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Detection of Concrete Reinforcement Damage Using Piezoelectric Materials: Analytical and Experimental Study

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Abstract : An effort for the detection of damages in the reinforcement bars of reinforced concrete members using PZTs is presented. The damage can be the result of excessive elongation of the steel bar due to steel yielding or due to local steel corrosion. In both cases the damage is simulated by considering reduced diameter of the rebar along the damaged part of its length. An integration approach based on both electromechanical admittance methodology and guided wave propagation technique is used to evaluate the artificial damage on the examined longitudinal steel bar. Two actuator PZTs and a sensor PZT are considered to be bonded on the examined steel bar. The admittance of the Sensor PZT is calculated using COMSOL 3.4a. Fast Furrier Transformation for a better evaluation of the results is employed. An effort for the quantification of the damage detection using the root mean square deviation (RMSD) between the healthy condition and damage state of the sensor PZT is attempted. The numerical value of the RSMD yields a level for the difference between the healthy and the damaged admittance computation indicating this way the presence of damage in the structure. Experimental measurements are also presented.

Keywords : concrete reinforcement, damage detection, electromechanical admittance, experimental measurements, finite element method, guided waves, PZT
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