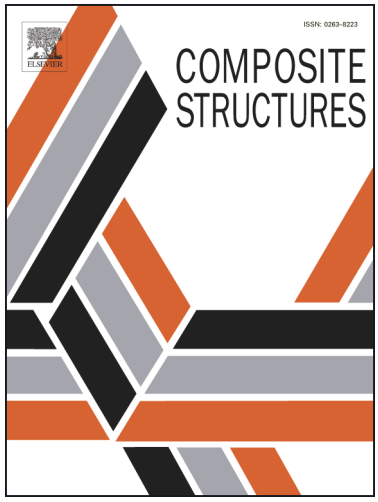

Location of Delaminations in Curved Laminated Panels

A. Muc, A. Stawiarski

PII: S0263-8223(15)00574-7
DOI: http://dx.doi.org/10.1016/j.compstruct.2015.07.030
Reference: COST 6609

To appear in: *Composite Structures*

Received Date: 10 June 2015
Accepted Date: 10 July 2015

Please cite this article as: Muc, A., Stawiarski, A., Location of Delaminations in Curved Laminated Panels, *Composite Structures* (2015), doi: http://dx.doi.org/10.1016/j.compstruct.2015.07.030

LOCATION OF DELAMINATIONS IN CURVED LAMINATED PANELS

A. Muc and A. Stawiarski

Institute of Machine Design
Cracow University of Technology
Kraków, Poland
e-mail: olekmuc@mech.pk.edu.pl

Abstract

In the present study the Structural Health Monitoring (SHM) area of science was applied to several levels of analysis: 1, confirmation the existence of damage, 2, determination of the size, location and orientation of the defect, 3, assessment the severity of the damage, 4, controlling the growth of damage and prognosis of service life of construction. The wave propagation in the panel/plate with local delamination was analyzed both numerically and experimentally. The excitation signal was generated by one actuator or more actuators to analyze the effectiveness of the method. Data from PZT sensors were collected by the analyzer and then signals were converted to digital ones with the use of MATLAB package. Based on collected data from different sensors and comparison with wave propagation model of intact structures it is possible to determine localization, size and orientation of defect using the proposed damage index. Experimental analysis has been compared with numerical results both for plates and flat cylindrical panels. In the next step of our analysis we considered optimal design of the location and number of piezoelectric sensors and actuators to characterize their influence on the structural dynamic response.

1. Introduction

The dynamic development of the contemporary technology caused a profound change in the design methods of the engineering structures. Continuously improvement of the existence production processes as well as application of the new methods affect on the dissemination of the composite materials as an alternative solution for typical materials. The safety and reliability of the structures mostly depend on effectiveness of the monitoring methods. The necessity of permanent monitoring the state of the structures and prognosis of the service life, as well as the economical aspects associated with optimal utilization of the machines and limitation of the maintenance time brought about the development of the Structural Health Monitoring (SHM) methods and systems. During the past two decades, extensive researches have been conducted in the area of vibrational based damage detection methods. The number of non-destructive inspection technics grows and depend on engineering application [1,2,3]. A basic assumption of SHM systems has been presented by Worden et al. [4,5]. A literature review which summarize the methods of data acquisition, signal processing, feature extraction and data fusion techniques can be found in Refs. [6,7,8,9]. In spite of many commercially used SHM systems and methods, most of the popular damage detection techniques do not give complete satisfaction because of their limitation. However only few methods can be applied in different type constructions made of various materials. One of the most efficient of them is the guided wave propagation method which is the subject of interest for researchers both in time and frequency domain for three decades. A classification of dynamic-based SHM techniques as a relationship between interrogation frequency and damage size was presented by Gopalakrishnan et al. [10]. A several techniques of inspection have been developed in time domain. Jeong et al. [11] presented a time reversal