Distributed fiber optic sensors for strain measurement
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Applications

Areas and geotechnical structures that are known as critical have to be continuously monitored. Due to the unknown location of failure, the proposed sensor system's sensitivity must continuously cover the whole area.

Overview of distributed fiber optic strain sensors

Several distributed fiber optic strain sensors are available covering a huge range of measurement parameters:

- Maximum strain & strain resolution
- Maximum distance & spatial resolution

POF-OTDR sensor

A pulse of light is launched into the polymer optical fiber (POF) and the backscattered light is recorded as a function of time which is correlated to the location via the speed of light. The intensity of the scattered light is related to the strain that is applied to the fiber. This sensor is also capable of measuring humidity.

Brillouin scattering based sensors

With distributed Brillouin sensing, the spatially resolved strain profile of a silica optical fiber can be recorded. The measurement is performed similar to the OTDR technique - by recording the scattering of an optical pulse. In contrast to the POF-OTDR technique, where the scattering intensity contains the strain information, Brillouin back scattering experiences a strain dependent frequency shift which assures a reliable measurement. A novel measurement system working in the frequency domain is currently being prepared for commercialization by fibrisTerre, a BAM spin-off company.

Optical backscatter reflectometer

The optical backscatter reflectometer (OBR) uses an interferometric technique to obtain a profile of scattering intensity along the optical fiber with extremely high spatial resolution (micrometer scale). If a reference measurement is known, a spatial shift to the measured curve can be evaluated and related to a strain or temperature distribution. The sensor can be used in silica fibers as well as in special low-loss polymer fibers (CYTOP). The latter increases the maximum strain at the cost of lower resolution. Just like the Brillouin scattering based sensor the OBR sensor is also sensitive to temperature.

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