Sustainable Structural Health Monitoring after Earthquake Based on Multiscale Entropy Analysis

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The structural health monitoring (SHM) is extremely important because Taiwan is located on the pacific seismic belt where earthquake hazards occur frequently. Maintenance management is required to control the life-cycle of a structure for providing safety and health conditions. This research aims to solve the scale effect of Experimental Modal Analysis and the limitations of visual inspection. Based on the Operational Modal Analysis, a fast and convenient SHM was developed for making decision on suitable solutions in order to extend the lifetime of structures. In this method, a portable seismometer is utilized to measure the microtremor signals of structures. Using the proposed algorithms to process the signals as well as applying Multiscale Symbolic Entropy (MSSE), the model of the structural states can be built. After the measurements and analyses, the MSSE models of an individual structure throughout a year have great consistency. By using the methods as stated, we can compare the healthy model with the stressed model after earthquake, then an examination of the structural damage could be done. After conducting practical analysis of a structure in National Chung Hsing University, we can clearly distinguish healthy and damaged case caused by 1999 Chi-Chi earthquake. The proposed sustainable SHM is suitable for the first stage investigation for numerous structures. Once a probabilistic damage is detected, a more specific detection will be further utilized.

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