MSSMat Laboratory of CentraleSupélec School of Engineering offers the following position starting from 1 April 2020 and limited for 36 months:

Early Stage Researcher (THREAD ESR6)

on the Marie Curie ITN funded project (full-time employment).

Identification of complex nonlinear constitutive laws for multi-wire cables

The position is offered within the EU Marie Skłodowska-Curie Innovative Training Networks in the project "Joint Training on Numerical Modelling of Highly Flexible Structures for Industrial Applications [THREAD]". The salary of the Marie Skłodowska-Curie Innovative Training Networks Fellowship (MSCA-ITN) follows the regulations set by the European Commission. The salary will include social security and will be composed of living, mobility and family allowances, where applicable, as outlined in the Grant Agreement and Horizon 2020 Marie Skłodowska-Curie Actions Work Programme, please see here: `http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-msca_en.pdf`

Background:

THREAD addresses the mechanical modelling, mathematical formulations and numerical methods for highly flexible slender structures like yarns, cables, hoses or ropes that are essential parts of high-performance engineering systems. The complex response of such structures in real operational conditions is far beyond the capabilities of current virtual prototyping tools. With 14 new PhD positions at 12 universities and research institutions in Austria, Belgium, Croatia, France, Germany, Norway, Slovenia and Spain, the project brings mechanical engineers and mathematicians together around major challenges in industrial applications and open-source simulation software development. It establishes an innovative modelling chain starting from detailed 3D modelling and experimental work to build validated 1D nonlinear rod models, which are then brought to a system-level simulation thanks to the outstanding numerical properties of the developed algorithms. This holistic approach combines advanced concepts in experimental and theoretical structural mechanics, non-smooth dynamics, computational geometry, discretisation methods and geometric numerical integration and will enable the next generation of virtual prototyping.

The current Early Stage Researcher PhD project (ESR) will be supervised by Damien Durville at MSSMat Laboratory (`http://mssmat.centralesupelec.fr`) in the CentraleSupélec School of Engineering (`https://www.centralesupelec.fr`), CNRS UMR8579, on the new campus of Université Paris-Saclay.

The MSSMat laboratory has extensive experience in the development of simulation code for the modeling of the mechanical behavior of entangled and fibrous materials, with various industrial applications (wire ropes, superconducting cables, textile cords, woven fabrics).

The current PhD project will focus on the development of a new higher order beam model that can represent the complex nonlinear behaviour of large steel ropes used as mooring lines in offshore engineering. For these ropes, usually manufactured as spiral strands, the frictional contact interactions between elementary wires that form the cable lead to a nonlinear behaviour under bending loading.

Requirements:

- MSc in Computational Mechanics, Mechanical Engineering, Computational engineering or related fields is preferred.

- Experience in numerical software development is highly desirable.

- Good skills in mechanical modelling, continuum mechanics and finite element simulation are desirable.

- High standard of spoken and written English.

- Qualification as an "Early Stage Researcher", i.e. at the time of appointment no doctoral degree and less than 4 years of research experience (full-time equivalent) after obtaining a degree that formally allows you to embark for a doctorate.

- Mobility requirement: at the time of appointment an "Early Stage Researcher" must not have resided or carried out their main activity in France for more than 12 months in the 3 years immediately prior to their appointment.

For more details please see here: `https://thread-etn.eu/apply/`

Tasks:

The goal of the project is to provide a homogenized model of large steel mooring cables used in offshore engineering, that is able to account for their nonlinear behaviour resulting from the frictional contact interactions between the elementary wires that form these cables.

The ESR will first use modelling tools developed at MSSMat to perform simulations of the mechanical behaviour of offshore mooring cables submitted to bending loading at the so-called microscopic scale, i.e. taking into account all elementary wires, in order to characterize the nonlinear response of such cables at the global macroscopic scale.

Improvements will then be made to the current beam model to make it able to represent the mooring cables at macroscopic scale, accounting in particular for the mechanisms that would have been identified through the simulations performed at microscopic scale. A particular attention will be given to the formulation of a constitutive model able to represent the hysteretic behaviour due to internal friction between wires.

The ESR will do a 3-month internship in secondment with Principia (`http://www.principia-group.com`), the industrial partner for this project, an engineering company specialized in offshore systems .

Application process:

Please submit your full application dossier only in English with registration number xxxxxxx until 15 January 2020. Applications must be submitted on the website `https://thread-etn.eu/apply/`. Applications must include a motivation letter tailored to the research project, the curriculum vitae (Europass format preferred), the digital copy of the highest academic degree (e.g. master) and the contact data of up to three scientific references.

For queries about the research project please contact M. Damien Durville (damien.durville@centralesupelec.fr).

For queries about the European Training Network THREAD, please contact the project coordinator at coordination@thread-etn.eu. The position is offered with reservation of possible budgetary restrictions. Application portfolios will not be returned, application costs will not be reimbursed.