Accuracy of Fiber Optic Strain Sensors



Overview

We have used SOFO fibre-optic strain gauges to perform measurements to check the overall relative deformation of a real reinforced concrete structure.

Key Takeaways

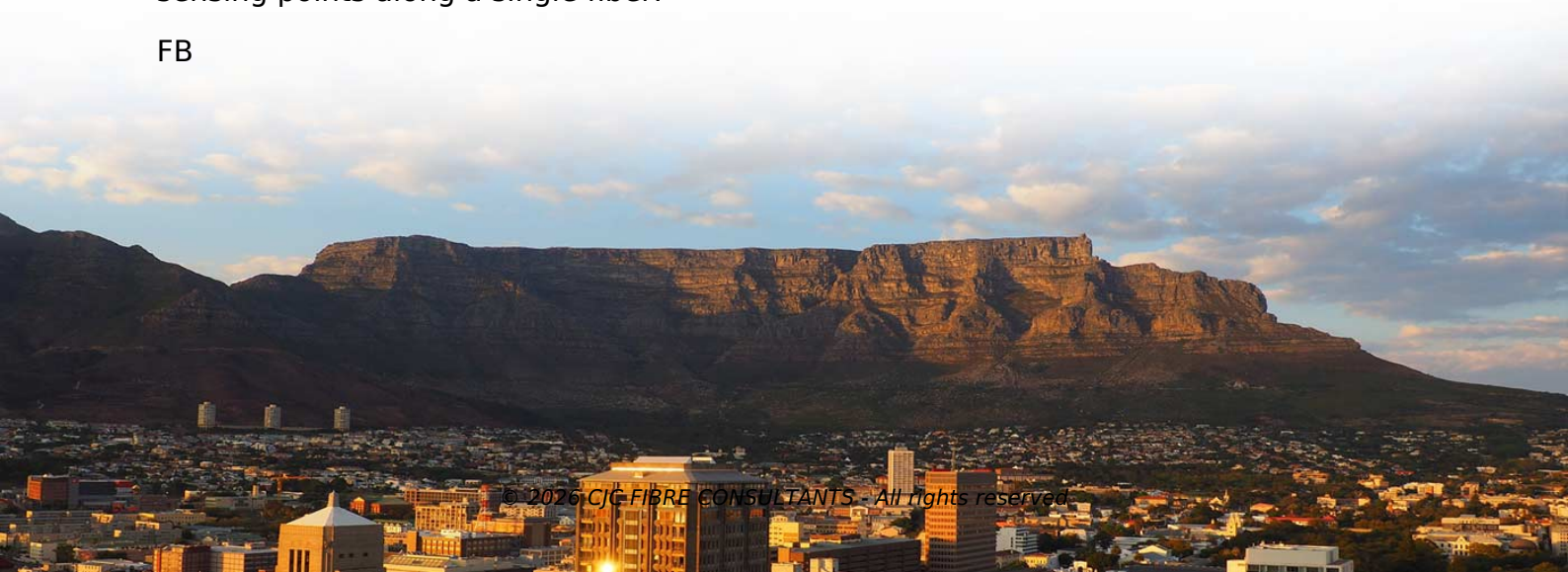
Fiber optic strain sensors can achieve high accuracy, with errors typically below 2% and excellent repeatability, making them suitable for precise structural monitoring.

Accuracy and Precision

Fiber optic strain sensors, including Fiber Bragg Grating (FBG) sensors and distributed optical fiber sensors using Optical Frequency Domain Reflectometry (OFDR), demonstrate high accuracy in strain measurements. Calibration experiments show that FBG and OFDR sensors can maintain strain measurement errors below 2% under repeated loading and unloading, with strong linearity and cyclic stability. The correlation coefficient (R^2) for strain test curves often exceeds 0.

998, indicating highly reliable measurements. Sensor Types and PerformanceFBG Sensors: These sensors reflect specific wavelengths of light that shift under strain. They provide accurate, stable, and multiplexable measurements, allowing multiple sensing points along a single fiber.

FB



© 2026 CJC FIBRE CONSULTANTS - All rights reserved

G sensors are resistant to electromagnetic interference, corrosion, and environmental factors, making them suitable for both static and dynamic strain monitoring. Distributed Sensors (OFDR/Rayleigh Backscatter): These sensors measure strain continuously along the fiber with sub-millimeter spatial resolution, enabling high-definition strain mapping over long distances. They are capable of monitoring strain over fibers up to 100 km, providing virtually continuous data for structural health monitoring.

