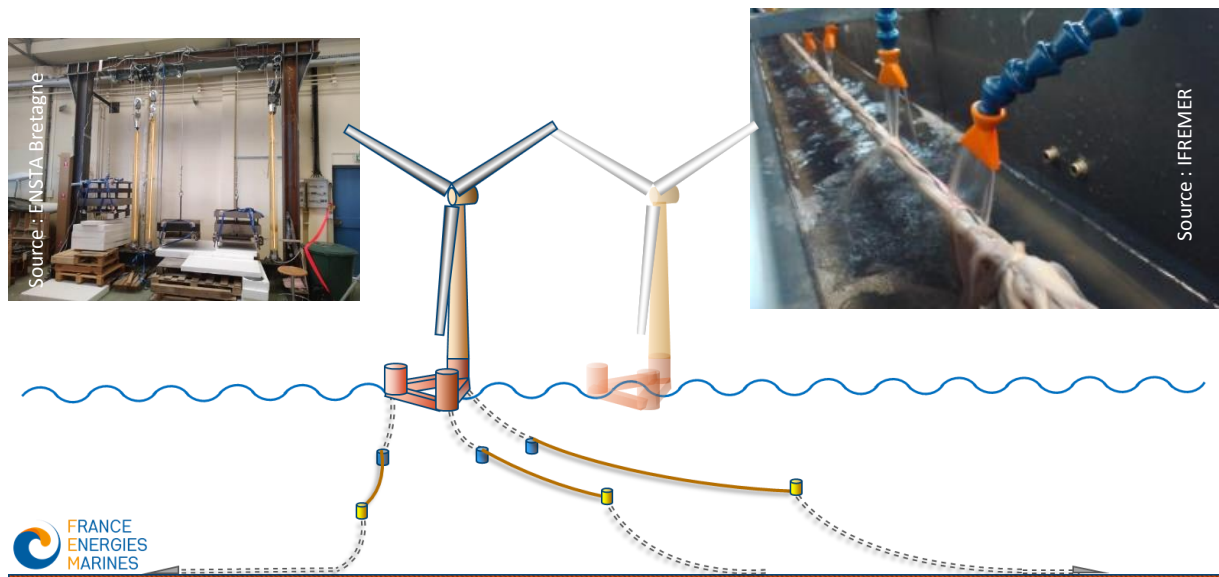


## Phd student within the MONAMOOR project

“Monitoring of polyamide mooring lines for offshore wind turbines”

N/Ref: FEM-SAS-2020-65



## Company Description

FRANCE ENERGIES MARINES (FEM), the national research institute dedicated to Offshore Renewable Energy (ORE), supports the nascent ORE industrial sector with the means and skills that increase competitiveness by mutualizing R&D costs, reducing risks and accelerating the acquisition of data and knowledge. FEM activities are founded on Research and Development projects based on a broad public-private partnership involving large groups, SMEs, regional authorities, advanced research and training institutions and competitiveness clusters, and with the support of the national *Investing for the Future* program. FEM collaborators are scientifically and technically involved in these projects thanks to their high level of scientific expertise. The headquarters of FEM are located in Plouzané (Brest area), France.

## Job Description

### Monamoor Project summary

The project is the second phase of a study involving academic research institutes, an SME developing instrumentation, a rope supplier, a certification society and a floating wind platform designer to improve the reliability of station keeping of floating offshore wind turbines. First the project will develop in parallel modelling tools for the mechanical behavior and long-term durability of nylon fiber

rope moorings, and the monitoring instruments which will allow their in-service response to be assessed. These two aspects are critical to optimize the mooring system. They will then be evaluated by instrumented tests on a moored buoy at sea. The present project will extend the TRL4 reached by the previous POLYAMoor project up to TRL7, thanks to results from a sea-trial demonstrator equipped with innovative sensors developed for in-service measurements. In parallel, this project will adapt the global mooring health monitoring strategy developed in the MHM-EMR project to this specific material.

## Main objectives of the PhD study

### Nylon rope behavior law development and validation

Two nylon rope behavior laws have to be developed, identified and validated by comparison with experimental test results. The test facilities of IFREMER and ENSTA are available for this activity, together with technician support.

### Meso-FE model development and validation

A meso-FE model has to be implemented into the FEM commercial software tool Abaqus, under finite deformation. Its parameters at the yarn scale have to be identified by dedicated experimental test devices. These devices have to be developed. This model has to be numerically simulated in the particular case of the Monamoor nylon rope construction. A dedicated tensile test on 4-tons nylon rope has to be conducted for the comparison with the meso-FE model predictions.

## Main Tasks of the PhD study

### Experimental work

Complex-loading-path tensile tests on nylon ropes under water flow.

Strain, displacement field measurement at the rope section scale during tensile tests on nylon ropes.

Design and development of experimental test devices for identifying the friction, tensile properties.

Contributions to the design of the mooring line for sea trials.

### Theoretical and numerical work

Development and Identification of the behavior law parameters based on tensile test results.

Numerical time 1D simulations of the visco-elasto-plastic nylon rope behavior laws.

Development and application of mechanical rope simulation using a meso-FE model in Abaqus code (finite deformation, friction laws).

## Required Qualifications, Skills and Experience

### Essential:

- **Experimental:** mechanical structure design, use and development of 100-kg to 10-ton electro-mechanical and hydraulic test machines (with technician support);
- **Theoretical:** mechanics of materials, continuum mechanics, finite deformations;
- **Numerical:** data analysis (Python, Matlab or C++), analytical function fitting, finite element structure quasi-static time simulation;

- **Language:** English is essential for project meetings and reporting.

**Desirable:**

- Knowledge of ORE systems ;
- an open mind and good team working skills.

## Candidate Profile

The candidate should:

- have scientific curiosity and a real taste for research activities;
- be autonomous, organized and like to go beyond what is expected;
- enjoy teamwork in a multidisciplinary spirit.

## Practical Information

**PhD supervisors:** Peter DAVIES (Ifremer) 40 %, Guilhem BLES, Yann MARCO (Ensta Bretagne) 40%. The candidate will be employed by the research department of “Design and monitoring of ORE systems” of France Energies Marines and supervised about 20% of time.

Starting date, location: **October 2020**, for a temporary position of **36 months** in Brest, France, at the IFREMER Marine Structures laboratory, the ENSTA Bretagne IRDL institute and FEM offices.

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CS 10070  
29280 PLOUZANÉ

**ENSTA Bretagne**  
2 rue François Verny  
29806 Brest cedex 9

**France Energies Marines**  
Bâtiment Cap Océan  
525 Av. Alexis De Rochon  
29280 Plouzané  
France

Periods of work are to be expected at the France Energies Marines headquarters in Brittany (Bâtiment Cap’Océan, 525 Avenue Alexis de Rochon, 29280 Plouzané).

**Final date for applications: August 15<sup>th</sup>, 2020**

Please send your CV and cover letter to the following electronic addresses:

- [contact@ite-fem.org](mailto:contact@ite-fem.org)
- [Peter.Davies@ifremer.fr](mailto:Peter.Davies@ifremer.fr)
- [guilhem.bles@ensta-bretagne.fr](mailto:guilhem.bles@ensta-bretagne.fr)
- [guillaume.damblans@ite-fem.org](mailto:guillaume.damblans@ite-fem.org)

In case of an expected secondment of the candidate by a member of France Energies Marines, the application should mention the agreement of the present employer.

**Access to Monamoor project:**

<https://en.france-energies-marines.org/R-D/Projects-in-progress/MONAMOOR>