



Development of Multi-Coils Circular Eddy Current Sensor for Characterization of Fibers Orientation and Defect Detection in Multidirectional CFRP Material

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ABSTRACT

This article presents a study of a Multi-coils circular eddy current non-destructive testing sensor for determining the fibers orientation as well as the detection of defect in multidirectional carbon fibers reinforced polymer (CFRP). The developed sensor contains 16 rectangular coils connected in series and supplied by a single-phase sinusoidal source. This sensor allows the annulations of the mechanical rotation of the conventional sensors and it permits to reduce the inspection procedure duration. The electromagnetic phenomena are calculated by using 3D finite element method (FEM) based on the electromagnetic AV-A formulation. Finally, the Multi-coils circular sensor responses are analyzed through polar diagrams of the impedance variation, where the defect is taken into consideration. A great concordance between the obtained results and those of literatures has been noticed. The provided results show that the proposed sensor allows an efficient characterization of multidirectional CFRP and detection of defects in different layers.

KEYWORDS

Multi-coils circular sensor; fibers orientations; defects detection; multidirectional carbon fibers; 3D FEM

1. Introduction

Non-destructive testing (NDT) techniques are used in the industry domain and science in order to evaluate the properties and the health of a wide variety of materials without causing damage. The techniques used in NDT are diverse (ultrasound, eddy currents, X-rays, radiography, bleeding, visual inspections ...). They depend both on the nature of the material. One of the conventional electromagnetic methods utilized for the inspection of conductive materials is eddy current nondestructive testing (EC-NDT) [1].

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