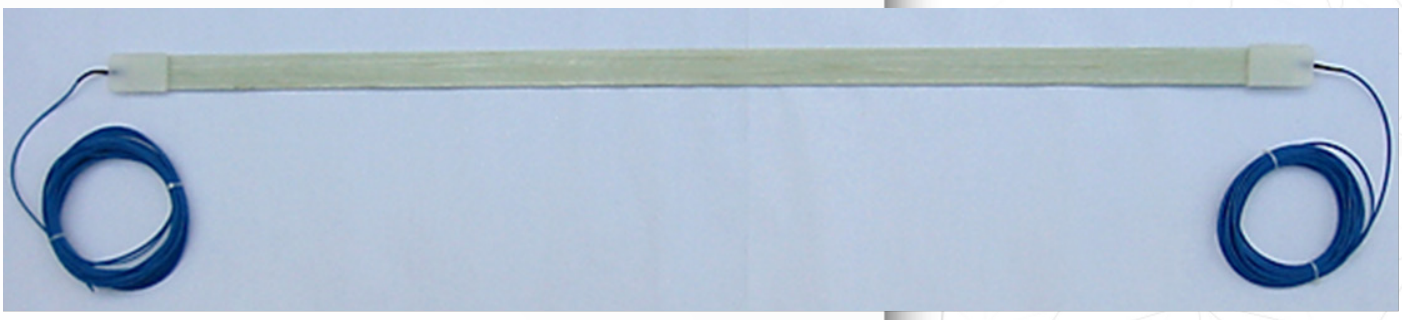
ASCANIO SENSING

FBG Instrumented Composite Tape

ENEA Spin-off

info@ascaniosensing.it

SCH-T0S-REV001



FBG Instrumented Composite Tapes are intended to monitor deformation of existing structures.

FBG Instrumented Composite Tapes are designed for surface application on existing concrete, metallic and masonry structures.

Application is done by use of either bolts or epoxy resin: holes are factory arranged for bolt application; a kit is provided to allow safe, easy and quick installation by epoxy resin.

FBG Instrumented Composite Tapes consist of carbon/glass composite flexible tape with an embedded array of optical sensors.

The length of the tape and the number of embedded sensors is customised according to the required monitoring spatial resolution.

FBG Instrumented Composite Tapes are provided with pass-through optical cable to allow in-series cabling.









APPLICATIONS

FBG Instrumented Composite 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 masonry vaults
- monitoring concrete/masonry walls
- monitoring bridge beams
- monitoring fractures and relative displacements

AVAILABLE SERVICES

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

AVAILABLE OPTIONS

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

SPECIFICATIONS

- Range: ±4000, ±6000 $\mu\varepsilon$ (1)
- Sensitivity: 1 $\mu\varepsilon$
- Accuracy: 1, 3, 5 $\mu\varepsilon$ (2)
- Geometry: custom shape
- 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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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

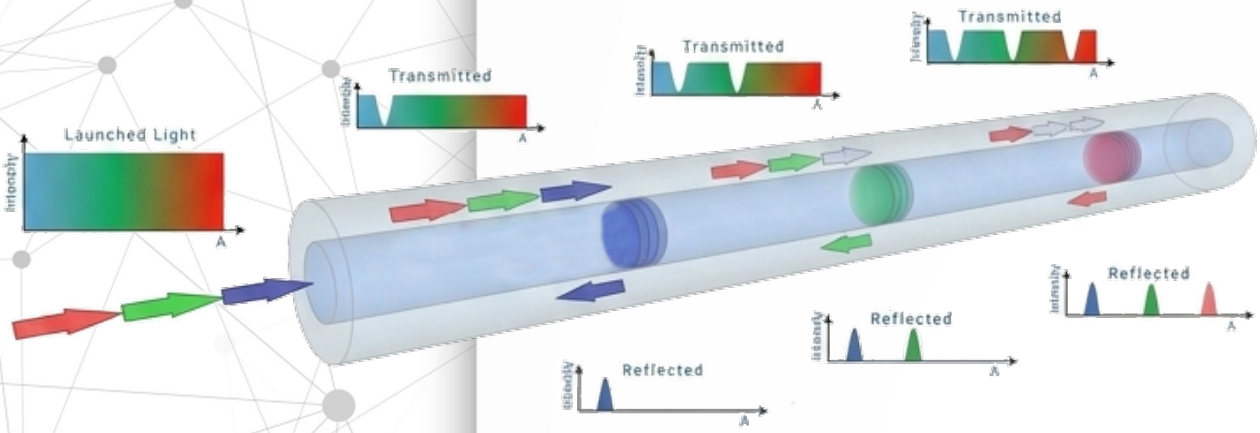
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FIBRE BRAGG GRATING (FBG)

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.

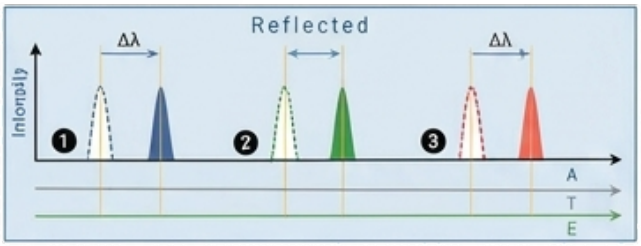
The signal of multiple Bragg gratings connected in-series along the optical fibre are all collected to the same channel of the datalogger and discriminated among each other by wavelength division multiplexing.



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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