

Measurement Accuracy of Fiber Optic Sensors



AI Overview

Fiber optic sensors offer high accuracy and sensitivity, with measurement precision often reaching microstrain levels for strain sensors and millikelvin resolution for temperature sensors, depending on the sensor type and interrogation method.

Key Factors Affecting Accuracy

Sensor Type: Intrinsic sensors, such as fiber Bragg gratings (FBG), Mach-Zehnder, and Sagnac interferometers, achieve high accuracy by detecting changes in wavelength, phase, or polarization within the fiber itself, often providing microstrain-level resolution for structural monitoring or sub-degree temperature sensitivity . Extrinsic sensors, which use the fiber to transmit light to an external sensing element, can also achieve high precision, particularly in inaccessible or high-voltage environments, though their accuracy depends on the transducer and light modulation method . **Interrogation Methods:** Accuracy is influenced by the method used to read the optical signal. Techniques like optical frequency domain reflectometry (OFDR) and optical time-domain reflectometry (OTDR) allow distributed sensing over long distances with high spatial resolution, while wavelength-shift detection in FBG sensors provides precise point measurements . Advanced signal processing and AI integration can further enhance measurement reliability and reduce noise . **Environmental Conditions:** Fiber optic sensors are inherently immune to electromagnetic interference and can operate in harsh environments, including high temperatures, strong magnetic fields, or chemically aggressive conditions, which helps maintain accuracy where electronic sensors might fail

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Optical fiber sensors offer attractive characteristics that make them very suitable and, in some cases, the only viable sensing

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Intelligent compensation method for measurement errors in optical

Abstract Temperature variations significantly degrade the measurement accuracy of fiber optic current sensors (FOCS)

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