论文

涡轮盘的J积分计算及临界裂纹长度a_(IC)的确定

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CALCULATION OF J-INTEGRAL AND DETERMINATION OF THE CRITICAL CRACK LENGTH a_(IC) INTURBINE DISKS

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摘要

涡轮盘是航空发动机的重要零件之一,在进行损伤容限的设计和分析中,需要准确地确定其临界裂纹长度a_{IC}。本文以一实际发动机Ⅰ级涡轮盘槽底裂纹为实例,通过破裂试验和细致地理论计算分析,得出确定临界裂纹长度a_{IC}的准则和具体方法;并且提出用破坏其正常工作状态的条件作为临界裂纹状态的判别条件。作者们还针对涡轮盘几何形状复杂和承受载荷复杂的特点,在进行弹塑性断裂力学的J积分计算时,采取了二次计算法,既简便又有较高的精度。

关键词:

Abstract:

A turbine disk is known as one of the important parts of a jet engine. In the design and analysis of its damage tolerance, it is necessary to determine the critical crack length aic exactly. Using the cracks at the bottom of firtree slots of the first stage turbine disk in an existing engine as an example, by means of the breakdown test and elaborate theoretical calculation, the criterion and the solution algorithm to determine the critical crack length aic are provided. It is suggested that the condition under which the engine could not normally operate be regarded as the critical state for the crack. In view fo the complexity of turbine disk shape and loading conditions, the authors have employed "twice evaluation algorithm'' for J-integral in the elasto-plastic fracture mechanics. This algorithm comes out simple and more accurate than those presented in literature.

Keywords:

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