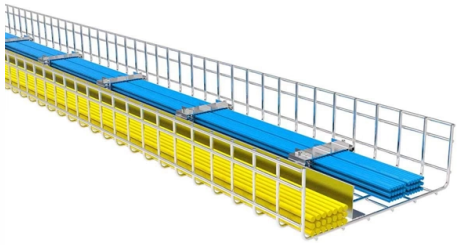
Principle of Cambodian Underground Temperature Measurement Optical Cable



Overview

This study proposed a sensor module that can monitor the temperature of the power cable joint using a fiber optic sensor.

Key Takeaways

Underground temperature measurement with optical cables relies on distributed temperature sensing (DTS), where optical fibers act as continuous linear sensors detecting temperature changes via light scattering effects.

Working Principle

Distributed Temperature Sensing (DTS) systems use optical fibers as sensors to measure temperature along the entire length of the cable, rather than at discrete points. A laser pulse is sent through the fiber, and as it propagates, a small portion of light is scattered due to interactions with the fiber material. This scattering occurs in three main forms: Rayleigh scattering: Light scattered at the same wavelength as the incident light, used for locating events along the fiber.

Raman scattering: Light scattered at different wavelengths, sensitive to temperature changes. The ratio of Stokes and anti-Stokes components varies with temperature, allowing precise measurement. Brillouin scattering: Low-frequency scattering influenced by both temperature and strain, useful for combined thermal and mechanical monitoring.



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Measurement Techniques

There are several methods to interpret the scattered light: Optical Time-Domain Reflectometry (OTDR): Measures the time it takes for backscattered light to return, similar to radar, to locate temperature events along the fiber.

Optical Frequency-

Domain Reflectometry (OFDR): Uses frequency-modulated light and Fourier transformation to obtain high-resolution local temperature profiles.

Code Correlation DT

S: Sends coded light sequences into the fiber, spreading optical energy over a sequence to improve signal-to-noise ratio and allow long-distance measurements with high accuracy.

Advantages for Underground Cables

Using optical fibers for underground temperature monitoring offers several benefits: Continuous temperature profile: Unlike point sensors, DTS provides a full thermal map along the cable length. Long-distance monitoring: Systems can measure over tens of kilometers, suitable for extensive underground networks. Electromagnetic immunity: Optical fibers are not affected by electromagnetic interference, making them ideal for power cable environments.

High spatial and temperature resolution: Typical systems achieve 1 m spatial resolution and ±1°C accuracy, with some systems capable of 0. 01°C resolution.

Practical Considerations

For underground power cables, the DTS system helps in: Monitoring cable ampacity: Ensuring the cable operates within safe thermal limits. Detecting hotspots: Identifying potential failures at joints or insulation defects. Optimizing maintenance: Providing real-time data to plan preventive actions and extend cable lifespan.

In Cambodia, such systems can be applied to medium- and high-voltage underground networks, improving safety, reliability, and operational efficiency while reducing the risk of overheating and cable damage.

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Article Content

Temperature monitoring techniques of power cable joints in

This study proposed a sensor module that can monitor the temperature of the power cable joint using a fiber optic sensor. The advantage of using fiber optic sensors is that they are not

A Sensor for Multi-Point Temperature Monitoring in Underground

This study introduces an alternative system for monitoring the temperature of underground cables using NTC thermistors. Its design allows for reducing the number of connection conductors for

Distributed Temperature Sensing (DTS) | AP Sensing

Distributed Temperature Sensing (DTS) systems provide temperature information for accurate thermal monitoring, fire detection, and condition assessment by utilizing standard fiber optic cables. These

Distributed Temperature Sensing

How does it work? The Luna Distributed Temperature Sensing systems use light, more specifically the Raman effect, to measure temperature. In one end of the system, a laser sends a pulse of light into –

Distributed temperature sensing

Distributed temperature sensing systems (DTS) are optoelectronic devices which measure temperatures by means of optical fibres functioning as linear sensors. Temperatures are recorded along the optical

Fiber Optic Distributed Temperature Sensing | US EPA

Temperature of the bath is independently measured over time using a high precision thermistor built into the control unit or a discrete temperature logger supplied by the user. The FO

Distributed Temperature Sensing and Real Time Thermal Rating for ...

This paper presents the distributed temperature sensing (DTS) technology and its application mainly on underground power cables. The main measuring principle is detecting the back-scattering light via

Distributed Temperature Sensing: Review of Technology and

Abstract—Distributed temperature sensors (DTS) measure tem-peratures by means of optical fibers. Those optoelectronic devices provide a continuous profile of the temperature distribution along the

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Development and Improvement of an Intelligent Cable Monitoring

Therefore, the application of distributed temperature sensing (DTS) technology on OFCPCs used as underground distribution lines is studied for the real-time and on-line monitoring of

Distributed Temperature Sensing

The underlying principle of distributed temperature sensing is a Raman scattering-based temperature measurement combined with optical time-domain reflectometry. To generate back-scattered light, a

(PDF) Distributed temperature measurements using optical fibre ...

This article experimentally examines the applicability of a temperature measuring and monitoring system using distributed temperature sensing by means of an optical fibre in an underground mine

Temperature Measurement Using Optical Fiber Methods: Overview

The paper deals with the overview of fiber optic methods suitable for temperature measurement and monitoring. The aim is to evaluate the current research of temperature measurements in the interval

Development and Improvement of an Intelligent Cable Monitoring

In the case of the optical fiber composite power cable (OFCPC), which is a power cable embedded with optical cables, electrical power networks and communication networks can be established

Considerations for advanced temperature monitoring of underground

Temperature monitoring using fiber optic sensors to get a distributed temperature profile along an underground cable circuit is increasingly being used by utilities. However, effectively

Development and Improvement of an Intelligent Cable

At the same time, many underground distribution line faults can be corrected by on-line monitoring the cable itself. For real-time checking of cable

Fiber Optic Temperature Sensors: Operation & Applications

Find out more about fiber optic temperature sensors, their principle of operation & how they are applied in industrial temperature measurement.

Internal temperature measurement and conductor temperature calculation ...

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Highlights • The temperature measurement effectiveness of optical fiber in the cable was studied. • The temperatures of the cable were measured by the BOTDR and thermocouples. • The

A distributed optical fiber sensor for temperature detection in power ...

The temperature profile obtained from measurements performed with optical fiber DTS method on a 126 m long 154 kV power cable is shown in Fig. 3. In the first 16 h of the total test

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