TELEFLUX: NON-CONTACT MONITORING OF MONOPILE FOUNDATIONS

Publieke samenvatting / Public summary

Aanleiding

Nowadays, additional steel is required in the design of monopiles, to account for fatigue consumption during impact installation. This steel excess is due to large safety factors, required since fatigue consumption is not known. To reduce this uncertainty, and thus the amount of steel used for each monopile, there is the need to measure strain during impact hammering. Currently, strains in and displacements of steel structures subjected to dynamic loads are monitored with sensors (strain gauges and accelerometers) that must remain in a physical contact with the structure. Attaching and detaching these sensors can be a cumbersome task and, in some environments, such as offshore, this is practically impossible. Moreover, these sensors are prone to damage when they are exposed to high stress levels, e.g. during an impact, which is the case for pile driving. A non-contact sensor removes these disadvantages, as such a measurement system requires no physical contact with the structure, making (re)deployment of the sensor time- and cost-effective.

Doelstelling

Recently, a non-contact strain measurement system was proposed and validated for steel monopile installations, utilizing the magnetic stray field generated by the structure to infer strains through the magnetomechanical effect. Successfully demonstrated during an onshore installation with a hydraulic impact hammer, the system has been extended to also measure the structure's velocity in

Projectinformatie / Project information

Projectnummer / Project number
EKOOELEK24-03731969
Subsidiebedrag / Grant amount
€ 487.513,00

Algemene informatie / General information

Penvoerder / Secretariat
TeleFlux B.V.

Volg Topsector Energie op X / Follow Topsector Energie on X

@TSEnergie

a non-contact manner to monitor the energy flux delivered by the hammer. However, these tests revealed the need for further modifications to achieve the desired performance. This project aims to design and build a non-contact sensor prototype capable of providing reliable and accurate real-time data during monopile installation, integrating it with tools like hammer sleeves and subjecting it to rigorous onshore testing to ensure it can withstand the significant forces encountered during hammer operation.

Korte omschrijving

The project involves the development, calibration, and validation of sensor technology through the creation of P1, P2, and P3 prototypes, encompassing both hardware and software development. Testing will be conducted in a controlled environment at the IQIP facility, as well as through onshore tests during various commercial projects. This includes ground-based static testing and dynamic sleeve-based testing while attached to a hammer. The data output will be rigorously compared to that of a conventional Pile Driving Analyzer (PDA) to assess the sensor's performance.

Resultaat

The project is structured into three work packages, each resulting in a key deliverable: a proof-of-concept, ground-based, standalone P1 prototype sensor; a sleeve-based, semi-integrated P2 prototype sensor capable of providing accurate measurements and withstanding all forces during hammer operation; and a fully tested P3 prototype, validated through sufficient operational test data to confirm its performance in onshore conditions. The outcomes of this project will support EKOO's mission to provide affordable, reliable, sustainable, and safe energy through Renewable Energy at Sea. The proposed solution enables real-time monitoring of stresses in monopiles during offshore installation, allowing for accurate estimation of fatigue life consumption. This deeper understanding of stress and fatigue can lead to significant life-time extension, design optimizations and cost savings for monopiles. Additionally, the technology offers

valuable insights into pile-soil interaction, which can be leveraged to optimize the driving process, benefiting both equipment manufacturers and installation contractors by enhancing efficiency and potentially reducing operational costs.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
Voor meer informatie over de Topsector Energie, ga naar **www.topsectorenergie.nl**.

Voor meer informatie over de TSE / Energie-Innovatie regelingen die RVO aanbiedt, ga naar **www.rvo.nl/tse**.