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Detection and characterization of defects using GMR probes and artificial neural networks

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Abstract

This work presents an eddy-current testing system based on a giant magnetoresistive (GMR) sensing device. Non-destructive tests in aluminum plates are applied in order to extract information about possible defects: cracks, holes and other mechanical damages. Eddy-current testing (ECT) presents major benefits such as low cost, high checking speed, robustness and high sensitivity to large classes of defects. Coil based architecture probes or coil-magnetoresistive probes are usually used in ECT. In our application the GMR sensor is used to detect a magnetic field component parallel to a plate surface, when an excitation field perpendicular to the plate is imposed. A neural network processing architecture, including a multilayer perceptron and a competitive neural network, is used to classify defects using the output amplitude of the eddy-current probe (ECP) and its operation frequency. The crack detection, classification and estimation of the geometrical characteristics, for different classes of defects, are described in the paper.

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Keywords

Non-destructive testing; Eddy currents; Magnetoresistive sensor; Neural network classifier

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