

Article Overview

Fiber optic sensors in Portugal commonly include Fiber Bragg Grating (FBG) sensors, interferometric sensors, and intensity-based sensors, widely used in structural monitoring, industrial applications, and biomedical research.

Types of Fiber Optic Sensors

Fiber Bragg Grating (FBG) Sensors FBG sensors are among the most widely used in Portugal, particularly for structural health monitoring and industrial applications. They work by reflecting specific wavelengths of light that shift in response to strain or temperature changes, allowing precise measurement over long distances. Companies like HBK FiberSensing in Porto specialize in FBG-based sensors, interrogators, and accessories, providing both standard and customized solutions for OEMs and critical infrastructure monitoring .

Interferometric Sensors These sensors measure changes in phase, polarization, or optical path length caused by external physical parameters. Interferometric fiber optic sensors are used in high-precision applications, including vibration monitoring, pressure sensing, and laboratory research. INESC TEC and other Portuguese research institutions have historically contributed to the development of interferometric and reflective fiber optic sensors .

Intensity-Based Sensors Intensity-modulated fiber optic sensors detect changes in light intensity caused by variations in the measurand, such as displacement, pressure, or chemical concentration. These sensors are simpler and cost-effective, suitable for industrial automation and environmental monitoring .

Other Specialized Sensors

- o **Optical Current Sensors:** Used in electrical power systems to measure current without electromagnetic interference .
- o **Functional Near-Infrared Spectroscopy (fNIRS) Sensors:** Employed in biomedical applications to monitor brain activity and oxygen saturation using red and infrared light .
- o **Multiplexed Fiber Arrays:** Allow multiple sensors to operate along a single fiber, enabling distributed sensing over long distances .

Advantages and Applications

Fiber optic sensors in Portugal benefit from the intrinsic properties of optical fibers: they are electromagnetically passive, chemically inert, and capable of long-distance and distributed sensing. These features make them ideal for:

- o Structural health monitoring of bridges, buildings, and pipelines
- o Industrial process control and automation
- o Biomedical and physiological monitoring
- o Environmental sensing in harsh or remote locations

Key Manufacturers and Research Institutions

- o HBK FiberSensing (Porto): FBG sensors and systems for industrial and infrastructure monitoring
 - o INESC TEC: Research and development in interferometric, reflective, and Bragg grating sensors
 - o PLUX: FNIRS sensors for biomedical applications
 - o Sarspec: Optical fibers and probes for spectroscopy and measurement systems
- These organizations highlight Portugal's strong presence in both research and commercial deployment of fiber optic sensor technologies.

6Wresearch actively monitors the Portugal Fiber Optic Connectivity Market and publishes its comprehensive annual report,

Wearable optical fiber sensors have great potential for development in medical monitoring. With the increasing

FiberSight is a technology company and CERN startup, specializing in smart sensing solutions using optical fibers as sensory

Monitoring infrastructure via continuous, kilometer-scale fiber-optic sensors, driving efficiency and sustainability.

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Our fibre-optic cable systems partly cover the same applications as conventional optical sensors. Depending on the customer's

Abstract: In this work the authors first summarily describe the main topics that were the subject of their post-graduate activity in fiber

Fiber Bragg grating (FBG) sensors have emerged as advanced tools for monitoring a wide range of physical

Operating from Porto, Portugal, our dedicated team specialises in the development, design, and manufacturing of Fiber Bragg

The development of fiber-optic technology was mainly driven by the requirements of the telecommunications industry.

The basic mechanisms available for the extraction of a reference signal are discussed and these are used for

the

A general overview of the R&D activity in fiber optic sensing developed over the last fifteen years in Portugal is given. Different topics

Key takeaway Sarspec specializes in developing optical solutions for spectroscopy, offering a variety of optical fibers and probes

In Portugal in the 1980s, the research on optical fibres was taking its first steps, and one of the most cohesive research groups was

Using fiber optic-based sensing Omnisens offers continuous, reliable monitoring for energy industry assets. A range of solutions is

We have developed the first fiber optic sensor capable of measuring simultaneously temperature and humidity. Every kilometer of

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