Motion control system for floating surface platforms and vessels

Summary

In this position you develop and assess the active motion control systems for floating structures such as floating wind turbines, unmanned monitoring vessels or floating production units. Aim of the control systems is to reduce the angular motions of the floating platforms. Floating structures of interest are either stationary or moving with relatively slow speed. Work includes the development, modelling and experimental assessment of various active stabilizing systems such as gyroscopes, active fin stabilizers, gimbal, active ballast tanks, thrusters, mooring lines 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 Kuressaare College
Application deadline:	Applications are accepted between January 01, 2024 00:00 and January 22, 2024 23:59 (Europe/Zurich)

Description

The project focuses on the generic-level assessment of the controlled stabilization of angular motions of floating surface platforms such as unmanned monitoring vessels, floating wind turbines, fish farms, hydrogen production units etc. 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. Several stabilization systems are to be considered: gyroscopes, active fin stabilizers, gimbal, active ballast tanks, thrusters, mooring lines etc. PhD project includes the experimental testing of selected stabilizers in the ship model test basin or in actual operating environment. It is foreseen that the stabilizing systems' behavior is to be assessed either in (i) a semi-analytical or numerical model including the description of the environmental loads and structural response, or in (ii) a machine-learning model, where experimental or numerical simulation data is used to develop a model for structure's response. 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 and monitoring systems 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 or to widen the suitable weather window for their efficient operation
- 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.

How to apply for a doctoral candidate position

Please read the admission guidelines at https://taltech.ee/en/phd-admission.

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/743 or scan the the code on the left with your smartphone.

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