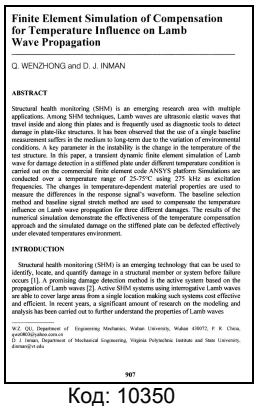

Finite Element Simulation of Compensation for Temperature Influence on Lamb Wave Propagation

Q. WENZHONG and D. J. INMAN

ABSTRACT

Structural health monitoring (SHM) is an emerging research area with multiple applications. Among SHM techniques, Lamb waves are ultrasonic elastic waves that travel inside and along thin plates and is frequently used as diagnostic tools to detect damage in plate-like structures. It has been observed that the use of a single baseline measurement suffers in the medium to long-term due to the variation of environmental conditions. A key parameter in the instability is the change in the temperature of the test structure. In this paper, a transient dynamic finite element simulation of Lamb wave for damage detection in a stiffened plate under different temperature condition is carried out on the commercial finite element code ANSYS platform Simulations are conducted over a temperature range of 25-75°C using 275 kHz as excitation frequencies. The changes in temperature-dependent material properties are used to measure the differences in the response signal's waveform. The baseline selection method and baseline signal stretch method are used to compensate the temperature influence on Lamb wave propagation for three different damages. The results of the numerical simulation demonstrate the effectiveness of the temperature compensation approach and the simulated damage on the stiffened plate can be defected effectively under elevated temperatures environment.

INTRODUCTION

Structural health monitoring (SHM) is an emerging technology that can be used to identify, locate, and quantify damage in a structural member or system before failure occurs [1]. A promising damage detection method is the active system based on the propagation of Lamb waves [2]. Active SHM systems using interrogative Lamb waves are able to cover large areas from a single location making such systems cost effective and efficient. In recent years, a significant amount of research on the modeling and analysis has been carried out to further understand the properties of Lamb waves

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Издательство DEStech Publications, Lancaster, 2011 год

8 стр; формат: 23,5 x 16 см; библиографический список: 12 единиц
ISBN: 978-1-60595-053-2

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Ключевые слова:

Содержание.