

chk - Review of Several New Improvements to Full Matrix Capture and the Total Focusing Methods

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Full Matrix Capture (FMC) and the Total Focusing Method (TFM) are revolutionizing phased array ultrasound. FMC and TFM are advanced acquisition and post-processing techniques, respectively, and can be implemented real-time for inspection purposes. FMC/TFM family provides many benefits over conventional Phased Array, with unique features, such as: a real-time high resolution reconstruction grid, viewing of several wave modes from one setup, improved vertical and lateral resolution, higher signal to noise ratio, improved flaw characterization and sizing, and reduced misinterpretation of geometric echoes versus defects. Raw FMC data can be saved and reprocessed later with improved signal processing algorithms. This paper will present a fundamental detailing of the FMC/TFM family, a sampling of TFM images from real-world defects, as well as highlighting improvements to speed up and optimize both FMC and TFM while keeping, and in some cases, improving signal-to-noise ratio. We also address the variable inputs to a system that can have a great overall effect on the FMC/TFM family inspection and data quality. In this paper, we also propose an adaptive approach of the total focusing method (ATFM) in order to take into account a complex specimen shape. ATFM requires a single data set for a single image and does not need multiple acquisitions to detect the profile. Several TFM acquisitions schemes are compared in terms of image quality (resolution, contrast) and computation time. We show that with ATFM the agreement between the theoretical profile and the estimated profile is good, and moreover the flaw positioning is correct.