

4.5.18. NEW ULTRASONIC ARRAY IMAGING OF CRACK-TYPE DEFECTS BASED ON SIMULATION-HELPED PROCESSING

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Advanced ultrasonic array techniques provide considerable amount of data making possible by the use of suitable processing algorithms enhanced capability of defects imaging and therefore improved localization and sizing. We present in this communication ultrasonic array 3D imaging tools developed in the framework of the French National Research program INDIAC.

The imaging technique is based on the application of the FTP algorithm of CIVA to data issued from Full Matrix Capure acquisition (FMC). A FMC acquisition is composed of as many shots as number of elements. One shot corresponds to one transmitting element, all the elements being active in reception. The reconstruction algorithm FTP consists basically in coherently summing the received signals at every point P in the sampled region of interest. Its output is a map of the summed amplitudes in this region which exhibits maxima at the defect location. To achieve the summation requires computation of the theoretical time of flights along the paths linking the transmitter the points P and the receiver. The connexion of the algorithm to CIVA forwards models allows to deal with non canonical situations. The objective of this communication is to present a new technique for imaging crack-type defects located closed to a backwall and giving rise to a multiplicity of possible echoes (tip diffraction, corner echoes, mode conversions). In order to make the imaging possible for defects detected through a multiplicity of M possible wave paths the FTP algorithm has been generalized to multimodal echographies.

Experiments have been carried out in order to evaluate the performances of the methods. We present results obtained on blocks containing various notches of different heights and orientations, simulating breaking or not breaking cracks. The results show that the technique allows to image the notch along its entire length. This is a quite remarkable result unreachable with classical inspection techniques and results offer new perspectives for the characterization of crack-type defects.