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DIGITAL TWIN: Spectral Analysis Verification of Payload Handling Operation on Vessels

[1]George Georgopoulos; [1]Angelina Pytharouliou*; [1]Panagiotis Delizisis; [1]Anastasios Kopanidis

[1]Asso.subsea, Elefsis, Greece

Abstract

Offshore and subsea lifting operations are an essential part of the offshore construction process. An element failure during an offshore lift can be the cause of equipment or asset damage, significant economic losses or even personnel injuries and fatalities. Due to the dynamic environment in which an offshore lifting operation is carried out, it is necessary to perform extensive engineering, planning and risk management for these activities.

The development of a digital twin for real-time remote monitoring of vessel motions and calculation of loads for payload handling can become a tool which will ensure safe and efficient operations in dynamic fluid (offshore) environments dominated by irregular sea states. By integrating real-time data and simulation techniques, a digital twin can accurately depict vessel motions and calculate loads in real time, providing valuable insights into the dynamic behavior of the vessel and the payload. This allows for proactive decision-making and adjustments to be made to ensure the safety and efficiency of payload handling operations.

The integration of the vessel's MRU with Orcaflex software via Python code enables the real-time simulation of vessel dynamic motion, providing operators with a visual representation of the vessel's movement and the calculation of the dynamic loads. Spectral analysis can verify the calculated dynamic loads by providing insight into the correlation between the wave spectrum and the motion spectrum, as well as verify the vessel RAOs, based on which the dynamic loads are mainly calculated during the initial analyses.

In conclusion, the development of a digital twin for remote monitoring of vessel motions and calculation of loads for payload handling can be a valuable tool which will ensure safe and efficient operations in dynamic environments. Overall, the development of a digital twin holds great potential in revolutionizing the way payload handling operations are conducted in dynamic fluid environments.

Keywords: Digital twin, Offshore lifting, Dynamic fluid environments