

Recent Development of Patch-Type Magnetostrictive Transducers for Ultrasonic Guided Wave Inspection of Pipes

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ABSTRACT

This paper presents recent developments of guided ultrasonic transducers using thin magnetostrictive patches applicable to pipe inspection. The main advantage of the magnetostrictive transducers over piezoelectric transducers is that the non-dispersive torsional mode can be effectively generated. Three kinds of patch-type magnetostrictive transducers, mainly developed by the authors and their colleagues, will be presented. A torsional-wave transducer using Z-shaped magnetostrictive patches will be presented first. The patch shape was designed so as to improve the transduction efficiency of slender rectangular patches which are obliquely bonded on a test pipe at 45° relative to the pipe axis to produce torsional waves. Secondly, a transducer that can generate and measure mega-Hertz torsional waves is presented. This transducer consists of a magnetostrictive patch circumferentially magnetized by permanent magnets and a meander coil. Because of small impedance of a meander coil, this configuration is good for generating MHz-frequency guided waves. Finally, as a means to image cracked pipes, a segmented patch array magnetostrictive transducer is presented. Instead of using a single patch completely wound around a pipe, an array of segmented magnetostrictive patches is employed and bonded on a test pipe. The advantage of this transducer is that both the circumferential and axial locations of a crack can be identified unlike non-segmented configurations.

INTRODUCTION

In recent decades, the ultrasonic guided wave technique has received a considerable attention as a potentially very effective tool for nondestructive inspection of long cylindrical structures such as pipes and tubes. Various types of transducers including piezoelectric, magnetostrictive and electro-magnetic

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Ключевые слова:

Содержание.

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