IDENTIFICATION OF WAVE ARRIVALS IN CROSS-HOLE SONIC LOGGING TESTS BY MEANS OF THE MAXIMUM LIKELIHOOD ESTIMATOR

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Abstract

Cross Hole Sonic Logging is a well known pile integrity non destructive test based on the propagation of an ultrasonic pulse through steel pipes placed inside a concrete pile. For the case of large diameter piles, this technique results more suitable than the traditional one, known as SIT (Sonic Integrity Testing) or PET (Pulse Echo Testing). However, the records of the received electrical signal captured by the ultrasonic transducer usually shows a poor appearance due to a low signal-noise ratio (SNR) that makes difficult to identify the arrival time. There are many signal processing methods that allow to overcome this problem, including the signal characterisation, filtration, estimation and the interpretation. Taking into consideration the probabilistic nature of the cross hole sonic logging’s signals, this paper introduces a maximum likelihood estimator as an alternative tool to process this type of signals. By means of this estimator, the signals appearance is significantly improved allowing a more confident identification of the arrival time of the receiver pulse’s signals.

A system constituted by the ultrasonic transducer and the corresponding propagation field is simulated with different signal-noise ratio (SNR) conditions. Based on this simulation, advantages and limitations of the proposed procedure are discussed. In addition, other applications of the technique are illustrated.

Keywords: Pile testing, Cross Hole Sonic Logging, Signal processing, Maximum likelihood