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航空铁磁材料磁记忆检测新方法

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New Magnetic Memory Testing Method of Aeronautical Ferromagnetic Material

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摘要

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摘要 为提高现有磁记忆检测方法的可靠性,充分考虑各向磁记忆信号分量特征,提出法向和切向相结合的磁记忆检测新方法,对航空铁磁材料18CrNi4A试件在不同拉伸载荷下同时采集法向和切向两个方向上的磁记忆信号,并对信号进行小波包滤波处理后取李萨如图,用图中封闭区域出现的位置判断应力集中部位,用封闭区域面积的大小判断应力集中程度,研究磁记忆信号法向分量和切向分量联合检测材料的应力状态。结果表明:对该材料试件磁记忆信号法向分量和切向分量进行小波包降噪方法切实可行,处于应力集中试件的磁记忆信号反映在李萨如图上会出现封闭区域,并且随着应力集中程度的增大,李萨如图上封闭区域的面积有增大趋势,材料出现明显屈服后,面积增大得更加明显。该方法具有一定的工程实际应用价值。

关键词: 无损检测 磁记忆检测 小波包 李萨如图 应力集中

Abstract: With the aim of improving the reliability of magnetic memory testing and by fully considering the characteristics of magnetic memory all component signals, a novel magnetic memory testing method which combines the normal and tangential signals is proposed. First, we acquire magnetic memory signals of aeronautical ferromagnetic tensile 18CrNi4A specimens under different tensile loadings in both the normal and tangential directions. Then the signals are filtered using wavelet package method, and Lessajou figure is obtained. The location of the close area in the figure indicates the place of the stress concentration, and the size of the close area is used to judge the extent of the stress concentration. With this method, research is conducted concerning the relation of magnetic memory signals between the normal direction and tangential direction under stress concentration. It is proved that the wavelet package denoising is feasible. The signals in the stress concentration part present a close area in the Lessajou figure, and the size of the close area increases with the increasing extent of stress concentration. When the obvious submit of the material exists, the size of the close area increases more rapidly. The method is of practical value in engineering application.

Keywords: nondestructive testing magnetic memory testing wavelet package Lessajou figure stress concentration

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