Modelling and control of robot locomotion in mixed terrains

Summary

This PhD project will investigate modelling and control methods for robot locomotion in mixed dry and submerged environments, in or over yielding terrains. Candidates from robotics-related disciplines with a strong control systems background are invited to apply. The work will be part of the upcoming EU-funded project PIPEON, which will investigate robotics and AI for inspection and maintenance of sewer pipes.

Research field:	Information and communication technology
Supervisor:	Prof. Dr. Maarja Kruusmaa
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Computer Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Accurate and stable locomotion is challenging but crucial for mobile robots in dynamic unstructured environments (such as sewers), that contain a combination of solid ground, loose or thick sediment layers. Additionally, locomotion systems that use reconfigurable actuators with non-traditional morphology, optimized for locomotion in these environments, may increase the complexity of the robot's control.

In this context, this PhD project will investigate modelling and control methods for robot locomotion in these challenging terrains, aiming to develop a robust control algorithms for locomotion. In particular, the focus is on modelling and control between the dynamic environment and the robot’s locomotion system, and on evaluating the controller performance not only in simulation but also in the physical sewer pipe environment.

The modelling effort will take into account the locomotion system's states and control inputs, as well as the condition of the terrain, to estimate the behaviour of the robot as it interacts with the dynamic environment.

The candidate will work in the EU-funded project PIPEON with 14 partners (academic, industrial and public) and will contribute towards integration, testing and validation of the methods and prototypes of the project.

Responsibilities

- Investigate and model the interaction between the robot and the terrain in the context of locomotion in mixed terrains
- Design, implement, and evaluate control strategies for robot locomotion
- Publish achieved results in high-quality journals and top conferences in robotics

Applicants should fulfill the following requirements:

- A master's degree in robotics-related engineering discipline with a strong background in control systems
- A clear interest in the topic of the position
- Excellent command of the English language
- 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 aid in organizational tasks relevant to the project

The following experience is beneficial:

- Experimental and/or theoretical robotics, with emphasis in robot locomotion
- Programming in C++, Python
- Working knowledge of ROS or ROS 2
- Working knowledge of modern robot simulation tools

We offer

- 4-year PhD position in a bioinspired robotics group in Estonia with 15+ years' experience in international and national funded projects
- The chance to do high-level research and collaborate with experts in one of the most challenging robotics fields, in the context of an upcoming EU funded project
- Opportunities for conference visits, research stays, and networking with various cooperation partners
- The university employs the Early Stage Researcher with a salary meeting or exceeding the median wage in Estonia (2500€ gross).

About the department

The Centre for Biorobotics (https://taltech.ee/en/biorobotics) specializes in research and development of robotics and sensing. On the robotics side, we are focusing on development of locomotion and control in underwater and multi-phase environments, where conventional terrestrial and underwater platforms are underperforming. In connection with robotics, we are focusing on developing bioinspired sensing methods in combination with conventional tools to improve situational awareness and navigation performance of our robots. Apart from robotics, we are also applying the bioinspired sensing methods in water flow sensing in natural environments (rivers, coasts etc.).

Our core competences are as follows:

- Development and manufacturing of underwater robotic platforms
- Robot locomotion and control in mixed environments
- Underwater sensing with applications in natural environments
- Mapping and navigation in unstructured environments

Some of our research activities include:

- Developing new principles of locomotion using soft and compliant actuators
- Control and navigation of underwater robots in flow, surges, and waves
- Robot sensing in underwater environments
- Distributed sensor networks for measuring and characterizing flow and turbulence
- Development of underwater sensor systems for safe navigation in harbors
- Measuring extreme flows including sub-glacial flows, rivers etc.
- Environmental sensors for monitoring and protection of critical infrastructure

(Additional information)

For further information, please contact Prof. Maarja Kruusmaa (maarja.kruusmaa@taltech.ee), Dr. Roza Gkliva (roza.gkliva@taltech.ee), or visit https://taltech.ee/en/biorobotics

To get more information or to apply online, visit https://taltech.glowbase.com/positions/1037 or scan the the code on the left with your smartphone.

Spatial Analytics on Urban Farming and Sustainable Transport

Summary

The overall goal of the project is to examine how urban food systems and sustainable transport systems interact spatially and temporally in the context of 15-minute cities and transit-oriented development. This early stage researcher (PhD) position is part of the TalTech-led research project Hyping Agriculture and Transit (HAT) in 15-minute Cities (15mC), which explores how food-growing, public transport-oriented communities can support urban transitions as green Proximity Oriented Developments (PODs).

Research field:	Building and civil engineering and architecture
Supervisor:	Jenni Vilhelmiina Partanen
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Cities increasingly face challenges in supporting sustainable urban lifestyles while ensuring access to food and low-emission mobility. The 15-minute city and transit-oriented development models offer promising frameworks, yet their spatial co-evolution with food systems remains underexplored. This PhD project investigates how urban food production and distribution interact with mobility systems using spatial analytics (GIS) and statistical tools. It focuses on identifying spatial and typological regularities, dependencies, and long-term changes, with Tallinn as the core case. Depending on the candidate's skillset, the research may apply machine learning tools or appropriate computational models to support analysis.

The project contributes to the wider HAT research initiative coordinated in Estonia and supported by an international consortium. It aims to provide data-driven knowledge for designing accessible and ecological urban food systems embedded in future mobility infrastructures.

The thesis should address tentatively the following questions:

1. What are the spatial patterns of urban farming and food distribution in relation to transport systems?
2. What spatial and statistical dependencies exist between these systems?
3. How can spatial analysis inform policy and design interventions in food-oriented urban developments?
4. What tools and models are appropriate for integrating data on food and mobility systems in urban planning?

Responsibilities and (foreseen) tasks

• Conduct spatial and temporal analyses using GIS and statistical tools
• Compile and process current (and historical if available) data on food and transport systems
• Identify patterns and dependencies in food-mobility interactions
• Apply or develop computational models or machine learning methods (if applicable)
• Contribute to project publications, workshops, and comparative activities
• Participate in project coordination and communication tasks

Applicants should fulfil the following requirements:

• A master's degree in geoinformatics, geography, landscape architecture, or a related field
• A clear interest in spatial analytics and planning, sustainability, and urban systems
• Strong and demonstrable skills in GIS and statistical analysis
• Familiarity with QGIS, ArcGIS, or similar spatial platforms
• Basic programming skills (e.g., Python, R)
• Excellent command of English
• Capacity to work independently and as part of a research team
• Willingness and ability to reside in Tallinn and start in September 2025

The following experience is beneficial:
• Experience with urban food systems or mobility planning
• Knowledge of machine learning or spatial modeling tools

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses or analytical approaches to be used.

We offer:
• A 4-year PhD position (early stage researcher contract) in one of Estonia's leading academic environments for planning, architecture, and urban spatial studies
• The chance to contribute to interdisciplinary research shaping future sustainable urban systems
• Participation in a nationally coordinated and internationally supported research consortium
• Opportunities for conference participation, academic exchange, and collaboration with top European universities

About the department

The **Academy of Architecture and Urban Studies** at Tallinn University of Technology (TalTech) is a research-intensive unit within the School of Engineering. The Academy is internationally recognized for its interdisciplinary approach combining architecture, urban planning, spatial analytics, and sustainability.

