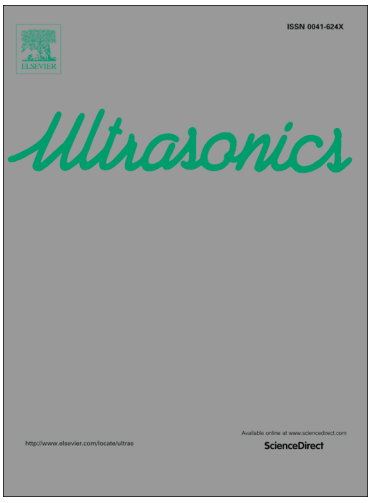

The evaluation of distributed damage in concrete based on sinusoidal modeling of the ultrasonic response

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The evaluation of distributed damage in concrete based on sinusoidal modeling of the ultrasonic response

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Abstract

Ultrasonic wave attenuation is an effective descriptor of distributed damage in inhomogeneous materials. Methods developed to measure wave attenuation have the potential to provide an in-site evaluation of existing concrete structures insofar as they are accurate and time-efficient. In this study, material classification and distributed damage evaluation were investigated based on the sinusoidal modeling of the response from the through-transmission ultrasonic tests on polymer concrete specimens. The response signal was modeled as single or the sum of damping sinusoids. Due to the inhomogeneous nature of concrete materials, model parameters may vary from one specimen to another. Therefore, these parameters are not known in advance and should be estimated while the response signal is being received. The modeling procedure used in this study involves a data-adaptive algorithm to estimate the parameters online. Data-adaptive algorithms are used due to a lack of knowledge of the model parameters. The damping factor was estimated as a descriptor of the distributed damage. The results were compared in two different cases as follows: 1) constant excitation frequency with varying concrete mixtures and 2) constant mixture with varying excitation frequencies. The specimens were also loaded up to their ultimate compressive strength to investigate the effect of distributed damage in the response