



谱载荷下三维构件疲劳分析的损伤力学方法

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Damage mechanics method to predict the fatigue life of 3-D structural members under spectrum load

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摘要

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摘要 建立了工程中常见的三维构件的一个损伤力学守恒积分,并利用此积分的守恒性与小范围损伤的条件,推导出计及损伤耦合效应时集中的应力与应变所应满足的方程.根据以损伤驱动力表示的损伤演化方程,推导了在谱载荷作用下,疲劳裂纹萌生寿命预估的解析表达式,建立了以等效应力表示的非分离变量型损伤演化方程,并在短周期加载条件下得到积分形式的疲劳寿命闭合解.对某飞机起落架为代表的三维构件在谱载荷作用下的疲劳寿命进行了预报.

关键词: 损伤力学 谱载荷 三维构件 疲劳寿命

Abstract: A conservative integral of three dimensional structures in damage mechanics was established. The expression of the stress and the strain considering the effect of damage coupling was deduced by means of the path independent property of this integral and the condition of small scale damage. Based on the damage evolution equations expressed by the damage driving force, a closed form solution to determine the fatigue crack formation life under the spectrum load was obtained. According to the above analysis, the damage evolution equation with equivalent stress of non variable separated type was established, and a closed form solution of integral type was obtained to determine the fatigue crack formation life under the short period load. The fatigue life of the landing gear of certain airplane as the representative of 3-D structural member is predicted.

Keywords: damage mechanics spectrum load 3-D structural member fatigue life

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