Its research focuses on:
• Urban planning and spatial analytics in technology-mediated cities
• Digital planning, design, and participatory methods
• Sustainability metrics and spatial adaptation strategies

The Academy's curriculum combines design, data, and systems thinking in preparing future professionals to address complex urban challenges.

Additional information
For further information, please contact Prof. Jenni Partanen (jenni.partanen@taltech.ee)
TalTech homepage: https://taltech.ee/en

To get more information or to apply online, visit https://taltech.glowbase.com/positions/1011 or scan the the code on the left with your smartphone.

Improving Stakeholder Processes in Estonian Georesources Through Generative AI

Summary

Georesource production is part of the foundation of our modern society, yet obtaining the social licence to operate (SLO) is particularly complex. Such projects often attract strong public opposition (also known as NIMBY or BANANA attitudes). At the same time, the reasoning and, moreover, solution ideas of opposing individuals are little researched. This is partially due to the high complexity of quantifying reasoning during classic surveys. The rise of Generative AI (GenAI) provides the technological leap that allows us to survey the reasoning of individuals and quantify it in an economic way. The aim of this project is to explore the possibilities of GenAI-supported surveys to understand the reasoning and solution ideas of stakeholders and to obtain an outlook for improved stakeholder inclusion processes.

Research field:	Earth sciences
Supervisors:	Prof. Dr. Wolfgang Dieter Gerstlberger Bruno Grafe
Availability:	This position is available.
Offered by:	School of Science Department of Geology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Supervisors

- Dr. Bruno Grafe, Department of Geology, School of Science, TalTech
- Prof. Wolfang Dieter Gerstlberger, Head of Unit - Sustainable Value Chain Management Unit: Department of Business Administration
- Industry co-supervisor: Dr. Stefanie Walter, Lots* GmbH, Germany

Duration of the project: 4 years (2025–2029)

Problem statement

Sentiment against resource extraction, be it primary or secondary, is at an all-time low in Estonia and the EU in general – although environmental standards are among the highest worldwide. Previous studies in Germany have further shown that sentiment against resource projects is dependent on the location of people surveyed: most negative in urban areas, most positive near mining areas; the less people know about mining, the more negative the sentiment is; knowledge about resources, how they are extracted, and their role in daily life is extremely limited. These problems are also known as Not-in-my-backyard (NIMBY), or more extreme, “Build absolutely nothing anywhere near anyone” (BANANA). However, resource projects require a “Social Licence to Operate” (SLO), which means that, irrespective of legal licences, the public does not oppose a project to the extent that operations are made impossible.

Surveys conducted in the field of mining and construction of large projects normally quantify the general sentiment on numerical scales but cannot capture the reasoning behind negative attitudes, the ideas of negatively opinionated individuals, let alone quantify these opinions and reasoning.

Solution and research approach

Semi-structured interviews allow for an assessment of reasoning behind pure opinion, but normally they have to be conducted by interviewers in person -– limiting the application. However, the rise of GenAI has paved the way for analysing large amounts of free text and classifying responses in near-real time. This allows semi-interactive surveys that react to user responses and ask for reasoning and proposed solutions. Another aspect is the possibility to classify and bin free-text replies and the ability to quantify responses based on their similarity (similar to sentiment analysis). This allows for the quantification of large amounts of unstructured answers.

The project aims to investigate the possibilities and boundaries in the use of GenAI for these tasks, with a focus on the specific domain of the georesource industry, as this is one of the most negatively viewed industries.

Aims

The objectives of this PhD project are to:

- gain insights into whether the willingness to cooperate with the survey increases or decreases through free-text surveys and/or interactive surveys;
- by using free text input, allow for unbiased answers of possible solution ideas to complex public problems;
- further develop the field of stakeholder involvement and the knowledge of its influencing factors;
- to increase the knowledge and competency in the deeper use of GenAI in Estonia;
- to gain insight on the cost and benefit of such an approach.

Responsibilities

The project will include:

- Design of next-generation surveys that utilise the potential of GenAI. Different design strategies are possible and should be explored. Ranging from free-text surveys over semi-structured interviews to complete chatbot interactions;
- Executing the implementation of the chosen survey concepts;
- Evaluation of the survey results, using GenAI and statistical methods;
- Evaluating the spatial distribution of sentiment and reasoning towards resource projects with regard to proximity to the projects;
- Presentation of the results in seminars, workshops, and conferences;
- writing scientific publications (three articles in international peer-reviewed journals are required) together with other team members;
- Participating in PhD courses and being involved in teaching undergraduates according to the regulations of the doctoral study programme at TalTech.

Requirements and beneficial experiences

- An M.Sc. degree in a related field
  - Social sciences with a focus on public relations / communication management and a strong dedication to learning about the resource industry,
  - Mining, civil or industrial engineering with experience or strong dedication to extend knowledge in the fields of communication management,
  - Economics, with a willingness to develop knowledge in stakeholder management and the resource industry;
- A clear interest in the topic of the position;
- Good statistical understanding;
- Knowledge/experience in GenAI API usage;
- Programming knowledge (such as Phyton, R);
- Proficiency in English;
- Strong and demonstrable writing and analytical skills;
- Capacity to work both as an independent researcher and as part of an international team.

We offer

- Friendly community and modern working environment within the TalTech campus in Tallinn, the capital of Estonia;
- Possibility to work on a currently very pressing topic with a great outlook for further use of the gained knowledge in the industry;
- Advisory by an industry partner;
- Becoming a member of an Estonian national research project and multi-institutional team. Tight international collaboration and regular visits to other European research centres, participation in conferences and workshops annually for presenting the results and building a network of research contacts.
- Gross income starting from EUR 2300 per month (increase depending on performance).

TalTech Department of Geology

The Department of Geology is the centre of expertise in geology, mineral resources, and mining at TalTech. Our researchers focus on bedrock geology, paleoenvironments, mineral resources, mining engineering and circular economy. We are responsible for study programmes on Earth systems and resources and host various labs and the largest geoscience collections in Estonia.

TalTech Department of Business Administration - Sustainable Value Chain Management Research Group

Sustainable value chain management focuses on preparing and supporting innovation and growth within a firm's strategic framework. The research group explores these opportunities using interdisciplinary methods from business, sustainability (e.g., Circular Economy), environmental economics, engineering, IT, design, and social sciences. Emphasis is placed on digitalization, smart production, Industry 4.0, Big Data, and strategic networks, aligned with Europe's smart, sustainable, and inclusive growth agenda. Projects are typically conducted in cooperation with businesses and supported by European or national initiatives.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/1004 or scan the the code on the left with your smartphone.

AI based Production Processes Optimization and Management System Development

Summary

The main objective of the research is to study and develop the AI based Production Processes Optimization and Management System. The main activities of the research are: modification of production monitoring system Dimusa; process optimization and management system prototyping; analysis, forecast and visualization modules. The production process optimization and management system have data collection, analysis, visualisation and data storage modules. As each production system has its own specifics with a huge variety of possible modifications, the system should be flexible for modifications. The trends are: web-based architecture, re-configurability, near real time performance, open-hardware and software, wireless connectivity, self-learning with predictive functionality, supported by cloud computing. The tasks of the work is also to create a digital twin of the production processes, which includes the movement of the materials and labour along the production path and processes. During the work a 3D virtual simulation model and digital-twin will be developed to describe production processes use cases and key indicators and to define a solution method for an artificial intelligence-based management system. During the work, the solution method will be validated and tested using real data from the production system based on the input from food-, wood- or machinery industry. Based on the digital twin, the user interface of the Dimusa operative monitoring system will be created, which uses the functionality of artificial intelligence to control and optimize the tasks and activities of production processes at different stages.

