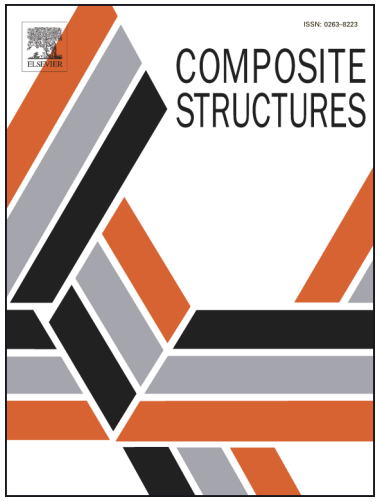

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NUMERICAL AND EXPERIMENTAL STUDIES ON VIBRATION BASED METHODS FOR DETECTION OF DAMAGE IN COMPOSITE BEAMS

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ABSTRACT
In this paper a new damage index for detection and location of damage is introduced. It is improved version of the earlier developed Poincaré map method based on forced response of the structure. The proposed method is compared with the most popular modal based methods for damage detection: the modal displacements, modal curvatures and the strain energy methods. A finite element model of intact and damaged composite beams is used in order to validate correctness and efficiency of the method. Moreover, the modal based and forced response are tested experimentally by using a scanning laser vibrometer. The advantages of the offered method and its application in SHM are demonstrated by numerical simulations and experimental tests.

I. Introduction

Damage in a structure could arise during the manufacturing process or during the operation. It can be defined as a reduction of the stiffness or/and thickness. These reductions lead to different dynamic responses from the equivalent structure without damage.
Structural health monitoring (SHM) is a process of discovering the presence of defects (or absence of defects) in the structure by the measured data for some known input. The following division of SHM to 4 levels is accepted [1]:
Level (1) Confirming the presence of damage
Level (2) Identification if damage has occurred and simultaneously determination the location of damage
Level (3) Identification if damage has occurred, determination the location of damage as well as estimation of the severity of damage
Level (4) Evaluating the impact of damage on the structure and determining its remaining life.
A SHM system which does not operate on-line also does not require real-time data belongs to the so called off-line SHM [2]. Otherwise it is called an on-line SHM system.
The vibration based methods for structural health monitoring are enable to evaluate the state of health of a structure analysing of its dynamic response. The vibration based methods have a