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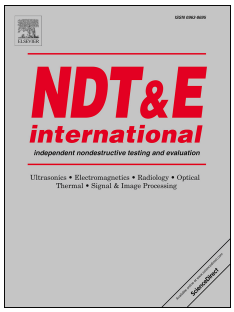

Development of omnidirectional A_0 mode EMAT employing a concentric permanent magnet pairs with opposite polarity for plate inspection

Zenghua Liu, Yanan Hu, Muwen Xie, Bin Wu, Cunfu He

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Development of omnidirectional A_0 mode EMAT employing a concentric permanent magnet pairs with opposite polarity for plate inspection

*Zenghua Liu, Yanan Hu, Muwen Xie, Bin Wu, Cunfu He

College of Mechanical Engineering and Applied Electronics Technology, Beijing University of Technology, Beijing, 100124, China

*Corresponding author: e-mail: liuzenghua@bjut.edu.cn

Abstract

This work presents an omnidirectional electromagnetic acoustic transducer (EMAT) for generating and receiving A_0 mode of Lamb waves in plate structures. The proposed EMAT is composed of a spiral meander coil (SMC) and a new concentric permanent magnet pairs with opposite polarity (CPMP-OP) for enhancing the generation and detection of A_0 mode. A finite element model was established to simulate the directions of the static magnetic field produced by the permanent magnets and the incentive process of guided waves. To verify the performance of the EMAT, several experiments were performed. Firstly, we experimentally verified that the developed EMAT could generate and receive a pure single A_0 mode omnidirectionally. Then, the relationship between the frequency response characteristic of the developed EMAT and the interval *l* (the distance between the two adjacent annular wires of the SMC) were explored. Furthermore, the circumferential consistency of the transducer was well demonstrated. Finally, the sensing performance of the developed omnidirectional A_0 mode EMAT employing a CPMP-OP was compared with that of EMAT with different structures of coils and permanent magnets. The experimental results indicated that the developed omnidirectional A_0 mode EMAT employing a CPMP-OP could enhance the signals of the A_0 mode.

Keywords: Lamb waves; EMAT, Plate; Permanent magnet; Omnidirectional; defect detection

1. Introduction

As a special ultrasonic propagation in the waveguide structure, ultrasonic guided waves are widely applied