

## Study Committee D2

Information Systems and Telecommunication

Paper 11053\_2022

# DAS TECHNOLOGY: AN OPPORTUNITY TO USE FIBRE OPTICS FOR ASSET MONITORING AND SECURITY APPLICATIONS IN ELECTRIC POWER UTILITIES

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### Motivation

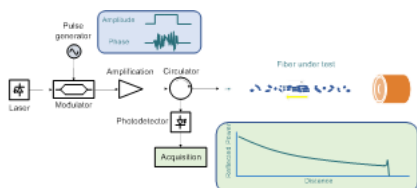
- **DAS Technology** can be used with different outputs for Electric Power Utilities, including both **economical and operative benefits**
- One of the great advantages of **DAS** is that, compared to single point measurement techniques, it can **reuse existing optical fibres** and turn them into distributed sensors to fully monitor power lines

### Key Points

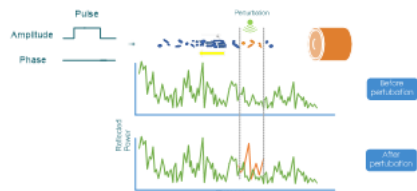
- Asset Management and Cost Reduction
- Asset Security
- Sustainability and Green Transition
- Maintenance Digitalization and Data Mining
- Use of existing fibre optic infrastructure

### Technology

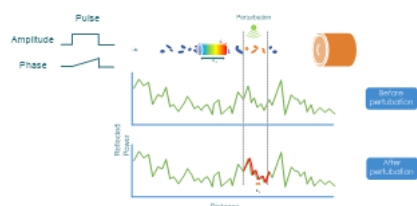
#### ○ OTDR Schematics



#### ○ Signal registered for a C-OTDR scheme



#### ○ Signal registered for a CP-OTDR scheme

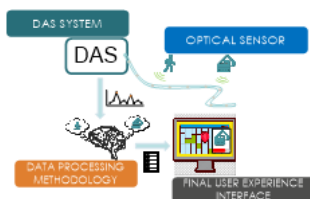


### Objects of investigation

- Underground power lines monitoring
- Subsea power lines monitoring
- Overhead power lines monitoring
- Asset perimeter security

### Data processing methods

#### ○ Structure of Processing Methodology



#### ○ Diagram of the data processing



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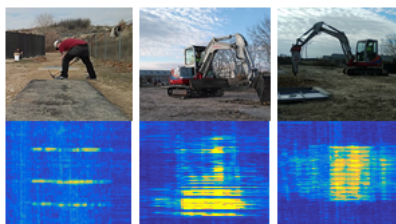
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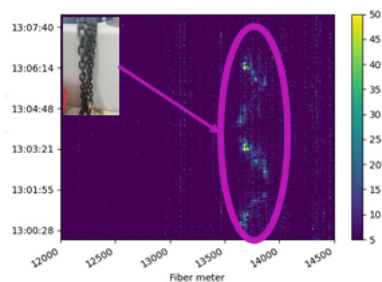
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## Test results

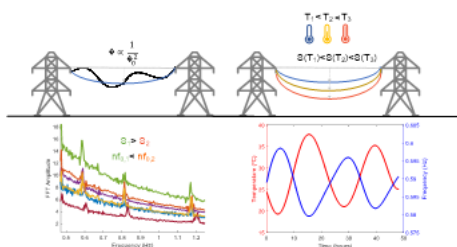
- *Underground power lines monitoring*



- *Subsea power lines monitoring*



- *Application of DAS technology in Dynamic Line Rating*



## Discussion

- With DAS technology, there is a **proactive response** from the EPU
- Different threats infringed upon the underground cables have **different associated pattern** registered by the DAS system
- The system is able to **detect** an event, correlate its features with a pattern library **and classify the event**
- Identifying the possible cause of an event can **help** the owner of the infrastructure to **decide if it is a threat or not**
- Subsea cables can suffer **damages caused by anchors** or trawling nets
- **These cables are also exposed** to natural-caused changes in the seabed around the cable
- Seismic activity close to the cable could also present a **potential risk** for the infrastructure
- Proactive, anticipation and prevention are the three key points to **avoid a repairing work** that in this scenario becomes a major task
- DAS system sensibility has been **successfully evaluated to detect vibration, hitting and dragging events** on the seabed near the cable

- DAS system ability has been evaluated for **frequency monitoring of vibration modes** in overhead power lines
- **Magnitude and variation** over time of these frequencies can **give valuable information** about structural parameters of the power line and environmental issues: **cable sag**, temperature variations, damping malfunction, fatigue failures, aeolians, etc

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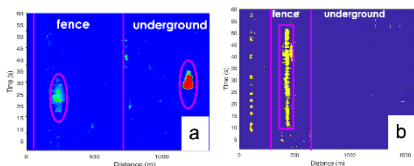
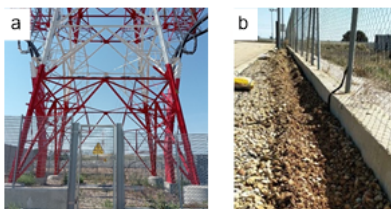
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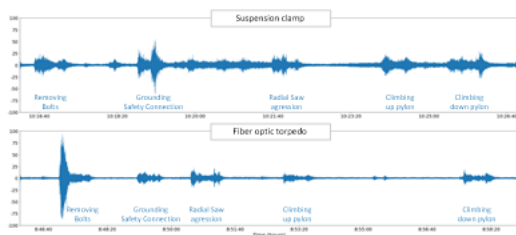
## Test results

- Asset perimeter security



## Discussion

- **Third party intrusion**, sabotaging activities or thefts in both substations and pylons are **visible through vibrations** in underground and fence cable.
- DAS sensibility has been evaluated in three scenarios: **continuous assets** (fibre sensor length longer than 100 m), **singular assets** (length shorter than 100 m) and towers.
- DAS system has been tested and calibrating for **detection of climbing and fence cutting events** in both continuous and singular assets.
- DAS system sensibility has been evaluated for **detecting of different events in towers** through the transmission of vibrations to the overhead cable.



## Conclusion

- Different applications of DAS technology have been tested, particularly in the fields of asset management and security.
- DAS technology has proven to be capable of obtaining distributed information along the line.
- Information provided by DAS technology is obtained automatically and in real-time.
- Not only does the system provide novel information that could not be obtained by other means before, but it also provides information we could already obtain, but in a more comfortable or quicker way.
- DAS technology has the advantage to use the fibre optic network already deployed by EPU for other original uses (i.e., communications), significantly minimizing its installation costs.
- It has been realized during pilot projects that other unforeseen applications are possible such as detection of seismic events or impacts in overhead lines.
- Potential uses of the DAS system by detecting different types of events makes our own fibre optic networks even more versatile.