Ultrasonic Non-Destructive Testing for Concrete and Metal

Technology #20180136

Analytical Reverse Time Migration Technique Detects Cracks in Concrete

The reverse time migration (RTM) is a simulation-based reconstruction technique that offers advantages over conventional methods such as Synthetic Aperture Focusing Technique (SAFT). RTM is capable of imaging boundaries and interfaces with steep slopes and bottom boundaries of inclusions and defects. However, RTM suffers from two primary bottlenecks: it is computationally costly and it demands massive memory. These bottlenecks have been removed by using an analytical approach. Analytical RTM is comparable to SAFT in terms of efficiency and its memory requirement is in the order of megabytes, so it can provide the image of the scanned medium in a few seconds. Another advantage of the analytical approach is that it generates less noise than the conventional RTM technique. The analytical RTM can be used for characterization of cracks with an arbitrary slope in metal and concrete elements. This method can also be used for locating the entire boundary of inclusions such as tendon ducts in concrete structures. The new technique has been applied to synthetic concrete slabs and has shown the potential of RTM in detecting bottom-up cracks and locating vertical boundaries.

Analytical RTM is Faster and Uses Less Memory

The emergence of ultrasonic dry point contact (DPC) transducers that emit horizontal shear waves has enabled efficient collection of high-quality data in the context of a nondestructive evaluation of concrete structures. This offers an opportunity to improve the quality of evaluation by adapting advanced imaging techniques. The proposed analytical approach not only eliminates the high memory demand, but also drastically reduces the computation time from days to minutes for problems of considerable size.

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BENEFITS AND FEATURES:

• Computationally fast
• Memory requirement is low
• Capable of characterizing cracks with an arbitrary slope
• Can be applied to metal and concrete components
• Can locate the bottom boundary of the inclusions and defects

APPLICATIONS:

• Locating the entire boundary of tendon ducts
• Damage detection in concrete structures
• Crack detection in metal and concrete structures
• Detection of cracks in concrete pavements
• Geometric measurement of concrete foundations and slabs

Phase of Development - Proof of Concept

Interested in Licensing?

The University relies on industry partners to scale up technologies to large enough production capacity for commercial purposes. The license is available for this technology and would be for the sale, manufacture or use of products claimed by the issued patents. Please contact Kevin Nickels to share your business needs and technical interest in this technology and if you are interested in licensing the technology for further research and development.

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