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisors:	Prof. Dr. Jüri Majak Kristo Karjust
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Applicants should fulfil the following requirements:

- a master’s degree in engineering
- practical and research competences and knowledge in electronics solution design
- a clear interest in the topic of the position
- 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 help in organizational tasks relevant to the project

(The following experience is beneficial:)

- General/basic understanding on numerical analysis of structures
- Programming in C++
- Working knowledge of SQL

- Working knowledge of statistics

To get more information or to apply online, visit https://taltech.glowbase.com/positions/1003 or scan the the code on the left with your smartphone.

Multimodal AI and ML Applications for Electric Power Systems

Summary

The Department of Electrical Power Engineering and Mechatronics at TalTech invites applications for a fully-funded PhD position in the field of AI applications in electric power systems, with a special emphasis on multimodal AI models and their applications in electric power systems. This interdisciplinary PhD position combines artificial intelligence (AI) and modern electric power systems. The primary objective of the research is to investigate and develop multimodal machine learning models capable of processing heterogeneous data sources—specifically time-series sensor readings, visual data (e.g., images and video streams), and unstructured textual documents. As electric power systems undergo digital transformation, the integration and intelligent analysis of such diverse data modalities are increasingly critical for operational reliability, predictive maintenance, system diagnostics, and grid optimisation. The PhD candidate will contribute to developing robust, interpretable, and scalable AI methodologies tailored to the requirements and constraints of power system applications.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Dr. Tarmo Korõtko
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

This PhD position offers an exciting opportunity to conduct cutting-edge research in the field of AI applications in electric power systems, with a special focus on applying GPT and DL technologies. The research will aim to develop innovative solutions that leverage the power of AI and machine learning (ML) to enhance the efficiency, reliability, and sustainability of electric power systems.

Digital sensors, monitoring systems, and automated control have resulted in electric power systems generating increasingly diverse and voluminous datasets. These include numerical time-series data from sensors and meters, visual input from drones and surveillance systems, and technical documentation in textual form. The ability to jointly analyse these distinct modalities using multimodal AI and ML models opens new avenues for system resilience, adaptive management, and enhanced situational awareness.

This doctoral research seeks to develop and assess advanced AI architectures capable of fusing multimodal data streams for power system monitoring, diagnostics, and control applications. The focus will be on the design, implementation, and evaluation of deep learning techniques—including, but not limited to, multimodal transformers, graph neural networks, and contrastive learning frameworks—that are attuned to the operational context of electrical infrastructure.

The project will include empirical testing on real and simulated datasets, drawn from smart grid components, substation monitoring systems, and operational reports. Emphasis will be placed on the explainability and robustness of the models, especially in mission-critical decision-support contexts.

Responsibilities and (foreseen) tasks

- Conduct a comprehensive review of multimodal learning techniques applicable to power systems
- Design and implement AI architectures for integrating time-series, visual, and textual data
- Evaluate the proposed models on benchmark datasets and real-world case studies
- Develop and test models in lab-based and/or field-simulated power system environments
- Investigate model robustness, interpretability, and computational efficiency
- Publish findings in peer-reviewed scientific venues and present at relevant academic conferences
- Support the organization of project workshops and dissemination activities.

Applicants should fulfil the following requirements:

- master’s degree in electrical engineering, computer science or applied informatics from last 5 years

- a clear interest in the topic of the position
- principal understanding of electric power systems and a strong background in AI technology
- Strong programming skills (e.g., Python, TensorFlow, PyTorch)
- excellent command of the English language
- ptofound writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to aid in relevant organizational tasks

The following experience is beneficial:

- (co-)authored published scientific papers
- practical experience in working with large datasets, databases and data science
- operations systems engineering

The candidate should submit a research plan for the topic, including the overall research and data collection strategy.The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading microgrids research group in the region with a large portfolio of pan-European and national research and development, and study projects, mainly concerned with renewable energy integration and digital and AI applications in electric power systems.
- The opportunity to carry out high-level research in the domain of AI applications in energy systems.
- Access to state-of-the-art research facilities for microgrids, renewables integration and power system digitalization.
- Opportunities for student exchange through EuroTeQ and Erasmus+ programmes, visits to research conferences and laboratory facilities and networking with leading universities and research centers.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research centre focusing on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in national and international cooperation networks and organizations. The department has coordinated and partnered in several international projects, including Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within 7 research groups. It operates state-of-the-art laboratories with high-end equipment, offering accredited services in lighting and different electrical measurements. The department's focus areas are domestic and global challenges related to increasing digitalisation, decarbonisation and decentralisation of electric power systems and increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- Optimisation of electric power systems and system analysis for electrification and decarbonisation
- diagnostics and monitoring of equipment and systems
- cyber-security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, and IoT applications in energy
- Implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimise systems and reduce energy consumption
- developing smart city solutions, including environmentally friendly and self-driving vehicles/drones, and digital twin applications.

Additional information

For further information, please contact Dr. Tarmo Korõtko tarmo.korotko@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/1002 or scan the the code on the left with your smartphone.

Shaping the sustainable value chain through science-based policy development

Summary

The project explores the role and possibilities of sustainable innovation in material value chains across different key industries in Estonia. It analyses how entrepreneurial ecosystems —networks of researchers, policymakers, and industry actors including startups — can drive circular practices, resource efficiency and support the sustainable transitions with the focus on shaping policy development based on scientific research. The research would be based on case studies, mainly qualitative data analysis and international comparative analysis, aiming to bridge research, practise and policy development to strengthen ecosystem dynamics that foster innovation and promote circular economy principles in key industrial sectors.

Research field:	Business
Supervisor:	Prof. Dr. Wolfgang Dieter Gerstlberger
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Preliminary research questions are:

- What are key industries, specific regional ecosystems and certain types of companies (e.g., SMEs, startups) currently in Estonia, which could drive sustainable innovation in material value chains in the future?
- Are there certain national and/or regional/local policy instruments which could support the transition of specific ecosystems and material value chains towards more sustainability?
- From a comparative point of view, are there relevant good practice examples outside Estonia, e.g. in Europe or also the OECD countries which could inspire Estonian companies and policy makers in reaching this transition goal?

List of crucial references

A list of potentially relevant authors and theoretical approaches to be considered for the specified PhD research plan:

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- Acerbi, F., Taisch, M. (2020). A literature review on circular economy adoption in the manufacturing sector. Journal of Cleaner Production, Volume 273, p 123086.
- Adams, R., Jeanrenaud, S., Bessant, J., Denyer, D., & Overy, P. (2016). Sustainability-oriented innovation: A systematic review. International Journal of Management Reviews, 18(2), 180–205.
- Ahmadov, T., Durst, S. & Gerstlberger W.(2025). Unveiling success factors for implementing and sustaining circular economy practices in small and medium-sized firms: multi-level perspective. The Bottom Line, 38(1) 71−98.
- Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. Journal of Cleaner Production, 45, 9–19.
- Hall, J., & Vredenburg, H. (2003). The challenges of innovating for sustainable development. MIT Sloan Management Review, 45(1), 61–68.
- Harima, A., Harima, J., & Freiling, J. (2024). Ecosystem Orchestration: Unpacking the Leadership Capabilities of Anchor Organizations in Nascent Entrepreneurial Ecosystems. Entrepreneurship Theory and Practice, 48(6), 1404- 1450. https://doi.org/10.1177/10422587241241824 (Original work published 2024)
- Camilleri, M. A. (2020). European environment policy for the circular economy: Implications for business and industry stakeholders. Sustainable Development. 28. 1804-1812. 10.1002/SD.2113.
- Fischer, B., Meissner, D., Vonortas, N., & Guerrero, M. (2022). Spatial features of entrepreneurial ecosystems. Journal of Business Research, 147, 27-36.

