ASCANIO SENSING

FBG Instrumented Rock/Wall Bolts

ENEA Spin-off

info@ascaniosensing.it

SCH-LC0S-REV001



FBG Instrumented rock/wall bolts provide self–monitoring capability of their working condition.

FBG Instrumented Rock/Wall Bolts are made custom. The sensors are installed on the adopted mechanical components (segmented bar, strand, solid beam, ...) prior to place them in position.

The installation and calibration of the sensors on the mechanical component can be done on site, but it is preferably done in our laboratories.
Various solutions have been developed to have the final instrumented components safely handled by standard-skilled workers operating with standard construction-working procedures.

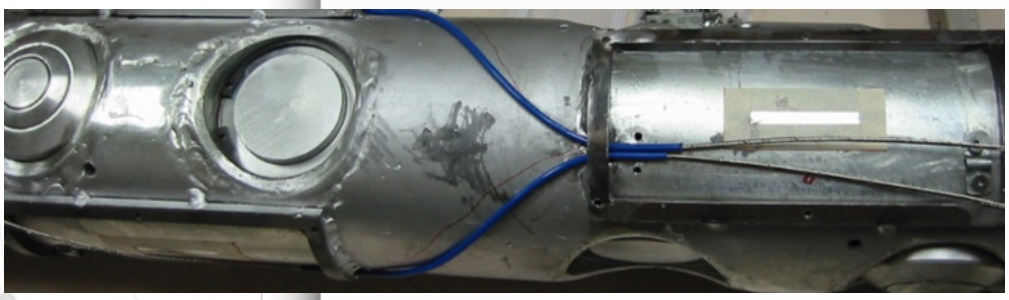
FBG Instrumented Rock/Wall Bolts provide self-monitoring capabilities for both initial tensing up when placed in position, and continuous monitoring of the working condition in the long term.

Multiple FBG sensors can be installed along the length of the bolt, chained as an array-of sensors, to provide control of differential working condition.





info@ascaniosensing.it



APPLICATIONS

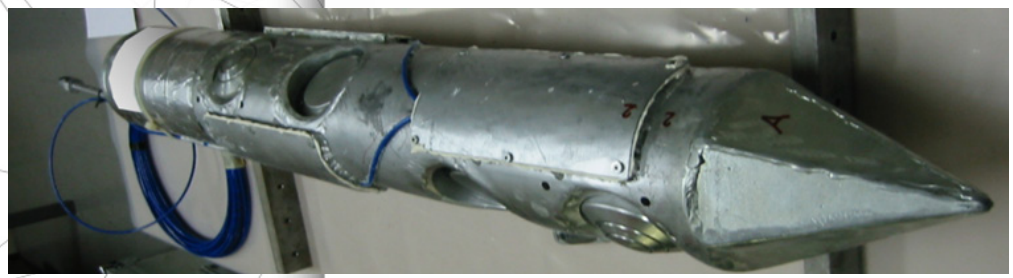
FBG Instrumented Rock/Wall Bolts are standard anchoring bolts equipped with a sensing system based on the Fiber Bragg Grating technology.

The sensing system is custom and provides self-monitoring capabilities to the otherwise pure-mechanical component.

Proved solutions have been developed for a variety of different anchoring bolt devices, and new developments is within the reach of the gained know-how of Ascanio srl.
The custom sensing solutions based on the Fiber Optic Technology offer many advantages with respect to the traditional (electrical) custom solutions.



- long term stability for structural static monitoring (monitoring of foundation settling, …)
- immunity to e.m. noise (monitoring close to power lines, …)
- easy cabling (sensors can be connected in series, …)
- no power supply at the monitored point (passive conditioning of the optical signal, …)
- dynamic response (deformation and frequency monitoring, replacement of accelerometers, …)



TYPICAL APPLICATIONS

- tunnelling
- underground mining
- soil nailing
- sheet pile walls
- D wall
- seismic retrofitting

AVAILABLE SERVICES

- support for monitoring system planning
- sensor installation and cabling
- data acquisition management

AVAILABLE OPTIONS

- built-in thermal deformation compensation
- multi-fibre pass-through optical cable
- chain-of-sensors on uninterrupted optical cable
- metallic shield and armoured optical cable

SPECIFICATIONS

- Max load: custom as per the application and the instrumented component
- Sensitivity: 0.001 max load
- Accuracy: 1x, 3x, 5x Sensitivity (depends on the adopted data acquisition system)
- Geometry: no significant alteration of the original geometry of the instrumented component
- Cables: custom length at both ends; custom armouring according to protection requirements

