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GROUP REF. : B1
PREF. SUBJECT :1
QUESTION N° : 4

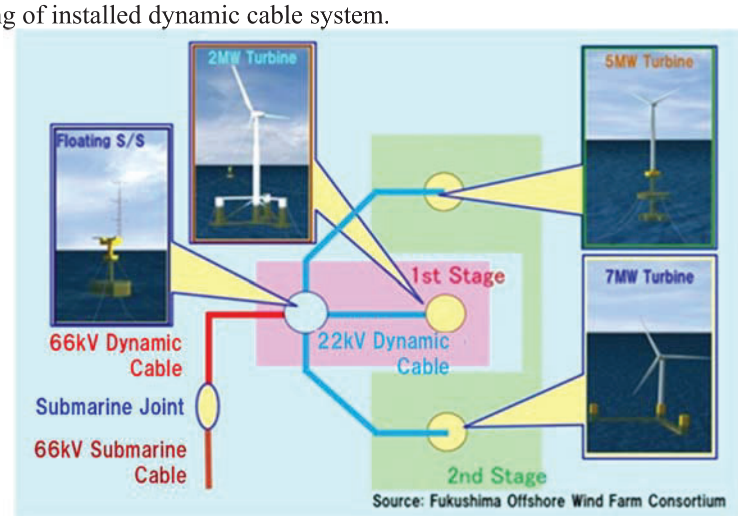
Fatigue analysis of installed dynamic cable system for offshore floating wind farm "Fukushima FORWARD Project"

1. Introduction

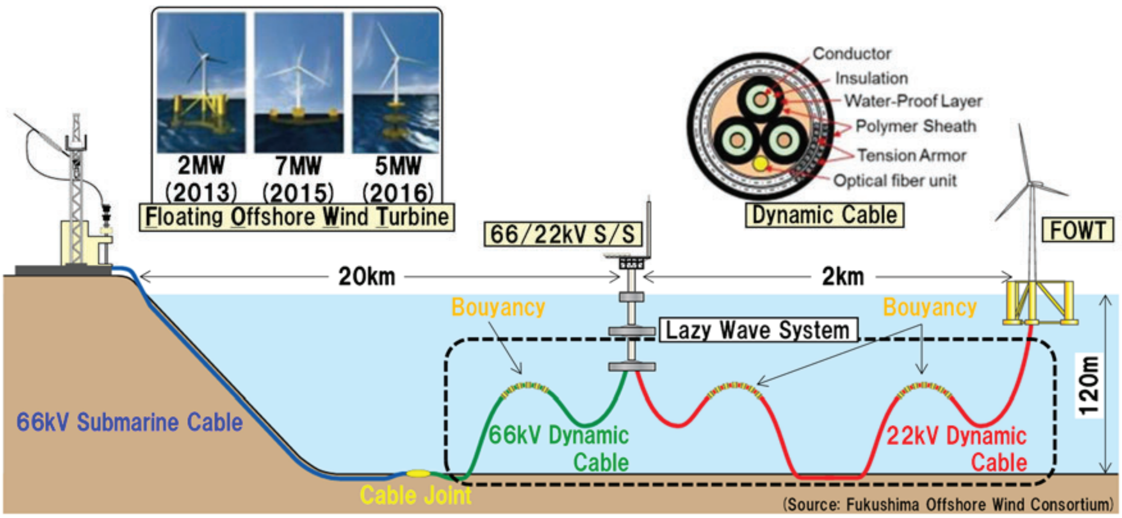
In Fukushima FORWARD Project, offshore floating wind farm facilities have been designed and constructed for demonstration purpose. The project has two construction period, the 1st stage (2011-2013) and the 2nd stage (2014-2016). In the 1st stage, a 2 MW down-wind type offshore floating wind turbine generator and a 25 MVA offshore floating substation were constructed for the first time in the world. In the 2nd stage, 5 and 7 MW new floating wind turbine generators were constructed. Power transmission system in operation since 2013 consists of 22kV inter-array dynamic cable and 66kV export dynamic/submarine cable. In this contribution, fatigue analysis based on the monitoring of installed dynamic cable system is reported.

