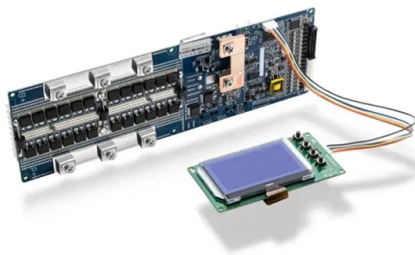


How to use a Bragg grating fiber optic sensor



Overview

The primary application of fiber Bragg gratings is in optical communications systems. They are specifically used as notch filters. They are also used in optical multiplexers and demultiplexers with an optical circulator, or optical add-drop multiplexer (OADM). Figure 5 shows 4 channels, depicted as 4 colours, impinging onto a FBG via an optical circulator. The FBG is set to reflect one of the channels, here channel 4.

Key Takeaways

A Fiber Bragg Grating (FBG) sensor measures strain, temperature, or pressure by reflecting a specific wavelength of light that shifts in response to environmental changes. Understanding the FBG Sensor

A Fiber Bragg Grating is a short segment of optical fiber with a periodic modulation of the refractive index in its core, which reflects a narrow band of light at a specific wavelength called the Bragg wavelength while transmitting other wavelengths. When the fiber is subjected to strain or temperature changes, the spacing between the grating points changes, causing a shift in the reflected wavelength. This shift is proportional to the physical quantity being measured.

Components Needed

- FBG Sensor: The optical fiber with the inscribed grating.
- Optical Interrogator: A device that sends light through the fiber and measures the reflected Bragg wavelength.

- **Data Acquisition System:** To record and analyze the wavelength shifts.
- **Mounting Hardware:** Adhesives, clamps, or protective coatings to attach the fiber to the structure being monitored.

Installation Steps

- **Prepare the Surface:** Clean and smooth the surface where the sensor will be mounted to ensure good adhesion and accurate strain transfer.
- **Attach the Fiber:** Use a suitable adhesive or mechanical fixture to secure the fiber. Ensure the fiber is straight and free from bends that could affect readings.
- **Connect to Interrogator:** Connect the fiber ends to the optical interrogator using standard fiber connectors.
- **Calibrate the Sensor:** Record the baseline Bragg wavelength under known conditions. This allows you to correlate wavelength shifts to strain or temperature changes.
- **Temperature Compensation:** If measuring strain, consider using a reference FBG or dual-grating setup to compensate for temperature effects .

Measurement and Data Interpretation

- The interrogator continuously monitors the reflected wavelength.
- Strain or temperature changes cause a shift in the Bragg wavelength, which is converted into physical units using the sensor's calibration factor or gauge factor.
- For dynamic measurements, ensure the interrogator sampling rate matches the expected frequency of changes in the monitored parameter.

Practical Tips

- Avoid sharp bends or excessive tension in the fiber to prevent signal loss.
- Protect the fiber from environmental hazards such as moisture, chemicals, or mechanical abrasion.
- For distributed sensing, multiple FBGs can be inscribed along a single fiber, each reflecting a different wavelength, allowing simultaneous monitoring at multiple points. By following these steps, an FBG sensor can provide highly accurate, electromagnetic interference-free measurements in applications ranging from structural health monitoring to industrial process control .

Article Content

A Guide to Fiber Bragg Grating Sensors

The use of FBG sensors is connected to the development of techniques to interrogate these sensors and detect Bragg wavelengths

Fiber Bragg grating

OverviewApplicationsHistoryTheoryTypes of gratingsGrating structureManufactureSee also

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