An approach to assessing mechanical fatigue of dynamic subsea cables for floating offshore wind turbines

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Summary

Floating platform offshore wind turbines will require cables to run through the water column, from their platform base at the water surface to the touchdown point on the seabed. The dynamic environmental loading on the cable induces dynamic mechanical stresses across the cross section of the cable. To give an understanding of the stresses that a dynamic cable would experience across its cross-section, the entire floating turbine system has been analysed. The calculated stresses across the cable cross-section are then used to perform a fatigue assessment of the dynamic cable. A summarised outcome of this work will be presented at the RAVE conference. The outcome gives a better understanding of the behaviours of dynamic subsea cables for the floating offshore wind industry. It can illustrate where along the length of the dynamic cable is a "hot spot" for fatigue failure. It can also be used to investigate at a component level, which components of the cable cross-section are most susceptible to fatigue, giving a greater insight to the failure mechanisms of dynamic subsea cables.

1. Introduction

Traditional fixed bottom wind turbine technologies are not best able to accommodate greater water depths; giving rise to new floating platform wind turbines. Much work has been completed in advancing floating wind technologies, including the LIFES50+ consortium[1]. The environmental loadings, by waves, currents and movements of the platform on the cable induces dynamic mechanical stresses across the cross section of the cable. These mechanical stresses are a new consideration in cable assessments, as traditional static cables used in fixed bottom platforms would not be exposed to these dynamic environmental loadings.

1.1 66kV Dynamic Array Cable

The cable modelled for this work is based on a 280m length of a JDR dynamic cable [2]. Table 1 gives some of the cables mechanical parameters:

Table 1 Cable Mechanical Properties

Mechanical Properties	
Outer Diameter	164mm
Insulation Material	WTR XLPE
Cable Armouring	Galvanised Steel
Minimum Bend Radius	164mm
Safe Working Load	250 kN
Diameter to weight ratio	4.27m^2/Te

2. Results

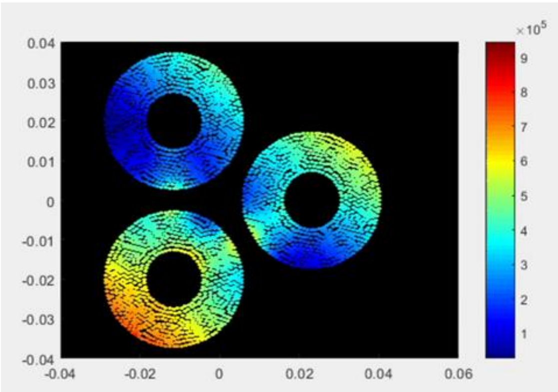

Figure 1: Von Misses Stress Distributions across Cable Insulation Layers at user defined point

Figure 1 shows the Von Misses stresses across the cable armouring layers. This stress history can be used to conduct a fatigue life estimate of the cable armouring layers. Users can also choose other components of the cable cross section to investigate, e.g. the armouring layers.

3. References

[1] "Lifes50plus - Innovative floating offshore wind energy," *Lifes50+*. [Online]. Available: http://lifes50plus.eu/. [Accessed: 14-Mar-2018].

[2] "J. Featherstone, "Dynamic Subsea Power Cables for Floating Wind & 66kV Subsea Power Cables, 6th Annual Advanced Submarine Power Cable & Interconnection Forum, Berlin," Jun-2017.