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Analytical and Experimental Investigation of Environmental Influences on Lamb Wave Propagation and Damping Measured with a Piezo-Based System

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One of the main concerns in structural health monitoring (SHM) for composite materials is to discern between changes that are related to actual damage in the structure and changes that originate from non-damaging alterations of the material or the survey system. For both the layout of a piezo-based system (i.e. mainly the sensor/actuator area density) and the interpretation of the acquired data, the changes of the viscoelastic material properties due to normal environmental factors as temperature or moisture absorption have to be considered. Additionally, the SHM system itself and the coupling adhesive used to connect it to the material can be influenced by these factors. Without a strategy to account for those influences, a high false alarm rate has to be expected.

In this presentation, experimental and analytical investigations of a SHM system based on Lamb waves measured with surface applied piezoelectric sensors are presented. The influence of temperature and humidity on the measured velocity and damping coefficients is shown as well as the high influence of both factors on the excitability of Lamb waves. Potential and limitations of analytical methods to describe the measurement system and the temperature/humidity-dependence of the piezoelectric elements properties, the adhesive layer and the material itself are investigated.

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Ключевые слова:

Содержание

Abstract
Introduction
Experimental investigation
Analytical investigation
Limitations of analytical approaches
Conclusions
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