

Structural Health Monitoring: Highlights & Challenges

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Abstract

Civil infrastructures, during their service life may be threatened by potential large seismic events, scouring, debris flow during severe typhoon, etc. To understand the current situation of structural integrity and reliability, it is important to have a monitoring system which can assess the health situation (damage detection) of structure periodically or after each disaster event. To achieve this damage detection goal, techniques on SHM need to be developed. The structural health monitoring process involves the monitoring of a structure over time, the periodic collection of response measurement from an array of sensors, the extraction of damage sensitive features through analyzing the data, and determine the current state of the health. Early damage detection and eventual estimation of damage is an important problem, since it forms the basis of any decision for structural repair and/or part replacement. Most damage detection methods use a relationship between a structure condition and a diagnostic symptom indicating damage. The emergency of damage can be indicated by a change of these symptoms. Therefore, different signal processing methods (such as SSI-COV, MV-AR model, BSS, etc.) are used to obtain features for damage symptoms. In this study, both input/output and output-only structural damage assessment algorithms were discussed.

It is known that civil infrastructure structure may be subject to a series of ground motion excitations during its service life in the earthquake prone area. Subspace identification method (SIM) will be discussed. Technique to remove spurious modes to identify the dynamic characteristics of building/bridge is presented. Recognition on the negative deviation from the structures resulting from earthquake-induced damage is also illustrated. Besides, for operational modal analysis techniques using output-only measurement are also discussed. Examples from both model-based and non-model based SHM algorithms will also be demonstrated. Finally, the challenges of SHM, particularly on locate and quantify the damage, will be raised.