Development of ECT Probe for Back Side Crack Evaluation

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Abstract:
Cracks are known as one of the defects that usually happen within a steel structure such as piping, funnel, bridges, buildings and other civil engineering structures, and can occur on the surface or subsurface of the structures. Detection of crack is crucial since cracking can cause dangerous damage to the structure which may lead to structural collapses and unfortunate events. Therefore, cracking needs to be discovered earlier before it reaches the point of fracture. Since NDT is becoming popular and necessary in certain conditions, there are few methods or techniques that have been founded in order to detect cracks based on different physics principles. Among them, electromagnetic method (eddy current testing (ECT)) is one of the favorable methods in NDT especially in metal industries in order to evaluate the crack without causing any damage to the subject.. This research presents the study and detailed analysis of an ECT probe's development based on AMR sensors for identifications of defects in galvanized steel plates. The probe consists of an excitation coil which is used to induce eddy current in sample plates and two AMR sensors to detect the differential magnetic response induced by eddy currents. In order to analyze the magnetic field distribution, which is detected by the AMR sensors, a phase sensitive detection technique by using a lock-in amplifier is applied. The performance of the ECT probe in the crack detection is evaluated using artificial slits on 2-mm galvanized steel plates. Using the developed ECT probe, the magnetic response is measured on the backside of the 2-mm galvanized steel plates. The output signal is detected and analyzed using imaginary components of the magnetic response vectors. The captured data show a signal change at the crack position. From the results, a correlation between depth and detected signals are clarified with respect to different frequencies.

Keywords: Non-Destructive Test; Eddy current; Anisotropic Magneto-Resistive

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