裂纹的可靠度指标, 最后将含多裂纹结构看作一个由所有裂纹组成的串系统, 求出各裂纹之间的相关系数, 并得出多裂纹结构失效概率的Ditlevsen界限值。数值算例表明, 本方法具有较强的适用性。

关键词 [固体力学](#) [断裂](#) [可靠性](#) [多裂纹](#) [一阶二次矩法](#) [随机有限元法](#)

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## Reliability analysis of structures with multi-crack

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**Abstract** Based on stochastic finite element method and reliability theory, a reliability analysis model for structures with multi crack was presented. Firstly, the expression of stress intensity factors was proposed using the least squares method. Secondly, uncertainties in material parameters, crack length and loading which affect fracture of structures were described as random variables, the reliability index for each crack was obtained by first order reliability method and stochastic finite element method. Finally, the structure with multi cracks was taken as a series system composed of all cracks, and the correlation coefficients between failure models were evaluated. The failure probability of the structure was computed by Ditlevsen bounds method. A numerical example was performed for a finite plate with multiple holes and cracks. The result shows that the suggested method is feasible and applicable.

**Key words** [solid state mechanics](#); [fracture](#) [reliability](#) [multi crack](#) [first order reliability method](#) [stochastic finite element method](#)

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