Automatic Scanning System for Surface / Internal Crack Detection of Fiber Reinforced Concrete Pipe

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The detection of concrete pipe cracks has received great attention in concrete pipe infrastructures. Typical concrete pipe inspection method for the crack detection is visual inspection using closed circuit television and laser. These inspections are performed in an accessible internal cracks on the outer surface (soil side) of a concrete pipe. Therefore, the approach has challenges to detect invisible or internal cracks. The crack evaluation method using non-contact mechanical wave propagation in concrete is one of the promising technique to detect and evaluate the concrete cracks. The approach proposed in this paper is to develop a rapid automatic contactless scanning system for detecting the cracks and other damages of fiber reinforced concrete pipe (FRCP) in both inner and outer cracks by using the auto-impacting system and MEMS airborne sensors. The test results show the proposed inspection system allows to detect both internal and surface cracks by calculating wave scattering and energy attenuation. The numerical finite element simulation The authors verified the experimental results using finite element (FE) model. The FE model of guided wave energy represents the intact, inner cracked, and outer cracked condition in concrete pipe. The laboratory testing results demonstrate the potential of the scanning system producing the crack map of the prepared concrete pipe specimen. The crack maps successfully indicate the crack locations and relative damage levels of inner and outer crack. The scanning with movable platform can be applied with the auto-impacting system and MEMS non-contact sensor in the further research.