

# **Setting Performance Evaluation Using Wireless and Contactless Ultrasonic System**

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Recent developments in wireless and contactless testing hardware, such as internet of things and air-coupled ultrasonics, have enabled new levels of setting performance evaluation for cementitious materials. A fully contactless ultrasonic system has been developed using 16 channel MEMS units and wireless data transfer toolkit, as shown in fig 1. Since surface preparation and direct coupling process are not needed, this system collects a large amount of test data across the field in a continuous manner. The measurements are carried out during hydration progress of cement, where the system monitors an initiation and propagation of leaky Rayleigh (LR) waves under the increase of shear capacity of solid. Densely obtained time-space domain data were transferred to frequency-wave number (f-k) domain using two-dimensional Fourier transform, in order to identify the development of LR wave velocity and amplitude without noise. The results illustrate that the developed system enables to acquire high-quality data during hydration and f-k domain analysis possibly provides meaningful information of elastic modulus without empirical correlation process. Further analytic studies of elastic waves are conducted through phase change materials such as fresh concrete. Based on the experiment and analytic study, appropriate applications of setting performance are suggested based on field perspectives.