Effect of Excitation Frequency on Magnetic Response Induced by Front- and Back-Side Slits Measured by a Differential AMR Sensor Probe

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ABSTRACT

Defects in steel structures are one of the major problems that may affect the functionality of the structure. Thus, the detection of the defects is fairly crucial to prevent any unwanted accident from occurring. Nondestructive Testing (NDT) is a group of methods that is widely used to detect those defects, especially cracks. This paper will be focusing on the detection of cracks (artificial slits) by using the Magnetic Flux Leakage (MFL) technique in the magnetic method of NDT. A nonsaturated differential MFL probe consists of two AMR sensors has been fabricated for the detection of front as well as backside slits. A measurement system which incorporates the developed probe attached on an XY-stage, a set/reset circuit, an amplifier circuit, a DAQ card, and PC is constructed where an XY-stage controller and a digital lock-in amplifier are developed with the implementation of LabVIEW. Then, the developed MFL probe's performance is evaluated by running several line scan measurements on a 2-mm galvanized steel plate sample engraved with artificial slits with depths that varies from 1.0 to 1.6 mm with variable excitation frequencies. The results show promising output where the slits could be successfully detected and its position could be further estimated. Furthermore, the correlation between the slit depth and difference (delta value) between the signal peaks and troughs could also be founded. Consequently, the optimum excitation frequency can be determined by plotting a graph of the slope of trend line of the delta values versus the frequency.

KEYWORDS: Non-destructive testing; NDT; Magnetic flux leakage; MFL; Anisotropic magnetoresistance; AMR

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