Interferometric Embedded Fiber Optic Sensor

Article Overview

Interferometric fiber optic sensors are advanced devices that utilize the interference of light to measure various physical parameters with high sensitivity and accuracy.

Overview

Interferometric fiber optic sensors are designed to detect changes in physical parameters such as temperature, strain, pressure, and refractive index. They operate based on the principle of interference, where light beams are split and then recombined after traveling different paths. The resulting interference pattern provides information about the measurand being monitored.

Types of Interferometric Fiber Optic Sensors
o Fabry-Perot Interferometers: These sensors consist of two partially reflective mirrors that create multiple reflections of light, allowing for precise measurements of distance or pressure changes.
o Mach-Zehnder Interferometers: This type splits the light into two paths, where one path interacts with the measurand. The two beams are then recombined to produce an interference pattern that indicates changes in the measurand.
o Michelson Interferometers: Similar to Mach-Zehnder, but uses a beam splitter to divide the light into two paths, with one path being affected by the measurand.
o Sagnac Interferometers: These sensors measure rotation and are particularly useful in applications like gyroscopes, where the interference pattern changes based on the rotation of the sensor.

Advantages

o High Sensitivity: Interferometric sensors can detect minute changes in physical parameters due to their reliance on interference patterns.
o Multiplexing Capability: Multiple sensors can be integrated into a single fiber, allowing for simultaneous measurements of different parameters.
o Immunity to Electromagnetic Interference: Fiber optic sensors are not affected by electromagnetic fields, making them suitable for harsh environments.
o Compact Size: Recent advancements have led to miniaturized designs that are easier to deploy in various applications .

Applications

Interferometric fiber optic sensors are used in a wide range of applications, including:

o Structural Health Monitoring: To assess the integrity of bridges, buildings, and other structures by measuring strain and deformation.
o Environmental Monitoring: For detecting changes in temperature and pressure in various environmental conditions.
o Medical Applications: In biomedical sensing for monitoring physiological parameters.
o Industrial Applications: Such as monitoring electrical partial discharges in power systems, which can indicate insulation failures .

Conclusion

Interferometric fiber optic sensors represent a significant advancement in sensing technology, offering high accuracy, sensitivity, and versatility across various fields. Their ability to operate in challenging environments and provide real-time data makes them invaluable in modern applications. As research continues, these sensors are expected to become even more integrated into everyday technology and industrial processes.

Abstract Fiber-optic extrinsic Fabry-Perot (EFPI) sensors have been successfully used for a wide range of applications.

The proposed LSTM-assisted interferometer opens new possibilities for high-sensitivity, wide-dynamic-range optical

The interferometric sensor is fabricated by fusing and tapering a standard single-mode optical fiber, and then

Many of the optical sensors use fiber or optical waveguide technology and are already integrated in communication

Also, a wide variety of Mach-Zehnder and Michelson interferometric sensors based on photonic crystal fibers are

Abstract and Figures This article describes a fiber-optic interferometric sensor and measuring scheme including input

We review recent advances in MOF-based OVE sensors, discussing design strategies, performance benchmarks, and applications in

A highly sensitive fiber-optic inclination sensor using a modal interferometer was proposed in the present study, which

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Fiber optic sensors have been widely used and studied in recent times. This paper presents operating principles and

Currently, the trend of the interferometric optical fibers is the miniaturization for microscale

Interferometric fiber optic sensors (FOSs) are local sensors that measure changes at specified points in a structure by detecting

Interferometric fiber-optic pressure sensor converts pressure signals into optical phase

Distributed optical fiber sensors characterized by spatially resolved measurements along a

This paper aims to review and categorize fiber optic interferometric sensors according to their operating principles,

Fiber optic interferometric sensors have found several industrial applications including fiber optic gyros for navigation in

Here, we summarize the recent progress of fiber-optic EFPI sensors, providing an overview of different physical and

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