- Marino, A. & Pariso, P. (2020). Comparing European countries' performances in the transition towards the Circular Economy. Science of The Total Environment. 729. 138142. 10.1016/j.scitotenv.2020.138142.

Responsibilities and (foreseen) tasks

-
- Conduct independent, collaborative and internationally comparative research on sustainable value chain management and innovation across key industrial sectors in Estonia, analysing the entrepreneurial ecosystems and developing science-based policies
- Perform literature reviews, develop conceptual frameworks and develop relevant research questions as well as as hypotheses/propositions
- Collect and analyse mainly qualitative, but if needed also quantitative (including secondary) data from companies, regulators, and other stakeholders across multiple countries, but focusing on Estonia
- Write academic publications for international peer-reviewed journals and conferences
- Actively participate in the department’s research group on sustainable value chain management, fostering circular economy practices, policy recommendations development based on field analysis
- Support teaching activities (e.g., seminars, supervision) related to sustainability, circular economy, resource efficiency, value chain management
- Engage in research communication, stakeholder engagement, and knowledge transfer activities with industry and policy partners
- Contribute to internal funding applications and national/international grant proposals
- Participate in the research and practitioner workshops where project findings are presented and discussed.
- The candidate is also expected to engage in small-scale teaching and supervision related to a PhD candidate’s field of expertise and active participation in the department’s activities.

The candidate is expected to have

-
- A Master’s degree (or equivalent) in business, innovation management, (engineering) environmental management, or a related field
-
- Demonstrated interest in at least one of the following areas: sustainable value chain management, fostering circular economy practises, sustainability related policy development
- Good analytical and writing skills, with the motivation to produce high-quality academic publications
- Strong communication and collaboration skills
- Very good command of English (both spoken and written)
- Capacity to work independently and collaboratively in an interdisciplinary and international environment.

The following experience is beneficial

-
- Prior experience in applied research or industry projects related to circular economy, value chain management, policy development
- Familiarity with qualitative and/or quantitative research methods
- Experience in stakeholder engagement or policy-relevant research
- Previous participation in international academic networks, research conferences, or student exchange programs
- Professional Estonian language skills
- Experience in project management, ideally both on EU and national level
- Experience with different national and/or EU funding schemes lile e.g. INTERREG, ERASMUS+, national Estonian tender schemes (e.g. of Ministry of Climate or Ministry of Economic Affairs and Communication)

The initial research plan

The candidate should submit an initial research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used. The research plan will be developed further considering project aim and research questions as well as ongoing project activities once the candidate is admitted.

We offer

- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.
- The chance to do high-level research in one of the most dynamic sustainability contexts globally.
- Opportunities for conference visits, research stays and networking with leading universities and research centres in the fields of energy, environmental and innovation studies
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the department

Tallinn University of Technology (TalTech) is an international scientific community with approximately 9,000 students and 2,000 employees; it is one of the largest universities in Estonia, the leading EU country in digitalisation. The university's strengths are broad multidisciplinary study/research interests, a modern research environment, and strong collaboration with international educational and research institutions. TalTech is aiming to be an organisation leading the way to a sustainable digital future.

The research carried out at the **Department of Business Administration** in the School of Business and Governance in TalTech deals with various aspects of business – entrepreneurship, sustainability, knowledge and technology transfer, operations and strategic management, digitalisation, marketing, supply chain management, accounting and performance management. The School has over 200 employees.

Additional information

For further information, please contact Wolfgang.Gerstlberger@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

TalTech has a green and one of Europe's most compact university campuses, including the Tehnopol Tallinn Science Park. Low hierarchy, academic freedom and a balanced work and family life are valued at TalTech. The university provides individual development and training opportunities, material and non-material tokens of acknowledgement, sporting opportunities at TalTech Sports Club and all-staff activities.

TalTech, as an employer, brings together representatives from a wide range of disciplines - engineers and economists, business and biotechnology, and data scientists - with a shared mission to develop Estonian higher education and research. Keywords that characterise TalTech today are rapid development, interdisciplinarity, and internationalisation. The university has an international working environment; the functional languages are English and Estonian.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/993 or scan the the code on the left with your smartphone.

Responsible and Ethical AI in Service Development and Delivery

Summary

This PhD project explores the intersection of responsible artificial intelligence (AI) in high-contact, human-centered services such as education, healthcare, banking, etc. As AI becomes integral across service sectors, ethical concerns have emerged as the most significant theme for practitioners and researchers. This project aims to understand how AI technologies are being ethically integrated into service design and delivery. Some examples include the use of AI in personalized learning, admissions, and student evaluations, AI-driven diagnosis and treatment recommendations, and AI in sensitive personal financial data handling, highlighting AI's criticality in consumers' trust, safety, and privacy. This research emphasizes AI-enabled services' ethical, social, and operational impacts on customers. The research will advance knowledge of AI-enabled, responsible service design and delivery that enhances customer experiences while ensuring fairness, transparency, and accountability. The societal and managerial implications of the research will provide frameworks to service providers to build trust through fairness, transparency, and responsibility while delivering AI-enabled services.

Research field:	Business
Supervisors:	Susanne Durst Aditi Sarkar
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main Supervisor: Assistant Professor, Aditi Sarkar (PhD)

Co-Supervisor: Adjunct Professor, Susanne Durst (PhD)

This research investigates how responsible and ethical AI can support the development and delivery of services across various sectors, with an illustrative focus on educational services (e.g., AI in classroom teaching and university support systems). Based on relevant theories such as the dynamic capability theory and recent findings (e.g., Kumar et al., 2024), this PhD project will study how organizations balance technological adoption with ethical considerations and customer-centric service innovation. Areas of interest include AI-driven personalization, automated decision- making, service innovation processes, ethical governance structures, and responsible management. The PhD candidate will engage in qualitative and/or mixed-methods empirical research, collaborate with industry stakeholders, and contribute to both academic theory and managerial practice.

This PhD topic addresses national and EU-wide strategic priorities on digitalization, AI ethics, and service innovation. As Estonia positions itself as a digital society, understanding how AI can be responsibly and ethically

deployed in key service industries (like education, public sector, and finance) ensures sustainable innovation and public trust. The research aligns with TalTech's vision on digital transformation and the Department's expertise in marketing, service development, and responsible innovation. It will contribute to capacity-building in AI governance and support Estonia's competitiveness as a leader in ethical digital services.