2. Dynamic cable system for offshore floating wind farm

Fig.1 shows schematic view of transmission and substation system of this project. Dynamic cable and a long-distance submarine cable were installed to connect the offshore floating wind turbines to onshore grid. Cross section of the dynamic cables and their configurations have been designed to be suitable for dynamic marine condition through analytic simulations and experiments. Validity of the design of cable behavior was confirmed through the monitoring of installed dynamic cable system.



(a) Top view of the system



(b) Side view of the dynamic cable system

Fig.1 Schematic view of transmission and substation system for offshore floating wind farm

3. Monitoring results of behavior of installed dynamic cable

The behavior of dynamic cable was continuously monitored throughout the operation by acceleration sensors attached on the cable. Fig.2 shows an example of the comparison between measurement results and simulation values. The values obtained in the field agreed well with the simulation results. Fig.3 shows an example of the fatigue damage analyzed from measurement results. The graph shows that dynamic cable has sufficient margin in their mechanical life time, more than 5 times the project period. This indicates that there is a possibility of optimizing the cable design by making use of behavior monitoring. It was confirmed that the measuring of the behavior is important for the cable design improvement.

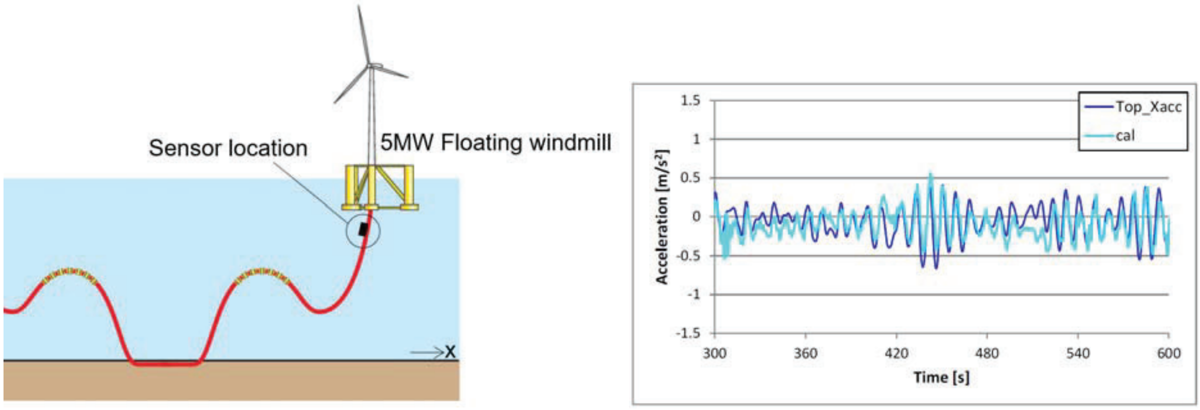


Fig.2 Comparison between measurement and simulation of the dynamic cable behavior

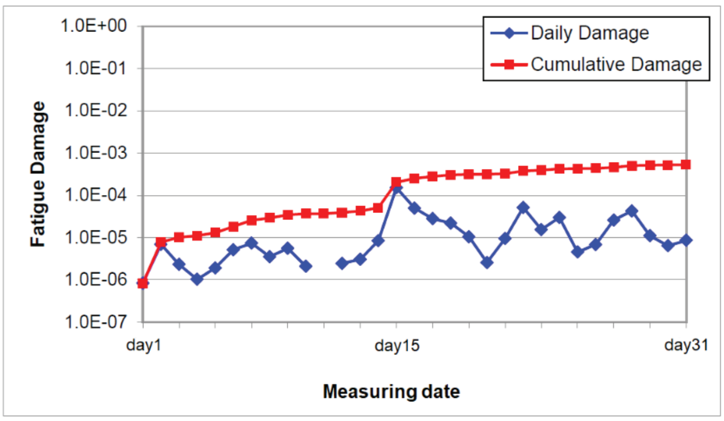


Fig.3 Fatigue damage analyzed from measurement results

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