Design of Fiber Optic Curvature Sensing System

Overview

Here, we present a miniaturized curvature sensing system by integrating a GaN-based optoelectronic chip with the plastical optical fiber (POF). Fiber Bragg Grating (FBG) sensors inscribed in multi-core optical fibers have been democratized over the years and nowadays offer a compact and robust platform for shape reconstruction. In this work, we propose a novel, computationally efficient method for determining the 3D tip position of a bent. The present work deals with a curvature sensor that consists of two segments of asymmetric multicore fiber (MCF) fusion spliced with standard single mode fiber (SMF). The MCF comprises three strongly coupled cores; one of such cores is at the geometrical center of the MCF. The two segments of MCF. Curvature detection is an essential technique for monitoring landslides, which are frequent and destructive disasters. The technology will enable cutting-edge applications in the fields of robotic and standard minimally invasive surgery – such as real-time position tracking, instrument and catheter navigation, force. Optical fiber curvature sensors have been considered as a promising option for human motion detection due to its good toughness, bending flexibility and anti-electromagnetic interference.

Article Content

Fiber Optic Shape Sensors: A comprehensive review

Fiber optic shape sensors are optical Multicore Fibers (MCF) or multi-fiber cables (with a similar section geometry to MCFs, but larger core spacing) capable of sensing multidimensional

A curvature fiber optic sensor with expandable measurement points

This has resulted in the widespread use of optical fiber sensing technology in shape evaluation, industrial production, structural health monitoring, aerospace, and other significant areas

2D and 3D Shape Sensing Based on 7-Core Fiber Bragg Gratings

A fiber-optic shape sensing based on 7-core fiber Bragg gratings (FBGs) is proposed and experimentally demonstrated. The investigations are presented for two-dimensional and three

Application of fiber-optic curvature sensor in ...

The fiber-optic curvature sensor (FOCS) method was applied as the primary one. Geometric leveling, accelerometer measurements of acceleration, and angular shift measurements

Evaluation of the fiber optic curvature sensor design parameters for ...

In this paper, the influence of sensitive zone design parameters on the performance of fiber optic curvature sensor (FOCS) with sensitive zone made of V-grooves is experimentally

Rapid and Accurate Shape-Sensing Method Using a

In this work, we propose a novel, computationally efficient method for determining the 3D tip position of a bent multi-core FBG-based optical fiber

Deep learning method for optical fiber curvature

Existing methods for curvature detection using fiber-optic sensors have limitations such as complex fabrication or large data size. We propose a

High-Sensitivity and Wide-Detection-Range Optical Fiber Vector ...

This paper proposes a high-sensitivity surface plasmon resonance (SPR) curvature sensor based on hard polymer-clad fiber (HPCF). The sensor employs an HPCF coated with gold and Ge Sb Te

Deep learning for highly efficient curvature recognition using fiber ...

A flexible fiber-optic sensor enabled by deep learning is proposed and experimentally demonstrated for highly efficient curvature sensing application. This sensing modulation system

Fiber-Optic Pressure Sensors: Recent Advances in

Abstract Fiber-optic sensing (FOS) technology has emerged as a cutting-edge research focus in the sensor field due to its miniaturized structure, high

Distributed Temperature and Curvature Sensing Based on Raman

We propose and experimentally demonstrate a distributed temperature and curvature sensing method based on spontaneous Raman backscattered lights in a few-mode optical fiber. A loop structure is

Composed multicore fiber structure for direction

Here, we propose a highly sensitive curvature sensor based on a strongly coupled MCF. Our device is easy to fabricate and requires a simple

Optical Fiber Curvature Sensor With High Sensitivity and a Broad ...

An optical fiber curvature sensor based on a no-core fiber (NCF) cascaded with a hollow-core fiber (HCF), realizing simultaneously high sensitivity and a broad dynamic range with the assistance of

Advances in fiber-optic-based 3D shape sensing technology

Abstract Fiber-optic 3D shape sensing technology, renowned for its immunity to electromagnetic interference and unparalleled spatial accuracy, is indispensable for real-time

Fiber-optic curvature sensor with optimized sensitive zone

A novel fiber-optic sensor that can measure curvature directly has been developed previously. In this paper, the transduction of curvature to light intensity is described analytically by

Miniature optical fiber curvature sensor via integration with GaN ...

Here, we present a miniaturized curvature sensing system by integrating a GaN-based optoelectronic chip with the plastical optical fiber (POF). The light emitter and detector are fabricated

Shape sensing technology based on fiber Bragg grating for flexible ...

Shape sensing techniques based on fiber Bragg grating (FBG) sensors capture geometric information, such as curvature and torsion, by inscribing multiple FBGs into optical fibers

Review of optical fiber bending/curvature sensor

Abstract A review for optical fiber bending sensors is presented. The article mainly focuses on the measurement methods of the structure bending. Firstly, the different optical fiber bending

Low confinement loss anti-resonant hollow-core fiber with a nested ...

The optical properties of hollow-core antiresonant fibers are primarily influenced by the negative curvature at the fiber core boundary . Therefore, employing elliptical cladding elements is one

Fiber Optic Shape Sensors: A comprehensive review

This paper presents an ambitious review of the current state of the art of Fiber Optic Shape Sensors (FOSS) based on Optical Multicore Fibers (MCF)

Design calibration and characterization of a robust low-cost fiber ...

In this work, a low-cost, robust and compact 2D deflection sensor based on a fiber-optic curvature sensor is presented. The paper discusses sensor design, calibration and characterization

Evaluation of the fiber optic curvature sensor design parameters for ...

MCF curvature sensors, based on the differential strain between cores, are particularly promising solutions explored in recent studies for the design of very high sensitivity, all-fiber,

Composed multicore fiber structure for direction-sensitive curvature ...

Ideally, a fiber optic curvature sen-sor must be cost effective and must provide the amplitude and the direction of curvature. In addition, the sensor must be sensitive, sim-ple, reliable, and very small in

Fiber optic shape sensing

The key constituent for this type of sensing is based on simultaneous and real-time monitoring of the induced strain in a multi-core optical fiber with included draw tower grating sensors (MCF-DTG®)

Sensing principle of fiber-optic curvature sensor | Request PDF

In this work, a low-cost, robust and compact 2D deflection sensor based on a fiber-optic curvature sensor is presented. The paper discusses sensor design, calibration and characterization

High Speed Fibre Optic Sensor Market Report and Forecast 2025-2034

This model also features fast response time for high-speed applications, including material handling, food processing, transportation, and packaging. Proximion designs and produces advanced fibre

Review of fiber optic sensors in geotechnical health monitoring

Meanwhile, various displacement and strain sensors based on these fiber optic sensing principles have proved to be successful in structural monitoring for a wide range of geological and

Sensing principle of fiber-optic curvature sensor

Fiber-optic curvature sensor offers many advantages within the specific application. To understand the sensing principle of this fiber-optic curvature sensor, ray-tracing is carried out to

Fiber Optic Shape Sensors: A comprehensive review

Fiber Optic Shape Sensing is an innovative Optical Fiber Sensing Technology that uses a fiber optic cable to continuously track the 3D shape and

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