Monitoring of damage state and early-age mechanical properties of concrete using embedded piezoelectric transducers: from theory to industrial applications

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Monitoring of concrete quality and degradation allows to optimize the construction and maintenance phases of concrete infrastructure, and in doing so, to reduce costs of construction and repair and avoid accidents with potentially dramatic consequences such as the collapse of the Genoa bridge, in August 2018.

Ultrasonic testing of concrete using external transducers is a proven method to monitor the mechanical properties and the quality of the concrete. At ULB-BATir, we have developed a new technology based on embedded ultrasonic piezoelectric transducers which allows to monitor in real-time and remotely the mechanical properties of concrete and the appearance of damage.

Two major developments have been made in the field : (i) the design and optimization of low cost embedded transducers to maximize the signal-to-noise-ratio both at early-age and over the long-term [1] , and (ii) the development of signal processing and feature extraction techniques to evaluate mechanical properties and the state of damage of the concrete over the whole lifetime of the structure [2-4].

The efficiency of the proposed methodology for concrete monitoring has been demonstrated on different laboratory tests both at early age and for crack monitoring in the long term, including the problem of variability due to operational conditions [5].

Current developments aim at applying this new technology in industrial applications, which is the topic of the on-going *Tweetcon* project (www.tweetcon.be).

This presentation aims at retracing the different steps of this research topic from the first fundamental theoretical developments to the current industrial applications.

References

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