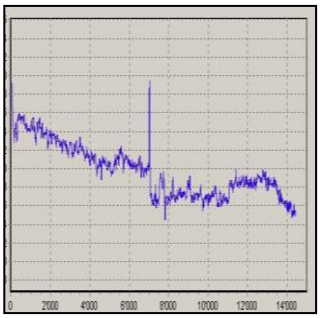
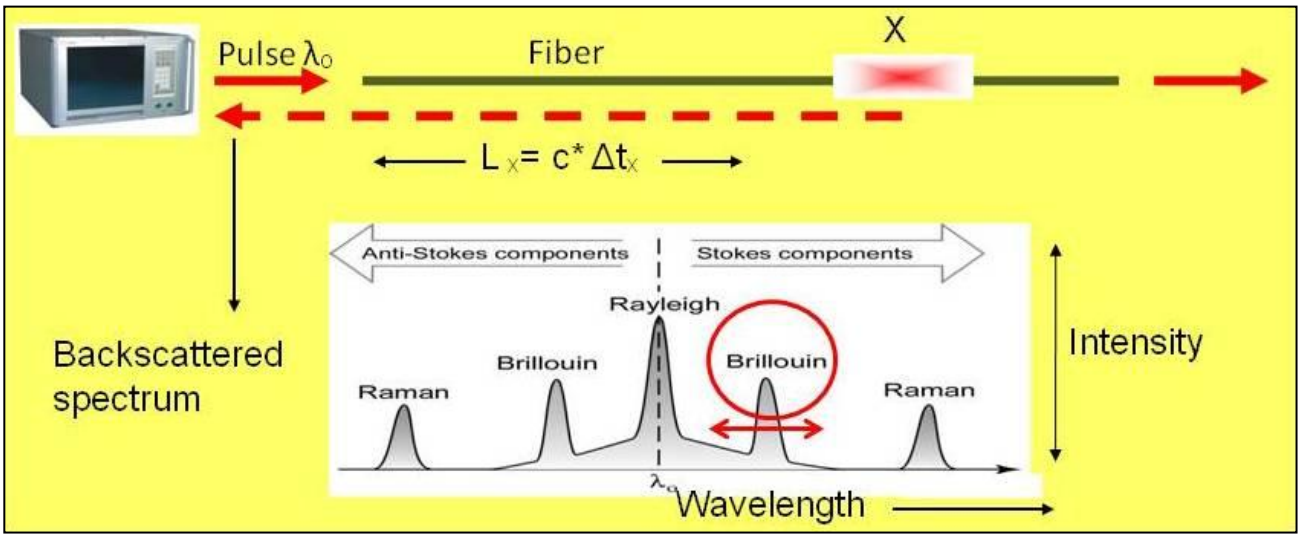


DSS - DISTRIBUTED STRAIN SENSING

- Long pipelines
- Railways
- Quay-walls
- Subsidence monitoring
- Dikes / Levees
- Monitoring soil stability.

OPERATING PRINCIPLE: SPONTANEOUS BRILLOUIN BACKSCATTERING

A reading unit constantly launches a high frequency light pulse of one specific wave length through an optical fiber. The fiber cable is attached to e.g. a pipeline or embedded in e.g. soil. The major part of the light exits at the end of the fiber but a small part is backscattered by natural phenomena to the reading unit. When the object under monitoring deforms the fiber is strained. The spectrum of the backscattered light then shows a shift of the so-called Brillouin wavelength. This shift has a precisely defined relation with the strain of the fiber. Thus the measurement of the Brillouin shift with length intervals of e.g. 1 meter produces the distributed strain over the entire length of the fiber and thereby the distributed deformation of the object under monitoring. The reading unit determines the location of each measurement by measuring the time that has elapsed between launching of the pulse and receipt of the backscattered light (radar principle – the velocity of light is constant).



