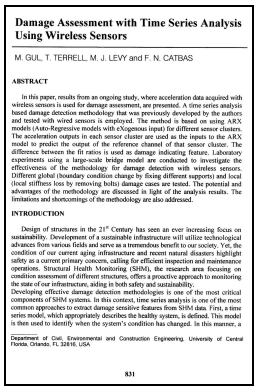

Damage Assessment with Time Series Analysis Using Wireless Sensors

M. GUL, T. TERRELL, M. J. LEVY and F. N. CATBAS

ABSTRACT

In this paper, results from an ongoing study, where acceleration data acquired with wireless sensors is used for damage assessment, are presented. A time series analysis based damage detection methodology that was previously developed by the authors and tested with wired sensors is employed. The method is based on using ARX models (Auto-Regressive models with eXogenous input) for different sensor clusters. The acceleration outputs in each sensor cluster are used as the inputs to the ARX model to predict the output of the reference channel of that sensor cluster. The difference between the fit ratios is used as damage indicating feature. Laboratory experiments using a large-scale bridge model are conducted to investigate the effectiveness of the methodology for damage detection with wireless sensors. Different global (boundary condition change by fixing different supports) and local (local stiffness loss by removing bolts) damage cases are tested. The potential and advantages of the methodology are discussed in light of the analysis results. The limitations and shortcomings of the methodology are also addressed.

INTRODUCTION

Design of structures in the 21st Century has seen an ever increasing focus on sustainability. Development of a sustainable infrastructure will utilize technological advances from various fields and serve as a tremendous benefit to our society. Yet, the condition of our current aging infrastructure and recent natural disasters highlight safety as a current primary concern, calling for efficient inspection and maintenance operations. Structural Health Monitoring (SHM), the research area focusing on condition assessment of different structures, offers a proactive approach to monitoring the state of our infrastructure, aiding in both safety and sustainability.
Developing effective damage detection methodologies is one of the most critical components of SHM systems. In this context, time series analysis is one of the most common approaches to extract damage sensitive features from SHM data. First, a time series model, which appropriately describes the healthy system, is defined. This model is then used to identify when the system's condition has changed. In this manner, a

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831

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Ключевые слова:

Содержание.