Abstract

Structural Health Monitoring (SHM) is an integral part of infrastructure maintenance and management systems due to socio-economic, safety and security reasons.

The behaviour of a structure under vibration depends on structure characteristics. The change of structure characteristics may suggest the change in system behaviour due to the presence of damage(s) within. Therefore the consistent, output signal guided, and system dependable markers would be convenient tool for the online monitoring, the maintenance, rehabilitation strategies, and optimized decision making policies as required by the engineers, owners, managers, and the users from both safety and serviceability aspects.

SHM has a very significant advantage over traditional investigations where tangible and intangible costs of a very high degree are often incurred due to the disruption of service. Additionally, SHM through bridge-vehicle interaction opens up opportunities for continuous tracking of the condition of the structure. Research in this area is still in initial stage and is extremely promising.

This PhD focuses on using bridge-vehicle interaction response for SHM of damaged or deteriorating bridges to monitor or assess them under operating conditions. In the present study, a number of damage detection markers have been investigated and proposed in order to identify the existence, location, and the extent of an open crack in the structure. The theoretical and experimental investigation has been conducted on Single Degree of Freedom linear system, simply supported beams. The novel Delay Vector Variance (DVV) methodology has been employed for characterization of structural behaviour by time-domain response analysis. Also, the analysis of responses of actual bridges using DVV method has been for the first time employed for this kind of investigation.