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Improved terahertz nondestructive detection of debonds locating in layered structures based on wavelet transform

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Abstract

Debonds locating is the difficulty of terahertz (THz) nondestructive detection within a multi-layered structure sample, since the air layer of debond part is too thin to detect. To solve this problem, we propose a wavelet transform method to process the THz detection 3D data, and reconstruct the three-dimensional image of the testing sample by wavelet coefficients. Through these we can clearly identify the debond area and accurately locate it. In order to distinguish the small interface peaks and noise, Lipschitz index was used as the basis, which is a reliable tool. Base on this method, we analysis two samples with debond layer respectively on the upper and lower interface of 2mm-thick insulation felt, the 3D reconstruction images provides excellent agreement with the actual samples.

Key words: Terahertz, Wavelet transform, Non-destructive testing, Composite materials, Signal processing

1. Introduction

Ceramic matrix composite (CMC) is a kind of composite material, which is based on ceramic substrate and composites with various kinds of fiber [1]. CMC has many advantages such as high hardness, chemical resistance, low density and high temperature resistance [2]. These advantages allow the widely application of CMCs in the field of aviation and space flight. CMC is often used by bonding, therefore the detection to the bonding condition between the CMC and the basis material is

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