

# **State-of-the-Art and novel trends in ultrasonic imaging of concrete structures**

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The novel technologies in ultrasound generation and data processing offer new opportunities for three-dimensional imaging of concrete structures. Especially the Full-Matrix-Capture (FMC) technique with its real-time imaging capability can be successfully utilized for quality assurance in construction industry. Although, the available testing instruments on the market implement the principle of linear transducer array with its two-dimensional B-Scan image reconstruction based on Synthetic Aperture Focusing Technique (SAFT) principle. The Dry-Point-Contact (DPC) transducers utilized in commercially available instruments for concrete testing with their matrix-like layout offer direct opportunity to implement three-dimensional Full-Matrix-Capture (FMC) data acquisition cycle. The obtained data can be in real-time processed by 3D-TFM reconstruction and visualized and evaluated three-dimensionally. For overcoming natural inspectability limitations of coarse grained materials like concrete, novel methods for acoustic evaluation of density gradients ("Acoustic Density") can be additionally applied along with TFM technique for extracting valuable additional information about slight acoustic impedance changes in the material by means of statistical processing of individual wavelets obtained by DPC transducer arrays and coherent integration of the impedance gradients. In the present contribution both state-of-the-art and novel true-3D imaging approaches are considered on real concrete inspection objects and the advantages of enhanced data processing in respect to improved information content and easiness of result interpretation are discussed.