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Study of optical fiber strain sensors used in coal mine architecture

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Abstract

In this paper, we introduced a new fiber-optic strain sensor with white light interferometric principle based on Fabry-Perot, which is capable of providing measurement for the building strain. Compared with a common optical fiber strain sensor, it has more advantages, such as low cost, high stability, and high anti-interference. The resolution of the fiber-optic stain sensor is up to 1με within the test range being ±5000με. The fiber-optic strain sensor system made up of this fiber-optic strain sensor is put into use in coal mine architecture.

Key words: *Fiber-optic, White light, Strain, Coal mine architecture*

1. Introduction

The past two decades have seen a rapidly growing interest in the field of fiber-optic sensors (Bock and Urbanczyk, 2000). The advantages of fiber optic sensors are wide bandwidth, compactness, geometric versatility and economy (Kersey, 1991). Optical fiber sensors have been developed for a variety of applications in industry, medicine, defense and research (Nellen, 1999). Some of these applications include gyroscopes for automotive navigation systems, strain sensors for smart structures and for the measurement of various physical and electrical parameters like temperature, pressure, liquid level, acceleration, voltage and current in process control applications (Varadan and Varadan, 1999).

The coal is the important energy in our country, meanwhile, the coal mine safety has been being concern widespreadly by the people (Yu *et al*., 2001). In this paper, we introduced a new fiber-optic strain sensor with white light interferometric principle based on Fabry-Perot, which is capable of providing measurement for the building strain of mine tunnel. White light interferometry is a low coherent interferometer that is used to avoid error and noise caused by bending of the fiber and fluctuation of the light source. Compared with a common optical fiber strain sensor, it has more advantage, such as low cost, high stability and absolute measurement.

2. Sensor configuration

The proposed strain sensor structure is shown in Figure 1, the fiber strain sensor system is based on white-light interferometric principle, which signal processing is that the optical signal wavelength is modulated in the Fabry-Perot cavity with fiber strain sensor system, and

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