

Design of innovative ultrasonic TOFD transducers

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TOFD is gaining presence in manufacturing and maintenance inspections because of its advantages compared to conventional ultrasonic techniques. TOFD technique is largely used in welds inspection to detect and dimension accurately defects perpendicular to the inspection surface. During TOFD inspection of thick welds, in order to cover the whole volume of the weld more than one pair of transducers are needed. Therefore, due to increased number of transducers, assuring the good coupling of all the transducer becomes a difficult task. In the same way, the cost of the inspection hardware increases, due to the need of additional inspection channels. With the objective to overcome these problems, a theoretical analysis has been performed to reduce the number of transducers needed in the TOFD inspection of thick components. For that purpose, different transducer geometries have been simulated in CIVA software, obtaining the crystal geometry which best fits the inspection requirements. Two strategies have been followed. On the one hand, the crystal curvature has been changed to un-focus the ultrasonic beam and, on the other hand, the shape of the crystal section has been modified to homogenize the ultrasonic beam pressure in the whole volume of interest. Once the optimum transducers geometry has been defined with CIVA software, the transducers have been manufactured and simulated results have been validated in thick calibration blocks with artificial defects.