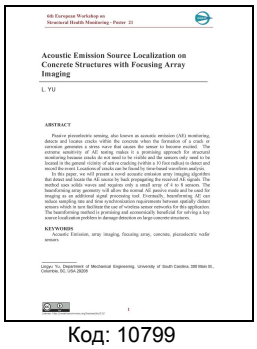

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Acoustic Emission Source Localization on Concrete Structures with Focusing Array Imaging

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ABSTRACT

Passive piezoelectric sensing, also known as acoustic emission (AE) monitoring, detects and locates cracks within the concrete when the formation of a crack or corrosion generates a stress wave that causes the sensor to become excited. The extreme sensitivity of AE testing makes it a promising approach for structural monitoring because cracks do not need to be visible and the sensors only need to be located in the general vicinity of active cracking (within a 10 foot radius) to detect and record the event. Locations of cracks can be found by time-based waveform analysis.

In this paper, we will present a novel acoustic emission array imaging algorithm that detect and locate the AE source by back propagating the received AE signals. The method uses solids waves and requires only a small array of 4 to 8 sensors. The beamforming array geometry will allow the normal AE passive mode and be used for imaging as an additional signal processing tool. Eventually, beamforming AE can reduce sampling rate and time synchronization requirements between spatially distant sensors which in turn facilitate the use of wireless sensor networks for this application. The beamforming method is promising and economically beneficial for solving a key source localization problem in damage detection on large concrete structures.

KEYWORDS

Acoustic Emission, array imaging, focusing array, concrete, piezoelectric wafer sensors

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Содержание

Abstract
Introduction
Experimental testing
Focusing array imaging algorithm
Results
Conclusions