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Numerical investigation to study the influence of thickness and electrical conductivity of metal-sheets on the LOI-Point of a PEC sensor

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ABSTRACT

The aim of this article is to determine a similar point to the Lift-Off intersection point (LOI) obtained from a geometric configuration of a Pulsed Eddy Current (PEC) sensor. This configuration enables easy determination of the LOI point through a single measurement, thus avoiding measurement noise. The sensor consists of an external excitation coil and two internal probes that overlap and have similar characteristics for reception. The similar point LOI is determined by the intersection of the signals from the transient response of the sensor's internal probes. Importantly, this point is independent of lift-off variation. Moreover, the amplitude and time measurement of this point vary with the variation of the physical and geometric properties of the sample. To assess the effectiveness of this similar point, a numerical code based on electromagnetic phenomena was developed. This code investigates the impact of thickness and electrical conductivity of metal sheets on the response of the PEC sensor, both with and without a ferrite core at this point. Additionally, a practical sensor prototype was constructed to validate the results obtained from the numerical model. The obtained results demonstrated a strong correlation between the numerical and experimental outcomes, thus confirming the effectiveness of the proposed technique.

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Introduction

In various industrial sectors, many non-destructive testing methods are currently employed for defect detection and qualification in metal parts [1–4], as well as for determining their physical and geometric properties [5–9]. Among these methods, electromagnetic techniques are the most important and commonly used. They are particularly useful for characterising magnetic, non-magnetic, and composite conductive parts containing conductive fibres [10–14]. Eddy current methods hold a crucial position

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