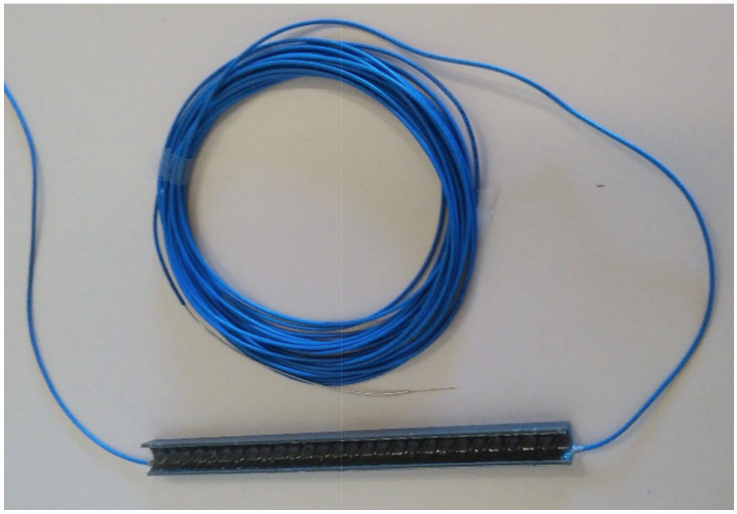
ASCANIO SENSING

FBG Rebar Strain Gauge

ENEA Spin-off

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SCH-R0S-REV001



FBG Rebar Strain Gauges are intended to monitor strain of rebars in reinforced concrete structures.

FBG Rebar Strain Gauges are designed for direct application on rebars by use of epoxy resin. The provided application kit allows safe, easy, and quick installation that can be soon followed by concrete pouring.

FBG Rebar Strain Gauges consist of a composite material ingot wits a concave surface that matches the surface of the rebar.

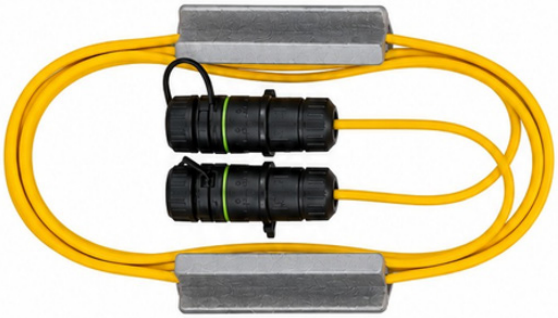
The standard design allows easy customization of gauge length, diameter of the concave surface and cable armouring.

Special designs have been developed for a variety of specialized application, and any specific customization requirement can be considered. As a special product, arrays of thin saddle-like have been developed, mostly intended for instrumenting cable and tendons to be inserted in worked holes for structural strengthening.

The Optical Strain Gauge is safely embedded in a thin cavity located just under the concave surface of the saddle and it is brought to tight structural bond with the rebar by the epoxy resin applied during installation.

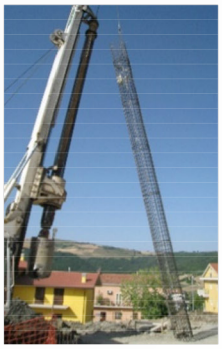
FBG Rebar Strain Gauges are prepared with pass-through optical cable of custom length to allow in-series cabling after installation.To simplify on site operations, they can be prepared as custom chain-of sensors ready for installation.

FBG Rebar Strain Gauges are produced custom, with the desired gauge length, saddle diameter and cable armouring







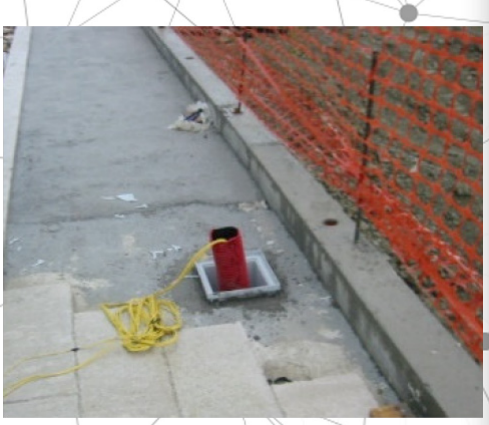




APPLICATIONS

FBG Rebar Strain Gauges Tapes are optical strain sensors based on the Fibre Bragg Grating technology and offer many advantages with respect to the traditional (electrical) displacement/deformation sensors.

- 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)







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TYPICAL APPLICATIONS

- monitoring concrete walls
- monitoring bridge beams

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
- sensors with custom shape for bent rebars
- metallic shield and armoured optical cable

SPECIFICATIONS

- Range: ±4000, ±6000 $\mu\varepsilon$ (1)
- Sensitivity: 1 $\mu\varepsilon$
- Accuracy: 1, 3, 5 $\mu\varepsilon$ (2)
- Geometry: custom shape and size according to rebar geometry
- Cables: custom length at both ends; custom armouring according to protection requirements

(1) Lower range may apply for array of sensors connected in-series
(2) Depends on data-acquisition system

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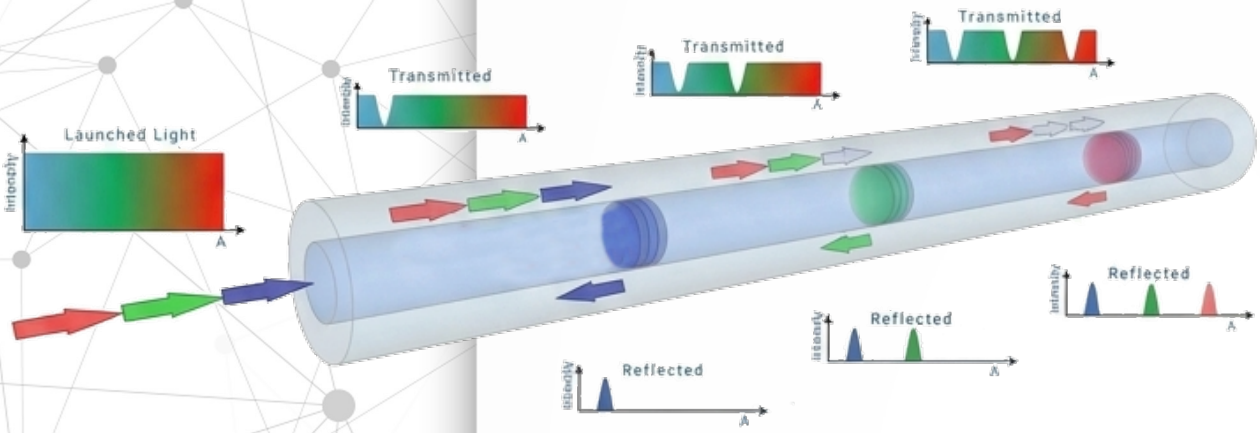
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FIBRE BRAGG GRATING (FBG)

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.

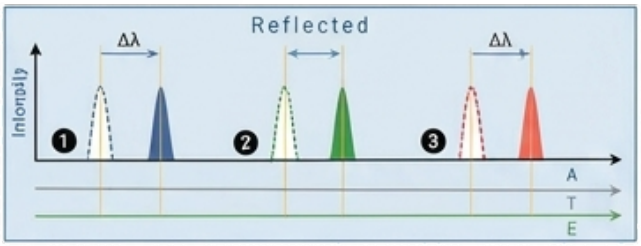
The signal of multiple Bragg gratings connected in-series along the optical fibre are all collected to the same channel of the datalogger and discriminated among each other by wavelength division multiplexing.



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

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