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# GMR based eddy current sensing probe for weld zone testing

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### Abstract:

The detection of flaws in the weld zone of conductive plates is an important issue and, in this field, different solutions using eddy current probes are mentioned in the literature. However, when eddy current pancake probes are used, it is difficult to detect the flaws or the welding non-uniformities due to the lift-off effects. Thus, in the present work we present a novel uniform eddy current probe architecture based on a tangential excitation coil with a rectangular geometry and highly sensitive giant magnetoresistances (GMR). The induced magnetic field is measured using a GMR sensor fixed on the axis midpoint inside the coil. The sensor sensitive axis is perpendicular to the excitation coil axis in order to measure only the induced magnetic fields caused by the presence of flaws. We developed an automatic testing system to characterize the sensor and to perform tests on aluminum plate specimens with flaws included in the weld zone.

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## Contents

#### I. Introduction

Eddy current testing has the important advantage of noncontact and fast testing of conductive plates. Thus, different eddy current probe (ECP) architectures to detect flaws are reported in the literature [1]–[3]. An excitation coil and a sensing element usually form the eddy current

probe. Magnetoresistances, anisotropic or giant, or coils can be used for the sensing element. The large noise and distortion due to the lift-off effect and to the electromagnetic material characteristics are general drawbacks for eddy current probe utilization. Resumer, good geometrical settings of the coils and an optimal signal conditioning and processing increase the capabilities of these probes in the detection of flaws. In the particular case of welding zone testing, the lift-off effect and the electromagnetic characteristics of the material hardly reduce the capability of pancake type excitation coils either using coils or magnetoresistors as sensing elements. Previous works report better results with uniform eddy current probes including tangential excitation and differential coil detection [4].

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