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ELECTROMAGNETIC METHODS

# Influence of Conductive Pollution on Eddy Current Sensor Signals[1]

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**Abstract**—This paper presents a study of a surface crack detection in which the volume is filled by conductive substances due to the polluting environment. Hence, this investigation demonstrates by numerical simulation that electric conductivity is a crucial property that has to be added to the other defect geometrical characteristics in order to complete the developed models. Consequently, introducing the tolerance in percent in the measured impedance is necessary in some conditions. So, the obtained results demonstrate that the signal amplitude passes from 0 to 78% of the maximal amplitude when the defect conductivity rises from 0 to 0.5 Ms/m. On the other hand, the relative difference of the resistance partincreases according to defect volume. For example, for a defect of 0.3 MS/m, the relative difference of the resistance varies from 52 to 62% of the maximal amplitude when the defect depth varies from 0.5 to 2.25 mm. These results can be exploited to show the effect of the conductive substances occupying the crack volume. In fact, the controller using EC-NDT technique must take into consideration the presence of conductive polluting elements in the crack volume. So, this condition becomes primordial and necessary according to the degree and nature of pollution.

*Keywords:* conductive pollution, crack, defect characterization, eddy current, non destructive testing

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## 1. INTRODUCTION

This document during their use, submitted to thermal, mechanical and chemical constraints crack can appear within the conductive plate surface [1]. Currently, some very advanced techniques permit to detect and to quantify some defects while using several methods such as eddy current nondestructive method. In the majority of the research works, the contributions are oriented toward the optimization of probes configuration in order to improve their sensitivity [2, 3]. However, in some conditions, the sensitivity doesn't depend solely on the sensor configuration, but it also depends on the capacity to inquire about the evolution of defect properties such as electric conductivity [4]. For example, in a polluting environment, the surface cracks cannot be detected with precision if we doesn't take into account the deposit of conductive substances (conductive particles, conductive fluids, etc.) that can occupy the defect volume [4, 5].

So, through three-dimensional finite element method (3D-FEM), we are going to estimate the capacity of pollution electric conductivity to conceal defect by affecting eddy current sensor signals. Therefore, it will be necessary to estimate the tolerance of detection in percent (%) to take into consideration according to inspection conditions.

[1] The article is published in the original.