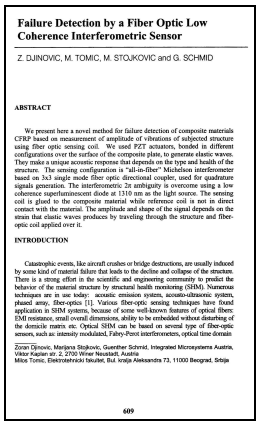

Failure Detection by a Fiber Optic Low Coherence Interferometric Sensor

Z. DJINOVIC, M. TOMIC, M. STOJKOVIC and G. SCHMID

ABSTRACT

We present here a novel method for failure detection of composite materials CFRP based on measurement of amplitude of vibrations of subjected structure using fiber optic sensing coil. We used PZT actuators, bonded in different configurations over the surface of the composite plate, to generate elastic waves. They make a unique acoustic response that depends on the type and health of the structure. The sensing configuration is "all-in-fiber" Michelson interferometer based on 3x3 single mode fiber optic directional coupler, used for quadrature signals generation. The interferometric 2π ambiguity is overcome using a low coherence superluminescent diode at 1310 nm as the light source. The sensing coil is glued to the composite material while reference coil is not in direct contact with the material. The amplitude and shape of the signal depends on the strain that elastic waves produces by traveling through the structure and fiber-optic coil applied over it.

INTRODUCTION

Catastrophic events, like aircraft crashes or bridge destructions, are usually induced by some kind of material failure that leads to the decline and collapse of the structure. There is a strong effort in the scientific and engineering community to predict the behavior of the material structure by structural health monitoring (SHM). Numerous techniques are in use today: acoustic emission system, acousto-ultrasonic system, phased array, fiber-optics [1]. Various fiber-optic sensing techniques have found application in SHM systems, because of some well-known features of optical fibers: EMI resistance, small overall dimensions, ability to be embedded without disturbing of the domicile matrix etc. Optical SHM can be based on several type of fiber-optic sensors, such as: intensity modulated, Fabry-Perot interferometers, optical time domain

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Ключевые слова:

Содержание.