1.14.5. AUTOMATED ULTRASONIC SCANNING AND IMAGING SYSTEM FOR APPLICATION AT CIVIL STRUCTURES

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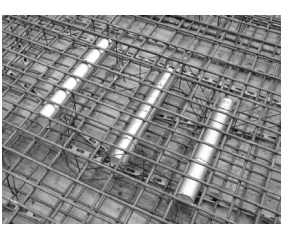
The development of ultrasonic imaging techniques for concrete application has reached a state that already allows solving a number of practical tasks. Imaging methods such as B-scan or SAFT (Synthetic Aperture Focusing Technique) reconstruction have been shown to facilitate thickness measurements, detection of tendon ducts and flaws, and can expose the inner structure of concrete elements. Still missing are integrated inspection systems which enable to use these techniques for planar scans.

This contribution presents an integrated ultrasonic measurement and imaging system built especially for this purpose, and shows results obtained with different transducer configurations. The system covers the complete acquisition and evaluation process of ultrasonic measurements on concrete structures. It consists of a multi-channel ultrasonic instrument, an automated mechanical scanner with three axes, and an integrated B-scan and SAFT-reconstruction imaging software that converts the measurements into two-dimensional and three-dimensional images. Different transducers can be used including longitudinal water coupled transducers and dry-coupled transversal transducers. Highlight is a 48-element/16-channel array transducer which can be electronically switched to increase the measurement speed considerably. The system can universally be used for precision laboratory work as well as tough in-the-field applications.

The systems capabilities are demonstrated with measurement results obtained on several test specimens and an extended test site. The site consists of an array of test fields contained in the floor of the institutes measurement hall. Each spot consists of three to six single targets of different size and depth, comprising line targets from 25 to 90 mm diameter, and reflecting and non-reflecting area targets of 50 and 100 mm diameter. Based on two-dimensional and three-dimensional measurement results, a number of measurement topics will be discussed such as imaging possibilities, direct and indirect target detection, structural noise and its suppression, and scan speed.



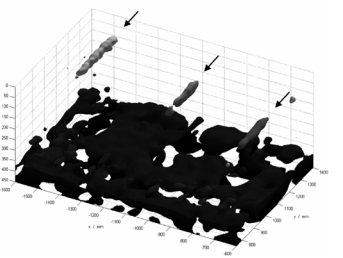


Fig. Three-dimensional SAFT reconstruction of a test specimen containing three partly filled tubes