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Damage Detection in Reinforced Concrete Slab Using Shannon Entropy Applied to Acoustic Emission Signals

Soumyadip Das, Aloke Kumar Datta, Pijush Topdar, and Sanjay Sengupta

Abstract Reinforced Concrete (RC) structures are known for their durability and capability of surviving a variety of adverse environmental conditions. However, due to external factors and operational conditions, hidden damage can grow that may eventually lead to gradual/sudden structural failure. Continuous sensor-based health monitoring of such structures will help in increasing their design life. The acoustic emission (AE) technique is one of the potential non-destructive sensor-based continuous structural health monitoring techniques, which helps in detecting the damage in real-time. AE sensors can receive acoustic emission signals, created by internal damage, which can be analyzed in the time–frequency domain through wavelet transform (WT). From the wavelet coefficients, the measure of disorder in a physical system, which is called entropy may be quantitatively described through the concept of Shannon Entropy. In the present study, an attempt has been made to use the Shannon Entropy, Entropy-Frequency curve, and cumulative entropy value to find the damage in an RC slab, where the damage has been simulated using the concept of pencil lead break (PLB). The study indicates that the Entropy-Frequency curve and cumulative entropy value can be utilized to find the damage location at different distances from the sensor location.

Keywords Reinforced concrete · Health monitoring · Non-destructive tests · Acoustic emission · Damage detection · Wavelet transform · Shannon entropy

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