Optical Cable Sonar Location Method

Article Overview

Distributed Acoustic Sensing (DAS) transforms standard fiber-optic cables into continuous sonar arrays capable of detecting and localizing underwater activity in real time.

Overview of the Method

The optical cable sonar location method relies on Distributed Acoustic Sensing (DAS), which converts existing fiber-optic cables into dense acoustic sensor arrays. A pulsed laser is transmitted through the fiber, and tiny backscattered signals caused by vibrations or strain along the cable are measured. These signals correspond to acoustic events such as vessel movement, anchor drags, diver activity, or cable faults, effectively turning the cable into thousands of "virtual microphones" along its length .

How Localization Works

o Signal Detection: Vibrations along the fiber caused by underwater activity create measurable changes in the backscattered light.
o Distance Estimation: The time delay of the backscattered signal allows the system to calculate the location of the disturbance along the cable with high precision, often within tens of meters .
o Event Classification: Advanced algorithms, including machine learning models, analyze the acoustic signatures to distinguish between different sources, such as ships, submarines, or environmental noise .
o Sonar Integration: For precise fault pinpointing, DAS can be combined with low-frequency sonar checks, validating the exact location of anomalies or cable faults with accuracy around +-10 meters .

Applications

o Maritime Surveillance: DAS-enabled cables can track vessels and submarines in real time, providing strategic and commercial monitoring capabilities .
o Infrastructure Protection: Subsea power cables, pipelines, and telecommunication lines can be monitored for mechanical disturbances, preventing damage and reducing downtime .
o Marine Conservation: DAS allows detection of marine species and environmental monitoring by capturing low-frequency sounds over long distances .
o Fault Detection: Offshore cable faults can be rapidly located, minimizing repair time and operational losses .

Advantages

o Real-Time Monitoring: Continuous surveillance along tens or hundreds of kilometers without deploying additional sensors .
o High Spatial Resolution: Virtual measurement points can be spaced every few meters along the cable .
o Cost-Effective: Utilizes existing fiber-optic infrastructure, avoiding expensive subsea installations .

o Weather and Light Independent: Unlike satellite or visual monitoring, DAS operates effectively in all conditions . In summary, the optical cable sonar location method leverages DAS technology to convert fiber-optic cables into extensive, real-time acoustic sensor networks. By combining precise distance estimation, signal classification, and optional sonar validation, this method provides a highly effective solution for underwater monitoring, infrastructure protection, and maritime surveillance .

Submarine and underground optical cables have been indispensable information transmission pipelines for decades. It is critical to

Detection of Fibre Optic cables at urban area using Ground Penetrating Radar and Electromagnetic Locator

This study investigates the tracking of underwater cables using autonomous underwater vehicles (AUVs) equipped with

Passive sonar Unlike the active sonar, passive sonar does not contain a transmitter, it contains only a receiver to receive sound

The methods of coarse estimation of the distance to the harmonic sound source by DAS to determine totally dielectric

Currently, with the development of sensing technologies, a variety of sensing methods based on optics, acoustics,

Optical-based technology is rapidly rising as a transformative alternative to the sonar-based ocean-related research

A ship-based seismic survey was conducted close to a fiber-optic submarine cable, and 50 km-long distributed

This study focuses on the automatic detection and localization of vessels near submarine fiber-optic cables using

Acoustic location is a method of determining the position of an object or sound source by using sound waves. Location can take

Route Design/Cable Laying Technologies for Optical Submarine Cables which displays the connectivity of the submersible sys-tem

Download Citation | Tracking cables in sonar and optical imagery | The classical paradigm of line and curve detection in

Optical Cable Sonar Location Method

The proposed method is specially designed for the slender target of submarine cables, which can achieve accurate

It detects vessel movement, anchor drag, diver activity, and other mechanical disturbances that threaten critical underwater

US, EU navies turning 750,000 miles of seafloor cables into submarine-hunting sonars

Ascertaining the precise locations of submarine cables is crucial to their maintenance and to monitoring marine environments using

Web: https://www.supremeacademicresearch.co.za