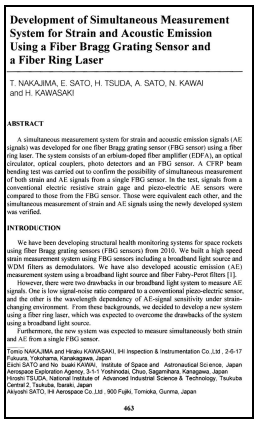

Development of Simultaneous Measurement System for Strain and Acoustic Emission Using a Fiber Bragg Grating Sensor and a Fiber Ring Laser

T. NAKAJIMA, E. SATO, H. TSUDA, A. SATO, N. KAWAI and H. KAWASAKI

ABSTRACT

A simultaneous measurement system for strain and acoustic emission signals (AE signals) was developed for one fiber Bragg grating sensor (FBG sensor) using a fiber ring laser. The system consists of an erbium-doped fiber amplifier (EDFA), an optical circulator, optical couplers, photo detectors and an FBG sensor. A CFRP beam bending test was carried out to confirm the possibility of simultaneous measurement of both strain and AE signals from a single FBG sensor. In the test, signals from a conventional electric resistive strain gage and piezo-electric AE sensors were compared to those from the FBG sensor. Those were equivalent each other, and the simultaneous measurement of strain and AE signals using the newly developed system was verified.

INTRODUCTION

We have been developing structural health monitoring systems for space rockets using fiber Bragg grating sensors (FBG sensors) from 2010. We built a high speed strain measurement system using FBG sensors including a broadband light source and WDM filters as demodulators. We have also developed acoustic emission (AE) measurement system using a broadband light source and fiber Fabry-Perot filters [1].

However, there were two drawbacks in our broadband light system to measure AE signals. One is low signal-noise ratio compared to a conventional piezo-electric sensor, and the other is the wavelength dependency of AE-signal sensitivity under strain-changing environment. From these backgrounds, we decided to develop a new system using a fiber ring laser, which was expected to overcome the drawbacks of the system using a broadband light source.

Furthermore, the new system was expected to measure simultaneously both strain and AE from a single FBG sensor.

Tomio NAKAJIMA and Hiroku KAWASAKI, IHI Inspection & Instrumentation Co.,Ltd , 2-6-17 Fukuura, Yokohama, Kanakagawa, Japan
Eiichi SATO and No. buaki KAWAI, Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, 3-1-1 Yoshinodai, Chuo, Sagamihara, Kanagawa, Japan
Hiroshi TSUDA, National Institute of Advanced Industrial Science & Technology, Tsukuba Central 2, Tsukuba, Ibaraki, Japan
Akiyoshi SATO, IHI Aerospace Co.,Ltd , 900 Fujiki, Tomioka, Gunma, Japan

Код: 10295

T. Nakajima, E. Sato, H. Tsuda, A. Sato, N. Kawai, H. Kawasaki

Development of Simultaneous Measurement System for Strain and Acoustic Emission Using a Fiber Bragg Grating Sensor and a Fiber Ring Laser

Издательство DEStech Publications, Lancaster, 2011 год

8 стр; формат: 23,5 x 16 см; библиографический список: 5 единиц
ISBN: 978-1-60595-053-2

A simultaneous measurement system for strain and acoustic emission signals (AE signals) was developed for one fiber Bragg grating sensor (FBG sensor) using a fiber ring laser. The system consists of an erbium-doped fiber amplifier (EDFA), an optical circulator, optical couplers, photo detectors and an FBG sensor. A CFRP beam bending test was carried out to confirm the possibility of simultaneous measurement of both strain and AE signals from a single FBG sensor. In the test, signals from a conventional electric resistive strain gage and piezo-electric AE sensors were compared to those from the FBG sensor. Those were equivalent each other, and the simultaneous measurement of strain and AE signals using the newly developed system was verified.

Ключевые слова:

Содержание.

Development of Simultaneous Measurement System for Strain and Acoustic Emission Using a Fiber Bragg Grating Sensor and a Fiber Ring Laser