A new approach to increase the subsurface flaw detection capability of pulsed eddy current technique

K. Sambasiva Rao, S. Mahadevan, B. Purna Chandra Rao, S. Thirunavukkarasu

PII: S0263-2241(18)30591-8
DOI: https://doi.org/10.1016/j.measurement.2018.06.065
Reference: MEASUR 5682

To appear in: *Measurement*

Received Date: 18 August 2016
Revised Date: 18 June 2018
Accepted Date: 28 June 2018

Please cite this article as: K. Sambasiva Rao, S. Mahadevan, B. Purna Chandra Rao, S. Thirunavukkarasu, A new approach to increase the subsurface flaw detection capability of pulsed eddy current technique, *Measurement* (2018), doi: https://doi.org/10.1016/j.measurement.2018.06.065

A new approach to increase the subsurface flaw detection capability of pulsed eddy current technique

K. Sambasiva Rao, S. Mahadevan*, B. Purna Chandra Rao and S. Thirunavukkarasu

Nondestructive Evaluation Division, Indira Gandhi Centre for Atomic Research Kalpakkam, HBNI, Kalpakkam, TN - 603 102, India

(*email: maharaja@igcar.gov.in)

Abstract

In this paper, the detection of subsurface flaws by pulsed eddy current (PEC) technique has been studied. Experiments have been carried out on an 8.0 mm thick stainless steel plate with subsurface flaws located at different depths below the surface by varying the excitation rise time (E_r). The conventional PEC signal parameters like peak amplitude (V_p), time-to-peak (T_p) and rise time (t_r) are influenced by noise and could not be effectively used to detect flaws located beyond 4.0 mm below surface. In this context, a new approach based on fitting the PEC response pulse to a modified inductor current equation has been proposed. Based on this approach, two parameters viz. time constant (τ) and voltage parameter (V_1/V_0) have been derived and used for detection and separation of flaws. The study shows that the two parameters derived from the proposed approach can be used to detect flaws located 6.0 mm below the surface with improved sensitivity. The advantage of the proposed approach is that, it does not require subtraction from reference signal to detect flaws. The derived parameters are also able to differentiate the subsurface and surface flaws.

Keywords: Pulsed eddy current; Subsurface flaws; Excitation rise time; Time constant; Voltage parameter; Detection; Feature extraction and Feature analysis.

1. Introduction

Nondestructive testing (NDT) is carried out to materials, parts, and other products in ways that do not adversely affect their reusability [1]. It is well known that nearly all structures possess flaws with sizes ranging from a few nm to a few mm. Detection of these flaws and their characterization with respect to size and shape is essential for ensuring quality and structural integrity of the materials. This is accomplished by using non-destructive evaluation