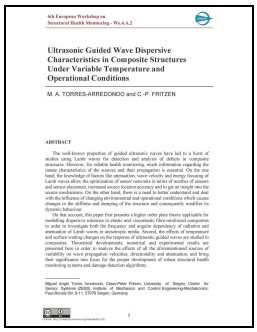

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Ultrasonic Guided Wave Dispersive Characteristics in Composite Structures Under Variable Temperature and Operational Conditions

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The well-known properties of guided ultrasonic waves have led to a burst of studies using Lamb waves for detection and analysis of defects in composite structures. However, for reliable health monitoring, much information regarding the innate characteristics of the sources and their propagation is essential. On the one hand, the knowledge of factors like attenuation, wave velocity and energy focusing of Lamb waves allow the optimization of sensor networks in terms of number of sensors and sensor placement, increased source location accuracy and to get an insight into the source mechanisms. On the other hand, there is a need to better understand and deal with the influence of changing environmental and operational conditions which causes changes in the stiffness and damping of the structure and consequently modifies its dynamic behaviour.

On that account, this paper first presents a higher order plate theory applicable for modelling dispersive solutions in elastic and viscoelastic fibre-reinforced composites in order to investigate both the frequency and angular dependency of radiation and attenuation of Lamb waves in anisotropic media. Second, the effects of temperature and surface wetting changes on the response of ultrasonic guided waves are studied in composites. Theoretical developments, numerical and experimental results are presented here in order to analyze the effects of all the aforementioned sources of variability on wave propagation velocities, directionality and attenuation, and bring their significance into focus for the proper development of robust structural health monitoring systems and damage detection algorithms.

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Ключевые слова:

Содержание