Use of Fiber Optic FP Sensors

Article Overview

Fabry-Perot (FP) fiber optic sensors are widely used for precise measurements of temperature, displacement, refractive index, and environmental parameters across scientific, industrial, and biomedical fields.

Temperature Sensing

FP fiber optic sensors are highly effective for temperature monitoring due to their compact size, high sensitivity, and immunity to electromagnetic interference. For example, a UV glue-filled FP cavity in a hollow capillary fiber can achieve a temperature sensitivity of 1.174 nm/?C in the 30-60 ?C range, making it suitable for marine surveys, biological diagnostics, and environmental monitoring without interference from pressure variations . These sensors are also used in chemical and industrial processes where precise temperature control is critical.

Refractive Index Measurement

FP sensors can measure the refractive index (RI) of liquids and solids by monitoring interference fringe contrast caused by Fresnel reflections. This capability is valuable in biochemical sensing, chemical analysis, and material characterization, where detecting small changes in RI is essential for quality control and research .

Displacement and Structural Monitoring

FP interferometric sensors are employed for small displacement measurements and structural health monitoring. By tracking wavelength shifts in interference fringes, these sensors can detect minute movements or deformations in smart structures, aerospace components, and civil engineering applications . Their high precision and immunity to environmental noise make them ideal for monitoring critical infrastructure.

Industrial and Environmental Applications

FP fiber optic sensors are used in oil and gas exploration, seismic and sonar detection, and aerospace engineering. Their versatility allows for remote sensing in harsh environments, including high temperatures and pressures, where traditional electronic sensors may fail . Additionally, they are applied in oceanographic research for real-time water temperature monitoring and environmental studies .

Biomedical and Laboratory Applications

In biomedical research, FP sensors are used for biochemical assays and diagnostics, where precise measurement of temperature, RI, or displacement is required. Their compact design and high sensitivity allow

integration into lab-on-a-chip devices and microfluidic systems for real-time monitoring of biological samples .

Summary

FP-type fiber optic sensors are versatile, precise, and robust, making them suitable for a wide range of applications:

o Temperature monitoring in industrial, marine, and biomedical environments
o Refractive index measurement for liquids, solids, and biochemical samples
o Displacement and structural health monitoring in aerospace and civil engineering
o Environmental sensing in harsh or remote conditions Their combination of high sensitivity, compactness, and immunity to electromagnetic interference ensures FP fiber optic sensors remain a key technology in modern sensing applications .

In Section 2, the fundamental physical sensing mechanism of the fiber-optic pressure sensor is thoroughly investigated, focusing on

Optical fiber sensors present several advantages in relation to other types of sensors. These advantages are

The discovery of fiber gratings, capitalizing on the photosensitivity of optical fibers in 1978

We review our works on Fabry-Perot (F-P) interferometric fiber-optic sensors with various applications. We give a

Since the 1980s, the use of fibre-optic sensors has steadily expanded across a range of applications. The underlying sectors have

In turn, the electromagnetic passiveness and environmental resistance can be maintained [19, 20]. Optical fiber sensor systems are

In dynamic testing, F-P sensors have been extensively used for the accurate measurement of parameters such as

This paper conducts a systematic analysis of the sensing mechanisms in fiber-optic

This review holds important academic and practical value. From a scholarly perspective, it systematically addresses the entire

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The designed fiber-optic acoustic sensing system has the features of resistance to electromagnetic interference,

Fiber-optic Fabry-Pérot (FP) sensor has the advantages of small structural size, high sensitivity, and immunity to

A Fabry-Pérot sensor is defined as an interferometer consisting of two partial mirrors facing each other, which generates an

Optical fiber Fabry-Perot (FP) interferometric pressure sensors have been attractive for a wide range of applications in

FiberPatrol FP1150 uses single-mode fiber optic sensor within telecommunications-grade cable. In addition

Here we review the basic principles of MEMS fiber-optic FP pressure sensors and then discuss the sensors based on

This paper reviews a wide variety of fiber-optic microstructure (FOM) sensors, such as fiber Bragg grating (FBG) sensors, long

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