SEASNAKE – Failure mode analysis of dynamic power cables

Background and motivation

Marine renewable energy is an energy resource which is expected to be very important for future energy production. Currently, harvesting of energy from waves undergoes a boom of innovation – some sources indicate that as many as 300 different wave energy converter (WEC) systems are under development today worldwide.

All WEC systems must be installed offshore. Some of them will be installed in arrays where the energy produced from individual WEC units will be collected in power collection hubs, which thereafter transfer the electricity from all the connected units to shore. To transfer the electricity produced from individual WEC units to hubs or to shore, cables suitable for the purpose and the environment are needed; see the left figure for a numerical model and the right figure for a photo of a real cable. Floating WEC systems are based on a technology that produces energy from primarily the heave motion. Thus, a cable connected to such a unit must be able to follow the WEC’s motions, and the motions caused by the waves and the ocean current.

Objectives and goals of the project

In the ongoing EU-funded project SeaSnake, an important task is to understand and analyze different failure modes of umbilical cables designed for different wave energy converters (WECs). Mechanical testing has been carried out on several cables and the results will be used in the thesis project. This thesis project will create numerical simulation models of the mechanical tests of the umbilicals. The models will be used to better understand the intrinsic failure modes in the experiments.

Methods and tools

The tools to be used are Matlab, the DNV-GL software SESAM, and the FE software ABAQUS. The report should be written in Word using a template provided by the department.

Industry partners: RISE Research Institutes of Sweden (https://www.ri.se/en) and NKT Cables (https://www.nkt.com).

Number of students: 2 students is recommended.

Prerequisites: FEA.

Tasks

- Literature study on the topic: numerical modelling and failure modes of umbilicals.
- Modelling: comparison of various alternatives to model the cable based on a failure mode analysis.
- Simulation of an umbilical fatigue test, analysis of the experimental data.
- Simulation of umbilical responses in a wave and ocean current load environment.
- Mechanical life model: recommendation of a numerical model of the umbilical together with a model which captures its failure modes when installed in a WEC in its intended environment offshore.
- Write a thesis report and present it on a public seminar.

Contacts

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