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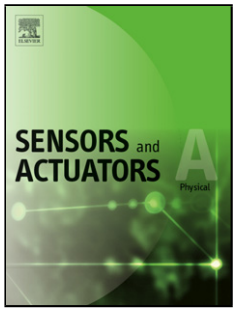

Title: Automatic parameter selection for Tikhonov regularization in ECT Inverse problem

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Automatic parameter selection for Tikhonov regularization in ECT Inverse problem

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Highlights

- The paper presents 2D reconstructed images of eddy current density in the aluminum plate by inverting the corresponding magnetic field, in order to determine information regarding the cracks.
- The paper is a step forward which is essential to automatically obtain a stable solution in the inversion method. The choice of the regularization parameter was automatically obtained from the relative variation of the reconstructed image energy, and compared with the L-curve criterion. Their advantages and disadvantages are discussed.
- The magnetic field measurements were obtained with a planar ECT probe around three different linear crack lengths and a non-linear L-shaped crack.
- For the experimental cases presented in the paper, the GMR sensor provided high enough signal to noise ratio to detect defects in aluminum plates and to perform the inversion problem with parameter selection.
- The inverse method with both parameter selection methods should work for any surface defect depth and any defect shape since the defect doesn't have a closed geometry, making both approach a potential candidate in the application of a complete automated ECT scanner.

Abstract—This paper presents 2D images of the eddy current distribution in an aluminium plate by inverting the corresponding magnetic field. Three linear defects with different lengths (5 mm, 8 mm, 12 mm) were machined in a 4 mm thick aluminium plate. The magnetic field maps were obtained experimentally using an eddy current measurement setup to scan the defect regions. The probe included in the system contains a planar coil to excite a sinusoidal current with spatially uniform current distribution, and a GMR sensor to measure one magnetic field component. The magnetic field maps were inverted using Tikhonov regularization. A proper choice of the regularization parameter value is essential for the success of the inversion method. In the present paper the determination of the regularization parameter was automated by careful analysis of the energy evolution of the current density data as a function of the regularization parameter. The validation of the resulting regularization parameters was obtained comparing this method with the well-known L-curve. The advantages and disadvantages of the two methods are discussed. Finally, the inversion method with parameter selection was tested with an experimental

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