An MFL Probe using Shiftable Magnetization Angle for Front and Back Side Crack Evaluation

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Abstract

Magnetic Flux Leakage (MFL) is one of the common methods in Non-destructive Tests employing magnetic technique. It can be used to detect flaws such as cracks in metallic materials such as steel, whereas, steel is widely known as a base material used for constructions. Therefore, early detection of these flaws is very crucial in order to prevent any accident that could cost lives. Conventionally, MFL method utilizes a strong magnetic field to saturate samples and detects the magnetic flux leakage. However, in this study, a sensitive magnetic probe has been developed to remove the need of using a strong magnetic field to saturate samples. the MFL probe is fabricated with 2 AMR sensors, a home-made amplifier circuit, a set/reset circuit and a flexible yoke. Furthermore, the flexible yoke is proposed in order to apply the magnetic field to the sample at different magnetization angles. Using the developed probe, we measure the magnetic responses at front and back side surfaces of a 2-mm galvanized steel plate at different frequencies. The sample itself is embedded with artificial slits with different depth, ranging from 1.0 mm to 1.6 mm. Moreover, the effect of different magnetization angle of 60° and 90° from the surface is also discussed. From the results, it can be said that the 60° magnetization angle from the surface is proved to provide a considerable improvement for the surface slit detection, while, having close to no effect compared to the 90° magnetization angle on the back side slit detection.

Keywords: NDT; Magnetic Flux Leakage; Crack In Steel; Magnetization Angle