Interdigital Lamb Wave Transducers for Applications in Structural Health Monitoring

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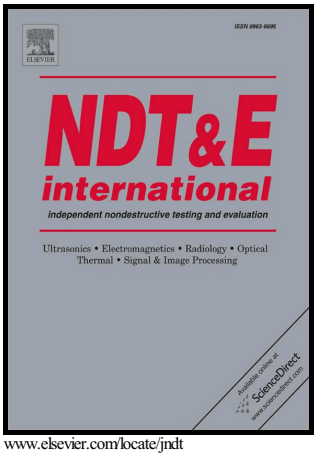

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Interdigital Lamb Wave Transducers for Applications in Structural Health Monitoring

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Abstract

Interdigital transducers (IDTs), thanks to their multiple capabilities have the potential of increasing versatility of SHM systems. Migration of the IDT technology in SHM systems and devices is reviewed in this paper. A summary review of different types of IDTs is presented and their salient features are presented in terms of their applicability in the Lamb wave based SHM systems. Comprehensive review is provided concerning the implementation of the IDT capabilities towards the development of SHM systems. Experimental results obtained with prototype IDTs are provided for illustration. Finally, future development directions of the IDTs dedicated to SHM systems are outlined.

Keywords: SHM, Lamb waves, piezoelectric transducers, interdigital transducers

1. INTRODUCTION

Structural health monitoring (SHM) systems are well known for their ability in increasing the reliability and safety of structures. SHM has potential to reduce the cost involved with periodic inspection, which is approximately one third of the cost in acquiring and operating those structures [1, 2]. Plate structures support guided waves (GW), like Lamb waves (LW), which travel large distances gaining the capability to interrogate large volumes of the structure [3, 4]. Realizing this advantage, researchers have reported the SHM strategies for plate structures using LWs [3, 5, 6, 7, 8]. However, major challenges lie in addressing the issues arising from the multimodal, dispersive and attenuating nature of LW propagating in metallic, composite and sandwich structure [9, 2, 3, 10, 11, 12, 13, 14]. Wave characteristics, like, velocity, wavelength and dispersion curves, can be controlled by selecting appropriate transducer and its operating frequency [2, 3, 4]. The range of wave propagation and thereby

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