A Review of Some Advanced Sensors used for Health Diagnosis of Civil Engineering Structures

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A Review of Some Advanced Sensors used for Health Diagnosis of Civil Engineering Structures

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Abstract

The developments in structural health monitoring techniques have led to the invention of various sensors that can be effective damage indicator. Due to environmental or electromagnetic effects and need for constant energy source, the traditional sensors are unable to provide accurate and continuous measurements. In light of these events, new and improved sensors have been developed, along with wireless technology, to assist the monitoring process. With the need of detecting more than one damage parameters, multiplexed sensors have been the main interest of researchers. This paper deals with the different sensors used for determination of strain, acceleration and corrosion. A brief comparative study has been performed and presented in the following review paper. Multiplexed Fiber optics sensor have proved quite effective for SHM and proved to be a good competitor with other sensors. Optimum Sensor Placement technique developed for low level damage diagnosis is Iterated Improved Reduced System (IIRS) Method.

Keywords: Non-Contact sensor, Strain Sensors, Dynamic Monitoring, Accelerometers, Corrosion Sensors, Multiplexed Sensor, MEMS, Fiber Optic Sensors, Optimal Sensor Placement

1. Introduction

Structural Health Monitoring (SHM) of civil structures, as the name suggests means a proper evaluation of the civil structural condition. SHM based techniques are Non-Destructive Damage Evaluation (NDE) or Non-Destructive Testing (ND/T) techniques which are able to identify damage in a structure at an early stage and evaluate the damage extent so that the engineers can carry out the maintenance with the help of this data. The main functions of SHM are: 1) damage detection or validating the performance of large-scale complicated structures, 2) accurate identification of damage location, 3) check the severity of damage or evaluation of health status and predicting the service life of the structure, and 4) real-time data collection and diagnosis of structural condition [1]. Previously, the most common monitoring process carried out to evaluate damage was only by visual examination. With the development of technology, various other methods have been introduced to evaluate the structural health. Non - destructive monitoring techniques used previously were the X-rays, thermography, radiography and many others which required direct access to all the parts of the structure. This condition is not possible to achieve in case of complex structures. SHM had a breakthrough when it was integrated with different modern technologies such as; magnetic, electrical, thermal, and photic and computer science technology [2]. The modern SHM technique includes sensing technology, data collecting or acquisition, transmission, storage or management and diagnosis of the structural health. These techniques, with integrated remote sensing, use of smart materials and computer biased knowledge system, allow a civil engineer to observe the performance of large