

## **Recent Advances in Structural Health Monitoring**

Presented by Ir Prof Dr Tommy Chan  
Queensland University of Technology (QUT)  
BE, ThM, MDiv, PhD, FHKIE, CEng, RPE, MICE, C.P. Eng, MIE Aust, NPER, MCSCE  
President of the Australian Network of Structural Health Monitoring

### **Abstract**

Structural Health Monitoring (SHM) involves the use of various sensing devices and ancillary systems to monitor the in-situ behaviour of a structure to assess the performance of the structure and evaluate its condition. Because of well demonstrating its effectiveness in helping reduce operational costs and increase safety and reliability, it has attracted numerous researchers working in the area for the last three decades. Structural Health Monitoring (SHM) research can be divided into three main categories: (i) system development, (ii) sensors / measurement and (iii) applications. This presentation will report the recent advances in SHM in these three categories. Under the first category, number of test-beds have been selected covering a range of civil structural systems from laboratory models (two large-scale bridge models) and four real structures (i.e. a highway bridge, one 5-star-green rated medium-rise building, and two footbridges at QUT). In the sensors/measurement category much of the recent work has been done to enhance the Fibre Bragg Grating (FBG) sensing technology. Recent developments include new FBG strain modulation methods and new FBG accelerometers using axial and/or transverse forces and vertical displacement measurements. The application category includes number of ongoing projects on developing various Damage Detection (DD) methods, e.g. correlation MSE with Multi-Layer Genetic Algorithm (ML-GA) based optimization, multi-criteria approach using combination of natural frequencies, Modal Frequencies (MF) and Modal Strain Energies (MSE) to detect damages in bridges, buildings and dams, Correlation based method using ratio of geometric MSE and natural frequency (GMSEF), Time Domain based methods based on Auto-Regressive (AR) and Auto-Regressive Moving Average (ARMA) models, Enhanced MF for locate damage in suspension bridge main cables and hangers. Apart from DD topics, a group has been involved in developing methods to identify the effective prestress force in prestressed concrete box girder bridges by combining various Moving Load Identification (MLI) methods and Electromagnetic Ultrasonic Transducers. Besides, the use of SHM for asset management will also be discussed.