

Advanced 3D-TFM Ultrasonic Spot-Weld Inspection

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Resistance spot-welds in the automotive industry are commonly inspected with conventional single element probes. This method however does not allow for a direct imaging and measurement of the materially connected area, which is the main quality criteria. To map the materially connected area matrix arrays with proper imaging capabilities are needed. Due to the requirement of an accurate and reproducible inspection result, single element acquisition of matrix array elements may not be sufficient and the coupling geometry of spot-welds poses a challenge to the array inspection. An advanced total focusing method employing a 2D matrix array which allows to inspect the 3D volume of the spot-weld under test has been developed. The total focusing method adapts dynamically to the surface profile and probe orientation such that the reconstructed 3D volume allows for a high-resolution imaging of the volume beneath the probe. For interpretation the reconstructed 3D volume is projected to a 2D image showing the positions and dimension of reflectors in a top view. This projected view is used to measure the dimension of the materially connected area. Extensive validation measurements on spot-weld samples will be discussed to highlight the achieved performance of the method in an industrial application.