Three-core fiber optic sensor

Article Overview

Three-core fiber optic sensors use multiple cores within a single fiber to enable high-sensitivity measurements of physical parameters like bending, refractive index, temperature, and shape.

Design and Structure

Three-core fiber optic sensors typically consist of three distinct cores embedded within a single optical fiber, which can be arranged in microstructured or hole-assisted configurations. In microstructured fibers, one core may be exposed in a hollow channel, another enclosed in an inner tube, and the third covered by cladding, forming a Mach-Zehnder interferometer when spliced with multi-mode fibers at both ends. Light propagating through the three cores interferes, producing a spectrum that can be analyzed using Fast Fourier Transform to extract sensing information such as refractive index and temperature with high sensitivity (-1319.56 nm/RIU for refractive index and 0.32 nm/?C for temperature) . Hole-assisted three-core fibers enhance sensitivity to vector bending, achieving maximum bending sensitivities of -27.282 nm/m in specific directions, making them suitable for precise structural monitoring .

Working Principle

The interference of light in the three cores forms the basis of sensing. Variations in external parameters like bending, temperature, or refractive index alter the optical path lengths in each core, shifting the interference pattern. By analyzing these shifts, the sensor can detect minute changes in the measured quantity. Multi-core fibers can also incorporate Fiber Bragg Gratings (FBGs) for shape sensing, enabling real-time 3D reconstruction of fiber deformation with sub-millimeter accuracy (

We have proposed and experimentally demonstrated a vector magnetic field sensor based on a magneto-sensitive

This work proposes an all-optical fiber sensing architecture with in-sensor computing that achieves <3 ns

Highlights o A triple-channel optical fiber SPR refractive index (RI) sensor with an operating band below 1000 nm is

Outline The fiber optic sensor has an optical fiber connected to a light source to allow for detection in tight spaces or where a small

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We have designed, fabricated, and characterized a fiber-optic three-dimensional vector accelerometer for vibration measurement.

<p>Multicore fiber (MCF) which contains more than one core in a single fiber cladding has attracted ever increasing attention for

We report a novel and highly sensitive torsion sensor that integrates a multicore fiber (MCF) within a Sagnac

A novel fiber optic sensor has been developed using suspended core fiber (SCF) to simultaneously measure the refractive index (RI)

Beyond telecom, multi-core fibers are used in fiber-optic sensors, where coupling between cores is sensitive to strain or temperature.

Therefore, the integration of optical fiber sensors in WSNs introduces benefits and new capabilities for the design of advanced hybrid

Pieces of the referred strongly coupled multicore fiber are used as sensors in a laser cavity incorporating a pulsed

In this work, we propose a novel, computationally efficient method for determining the 3D tip

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

The multicore fiber (MCF) shape sensing technology utilizes the strain distribution characteristics of each core to

We have experimentally proposed an all-fiber temperature-insensitive twist sensor, which is fabricated by splicing a three-core fiber

A vector bending sensor based on hole-assisted three-core fiber Mach-Zehnder interferometer is demonstrated. The maximum

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