

Hydrodynamic Response Of Cables

Publieke samenvatting / Public summary

Aanleiding

Offshore structures have become a crucial part of the energy transition. The foundations of these structures can alter flow directions, cause flow amplification, and create complex localized flow structures. These changes may lead to the generation of scour and impact the performance of submerged components, such as cables. These cables are exposed to these complex flow fields, complicating the understanding of how these flows interact with cable designs and how they contribute to the fatigue life of the cables. A key phenomenon that may affect underwater cables in these environments is vortex-induced vibrations (VIV). VIV occurs when the flow around a cable separates, generating vortices that interact with the cable at a characteristic frequency close to one of the cable's eigenfrequencies. This interaction causes the cable to resonate, leading to oscillations in both the cross-flow and inline directions. These oscillations can result in circular motions that vary along the free-span length of the cable, which can significantly contribute to fatigue damage over time.

Doelstelling

The TKI Hydrodynamic Response Of Cables (HYROC) project focuses on understanding the VIV response of short, curved (and pre-strained) underwater cables in waves and currents to assess its relevance to fatigue lifetime. The current recommended practices and models for predicting fatigue damage due to VIV are considered conservative. These models often suggest a high occurrence of VIV over the lifetime of a cable, despite the low likelihood of such occurrences in conditions like short waves due

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to time-scale differences. These practices do not adequately account for all relevant factors that are in reality present. Understanding how waves with oscillatory motion affect VIV is crucial, particularly in terms of how quickly flow velocity changes relative to the time needed for VIV to develop. Factors such as the rise time needed to initiate VIV versus the wave period, the time required for VIV to decay versus the wave period, and the dominance of currents over waves may also play significant roles.

Korte omschrijving

The project's approach is based on a systematic evaluation of the system using recent literature and experimental testing. The experimental tests aim to emulate VIV on a large-scale representative cable configuration, varying conditions such as current dominance, wave characteristics, and cable configuration to determine if VIV can occur. If VIV is observed, the study will investigate key questions, such as how wave size relative to current velocity affects VIV and which wave periods relative to the cable's eigenfrequency can induce VIV.

Resultaat

The findings will be summarized in a journal paper, proposing a procedure for accounting for VIV for short underwater cables near offshore structures, and will serve as a reference for understanding the contribution of VIV to cable fatigue lifetime.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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