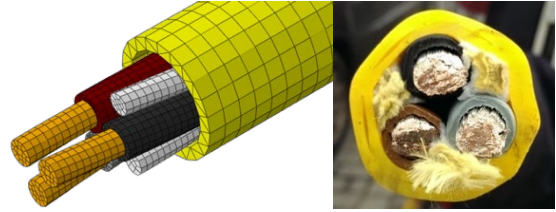


SEASNAKE – Failure mode analysis of dynamic power cables

(Scientific fields: Solid mechanics, Naval architecture, Civil engineering)

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. 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 a former research project “*Dynamic cables*” funded by the Swedish Energy Agency, an important task was to understand and analyze different failure modes of an umbilical cable specifically designed for the wave energy producer company Waves4Power. Different types of mechanical testing have been carried out on this umbilical and the results will be used in the thesis project. This thesis project will create numerical simulation models of the mechanical tests and the umbilical. These models will be used to understand the failure modes in the experiments, and in the WEC system where the cable will be used, and to evaluate how well the failure modes can be captured by the simulation models.

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. The methods to be applied in the MSc project should include:

- Numerical simulation of cable motions and structural response in a wave environment.
- FE analyses of the cable's structural response.
- Analysis of experimental data from the mechanical tests.
- Numerical simulation of a fatigue experiment.
- Failure mode analysis – mechanical life model.

The project should be carried out by two students working together.

The thesis should be written in Word using a template provided by the department.

The MSc thesis project should incorporate (at least) the following 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.

Contact person (examiner and supervisor at Chalmers):

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