STIMULATED BACKSCATTERING

Our DSS-system utilises an even more advanced backscatter technology: the fiber cable has a loop configuration and the reading unit launches a continuous light wave in a direction opposite to the direction of the pulse. This results in much more accurate readings over much longer distances: one single reading unit can produce the distributed strain over distances as long as 50km at intervals of 1m (the equivalent of 50.000 sensors!) with an accuracy of 20microstrain (= 0,02mm/m).

TEMPERATURE

The phenomenon of the Brillouin shift also occurs under the influence of temperature change. Also here a mathematical relation exists between the shift of the wave length and temperature. To distinguish strain form temperature a second parallel fiber is used when monitoring an object with varying temperatures. This additional fiber is a slack (loose tube) fiber that lies loose in its jacket and therefore is not subject to strain when deformations occur. By compensating the readings of the strain fiber with those of the temperature fiber the true distributed strain is obtained. In many deformation monitoring applications it is required to monitor the distributed temperature as well. Our technology offers both combined in one system.

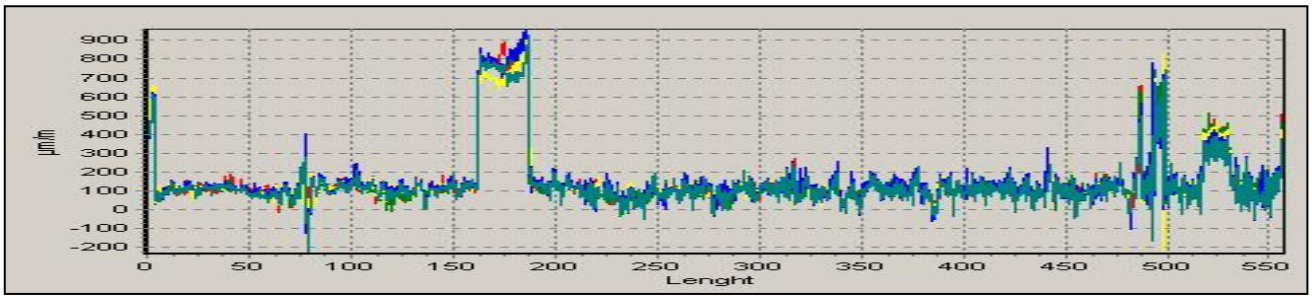
TYPES OF SENSOR

The sensor (i.e. the fiber cable) is available in two basic versions: As a cable or as a geotextile with integrated optical fiber. In particular for geotechnical applications the latter is often preferred as it has the advantage of a wider monitoring reach. It is also applied when it is desired to combine the classical structural duty of a geotextile with a monitoring function.

PROVEN TECHNOLOGY

Our DSS-systems are applied for monitoring embankments, dikes, long pipelines, railways and port facilities. A DSS-system guards the structural integrity of the object 24 hours per day / 365 days per year. We offer a complete package including installation, commissioning, start-up and if so desired the data management via our web server that can be accessed by our clients. The asset manager automatically receives a warning or an alarm (via SMS and email) whenever pre-set measurement values are reached. The system already has demonstrated its adequacy many times e.g. by warning for impending collapses of the soil behind a number of quay-walls in the Port of Rotterdam as a result of which calamities could be averted. And it predicted the exact spot of failure of the IJkdijk (Bellingwolde) 48 hours in advance!

Visualisation of a DSS-system for a pipeline



Soil deformation behind a quay wall

TECHNICAL SPECIFICATION

Measuring range	: 50km, with booster station up to 200km
Number of channels	: 2, 4 or 8 with multiplexer
Type of optical fiber	: single mode
Spatial resolution	: 1,00 to 2,00m
Strain accuracy	: 20µε (0,02mm/m)
Temperature range	: -25° to +80°C with standard sensing cable -50° to +300°C with special cable.
Temperature resolution	: 0,005° to 1,0°C depending of measurement time and desired spatial resolution
Measurement time	: 10 seconds to 5 minutes depending on desired resolution
Requires power	: 400W.

Special detection cable

Geotextile with integrated optical fiber

P.O. Box 497 Tel. +31-341-274470
8070 AL Nunspeet Fax. +31-341-274471
The Netherlands
Email: info@inventec.nl
Website: www.inventec.nl