Responsibilities and (foreseen) tasks

- Design and conduct independent research on responsible and ethical AI applications in services marketing
- Carry out empirical studies such as experiments in the service sectors
- Develop and publish peer-reviewed journal articles and present at international scientific conferences
- Collaborate with service firms, universities, and ethical AI organizations
- Contribute to ongoing research projects at the Department of Business Administration
- Participate in doctoral training and departmental activities

The candidate is expected to have

-
- A Master’s degree in Marketing, Business, Information Systems, Service Design, or related fields
- Strong interest in responsible innovation, digital ethics, and service development and management
- Willingness and commitment to develop the necessary skills and competences to design and conduct independent academic research at the doctoral level
- Conduct qualitative/quantitative data analysis
- Excellent written and spoken English communication skills

The following experience is beneficial

- Demonstrated prior exposure to AI/ML concepts or applications in business
- Demonstrated experience with empirical research methods (e.g., interviews, surveys, experiments, case studies)
- Familiarity with service marketing or service design literature
- Academic writing and publication experience

The initial research plan

The candidate should submit an initial research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used. The research plan will be developed further considering project aim and research questions as well as ongoing project activities once the candidate is admitted.

We offer

-
- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.
- Opportunities for conference visits, research stays and networking with leading universities and research centres
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the department

TalTech is an international community with 9,000 students and 1,800 employees, making it one of Estonia’s largest universities and a leader in EU digitalisation. The university boasts multidisciplinary research, a modern environment, and strong international collaboration. Its green, compact campus includes the Tehnopol Science Park and the Mektory Innovation Center, which supports research funding and business expertise. TalTech values low hierarchy, academic freedom, and work-life balance, offering development opportunities, recognitions, and recreational activities, including a sports club and all-staff events. TalTech as an employer brings together representatives from a wide range of disciplines – engineers and economists, business and biotechnology, and data scientists – with a common mission to develop Estonian higher education and research. Keywords that characterise TalTech today are rapid development, interdisciplinarity, and internationalisation. The university has an international working environment, and the working languages are English and Estonian.

TalTech School of Business and Governance (SBG) offers interdisciplinary education in economics, international business management, and law, fostering innovation in a diverse community with 18% international students from 60 countries. Influential alumni in Estonian politics and business reflect our commitment to quality education. The faculty includes globally recognized researchers and practitioners, with nearly 30% having an international background. SBG, with over 200 employees, conducts research on modern business aspects—entrepreneurship, technology transfer, strategic management, marketing, supply chain, accounting, digitalisation, sustainability, and more—focusing on individual and organizational performance. Our department is known for its strong team spirit and engaging events, large scale teaching in all levels and growing research activities. In the international ranking of Times Higher Education, TalTech's School of Business and Governance has climbed a hundred places in the last year and is now ranked 301-400 among the world's best in business and economics.

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Additional information

For further information, please contact Aditi.Sarkar@taltech.ee and Susanne.Durst@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

List of crucial references

A list of potentially relevant authors and theoretical approaches to be considered for the specified PhD research plan:

Huang, M.-H., & Rust, R. T. (2018). Artificial Intelligence in Service. Journal of Service Research, 21(2), 155–172. https://doi.org/10.1177/1094670517752459

Huang, M.-H., & Rust, R. T. (2021). Engaged to a Robot? The Role of AI in Service. Journal of Service Research, 24(1), 30– 41. https://doi.org/10.1177/1094670520902266

Kumar, V., Ashraf, A. R., & Nadeem, W. (2024). AI-powered marketing: What, where, and how? International Journal of Information Management, 77, 102783. https://doi.org/10.1016/J.IJINFOMGT.2024.102783

Nguyen, T.-M., & Malik, A. (2022). Impact of knowledge sharing on employees' service quality: the moderating role of artificial intelligence. International Marketing Review, 39(3), 482–508. https://doi.org/10.1108/IMR-02-2021-0078

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Peripheral migrant entrepreneurial identities within urban transformation

Summary

The project focuses on the interrelation between transnational migration flows, entrepreneurial agency, and urban placemaking in Tallinn by studying the (in)formal entrepreneurial practices of underrepresented migrant groups, whose presence in urban space is simultaneously marked by visibility and invisibility. By integrating theoretical frameworks from entrepreneurship and urban studies, the project explores how the spatial and temporal dynamics of urban transformation generate both opportunities and constraints for these practices, and, respectively, how urban (in)formal economies are shaped by the marginalised agencies. This is expected to advance the conceptualisation of contemporary entrepreneurial identities as they emerge from peripheral migrant experiences shaped by neoliberal urban dynamics. While primarily intended to employ a qualitative methodology, the project can be enhanced through a mixed-methods approach (quantitative and/or spatial data). In Tallinn, a second-tier capital city geographically situated on the margins of the European Union, a small but growing community of "new" migrants from geographically and/or culturally more distant areas is emerging. Given the uncertainties of the time, the increase of these groups and their implications for society and the economy are to be expected. While the theorisation of related processes is largely developed on such migrant entrepreneurs in cities and metropolises of the "old" Europe, the academic research often overlooks the perspective of Eastern European cities, which have only relatively recently begun receiving more of those migrant groups. This project, with a specific focus on (in)formal entrepreneurial activities, aims to generate deeper insights into the socio-cultural and economic implications of these new and underrepresented migrant groups on urban life and economies in cities like Tallinn. The research is expected to offer relevant input for urban governance to better respond to the needs of an increasingly diverse urban population and to support their integration by enhancing both their socio- cultural wellbeing and economic contribution to the Estonian society. Drawing on a relational concept of space (e.g. Löw 2018; Amin and Thrift 2002; building on Lefebvre 1974) and migrant entrepreneurship studies (Kloosterman et al 1999; Kloosterman and Rath 2001; Ram and Jones 2008), the project would also support a more complex consideration of the unique and dynamic ways in which these groups contribute to the social creation of urban space.

Research field:	Business
Supervisors:	Aki Harima Liis Ojamäe
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main Supervisor: Associate Professor Liis Ojamäe, PhD

Co-Supervisor: Tenured Associate Professor Aki Harima, PhD

Responsibilities and (foreseen) tasks:

- During the PhD studies, the student is expected to develop and implement a more detailed research plan within the proposed topic, resulting in at least three peer-reviewed articles published in international journals, meeting the standards required for a PhD thesis.
- The candidate is also expected to engage in small-scale teaching and supervision related to a PhD candidate's field of expertise and active participation in the department's activities.

The candidate is expected to have

- a master's degree in social sciences or in other areas with additional proof of social science research skills
- a clear interest in the topic of the position

- excellent command of English (additional language skills are beneficial)
- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team

The following experience is beneficial:

- urban studies related knowledge, skills and experience
- working knowledge in software and tools relevant for social and urban research, e.g. qualitative analysis software, quantitative analysis software, GIS
- previous research experience or publications

The candidate should submit an initial research plan that further develops the project's focus and aim, as well as its theoretical and methodological framework as outlined above, and includes initial research questions, a data collection strategy, methods of analysis, and a proposed timeline.

We offer

-
- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.
- Opportunities for conference visits, research stays and networking with leading universities and research centres in the fields of urban and entrepreneurship studies
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the department

Tallinn University of Technology (TalTech) is an international scientific community with approximately 9,000 students and 2,000 employees; it is one of the largest universities in Estonia, the leading EU country in digitalisation. The university's strengths are broad multidisciplinary study/research interests, a modern research environment, and strong collaboration with international educational and research institutions. TalTech is aiming to be an organisation leading the way to a sustainable digital future.

