

## UK Research Centre in NDE

### Engineering Doctorate

#### Electromagnetic NDE - Assignment 2019

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#### Background

This 1-week intensive short course introduced you to the basics of Electromagnetic (EM) Nondestructive Evaluation (NDE) and placed these specialized techniques into the context of other NDE principles. At this point, you should be able to judge the applicability, advantages, disadvantages, and technical limitations of EM NDE techniques when faced with inspection challenges. This assignment takes the form of a case study which should represent the kind of problem facing an NDE engineer in an industrial company.

#### The Assignment

The assignment is chosen mainly to test how well you have understood the relative advantages and disadvantages of EM nondestructive testing (NDT) techniques and how they are used to inspect components.

You may make references to course notes (lecture slides) or text-books, and seek advice from colleagues, provided you acknowledge any significant input from others (as you would do if this were a real-life situation). Otherwise it must be your own work.

It should be submitted by email to me as a PDF file attachment, by 21<sup>st</sup> June 2019. After assessment you will be notified whether or not you have passed. If the quality is border-line, I may ask you to make improvements and resubmit.

#### The Problem

You work as a NDE/NDT engineer for a company that operates a chemical plant. Your manager has asked you to propose possible NDT techniques for detecting three types of service-related flaws in the extensive pipe system throughout the plant. These are, (i) internal and external corrosion, (ii) internal erosion, and (iii) stress corrosion cracking. The pipes are made of 400 and 300 series stainless steel, the outer diameter varies between 20 and 100 mm, and the wall thickness is typically 5% of the outer diameter.

In some places, the pipes are covered by painting. It is preferable to do the inspection without removing the paint, but if necessary the paint can be removed for the test. It is preferable to do all inspection from the outside, but if absolutely necessary internal inspection is also acceptable.

It has been established that corrosion/erosion damage of less than 5% wall thickness is acceptable, but 35% is critical. Stress corrosion and fatigue cracks extending over 20% of the wall thickness should be detected. The inspection can be limited to critical areas where structural damage is expected based on prior experience and numerical simulations. In some cases, these critical areas include welds and bent parts.

The assignment should be suitable for submission to a busy industrial manager, so that conciseness and relevance are more important than length. Therefore only give brief background information about the different EM NDT techniques – only include sufficient information to justify your choice of technique. Please do not cut and paste material from lectures notes. Only very few words are required to eliminate methods that are clearly unsuitable. However, you should explain how the inspections will be carried out, including how the chosen system(s) will be calibrated. Choose your own format, using tables and diagrams as you wish.

CALIBRATION needs to be mentioned