Non-Confidential Description - PSU No. 3870
“A Novel System for Non-destructive, Air-coupled Impact Echo (IE) Investigations of Concrete and Masonry”

Keywords/ Field of the Invention:
Non-destructive testing, Automated Impactor

Links:
Inventor Website

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Background
The impact echo (IE) method uses non-destructive impacts to generate stress waves that travel in material under impact. Current commercial IE systems use piezo-based sensors that measure the displacement of a masonry or concrete substrate subjected to nondestructive impacts using either spring ball impactors or a solenoid-driven impacting mass. When the displacement versus time record from these sensors is transformed to the frequency domain, the presence of defects such as delaminations, cracks, honeycombing, voids, etc. can be detected by studying shifts in the frequency peaks. Moreover, the thickness of various concrete and masonry elements can be measured.

Invention Description
Consisting of an automated IE system that includes integrated software and hardware systems, the invention offers the following advantages over currently available competitive technologies; 1) ease of sensor placement during testing, 2) sharper and more distinct peaks in frequency spectra, 3) ability to accurately obtain readings through floor tiling material. By rapidly scanning the masonry and concrete substrates, the end-user can make more accurate, quicker decisions regarding the substrate’s continued serviceability and/or repair. For example, the invention has accurately located sizable horizontal cracks within slabs that are not visible through visual inspection of the surface(s). The invention enables the combination of IE and experimental modal analysis work, which offers an efficient means of conducting overall assessments of potential defects in concrete or masonry structures locally and globally.

The software contributes significantly to this automated IE system by guiding the operator through grid-based scans of substrate materials, selection of frequency peaks and generation of frequency contour plots to visualize the substrate material. Figure 10 (attached hereto) is a screen shot of the IE test tab in the software interface. The software’s database structure facilitates summarization of thousands of impacts across any number of grids for a given project.

Status of the Invention
A working prototype is available for on-site demonstrations to prospective licensee(s). The prototype can be operated on a tripod, field cart, or held by hand to evaluate impacts in any orientation. The prototype can be easily modified to use multiple impactors of various sizes.