October 15, 2024

FOSA 2024 Awards Application - Quantitative Depth of Burial State

Award Category

Innovation Award

Product Innovation

Quantitative Depth of Burial State (qDoBS) Method for Offshore Power Cable Monitoring

Product Information

With the actual accelerated transition towards more sustainable energies, the deployment of wind farms and submarine power cables has significantly increased in the last few years and will expand significantly in the near future. Therefore, monitoring the growing number of offshore power cables has become very important to identify possible damage risks and avoid long power outages at an early stage. In fact, these cables are commonly buried during the installation phase but may suffer from exposure due to waves and seabed currents. The exposed offshore cable sections may then represent a threat due to possible damage by fishing and anchoring activities which generates costly repairs and power outages, in addition to unforeseen influences on the sensitive marine environment.

AP Sensing has implemented an innovative, fast, and accurate approach to calculate the quantitative depth of burial state (qDoBS) of submarine power cables based solely on the Distributed Temperature Sensing (DTS) and cable load data without the need for time-consuming thermal modeling.

The main principle of our method relies on calculating of the local load temperature-change correlation function, the so-called thermal response of the cable. In fact, the less the cable is buried, the faster the dissipated heat can be transported away, and hence the lower the temperature change is measured by the fiber upon a load change.

By calculating the correlation of the thermal response with a reference burial depth profile of the cable, the real-time quantitative depth of burial profile can then be determined with centimeter level accuracy at any time.

The reference burial depth profile of the cable does only need to be provided once as part of the system commissioning and can be obtained either from the power cable installation survey for new cable installations or from survey data using a Remotely Operated Vehicle (ROV) for retrofits.

The effectiveness and precision of this method is demonstrated by comparing the calculated quantitative Depth of Burial State results with a burial depth profile determined during an ROV survey on the 500 kV Skagerrak4 HVDC interconnector between Norway and Denmark.

Submitted by

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People involved

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Organizations to be recognized

Statnett (Norway)
Energinet (Denmark)

Project or Product Location

The product has been deployed for Skagerrak4 interconnector between Norway and Denmark.

Describe why it should win the award

AP Sensing's innovative approach to determine the quantitative depth of burial state is based only on the measured power cable load and the temperature traces collected by the DTS instrument. The reference burial depth profile is only required for initial calibration.
In contrast to the known Depth of Burial (DoB) technique, our method does not require any precise knowledge of the ambient conditions and thermal parameters of the seabed and does not depend on the absolute temperature values measured along the cable. This significantly reduces the commissioning effort, avoids any uncertainties caused by measurement deviations, and is especially applicable to retrofits, where soil sample data might be outdated or not available at all.
Commissioning of the qDoBS solution was achieved within one day without any additional information of the power cable parameters and seabed properties, and the first results were obtained within approximately one month after system configuration.

This shows a clear advantage in comparison to thermal model generation of other DoB solutions, where configuration can take up to one month, and first calculations may be obtained after several months with all known limitations stated above.
With the new qDoBS technique, we offer to Transmission System Operators (TSOs) a strong tool to have a real-time insight into the depth of burial of offshore power cables, localize exposed cable sections effectively, and perform better predictive maintenance by planning additional protection precisely in order to reduce the risk of power cable faults.