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预估金属构件疲劳全寿命的损伤力学-有限元法

郑旭东, 张行

北京航空航天大学

DAMAGE MECHANICS FINITE ELEMENT METHOD FOR PREDICTION OF TOTAL FATIGUE LIVES OF METAL STRUCTURE MEMBERS

Zheng Xudong, Zhang Xing

Beijing University of Aeronautics and Astronautics

摘要

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摘要 引用损伤力学方法研究金属构件疲劳问题,建立了应力场-损伤场耦合基本方程与有限元素-附加载荷解法,并以损伤划分步长推导了构件疲劳裂纹形成与扩展寿命的预估公式。本文用以上方法预估2024与7075两种材料、多种几何参数含缺口板试件全寿命。结果表明,理论S-N曲线与实验S-N曲线吻合良好。本方法所需机时较少,可能用于工程实际。

关键词: 损伤力学 含缺口板试件 疲劳全寿命

Abstract: Damage mechanics method is applied to studying fatigue problems of metallic structure members. Coupling governing equations of stress-damage field and finite element-additional loading method are established. Furthermore, formulas of predicting fatigue crack formation and propagation lives of structural members are derived with damage increment as step length. Total lives of typical notched plates with various geometrical parameters, made of 2024 and 7075 are estimated. The results show that the agreements between theoretical S-N curves and experimental ones are very nice. This method requires short CPU time and can be applied to engineering practice.

Keywords: damage mechanics plate specimen with notch fatigue total life

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