Fiber-Optic Interferometric Sensors

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Technology description

Executive Summary

Fiber-optic sensors using optical interferometers have application for sensing a variety of parameters such as acoustic waves, strain, temperature, and refractive index. The technology is a demodulation method that does not require laser wavelength tuning. The technology provides adaptive ultrasound detection with improved accuracy and high speed.

Description of Technology

In this system, the laser source is divided into two channels. One channel goes through an intensity modulator (IM) that keeps the original wavelength and the other channel undergoes a small wavelength shift as well as intensity modulation implemented by an acousto-optic modulator (AOM). The wavelength difference between the two channels is designed to be odd times of a quarter of the free spectral range of the sensor. This configuration ensures that the wavelength of at least one channel is located on the spectral slope for sensitive demodulation, regardless of spectral positions of the fringes. The high-frequency rf modulation signal of the IM channel serves as a carrier signal for the ultrasonic waves. In the meantime, the light intensity of the AOM channel is also modulated with a rf frequency which is different from that of the IM channel. The ability to separately extract the ultrasonic signals from both channels is enabled by a recently technique using laser intensity modulation. Proof-of-concept experiments have been carried out to demonstrate the capability for adaptive ultrasound detection.

Application area

Composite material
Laboratory testing
Energy & Defense

Advantages

No laser wavelength tuning required
High Speed
Adaptive ultrasound detection

Institution

Michigan State University

Inventors

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