The research carried out at the **Department of Business Administration** in the School of Business and Governance in TalTech deals with various aspects of business – entrepreneurship, sustainability, knowledge and technology transfer, operations and strategic management, digitalisation, marketing, supply chain management, accounting and performance management. The School has over 200 employees.

Additional information

For further information, please contact Associate Professor Liis Ojamäe at liis.ojamae@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

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Sustainable Service Innovation in Technology-Driven Business Models

Summary

In the context of accelerating digital transformation and growing sustainability imperatives, technology-driven business models are undergoing profound innovation. The project aims to explore how digital services can drive sustainability while scaling globally and how sustainable innovation in technology-driven models in general interacts with international business expansion. The applications for this study can be mobile banking, decentralized finance, blockchain, decentralized autonomous organization, AI, technology ventures and others. Examining the interplay between sustainability-oriented service innovation and institutional, regulatory, and cultural dynamics across borders, with a particular focus on risk management strategies and addressing uncertainties in international markets will be conducted by comprehesive qualitative and/or quantitative methodology and international comparative analysis. The project outcomes will contribute to business models studies, innovation capabilities, risk mitigation approaches and ecosystem partnerships that facilitate sustainable international growth in fintech and other technology driven businesses. Research will contribute to theory at the intersection of international business, service innovation, risk management, and sustainability transitions.

Research field:	Business
Supervisors:	Marina Järvis Daria Podmetina
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main Supervisor: Senior Researcher Daria Podmetina (PhD)

Co-Supervisor: Assistant Professor Marina Järvis (PhD)

The research will address the opportunities and challenges of sustainable innovation in fintech and other technology driven businesses, with a special emphasis on risk management. The project will analyze how companies identify, assess, and manage risks related to regulatory changes, cybersecurity, market volatility, and cross-border operations. By integrating risk management frameworks into the analysis of sustainable business models, the research will provide actionable insights for practitioners and policymakers aiming to foster robust and responsible international expansion.

We foresee a planned cooperation with relevant fintech and technology professional in academia, including Taltech and in industry and also integration into relevant projects in the field.

Responsibilities and (foreseen) tasks

- Conduct independent and collaborative research on sustainable innovation in technology-driven business models with international business implications, including the identification and management of key risks (regulatory, technological, operational, and reputational).
- Perform literature reviews, develop conceptual frameworks, and formulate relevant research questions and hypotheses.
- Collect and analyze qualitative and/or quantitative data from companies, regulators, and other stakeholders across multiple countries, including Estonia.
- Write academic publications for international peer-reviewed journals and conferences.
- Actively participate in the department's research group(s) on sustainable innovation, international business, or digital transformation and risk management.
- Support teaching activities (e.g., seminars, supervision) related to innovation, entrepreneurship, or international business and risk management.

- Engage in research communication, stakeholder engagement, and knowledge transfer activities with industry and policy partners.
- Contribute to internal funding applications and national/international grant proposals.
- Contribute to small-scale teaching and/or supervising activities of the department.

The candidate is expected to have

- A Master's degree (or equivalent) in business, innovation management, economics, international business, entrepreneurship, or a related field
- Demonstrated interest in at least one of the following areas: fintech, sustainability, service innovation, or international business
- Good analytical and writing skills, with the motivation to produce high-quality academic publications
- Strong communication and collaboration skills
- Very good command of English (both spoken and written)

The following experience is beneficial

- Prior experience in applied research or industry projects related to digital business models, innovation, or financial services
- Relevant academic publication experience and participation in national and international conferences
- Familiarity with qualitative and/or quantitative research methods
- Familiarity with data collection/analysis software like NVivo, MaxQDA, SPSS, Stata, Qualtrix etc.
- Experience in stakeholder engagement or policy-relevant research
- Previous participation in international academic networks, research conferences, or student exchange programs
- Background in working with or researching digital platforms, startups, or innovation ecosystems and risk management in business contexts.

This project aligns with TalTech's strategic focus on digital transformation, green economy, and innovation for sustainable development. By investigating how fintech-enabled service innovation can foster sustainable international business models, especially in small open economies like Estonia, the project will generate valuable insights for policymakers, entrepreneurs, and investors. The integration of risk management into the research will help Estonian companies anticipate and mitigate challenges in international markets, supporting Estonia's ambitions in digital finance and green innovation. The project will strengthen research capacity within the Department of Business Administration in sustainable and international innovation, risk management, and support talent development in Estonia's innovation ecosystem.

The project team will actively apply for national and international research funding to support the Early-Stage Researcher's salary and research activities. Key funding sources include:

- Estonian Research Council grants
- Erasmus, Horizon Europe and Digital Europe Programme calls relevant to fintech, sustainability, and service innovation
- Collaboration with Estonian and European industry partners for co-funded or contract research
- Targeted applications to foundations and bilateral cooperation funds supporting digital and sustainable transformation (e.g., Nordic-Baltic cooperation, EIT Digital/Climate)

The PhD student will be involved in grant writing and project development to build long-term research and career sustainability.

The initial research plan

The candidate should submit an initial research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used. The research plan will be developed further considering project aim and research questions as well as ongoing project activities once the candidate is admitted.

We offer

-
- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.

- The chance to do high-level research in one of the most dynamic sustainability contexts globally.
- Opportunities for conference visits, research stays and networking with leading universities and research centres in the fields of energy, environmental and innovation studies
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the department

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Additional information

For further information, please contact Daria.Podmetina@taltech.ee and Marina.Jarvis@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

List of crucial references

A list of potentially relevant authors and theoretical approaches to be considered for the specified PhD research plan:

- Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research policy, 31(8-9), pp.1257-1274.
- Chesbrough, H., 2011. Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.
- Boons, F. and Lüdeke-Freund, F., 2013. Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. Journal of Cleaner production, 45, pp.9-19.
- Offiong, U.P., Szopik-Depczyńska, K., Cheba, K. and Ioppolo, G., 2024. FinTech as a digital innovation in microfinance companies–systematic literature review. European Journal of Innovation Management, 27(9), pp.562- 581.
- Moro-Visconti, R., Cruz Rambaud, S. and López Pascual, J., 2020. Sustainability in FinTechs: An explanation through business model scalability and market valuation. Sustainability, 12(24), p.10316.
- Zournatzidou, G., 2025. Green Finance and Sustainable Development: Investigating the Role of Greentech Business Ecosystem Through PRISMA-Driven Bibliometric Analysis. Administrative Sciences, 15(4), p.150.
- Oh, S., Chung, G. and Cho, K., 2024. New sustainable fintech business models created by open application programming interface technology: A case study of Korea's open banking application programming interface platform. Sustainability, 16(16), p.7187.

- Al-Okaily, M., Al Natour, A.R., Shishan, F., Al-Dmour, A., Alghazzawi, R. and Alsharairi, M., 2021. Sustainable FinTech innovation orientation: a moderated model. Sustainability, 13(24), p.13591.
- Davidson, S., 2025. The nature of the decentralised autonomous organisation. Journal of Institutional Economics, 21, p.e5.

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Business process automation through AI: development and evaluation of virtual assistants powered by Large Language Models

Summary

The overall goal of the project is to experimentally examine the opportunities involved in using large language models and other AI applications in domains of business. The focus is on building virtual assistants to automate various business processes. The effectiveness of such automations is measured by computational methods and by pilot testing in an actual business context. The project resides in the field of business information systems, which is an overlap of software engineering and business administration. The project addresses the following central research question: How can large language models be effectively developed and integrated as virtual assistants to automate and enhance business processes in real-world organizational settings?

