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Induction defectoscope based on uniform eddy current probe with GMRs

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Abstract:
Defect detection in conductive plates represents an important issue. The present work proposes an induction defectoscope that includes a uniform eddy current probe with a rectangular excitation coil and a set of giant magnetoresistance sensors (GMR). The excitation current, the acquisition of the voltages delivered by the GMR and the signal processing of the acquired signal are performed by a real-time control and processing unit based on a TMS320C6713 digital signal processor (DSP). Different tests were carried out regarding the excitation coil position versus crack orientation and also regarding the GMR position inside the coil and the best response concerning the crack detection for a given aluminum plate specimen. Embedded software was developed using a NI LabVIEW DSP module including sinusoidal signal generation, amplitude and phase extraction using a sine-fitting algorithm and GUI for the induction defectoscope. Experimental results with probe characterization and detection of defects were included in the paper.

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Contents

I. Introduction

Eddy current testing has the important advantage of noncontact and fast testing of conductive plates. Thus, different eddy current probe (ECP) architectures to detect flaws are reported in the literature [1]–[4]. An excitation coil and detection coils usually form the eddy current probe. The use of giant magneto resistors as sensing components of ECPs has greatly increased its sensitivity [5]. Some drawbacks of this kind of architecture are the large noise and distortion due to the lift-off effect and to the electromagnetic material characteristics. Uniform eddy current probes are mentioned in literature as a solution that provides higher immunity to the noise associated with the lift-off effect. Uniform eddy current probe (UECP) architecture is reported by Koyama [6] including a tangential excitation coil having differential coil detection disposed inside the excitation coil. Good results were obtained using this probe in the area of crack detection in a weld zone. NDT system based on uniform eddy currents is also part of the United States Patent 4594549 US patent [7].

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