Abstract

This paper describes the use of a bridge model equipped with 18 Pasco Load Cell accelerometer sensors for the measurement of changes in vibration frequency with changes in load (25%, 50%, 75%, and 100% of its full capacity) at four different points on the bridge. The raw data obtained were thereafter analyzed in Excel using Fast Fourier Transform (FFT) to ensure the authenticity of the readings from the Pasco sensors. Results have shown that the small difference between the sensor data and the FFT results proved the effectiveness of the sensors to reflect the structural conditions accurately. Analysis showed that the first natural frequency with highest amplitude is sensitive to structural damage and hence an important parameter in the damage detection process. Also, it was found from this research that the level of damage to the bridge generally increases with an increase in the applied load; the higher the load, the greater the level of damage detected. The classification of the structural conditions based on vibration patterns was carried out by using the Support Vector Machine algorithm trained with the Radial Basis Function kernel, accuracy rates of 91.57% and 100% were obtained in damage detection and damage localization, respectively. The results show that this SVM model has the potential for application in bridge maintenance improvement, but before it can be applied in practice, it must be validated for other types of bridges and under different environmental conditions.

Keywords: Structural health monitoring, Wireless Sensor Network, Support Vector Machine, Damage Detection, Damage Localization.