Research field:	Business
Supervisors:	Prof. Dr. Karin Reinhold Tarmo Koppel
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main Supervisor: Associate Professor Karin Reinhold (PhD)

Co-Supervisor: Lecturer Tarmo Koppel (PhD)

The ongoing trend of digital transformation across industries has intensified scholarly and practical interest in the optimization and automation of organizational business processes. Artificial Intelligence (AI), particularly in the form of Large Language Models (LLMs), has emerged as a powerful tool capable of understanding and generating human-like language. This opens new possibilities for developing virtual assistants that can perform complex business tasks. Despite their opportunities, the practical integration and evaluation of LLM-based virtual assistants in real-world business settings remain underexplored.

The research aims to explore the potential of AI applications, particularly LLMs, in business process automation. In this work the candidate develops virtual assistants capable of performing diverse business tasks and evaluate their performance in practical scenarios.

The thesis should address the following questions:

- What are effective methodologies for evaluating AI-based virtual assistants in business contexts?
- What are computational trade-offs between accuracy, efficiency, and cost-effectiveness in AI-driven business solutions?
- What strategies are effective for ensuring the scalability and robustness of AI-powered virtual assistants in dynamic business environments?
- Which business processes are most suitable for automation using virtual assistants powered by LLMs?
- How do user-centered designs influence the adoption and effectiveness of virtual assistants in businesses?
- What best practices can be established for integrating virtual assistants into existing business workflows?

Responsibilities and (foreseen) tasks

- Develop an analytical framework for experimental approaches to applied AI in domains of business.
- Design and develop virtual assistants to address specific business needs.
- Pilot test these virtual assistants in live business environments, iterating based on feedback.
- Collect qualitative and quantitative data and conduct case studies on the selected use cases.

- Contribute to data collection by conducting interviews, surveys and other methods.
- Based on findings, provide actionable recommendations for businesses interested in implementing AI- powered virtual assistants.
- Contribute to the organization of research and practitioner workshops and other topical events.

The candidate is expected to have

- A master's degree in software engineering, business process analysis, data analytics or other area relevant to this project
- A clear interest in the topic of the position
- Good English in communication and writing
- 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

- Development of web applications.
- Familiarity with large language models (LLMs) and multimodal models (LMMs), including voice and image processing.
- Knowledge of NLP methods and LLM techniques such as retrieval-augmented generation (RAG) and fine-tuning.
- Programming skills in Python.
- SQL database management.
- Predictive analytics, time-series analysis.
- Statistical analysis.
- Decision-making approaches (e.g., decision trees, reasoning frameworks).

The initial research plan

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer

- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.
- Opportunities for conference visits, research stays and networking with leading universities and research centres
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the department

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Additional information

For further information, please contact Karin.Reinhold@taltech.ee and Tarmo.Koppel@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

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The DefenseTech Entrepreneurial Ecosystem: Driving Security Innovation and Resilience in Europe

Summary

This project explores the emerging DefenseTech entrepreneurial ecosystem in Europe, with a specific focus on how startups, corporates, intermediaries, and governments collaborate to foster security innovation and societal resilience. The research examines the dynamics and institutional arrangements that enable or constrain entrepreneurial initiatives in the defense and dual-use technology sectors. By analyzing case studies across key European hubs and applying theories from entrepreneurship, innovation systems, and institutional theory, the project aims to deepen our understanding of how new ventures contribute to strategic autonomy and technological sovereignty in a rapidly evolving geopolitical landscape.

Research field:	Business
Supervisors:	Prof. Dr. Tarmo Kalvet Jan Harima
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main Supervisor: Research Fellow Jan Harima (PhD)

Co-Supervisor: Adjunct Professor Tarmo Kalvet (PhD)

In response to rising geopolitical tensions and evolving security threats, Europe has witnessed a surge of interest in DefenseTech—technologies that serve both military and civilian purposes. Startups and innovation-driven SMEs have begun to play an increasingly prominent role in developing cutting-edge solutions in areas such as cybersecurity, AI, drone technology, and space systems. However, the entrepreneurial ecosystem that supports such innovations remains under-researched, particularly in terms of its formation, governance, and long-term viability.

This doctoral project investigates how European DefenseTech ecosystems emerge, evolve, and contribute to national and continental security and innovation agendas. It asks how different actors—including startups, defense ministries, venture capital firms, and accelerators—interact and co-create the conditions necessary for defense-related innovation.

The PhD student will conduct in-depth qualitative research across multiple European regions, with Tallinn as one potential case, examining the institutional logics, funding mechanisms, and conflict dynamics that shape ecosystem trajectories. The project contributes to critical debates on innovation sovereignty, strategic autonomy, and the role of entrepreneurship in the new security landscape.

Responsibilities and (foreseen) tasks

- Design and implement a rigorous qualitative research strategy including multi-site case studies in Europe.
- Contribute to academic literature through at least three peer-reviewed publications in internationally recognized journals.
- Participate in the research, teaching, and supervision activities of the Department of Business Administration.
- Collaborate with interdisciplinary research teams across TalTech and partner institutions.
- Apply for additional research funding and contribute to ongoing projects in entrepreneurship and innovation policy.
- Participate in the research and practitioner workshops where project findings are presented and discussed.
- The candidate is also expected to engage in small-scale teaching and supervision related to a PhD candidate's field of expertise and active participation in the department's activities.

The candidate is expected to have

- Strong research and analytical skills, particularly in qualitative research methods.

- A Master's degree in entrepreneurship, innovation, public policy, security studies, economic geography or a related social science discipline.
- Fluency in English; knowledge of Estonian and other European languages is a plus.
- Demonstrated interest in topics related to entrepreneurship, innovation ecosystems, and/or security technologies.
- Capacity to work independently and collaboratively in an interdisciplinary and international environment.

The following experience is beneficial

- Previous research experience and/or publications
- Experience in working with qualitative research methodology

The initial research plan

The candidate should submit an initial research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used. The research plan will be developed further considering project aim and research questions as well as on-going project activities once the candidate is admitted.

We offer

- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.
- The chance to do high-level research in one of the most dynamic sustainability contexts globally.
- Opportunities for conference visits, research stays and networking with leading universities and research centres in the fields of energy, environmental and innovation studies.
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About TalTech and about the department

Tallinn University of Technology (TalTech) is an international scientific community with approximately 9,000 students and 2,000 employees; it is one of the largest universities in Estonia, the leading EU country in digitalisation. The university's strengths are broad multidisciplinary study/research interests, a modern research environment, and strong collaboration with international educational and research institutions. TalTech is aiming to be an organisation leading the way to a sustainable digital future.

TalTech, as an employer, brings together representatives from a wide range of disciplines - engineers and economists, business and biotechnology, and data scientists - with a shared mission to develop Estonian higher education and research. Keywords that characterise TalTech today are rapid development, interdisciplinarity, and internationalisation. The university has an international working environment; the functional languages are English and Estonian.

The research carried out at the **Department of Business Administration** in the School of Business and Governance in TalTech deals with various aspects of business – entrepreneurship, sustainability, knowledge and technology transfer, operations and strategic management, digitalisation, marketing, supply chain management, accounting and performance management. The School has over 200 employees.