Advantages Over Traditional Strain Gauges

Fiber optic sensors offer several benefits compared to conventional resistive strain gauges: High sensitivity and stability with minimal drift over timeLightweight and flexible, allowing embedding in structures without affecting integrityImmunity to electromagnetic interference and harsh environmental conditionsSpatially continuous measurements, capturing thousands of points along a single fiber Practical Accuracy ConsiderationsThe actual accuracy of fiber optic strain sensors depends on factors such as sensor type, installation quality, environmental conditions, and interrogation system. In well-calibrated systems, errors are typically within 1–2%, and repeatability is excellent, making them suitable for critical applications in civil engineering, aerospace, energy, and transportation.

Overall, fiber optic strain sensors provide highly precise, reliable, and scalable strain measurements, outperforming traditional mechanical sensors in both accuracy and operational flexibility.

Article Content

Strain Measurement Technology and Precision Calibration Experiment ...

In this paper, accuracy calibration experiments and the related analyses of two fiber-optic sensing technologies, the fiber-optic grating (FBG) and optical frequency domain reflectometry (OFDR), are

Strain data correction of distributed optical fiber sensors using ...

The results of an experimental model and an actual bridge show that, comparing with the current methods, the proposed method effectively improves the accuracy of strain data from the

A Comprehensive Study on Measurement Accuracy of Distributed

This work proposes a novel method of embedding FOSs using capillaries within solid structures and investigates fiber positions and orientation uncertainties within capillaries of different

Accurate Strain Sensing With Fiber-Optic Fabry–Perot Sensors Based

© 2026 CJC FIBRE CONSULTANTS - All rights reserved

In this work, we proposed a new method of demodulating the spectrum of fiber-optic Fabry–Perot (FP) strain sensors by employing convolutional neural networks (CNNs) adding long short-term memory

Strain transfer theory of industrialized optical fiber-based sensors in ...

To eliminate this error and improve the measurement accuracy, strain transfer theory is developed to establish the quantitative relationship of strains between the host material and the

Analysis of the accuracy of fibre-optic strain gauges

We have used SOFO fibre-optic strain gauges to perform measurements to check the overall relative deformation of a real reinforced concrete structure. Long-term monitoring of the

Comparison of mechanical strain measurement accuracy of fiber

yer was performed in order to measure the precision of strain detection by the Sm. rt-layer. Some inaccuracy in strain detection was found during the analysis of the results. In order to find out the

Calibration Technology of Optical Fiber Strain Sensor

The precise calibration of the optical fiber strain sensor has great practical value in prolonging the survival rate of the sensor, improving the measurement accuracy, and meeting the

Optical Fibre-Based Sensors—An Assessment of Current Innovations

Optical fibre sensing techniques take advantage of the interaction between light and the fibre''s properties to enable accurate and reliable measurements. Some of the optical fibre sensors

Reconstruction error model of distributed shape sensing based on the ...

In this study, we propose a method for simultaneous shape reconstruction and twist measurement based on optical frequency domain reflectometry (OFDR), enabling the successful decoupling of

Tailored fiber optic sensing components & solutions

We offer unique turn key fiber optic sensing solutions to our clients. By the deep application know how and the >15 years of fiber optic sensing experience we are

SPIE Digital Library

Search the SPIE Digital Library, the world''s largest collection of optics and photonics peer-reviewed applied research. Subscriptions and Open Access content available.

© 2026 CJC FIBRE CONSULTANTS - All rights reserved

Cleveland Electric Labs | The Best Thermocouple

Get the precision measurements you need with ultra high-temperature thermocouples and industrial sensors from the industry leader, Cleveland

A Comprehensive Study on Measurement Accuracy of Distributed Fiber ...

Embedding fiber optic sensors (FOSs) within parts for strain measurement is attracting widespread interest due to its great potential in the field of structural health monitoring (SHM). This

Laboratory Tests Using Distributed Fiber Optical

Using fiber optics as a tool for different kinds of geotechnical monitoring can be highly attractive and cost-effective when compared to

Strain measurement consistency of distributed fiber optic sensors for ...

The strain-frequency shift coefficient and temperature-frequency shift coefficient of distributed fiber optic sensing based on Optical Frequency Domain Reflectometry in different test

Optical Fiber Sensors: Working Principle, Applications, and Limitations

Recent progress in numerous sensing fields, including environmental, industrial, and biomedical are discussed for each class of fiber-optic sensors. The review highlights the methods

Strain transfer effect on measurements with distributed fiber optic sensors

Abstract Strain transfer phenomenon in distributed fiber optic sensors (DFOS) has shown significant effects on sensor survival and measurement of strain distributions as well as detection and

© 2026 CJC FIBRE CONSULTANTS - All rights reserved

Contact Us

Continue your research online:

Website: https://cjcconsultants.co.za
Technical inquiry: https://cjcconsultants.co.za/contact.html

This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

© 2026 CJC FIBRE CONSULTANTS - All rights reserved