Ultrasonic inspection of complex parts with TRL matrices probes mounted on water wedges using an adaptive plane wave imaging approach for combined pulse-echo and pitch-catch modes

FAYE DEARDURFF[1], Gavin Dao[2]

[1]accounting, ADVANCED OEM SOLUTIONS, USA, [1]Business Development, LLC, USA

Advanced post-beamforming methods such as Advanced FMC/TFM are powerful approaches for fast and high-quality imaging of industrial parts. After complex transmitting patterns, the image reconstruction is obtained using post-processing beamforming. Usually, these acquisition and reconstruction processes need the knowledge of the geometry of the part under test in order to be efficient. Therefore, in the case of parts with complex geometries such as pipes, weld beads, or fans, a conventional imaging algorithm gives inadequate results. In this paper, we propose an adaptive method of TFM-like imaging approaches for pieces with complex profiles. Using a single data set, the method estimates the profile of the piece and performs the image reconstruction. About the experimental setup, we use two TRL matrix probes mounted on flexible wedges that can adapt to complex surfaces without an inspection in immersion. The contribution of this work is that we provide all modes between the two probes (pulse-echo of probe 1, pulse-echo of probe 2, pitch-catch from probes 1 to 2, pitch-catch from probes 2 to 1). The developed adaptive imaging method permits a real-time display of the four modes thanks to massive parallel computations. Results are presented from a steel pipe section containing artificial defects. The employed probes are two matrices having 128 elements (8x16 elements), centered at 1.5MHz, with a 3 mm pitch. The phased-array device is a 256-channel full-parallel from Advanced OEM Solutions (AOS). The proposed method reveals a better flaw and geometry positioning than a naive approach.