Investigation on an Encircling Pulsed Eddy Current Probe Performance Using COMSOL Multiphysics®

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Abstract

Conventional eddy current techniques have been used to a great extent for detection of surface breaking defects in conductive materials [1]. However, detection of sub-surface defects is limited due to the single frequency and skin effect phenomena Pulsed Eddy Current (PEC) techniques excite the probe's driving coil with a repetitive broadband pulse, usually a square wave [2]. The resulting transient current through the coil induces transient eddy currents in the test piece, these pulses consist of a broad frequency spectrum, and the reflected signal contains important depth information [3]
The work in this paper employs COMSOL Multiphysics®, the finite element (FE) modelling software, to investigate the behaviours of a new probe design. This work involves modelling of an encircling coil around a steel pipe with and without insulation. The 3D modelling of the coil wrapped around the steel pipe with 50 mm distance was employed to make it possible to introduce discontinuity and material loses at later stages. A comparison between the simulation results and experimental results collected by GMR (Giant Magnetoresistance) sensors was also carried out.
In Summary, COMSOL Multiphysics® proved to be useful in presenting a visualization of diffusion of magnetic flux around the pipe and its interaction with the surrounding defect region, which led to development of an optimum probe design including selecting the appropriate magnetic field sensors and their locations around the driver coil.

Reference

References

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