Detection of crack on a mild steel plate by using a magnetic probe incorporating an array of fluxgate sensors

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ABSTRACT
Magnetic flux leakage (MFL) and eddy current testing (ECT) are two of the most commonly used techniques to detect cracks in ferromagnetic materials. The MFL technique excels in determining the locality of a crack, while the ECT technique can provide useful information regarding the dimension and orientation of cracks. The objective of this research is to propose a simultaneous application of both MFL and ECT techniques in a single probe and to improve the visual resolution of the defect by superimposing signals from a sensor array. A magnetic probe was developed with an array of fluxgate sensors and two excitation coils. Line scan measurements and 2D mapping of artificial slits with different depths were conducted on a mild steel SS400 plate with a thickness of 12 mm to evaluate the performance of the developed probe. The line scan measurement results demonstrated the ability of the probe to detect the presence of artificial slits on the sample and to predict the depth of the slits, especially at the 110-Hz excitation frequency. Then, from the 2D mapping results, the location of the slit was determined. Furthermore, by obtaining a superimposed 2D map generated by each sensor, an improved 2D map resolution with lower background noise was obtained.

KEYWORDS
Nondestructive Testing; Magnetic Flux Leakage; Eddy Current Testing; Crack; Fluxgate sensor

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