Design and assessment of active stabilizing systems for floating structures

Summary

In this position you develop and assess the active stabilizing systems for floating structures such as floating production units, floating wind turbines or assemblies containing measuring equipment. The floating structures are either stationary or moving with relatively slow speed. Work includes experimental testing and numerical assessment of various active stabilizing systems such as mooring lines, gyroscopes, active fin stabilizers, gimbal, active ballast tanks, thrusters etc.

Research field:	Environmental, marine and coastal technology
Supervisors:	Kristjan Tabri Dr. Dhanushka Chamara Liyanage
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture Kuressaare College
Application deadline:	Applications are accepted between October 02, 2023 00:00 and October 23, 2023 23:59 (Europe/Zurich)

Description

The project focuses on the controlled stabilization and dynamic response of floating offshore structures (wind turbines, fish farms, hydrogen production units) and structural assemblies containing measuring equipment. It is foreseen that large structures are moored to the sea bottom while smaller structures or assemblies could be either stand-alone or connected to other surface vessels, e.g. underwater monitoring equipment connected to an autonomous vessel. In the context of the Baltic Sea, these novel structures differ from conventional offshore structures by being somewhat smaller, less rigid and operate in relatively shallow water. These structures experience short wave lengths and for some instances also seasonal ice loads typical for the Baltic Sea.
The focus will be on controlling and minimizing the angular motions of the system in order to reduce the submerged volume to fulfil stability criteria. Several stabilization systems are to be assessed: mooring lines, gyroscopes, active fin stabilizers, gimbal, active ballast tanks, thrusters etc. PhD project includes the experimental testing of selected stabilizers in model basin and the development of numerical assessment model. It is foreseen that the systems are to be assessed in a numerical model, where the loads (winds, waves, ice), response and the influence of the stabilizing systems is evaluated in the same simulation environment. A direct numerical model based on the Multi-Material Arbitraty Lagrangian Eulerian method is assumed to be a suitable tool for numerical assessment of dynamics of the structures. Digital Twin of the structure will be developed to predict and optimize its behavior.

Why is this research necessary

- Tightening environmental restrictions, demand for new energy sources, more extensive exploitation of maritime domain and the developments in blue economy sectors will introduce new floating offshore structures worldwide, including also the Baltic Sea and Estonian waters.
- More advanced and efficient structures are to be developed for competitive an international maritime domain.
- Development in control technologies, automation and robotics allows to develop novel solutions to minimize the angular motions of the structures and thus, reduce the submerged volume required to fulfil the stability criteria.
- New structural configurations cannot be assessed using conventional simplified models. Thus, more universal approaches and tools are required.
- The goals of the research correspond with the priorities of the EU (greener and safer surface transport, sustainable energy resources).

Requirements & Qualifications
The call is open for candidates with a wide range of backgrounds inside and outside of Estonia. Most importantly, high level of interest and motivation towards, and deep understanding on, computational mechanics and mechatronics is required. A suitable background may come from mechanical/material engineering, marine engineering, mechatronics,

civil engineering, engineering physics, applied or computational mechanics, or related disciplines. Prior experience on working with FE codes LS-DYNA or ABAQUS is a significant advantage as well as skills with programming tools such as Matlab, Python or Fortran. The candidate should prove his/her capabilities in writing the technical report and scientific papers in high quality journals. Experience in collaborative research/publication with the existing TalTech staff is also a plus. The applicant for the position must have a Master's degree and must fulfil the requirements for doctoral students at the Tallinn University of Technology (https://taltech.ee/en/phd-admission).

During the assessment emphasis will be put on your potential for research, motivation and personal suitability for the position.

Employment

The position is at the School of Engineering at Tallinn University of Technology. The expected duration of doctoral studies is four years. Following the standard practice in the School of Engineering, the contract will be made initially for one year, then extended after a successful progress review. The salary is according to the salary system of Tallinn University of Technology.

The position will be fulfilled as soon as a suitable candidate is found. TalTech reserves the right for justified reasons to leave the position open or to extend the application period.

Further information

- Job locations Kuressaare & Tallinn, Estonia.
- For additional information, please contact Associate Professor Kristjan Tabri (email: kristjan.tabri@taltech.ee).

To get more information or to apply online, visit https://taltech.glowbase.com/positions/714 or scan the the code on the left with your smartphone.