

Belongs to the intensity-type fiber optic sensor



Overview

Optical fibers can be used as sensors to measure, , and other quantities by modifying a fiber so that the quantity to be measured modulates the,,, or transit time of light in the fiber. Sensors that vary the intensity of light are the simplest, since only a simple source and detector are required. A particularly useful feature of intrinsic fiber-optic sensors is that they can, if required, provide distributed sensing over very large distances.

Key Takeaways

Intensity-based fiber optic sensors detect changes in light intensity caused by environmental variations, making them simple, cost-effective, and suitable for distributed sensing applications.

Overview
Intensity-based fiber optic sensors operate by measuring variations in the intensity of light transmitted through an optical fiber. The basic principle involves a light source, optical fiber, sensing element, and a detector. Environmental changes such as vibration, pressure, or displacement modulate the light intensity, which is then converted into an electrical signal for measurement and analysis .

Working Principle



These sensors rely on multi-mode, large-core fibers to transmit light. When an external physical parameter, such as vibration or bending, affects the fiber, it causes a change in the light intensity reaching the detector. For example, in a vibration sensor, the amplitude of vibration alters the light transmitted from one end of the fiber to the other, allowing the system to measure the vibration magnitude . Common mechanisms include:

- Microbend sensors: Small bends in the fiber cause light leakage, changing intensity.
- Evanescent wave sensors: Light interacts with the surrounding medium, and changes in the medium affect intensity.

Advantages

- Low cost and simple design.
- Can function as distributed sensors over long distances.
- Easy to implement and capable of multiplexing multiple sensors along a single fiber.
- Resistant to electromagnetic interference and suitable for harsh environments .

Limitations

- Sensitivity to variable losses such as splices, connector losses, microbending, and macrobending.
- Relative measurements rather than absolute values, which may require calibration.
- Light intensity variations can be influenced by environmental factors unrelated to the measurand, potentially affecting accuracy .

Applications

Intensity-based fiber optic sensors are widely used in:

- Vibration monitoring in machinery and structures.
- Displacement and pressure sensing in industrial systems.
- Structural health monitoring for bridges, buildings, and pipelines.
- Environmental sensing where distributed measurements are required . These sensors are particularly valuable in remote or hazardous locations where electrical sensors may be unsafe or impractical, such as near high-voltage equipment or flammable materials . In summary, intensity-based fiber optic sensors provide a simple, cost-effective solution for detecting physical changes by monitoring light intensity variations, with applications ranging from industrial monitoring to structural health and environmental sensing.

Article Content

Fiber-optic sensor

Optical fibers can be used as sensors to measure strain, temperature, pressure and other quantities by modifying a fiber so that the quantity to be measured modulates the intensity, phase, polarization, wavelength or transit time of light in the fiber. Sensors that vary the intensity of light are the simplest, since only a simple source and detector are required. A particularly useful feature of intrinsic fiber-optic sensors is that they can, if required, provide distributed sensing over very large distances.

Fiber Optical Intensity Sensors

Fiber optical intensity sensors are made of optical fibers connected to a miniaturized optical sensor which is based on either a

A Self-Referencing Intensity-Based Fiber Optic Sensor with Multipoint ...

A self-referencing, intensity-based fiber optic sensor (FOS) is proposed and demonstrated. The theoretical analysis for the proposed

Fiber Optic Sensor

Phase modulation fiber optic sensors (also referred to as fiber optic interferometers) are similar to the intensity-based sensors albeit

Intensity-Modulated Fiber-Optic Sensor: A Novel Grid Measurement Unit

This article presents a novel approach to physical-displacement-based power grid measuring via an intensity-modulated fiber-optic

Optical Fiber Sensors: Classification & Applications

Abstract— Beside advantages; recent advances and cost reductions has aroused interest in optical fiber sensing. So, the outgrowths

Types of Fiber Optic Sensors

The optical signal produced by the optical source and is transmitted through the transmitting fiber in the modulation zone. The optical

Fiber-optic sensor

A fiber-optic sensor is a sensor that uses optical fiber either as the sensing element ("intrinsic sensors"), or as a means of relaying

Optical Sensors – light, power, intensity, forces, displacements and ...

The term optical sensor can refer to two types of devices: those that sense properties of light itself, like power or intensity, and those

Inside Fiber Optic Sensors: Categories, Materials, and Core

Fiber optic sensors are sophisticated devices that utilize light transmitted through optical fibers to detect and measure

What Are Fiber Optic Sensors and How to Choose the Right One?

This article introduces optical fiber sensors, covering their definition, principle, types, applications, selection specs and

What is a fibre optic sensor? | Sensor Basics: Principle ...

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

Fiber Optic Sensors and Their Applications

Another type of intensity based fiber optic sensor is the evanescent wave sensor that utilizes the light energy which leaks from the

A Brief Introduction to Fiber Optic Sensors and their Types with ...

The first fiber-optic sensing patents had been submitted and had appeared as a test product mentioned in the literature. Eli

Fiber Optic Intensity-Modulated Sensors: a Review in Biomechanics

Abstract: Fiber optic sensors have a set of properties that make them very attractive in biomechanics. However, they remain

Fiber Optic Sensors: Fundamentals, Principles & Applications

Optical Fiber (Transmission Medium, Sensing Element) Light modulated due to interaction with parameter of interest (Measurand)

Optical Fiber Sensors Guide

An optical fiber sensing system is basically composed of a light source, optical fiber; a sensing element or transducer and a detector

Extrinsic and intrinsic types of fiber optic sensors.

Another type of intensity based fiber optic sensor is the evanescent wave sensor (see Figure 7) that utilizes the light energy which

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