NOVEL METHODS FOR STRUCTURAL HEALTH AND LOAD MONITORING BY HIGH RESOLUTION ULTRASONIC TIME-OF-FLIGHT DETECTION

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Abstract

Ultrasonic non-destructive testing is well established for the monitoring of structural deficiencies. Beside of the echoes generated by cracks, anharmonic interaction leading to frequency doubling is also among the established schemes. We have developed and applied a novel scheme that is on one hand based on anharmonic effects arising from the interaction of travelling ultrasonic waves with quasi-static loads but on the other hand, if guided ultrasonic waves are employed, can also sensitively monitor stiffening by tolerable loads and even irreversible deformation or delamination caused by excessive loads.

Keywords: Structural health monitoring (SHM), Lamb waves, guided waves, time-of-flight (TOF)

1. Introduction

The propagation of ultrasound waves in materials is of particular interest for the non-destructive characterization of materials (Kundu *et al*., 2004). This problem has been investigated for over a century in mechanics of deformable solid materials and has been applied for practical application for ultrasonic wave propagation. Various theoretical and numerical models have been proposed in the framework of continuum mechanics for the development of generalized dispersion curves for propagation of bulk, surface and guided wave modes with

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