航空学报
ACTA AERONAUTICA ET ASTRONAUTICA SINICA
ISSN 1000-6893
CN 11-1929/V

航空学报 » 2013, Vol. 34 » Issue (10) :2341-2348 DOI: 10.7527/S1000-6893.2013.0162

无限大板圆孔边双裂纹的裂纹面位移权函数解

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Weight Function Solutions of Crack Surface Displacements for Double Cracks Emanating from a Circular Hole in an Infinite Plate

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摘要

针对飞机结构中常见的孔边裂纹问题,结合塑性诱发的疲劳裂纹闭合分析需求,利用权函数封闭解法计算了无限大板圆孔边双裂纹在远方拉伸和部分裂纹面均布应力两种载荷条件下的裂纹面位移。研究表明,权函数法是一种强有力的计算任意载荷条件下裂纹面位移的高效、高精度方法。通过对权函数法计算结果的合理拟合,得到了两种载荷条件下裂纹面位移的高精度解析表达式,从而为无限大板圆孔边双裂纹的裂纹闭合分析和张开应力求解提供了高效、高精度的手段。

关键词： 孔边裂纹 裂纹面位移 条带屈服模型 权函数法 裂纹面位移方程

Abstract:

This paper is aimed at crack surface displacement solutions for cracks at a circular hole, which is a common crack configuration in aircraft structures. The weight function method is used for calculating crack surface displacements for double cracks under both remote uniform tension and partial crack surface uniform segment loading. It is found that the weight function method is a very efficient and highly accurate method for calculating crack surface displacements under arbitrary load conditions. By rational curve fitting to the results obtained from the weight function method, accurate analytical expressions for crack surface displacements for the two load cases are developed. The present study provides an efficient and accurate means for crack closure and crack opening stress analysis for double cracks emanating from a circular hole in an infinite plate.

Keywords: crack at a circular hole crack surface displacement strip-yield model weight function method crack surface displacement equation

Received 2012-12-27; published 2013-03-19

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引用本文:

童第华, 吴学仁. 无限大板圆孔边双裂纹的裂纹面位移权函数解[J]. 航空学报, 2013, 34(10): 2341-2348.DOI: 10.7527/S1000-6893.2013.0162

TONG Dihua, WU Xueren. Weight Function Solutions of Crack Surface Displacements for Double Cracks Emanating from a Circular Hole in an Infinite Plate[J]. Acta Aeronautica et Astronautica Sinica, 2013, 34(10): 2341-2348.DOI: 10.7527/S1000-6893.2013.0162

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