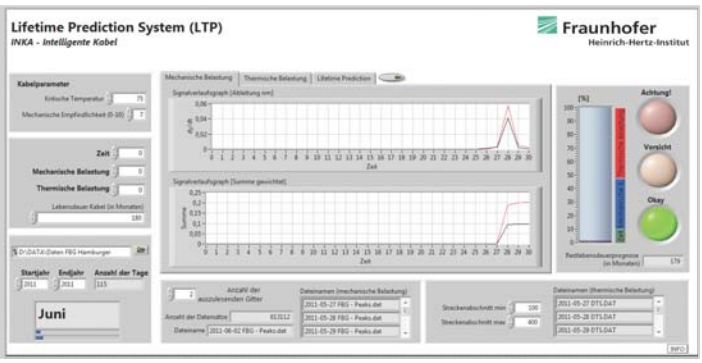
Fraunhofer
Heinrich Hertz Institute

Power Cable and Building Monitoring in Real-Time

The Temperature and Mechanical Stress Analyzer (TAMA)

The Temperature and Mechanical Stress Analyzer (TAMA) is a system for the real-time monitoring of power cable and building health. Developed by the Fraunhofer Heinrich Hertz Institute department Fiber Optical Sensor System located in Goslar in cooperation with Draka Industrial Cable GmbH, the TAMA's combination of hardware, software, and innovative sensor technology enables remotely real-time monitoring of system-relevant (power) cables and building structures.The TAMA system is a hardware component of the DRAKA Lifetime Prediction System (DLPS). It is integrated directly into the power cables. In addition, alarm chains can be triggered by customized implemented pattern recognition of undesired incidents.



Screenshot Lifetime Prediction Software

Challenges

Monitoring distributed temperature and mechanical stress in power cables is a huge challenge due to the applied optical systems and the used fiber-optic sensor including the implementation of the filigree sensors in power cables and buildings. TAMA supports power plant operators as well as building engineers in

Technical Background

The Temperature and Mechanical Stress Analyzer TAMA captures and analyses the temperature distribution and mechanical stress of cables in real-time. Therefore, two independent sensor systems are combined in a 19-inch housing: the Raman-backscattering and the fiber-Bragg-grating techniques. First mentioned is responsible for the distributed temperature sensing along the respective fiber. Due to this technique, so called hot spots, which are obvious signs for a defect of the power cable, can easily be detected at the very beginning. Consequently, the regarded power cable can be replaced without major financial losses before reaching a critical point leading inevitably to a short-circuit.
The fiber-Bragg-grating technique focuses on the mechanical stresses of cables by involving a temperature compensation using the results of the Raman-backscattering temperature sensor. Dependending on the implementation and alignment of the fiber-Bragg-gratings within the power cable or building structures several different stresses can be addressed such as bending or torsion stresses. Using the data, the aging process of the cables or the building structures can be predicted. Consequently, well-founded statements concerning the remaining lifetime of the cable or the building structures can be given by TAMA.

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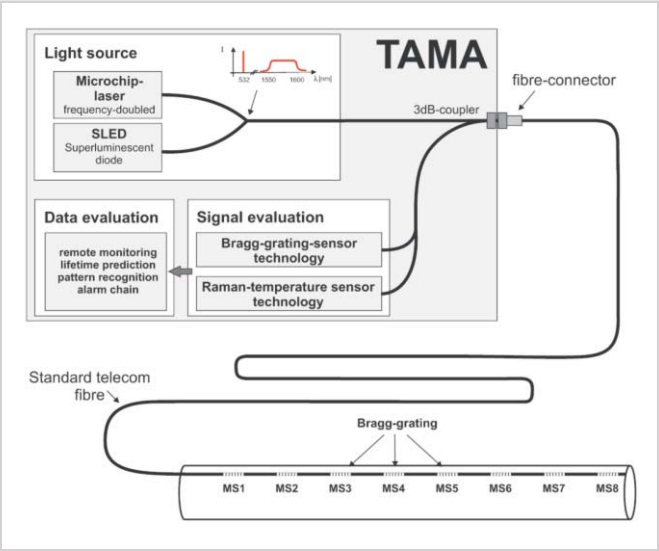
Fiber Optical Sensor Systems



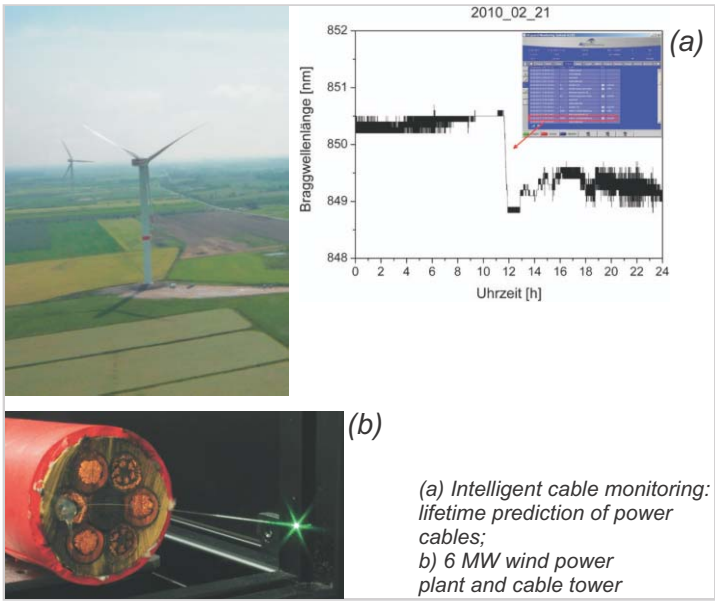
The TAMA for distributed temperature and mechanical stress monitoring.

Fiber Sensor

Due to an innovative sensor production process based on femtosecond laser material processing, costs-effective standard-telecom fibers can be used for both sensor techniques.The low-cost fiber sensors can be built in system-relevant structures on a pro forma basis and could be read out if required.
In comparison to conventional produced fiber-Bragg-grating sensors, these fiber sensors are more durable and temperature stable. Therefore, the fiber sensors produced at the Heinrich Hertz Institute withstand temperatures up to the damage threshold of the respective applied fiber, which can be up to 800 °C or even higher.

Benefits

- Mechanical stress monitoring in real-time
- Resolution for mechanical stress monitoring adaptable to relevant requirements (e.g. power cable monitoring or building monitoring)
- Distributed temperature monitoring with a spatial resolution of ±0.3 m and a temperature resolution of up to ±1 °C
- Prepared for remote monitoring
- All-in-one solution within a 19-inch housing
- Corresponding sensors are manufactured using standard-telecom fiber in a new innovative production process – sensors withstand temperature up to 800 °C



(a) Intelligent cable monitoring: lifetime prediction of power cables;
b) 6 MW wind power plant and cable tower

User example of TAMA in a 6 MW wind power plant.

Contact

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