Workshop

Title: Fundamentals of Structural Health Monitoring with novel applications

Summary: Structural health monitoring (SHM) is crucial for the maintenance and continuous operation of infrastructure. It entails the deployment of an array of sensors on the structure or a network of structures of interest, acquiring response data of the structures, extracting meaningful features from the acquired data for assessing the current condition of the structures as a basis for estimating the remaining useful life of the structures in case a damage has been induced. The goal of an SHM system is to ensure that such critical information may be acquired from the structure while it is in full operational condition.

The existing literature consists of a plethora of SHM algorithms, based on the type of signal acquired from the structure. These algorithms fuse physics associated with vibrations and dynamic characteristics, with advanced signal processing methods for the purpose of continuous monitoring and assessment. Currently, the SHM research community is focused on development of novel and reliable SHM algorithms as well as sensor development for efficient response data acquisition. The developed SHM algorithms should be robust to any variations in the environmental and operational condition of the structure of interest.

In this workshop we first discuss the fundamentals of SHM based on vibration behavior followed by the introduction of two novel and path breaking methods for structural monitoring. These methods are seismic deconvolution interferometry and motion magnification-based vibration monitoring. The former involves data acquisition from traditional sensors like accelerometers for characterization of the structure by studying waves that propagate in the structure when subjected to external excitations, both ambient as well as extreme loads. The latter employs an advanced computer vision algorithm called “motion magnification”, that helps magnify structural vibrations invisible to the naked eye, for achieving vision-based monitoring of infrastructure. We demonstrate the efficacy of these two approaches using field data from case studies.