SCH-LC0S-REV001

ASCANIO S.r.l.
Loc. Lopilato, 8 - Staletti 88069 (CZ)
C.F./ P.I. Catanzaro 03921500793 - N. REA CZ 222346 - CUU KRRH6B9
Duns Number 442648851
Pec: ascanio-srl@pec.it
Web: www.ascaniosensing.it

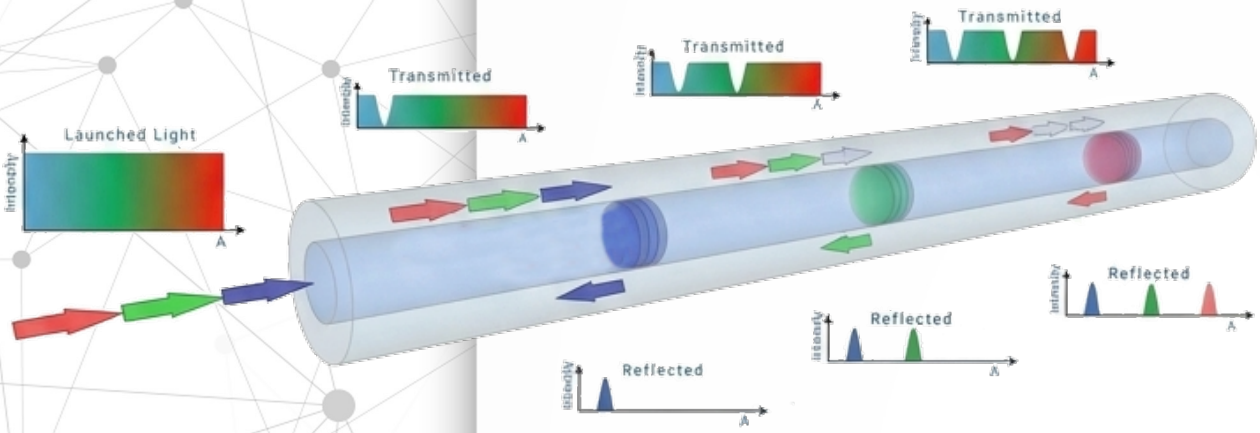
info@ascaniosensing.it

FIBRE BRAGG GRATING (FBG)

Bragg gratings are produced by modulation of the refractive index of a small segment of an optical fibre, typically 10mm long. The short optical fibre segment corresponds to the sensor, while the optical fibre only delivers the signal of the sensor to the datalogger. Bragg gratings acts as reflection pass-band filters, as sketched in the figure.

A narrow and peaked band is reflected at the grating, while the other wavelength components propagates. Multiple Bragg grating can stay along one optical fibre, each tuned to reflect a well distinct peaked band. The peak wavelength reflected by each Bragg grating strongly depends on its temperature and tensional state: a variation of those two features causes a variation of the reflected peak wavelength.
The measurement of the reflected peak wavelength allows to measure the temperature and deformation variation occurring at the Bragg grating. Bragg gratings can thus be used as temperature or strain sensors by attaching them in thermal or structural contact with the object to be monitored. By use of special devices acting as transducers, Bragg gratings can measure a multiplicity of parameters, such as tilt, relative displacement, acceleration, humidity, ... and more.

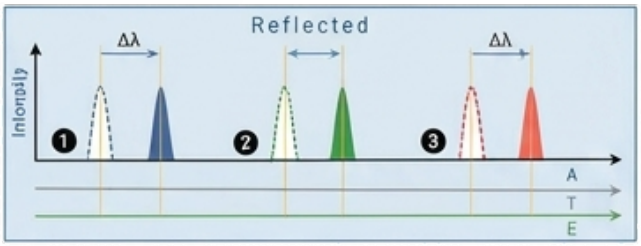
The signal of multiple Bragg gratings connected in-series along the optical fibre are all collected to the same channel of the datalogger and discriminated among each other by wavelength division multiplexing.



As the light propagates along the fibre, each Bragg grating reflects some narrow band peaked light.

Bragg gratings are tuned to reflect each a narrow band peaked at a different wavelength, so that all Bragg gratings can be interrogated. Each peak experiences a shift if the corresponding grating is subject to a temperature or a strain variation.

Temperature and strain measurement is thus encoded in wavelength shift measurement.



The top graph depicts the shift due to:
- Temperature / strain increase at grating 1 and 3
- Temperature / strain decrease at grating 2

info@ascaniosensing.it