Intelligent motion control system for Maritime Autonomous Surface Ships (MASS)

Summary

In this position, you develop an intelligent motion control system for Maritime Autonomous Surface Ships (MASS). Aim of the control systems is to optimize the MASS's behavior and response in demanding environmental conditions, with the focus on stabilizing the of angular motions and improving the navigational precision and path-following. MASS control is based on the identified wave/environmental conditions and on the feedback loop of ship's response.

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, 2025 00:00 and January 24, 2025 23:59 (Europe/Zurich)

Description

This research focuses on developing an intelligent motion control system for maritime autonomous surface vessels (MASS) with the aim to stabilize the angular motions and to improve the navigational precision and path-following. The expected solution combines the three core elements:

- **situational awareness** to perceive and estimate the external conditions (waves, wind, current) and incoming disturbances;
- **behavioral model of the vessel** to predict the vessels response under external conditions and disturbances;
- **motion control system** to execute the control and compensation actions if the predicted ship response falls outside the functional requirements (e.g. maximum roll angle or navigational precision)

For the stabilization of angular motions, an active stabilizing system is to be proposed based on gyroscope, active fin stabilizers etc. The proposed stabilizing system will differ from traditional gyroscope-based systems by utilizing real-time ship response and data from a situational awareness module to respond to actual environmental conditions and individual disturbances.

It is foreseen that the ships behavioural model and motion control system actions are to be assessed in a surrogate model combining (i) a semi-numerical model including the description of the environmental loads and structural response, and (ii) a machine-learning model to for smooth adaptation and feedback-based calibration.

PhD project includes the laboratory and field testing of the developed solution on the existing MASS platforms.

Responsibilities and tasks

- Develop a situational awareness model that based on the ship response characterizes the dominant wave conditions with a focus on wave direction identification.
- Develop a behavioral model of the vessel that links the incoming disturbances (waves) to the ship response prediction.
- Develop a motion control system of the vessel that allows to stabilize the angular motions of the vessel
- Apply the proposed models and systems in laboratory environment and real-word scenarios.
- Publish the research results in 3-4 publications in high-ranking journals and conferences

Requirements & Qualifications

- M.Sc. degree or equivalent in marine technology, mechanical engineering, mechatronics, technical physics, applied or computational mechanics or a related field.
- Skills with programming tools such as Matlab or Python, for example.

- Embedded software development, writing and analytical skills.
- Prior experience on working with seakeeping software (e.g. HyrdoMax) is an advantage, while not exclusionary requirement.
- Strong interest in the research topic, based on their previous experience.
- Excellent English communication skills.
- Ability to work as an independent researcher

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

We offer

- Collaborate and engage with developing autonomous technologies. Access to the actual field data from autonomous platforms
- Access to research infrastructure (test basin), sensors and autonomous platforms
- Opportunities for visiting conferences, research stays and networking with globally leading universities and research centers.

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.

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

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Dhanushka Chamara Liyanage dhanushka.liyanage@taltech.ee)

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