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GMR array uniform eddy current probe for defect detection in conductive specimens

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Abstract

The usage of eddy current probes (ECP) with a single magnetic field sensor represents a common solution for defect detection in conductive specimens but it is a time consuming procedure that requires huge amount of scanning steps when large surface specimens are to be inspected. In order to speed-up the nondestructive testing procedure, eddy current probes including a single excitation coil and an array of sensing coils present a good solution. The solution investigated in this paper replaces the sensing coils for giant magneto-resistors (GMRs), due to their high sensitivity and frequency broadband response. Thus, the ECP excitation coil can be driven at lower frequencies than the traditional ones allowing defects to be detected in thicker structures.

In this work an optimized uniform eddy current probe architecture including two planar excitation coils, a rectangular magnetic field biasing coil and a GMR magnetometer sensor array is presented. An ac current is applied to the planar spiral rectangular coil of the probe, while a set of GMR magnetometer sensors detects the induced magnetic field in the specimens under test. The rectangular coil provides the DC uniform magnetic field, assuring appropriate biasing of the GMR magnetometers of the probe, setting-up the functioning point on the linear region and at the same branch of the GMR static characteristics. The differences on the images obtained for the same specimen for each GMR are reduced if all sensors are biased on the same working point. Elements of the automated measurement system used to inspect the plate under test using the proposed eddy current probe, including a validation

on a 2D template matching algorithm and the corresponding experimental results are included in the paper.

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Keywords

Non-destructive testing; Uniform eddy current probe; Giant magneto-resistance sensors array; Sensor biasing; 2D template matching

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