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Optical fiber Bragg grating-based pressure sensor for soil monitoring applications

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Abstract

An optical-based pressure sensor for a 150 × 150 mm surface was designed and fabricated. The sensor utilizes a fiber Bragg grating (FBG) attached to a 30 × 30 × 30 mm actuator as the pressure sensing mechanism. The middle section of the actuator, which is circular, can bend into an elliptical form and, in the process, pull the FBGP via both ends when force or pressure is applied, thus converting the pressure applied to its surface into a wavelength shift. In laboratory testing, a sensitivity of 0.152 nm / kPa was obtained. Subsequently, the pressure sensor was tested in the field by burying it 20 cm underground to measure soil pressure, while another FBG was spliced in series to the FBGP to compensate for temperature variations. Testing shows that the proposed design can realize a compact optical-based pressure sensor with enhanced soil monitoring applications such as dynamic soil pressure caused by soil movement. © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

Author Keywords

fiber Bragg grating sensors; fiber Bragg gratings; ground movement; pressure sensor; soil pressure

Index Keywords

Actuators, Fiber optic sensors, Optical fiber fabrication, Pressure sensors, Soils; A.Fibres, Fiber Bragg Grating Sensors, Ground movement, Monitoring applications, Optical fiber Bragg gratings, Optical-, Pressure sensing, Sensing mechanism, Soil monitoring, Soil pressure; Fiber Bragg gratings

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