ADVANCED STRUCTURAL HEALTH MONITORING SYSTEM FOR BRIDGES IN SRI LANKA

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Bridges are a critical component of the transportation infrastructure system because a failure in a particular bridge may affect a wide range of areas adversely. Also, the intensity and frequency of natural shocks and stresses that can affect the performance of the bridges, such as earthquakes, floods, and tsunami have rapidly increased during the past few years, which increases the vulnerability of bridges by combining with aging. Hence it is crucial to monitor the current health of bridges so that devastating failures could be avoided by following a structured maintenance program. In that case, advanced Structural Health Monitoring (SHM) systems that are rapidly developing for past decades with the development of IoT, have been used for bridge monitoring purposes in other countries. However, the condition of the bridge monitoring system is not so developed in Sri Lanka yet. Also, the commonly used methods such as visual inspection and traditional tethered methods are incorporated with some drawbacks. Therefore, the requirement for an advanced SHM system for bridge monitoring in Sri Lanka has been raised. In this study, a low-cost wireless synchronous sensor network developed by the Department of Civil Engineering, University of Moratuwa was applied and monitored on a bridge as a pioneering step of implementing an advanced online SHM system for bridges in Sri Lanka. Here, the synchronous vibration time history of the structure was measured using the sensor network with high accuracy. After a filtration process, the data was applied for calculating the experimental modal parameters such as natural frequencies and mode shapes using Fast Fourier Transformation (FFT) and peak picking method. Finally, the experimental results were compared with the results of Finite Element Analysis (FEA) through the Modal Assurance Criteria (MAC). The MAC analysis showed values greater than 0.84 for the first four modes shapes which indicates a good correlation with the experimental results and the FEA results. Furthermore, the measured acceleration data was used to assess the serviceability state of the bridge as well.

Keywords: structural health monitoring; bridges in Sri Lanka; advanced wireless sensor network; acceleration time history; Operational Modal Analysis

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