

THE UNIVERSITY OF CONNECTICUT

CIVIL & ENVIRONMENTAL ENGINEERING

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ADVANCES IN SMART STRUCTURE TECHNOLOGIES
FOR CIVIL INFRASTRUCTURE

ABSTRACT

Smart civil engineering structures incorporate electronic devices to generate information that can be used for enhancing their own performance and/or the performance of other related systems. Three main components can be typically integrated with a structural system in order to generate a smart structure: sensing and sensor networks, data processing and decision-making, and actuation and control. This dissertation contributes to the state of the art of smart structural technologies for civil infrastructure through investigations on each one of these areas. For the area of sensing and sensor networks, fieldwork on structural health monitoring (SHM) was performed. In particular, it was demonstrated that it is possible to use infrasound measurements to identify low-frequency global vibrations of in-service highway bridges. In the area of data processing and decision-making, field and numeric research was conducted on Bridge Weigh-In-Motion (BWIM). This research provided insight on the sensitivity and efficacy of the strain-only influence area method under different experimental conditions. Finally, in the area of actuation and control, numerical research was performed on seismic protective systems. The studies on this section include both passive and semi-active control strategies for the connected control method of adjacent base-isolated buildings. It is shown that coupling adjacent base isolated building have the potential to reduce the base displacements without compromising the floor accelerations.