The comparison of standard and innovated eddy current testing

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Abstract **This article deals with eddy current testing (ECT) which belongs to the electromagnetic non-destructive methods. The main purpose of this work is the comparison of standard harmonic ECT with swept frequency eddy current technique. An austenitic steel plate containing notches with different depths is investigated here. The study compares the experimental results and advantages of both methods.**

Keywords **eddy current technique, austenitic steel, harmonic excitation, swept frequency excitation.**

I. INTRODUCTION

The Eddy Current Testing (ECT) is one of successful non-destructive methods used for evaluation of various conductive materials. Basis of the standard ECT is a movement of a testing probe over a conductive material surface. The swept frequency eddy current technique represents a new approach. During the testing, frequency of exciting signal is changed in a wide range while the probe is in a fixed position.

In the final analysis the both mentioned methods provide a result of the presence or absence of cracks in a material. These types of testing are very important for the further use of the product. The damaged object can lead towards various negative consequences.

II. EDDY CURRENT TESTING

Eddy current testing belongs to the non-destructive methods, it means that the object does not change its structure and parameters and it remains in the original state. The principle of this method concerns the discovery of the electromagnetic (EM) induction. In brief, if a coil is fed by alternating current it creates time-varying electromagnetic field around the coil. An object made of electrically conductive material situated close to the coil is subject to an induction of EM field in it and finally current flow is created. These currents are in closed paths like whirlpools and because of this they are called the eddy currents. Presence of cracks in evaluated material causes the change in coil impedance during this testing, [1], [2].

The final signal is influenced by the electrical conductivity γ, the excitation frequency f, magnetic permeability μ and the presence of defects in the object. Very low conductivity of the evaluated material causes the absence of induced EM field and consequently the eddy currents are not created, [1].

Swept frequency eddy current technique is a modern technique which allows continuous and long-term monitoring of an investigated object without need of a testing coil movement. It is suitable for evaluation of objects with complicated scanning surface. The basis of this method is a change of frequencies in a wide range. Frequency response characteristics are evaluated in this case. Swept frequency technique provides results evidencing the success in detection, [3], [4].

III. MEASUREMENTS

Experiments are realized by eddy current probe which contains two coils. One coil is dedicated for excitation of eddy currents and the second coil receives responses.

A plate specimen made of austenitic steel (SUS316L) as shown in Fig. 1 is inspected by the probe. This plate contains three defects which differ in only one parameter – the defect depth d_d = 1, 5 and 9 mm.

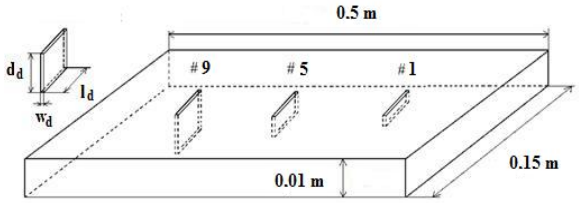

Fig. 1 The plate of austenitic steel

The testing probe is located perpendicular over this plate. The scanning range <-10mm, 10mm> is used in the case of standard ECT while position of zero reflects the place of a defect centre. In case of the swept frequency testing, the probe is positioned directly above the defect centre during the entire testing.

IV. CONCLUSION

Eddy current testing provides very good results in the field of non-destructive evaluationissue. The full paper will compare and describe advantages of two said methods using experimental results and theoretical knowledge.

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