1.2.6. DEFECT CHARACTERIZATION IN TAILOR WELDED BLANKS USING AN EDDY CURRENT AND HARMONIC FLUX LEAKAGE INTEGRATION

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Introduction. The EU is the largest automotive production region in the world and the industry comprises 6.5% of the manufacturing sector in the European Union. Direct employment by the automotive industry stands at about 2.2 million employees, while the total employment effect (direct and indirect) is estimated to be about 12 million. Tailor Welded Blanks (TWB) are very popular in car manufacturing because it can enable product and manufacturing engineers to "tailor" the blank so that steel's best properties are located precisely within the part where they are needed. This process not only reduces the weight of the finished part, but also can be used for part integration, thereby eliminating many reinforcements and stiffeners.

The quality of the weld in a TWB is critical due to the posterior forming operations and the ASP and ISO have specified guidelines for evaluating TWB weld quality. However, each of the possible non destructive system used to inspect the welds have their limitations and the industry do not have a unified criterion about the requirements.

This paper examines the integration of harmonic magnetic flux leakage and eddy current in a novel approach and as an economical system to evaluate the quality of the weld. The development of a laboratory set up is described and the ability of the system to detect lack of penetration, lack of fusion, mismatch, no-weld and pinholes under industrial requirements is demonstrated. In addition, a discussion of signal processing, automatic feature extraction and classification of defects is presented.

Basic Results. The initial trials to validate the experimental NDT developed inspection device were done using engineered imperfections simulating different weld defects (lack of fusion, lack of penetration, pinholes, mismatch, no-weld, etc.). All the experiments were done using two ST07 zinc coated steel, one of 1.66 mm of thickness and another one of 0.90 mm.

These trials allow us to know the correlation between the weld defects and the acquisition signals from the NDT inspection device developed.

Once determined the correlation between the weld defects and the signals obtained, the second step of the investigation consisted in establishing the sensitivity of the device developed in order to determine the minimum size of the defects that can be detected.

Summary. The data acquired from the developed inspection device (integrating both Eddy Current and Magnetic Flux Leakage) shows that this device is potentially viable for NDT inspection of TWB laser welded joints.

The different trials carried out describe the ability of the system to detect different weld imperfections like lack of penetration, lack of fusion, mismatch, no-weld and pinholes under industrial requirements.

Based on these results, future work will focus on the development of automatic defect detection and pattern recognition issues. This development will allow the characterization of the acquired signals associated with weld defects. Furthermore, this development will permit to evaluate the behaviour of the device developed in an industrial environment.