

Digital Twins and Maritime Safety

Summary

The plan is to establish a very active research group on the topics such as Hydrography, Aids to Navigation, Waterway design, and Nautical Cartography in Estonia. Internationally, the aim is to apply science-based solutions on managing the safety of waterways and ensuring maritime safety (including hydrography, navigational risk assessment, waterway design, etc.) On all these topics, the new digital solutions, increased automation, and application of AI and machine learning will be the dominating and important research areas. The future in this area will be on the digital twins of the ship, ship operations, and the environment i.e. the sea surface and the sea bottom. The advanced ship simulator center of TalTech can be important to conduct various types of studies needed in the future to understand the very complex phenomena and especially the interactions between various digital twin parameters.

Research field:	Maritime studies
Supervisors:	Inga Zaitseva-Pärnaste Pentti Jouko Sakari Kujala
Availability:	This position is available.
Offered by:	Tallinn University of Technology Estonian Maritime Academy
Application deadline:	Applications are accepted between October 02, 2023 00:00 and October 23, 2023 23:59 (Europe/Zurich)

Description

Supervisor: Prof. Pentti Jouko Sakari Kujala
Co-supervisor: Inga Zaitseva-Pärnaste

Description

The maritime industry faces several challenges in its digital transformation such as lack of standardization and interoperability, resistance to change, cybersecurity risks and growing threat landscape, limited infrastructure and connectivity, integration with existing systems and processes, costs, regulations as well as compliance, and legacy infrastructure. At the same time, new environmental demands will challenge the whole maritime sector. All these will have a remarkable impact on maritime safety. It is anticipated that in the future we need to understand the links between holistic maritime safety, automation and cybersecurity to address all these topics holistically in terms of both safety, automation, and cyber security functions and pillars.

There are number of levels on digital twins such as ship equipment level, ship systems level, ship type level, shipping level, shipping fleet level, marine environment level, fairway infrastructure level, etc.

The planned doctoral work can be adjusted based on the background of the selected candidate, but possible objectives for the work can be:

- Systematic review of the existing knowledge of digital twins in various levels
- Analysis of the link between automation, digital twins, and cyber security at various levels
- Deep analysis of the development needed for the most critical digital twin elements for the future of maritime shipping

Responsibilities and (foreseen) tasks:

- Conduct research on the development of educational technologies for describing digital twins
- Design and develop simulation-based tools to understand the behaviour of selected digital twins
- Collaborate with other researchers and industry partners to develop new applications for educating purposes of digital twins in practice
- Write scientific publications and present research findings at conferences and meetings
- Participate in departmental activities, such as seminars and workshops
- Supervise students (master's, bachelor's)



Applicants should fulfil the following requirements:

- a master's degree in maritime technologies, maritime transport, computer science, or related fields
- the candidate has a high academic level
- a clear interest in the topic of the position
- programming skills
- excellent command of English
- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to provide assistance in organizational tasks relevant to the project

The following experience is beneficial:

- Experience with Maritime activities
- Working knowledge of simulation tools and data analysis

We offer:

- A fully paid 4-year PhD position. The chance to do high-level research in a multidisciplinary team (Maritime operators, ship system experts, IT & OT engineers)
- Opportunities for conference visits, research stays, and networking

About the department

Estonian Maritime Academy, a structural unit of Tallinn University of Technology, provides multi-level education and does professional research in marine sciences and fields related to them, making it the only competence centre of its kind in Estonia.



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