A Damage Detection Technique by Distributed Strain Measurements using Long-gage Fibre Bragg Grating Sensors

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Summary

In this paper, a damage detection technique for flexural structure using strain measurements from long-gage fibre Bragg grating (FBG) sensors for structural health monitoring (SHM) was developed. An experimental investigation of flexural beams based on distributed long-gage fibre optic sensors was carried out. A method of damage detection for flexural structure from distributed dynamic strain measurements was proposed and verified. Furthermore, a parameter study of the damage detection index proposed by author by means of analysis of experimental data was performed and the possible range for practical utility of the damage detection method was confirmed here. The above damage detection technique could be applied to the health monitoring of bridge and other flexural structures.

Keywords: structural health monitoring; long-gage fibre Bragg grating sensor; damage detection technique; distributed dynamic strain measurements; flexural structures.

1. Introduction

Regarding the on-going development of available fiber optic sensing techniques, FBG sensor in nature holds the excellent ability to provide a measurement having higher precision and measuring stability. A series of lab experiments and theoretical studies for the utilities of distributed long-gage FBG sensor system by authors has been performing since 2006. Such works include theoretical and experimental studies by Li & Wu [1][2][3] and Yang et al. [4][5], the actual survey for an old under-use RC bridge named KAWANE located in Ibaraki Japan from 2008 [6][7].

On the bases of above studies, a damage detection technique for flexural structure using strain measurements from long-gage FBG sensors was developed. An experimental investigation of flexural beams based on a distributed sensing system was carried out. A method of damage detection for flexural structure from distributed dynamic strain measurements was proposed and verified. Furthermore, a parameter study of the damage detection index proposed by author by means of analysis of experimental data was performed and the possible range for practical utility of the damage detection method was confirmed here. This damage detection technique could be applied to the health monitoring of bridge and other flexural structures.

https://doi.org/10.2749/222137814814069714
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