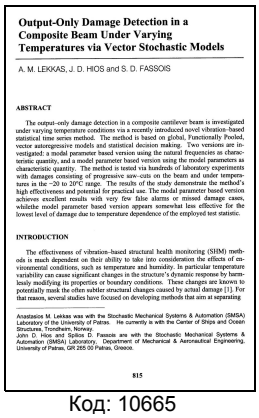

Output-Only Damage Detection in a Composite Beam Under Varying Temperatures via Vector Stochastic Models

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ABSTRACT

The output-only damage detection in a composite cantilever beam is investigated under varying temperature conditions via a recently introduced novel vibration-based statistical time series method. The method is based on global, Functionally Pooled, vector autoregressive models and statistical decision making. Two versions are investigated: a modal parameter based version using the natural frequencies as characteristic quantity, and a model parameter based version using the model parameters as characteristic quantity. The method is tested via hundreds of laboratory experiments with damages consisting of progressive saw-cuts on the beam and under temperatures in the −20 to 20°C range. The results of the study demonstrate the method's high effectiveness and potential for practical use. The modal parameter based version achieves excellent results with very few false alarms or missed damage cases, whilethe model parameter based version appears somewhat less effective for the lowest level of damage due to temperature dependence of the employed test statistic.

INTRODUCTION

The effectiveness of vibration–based structural health monitoring (SHM) methods is much dependent on their ability to take into consideration the effects of environmental conditions, such as temperature and humidity. In particular temperature variability can cause significant changes in the structure's dynamic response by harmlessly modifying its properties or boundary conditions. These changes are known to potentially mask the often subtler structural changes caused by actual damage [1]. For that reason, several studies have focused on developing methods that aim at separating

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Ключевые слова:

Содержание.

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