TalTech has a green and one of Europe's most compact university campuses, including the Tehnopol Tallinn Science Park. Low hierarchy, academic freedom and a balanced work and family life are valued at TalTech. The university

provides individual development and training opportunities, material and non-material tokens of acknowledgement, sporting opportunities at TalTech Sports Club and all-staff activities.

Additional information

For further information, please contact Jan.Harima@taltech.ee and Tarmo.Kalvet@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

List of crucial references

A list of potentially relevant authors and theoretical approaches to be considered for the specified PhD research plan:

- Harima, A., Harima, J., & Freiling, J. (2024). Ecosystem orchestration: Unpacking the leadership capabilities of anchor organizations in nascent entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, *48*(6), 1404-1450.
- Shi, X., & Shi, Y. (2022). Unpacking the process of resource allocation within an entrepreneurial ecosystem. *Research Policy*, *51*(9), 104378.

- Spigel(2017)_The relational organization of entrepreneurial ecosystems
- Spigel, B., & Harrison, R. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic entrepreneurship journal*, *12*(1), 151-168.
- Wurth, B., Stam, E., & Spigel, B. (2022). Toward an entrepreneurial ecosystem research program. *Entrepreneurship Theory and Practice*, *46*(3), 729-778.
- Xu, L., Yang, S., Liu, Y., Newbert, S. L., & Boal, K. (2023). Seeing the forest and the trees: Exploring the impact of inter-and intra-entrepreneurial ecosystem embeddedness on new venture creation. *Academy of Management Journal*, *66*(6), 1954-1982.

Reporting of Environmental, Social and Governance (ESG) activities: Global perspective

Summary

This PhD position at TalTech School of Business and Governance focuses on investigating the rapidly evolving landscape of ESG considerations within the global business context. The research, conducted within the Department of Business Administration and potentially collaborating with the Center for Responsible Economy and ESG, can explore diverse areas such as ESG reporting harmonization across different regions and company sizes, the economic impact of mandatory ESG disclosures, the quality and assurance of ESG information, the connection between ESG factors and financial performance, or how investors utilize ESG data in their decision-making in all over a supply chain. The primary goal is to produce a high-quality doctoral dissertation based on independent research within these dynamic fields of ESG, ESG reporting, and/or international accounting.

Research field:	Business
Supervisors:	Dr. Merle Ojasoo Jiri Strouhal
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Business Administration
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main Supervisor: Associate Professor Merle Ojasoo (PhD)

Co-Supervisor: Visiting Professor Jiri Strouhal (PhD)

Submission of documents 01.06.2025.-31.06.2025. Deadline for interviews: 08.08.2025. Approval of candidates and the start of the work: as soon as possible, no later than in September 2025. More information about admission **here.**

The PhD thesis will investigate the rapidly evolving landscape of ESG considerations within the global business context. Potential research areas include but are not limited to:

1. ESG reporting harmonisation and divergence

Investigating the factors driving differences and similarities in ESG disclosure practices across countries (EU, non-EU), industries (with strong impact on Estonian GDP) and company size (listed companies, large companies, SMEs), particularly in relation to emerging ESG reporting frameworks (ESRS, IFRS S1+S2)

1. Impact of ESG reporting mandates

Analysing the economic consequences (e.g. on firm value, cost of capital, investment decisions) of mandatory ESG disclosure requirements in different jurisdictions throughout the supply chain

1. ESG information quality and assurance

Examining the determinants of ESG reporting quality, the role and effectiveness of assurance practices for ESG information, and its integration with traditional financial reporting assurance

1. ESG factors and financial performance

Exploring the relationship between corporate ESG performance/disclosure and financial performance metrics within an international comparative context

1. Stakeholder use of ESG information

Studying how stakeholders incorporate ESG information into their decision-making processes across different capital markets and regulatory environments

The evolution of Environmental, Social and Governance (hereinafter ESG) reporting in Europe is a testament to the region's increasing commitment to sustainable development. What began as voluntary environmental disclosures has transformed into a comprehensive, regulated framework, driven by the imperative to address pressing global challenges. ESG reporting has become an essential tool for corporate transparency and accountability, driven by growing regulatory requirements, investor expectations, and stakeholder demands.

The integration of ESG factors into corporate strategies has increasingly attracted the attention of scholars and practitioners, as businesses are compelled to align their operations with sustainability principles to enhance competitive advantage and regulatory compliance (Rabaya et al., 2022). Several studies have explored the multifaceted impact of ESG disclosure on firm performance, governance structures, and financial stability, highlighting its role in risk mitigation and value creation (Nicolo et al., 2022). The growing prominence of ESG reporting has fuelled extensive academic discourse on its implications for corporate performance, sustainability practices, and financial decision-making. A significant body of research has examined the evolving landscape of ESG disclosures, highlighting the challenges and benefits associated with regulatory frameworks, corporate transparency, and financial outcomes (Gholami, et al., 2022). The Toscano`s et al. (2022) study highlights that while ESG frameworks are intended to enhance transparency, the absence of standardized metrics often leads to greenwashing, wherein companies superficially adopt sustainability measures without meaningful integration into their business models. Empirical evidence suggests that ESG performance has a direct impact on corporate financial outcomes, influencing factors such as investor trust, financial irregularities, and regulatory compliance (Liu & Jin, 2023). Firms with strong ESG performance exhibit lower financial irregularities, primarily due to enhanced corporate governance mechanisms and increased stakeholder scrutiny (Liu & Jin, 2023).

Despite significant advancements in ESG research, several gaps remain. The heterogeneity in ESG measurement frameworks poses challenges in cross-sectoral and cross-regional comparisons (Arvidsson et al., 2022). Standardization efforts, such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB), aim to address these inconsistencies, yet widespread adoption remains limited (Arvidsson et al., 2022). Additionally, the causal relationship between ESG performance and financial outcomes warrants further investigation, particularly in the context of emerging markets and high-growth industries (Zahid et al., 2023).

Responsibilities and (foreseen) tasks

- Conduct independent, high-quality academic research culminating in a doctoral dissertation focused on ESG, ESG reporting, and/or international accounting.
- Collaborate with faculty and potentially other Ph.D. students on research projects.
- Aim to publish research findings in leading peer-reviewed academic journals (Scopus indexed journals, Web of Knowledge indexed journals)
- Present research at national and international academic conferences.
- Contribute actively to the research environment within the Department of Business Administration as well as TalTech School of Business and Governance
- Actively collaborate with the Center for Responsible Economy and ESG
- Participate in the research and practitioner workshops where project findings are presented and discussed.
- The candidate is also expected to engage in small-scale teaching and supervision related to a PhD candidate's field of expertise and active participation in the department's activities.

The candidate is expected to have

-
- a master's degree in accounting, finance, business administration, economics, or a closely related field
- a genuine and demonstrable interest in ESG/sustainability issues and accounting research
- excellent written and verbal communication skills in English
- strong and demonstrable writing and analytical skills
- working knowledge of statistics
- high level of motivation 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

-
- previous experience in qualitative research
- previous experience in quantitative research
- genuine interest in ESG-related topics

The initial research plan

The candidate should submit an initial research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used. The research plan will be developed further considering project aim and research questions as well as ongoing project activities once the candidate is admitted.

We offer

- 4-year PhD position (employed as an Early-Stage Researcher at the Department of Business Administration) in a strong team of researchers.
- The chance to do high-level research in one of the most dynamic areas of accounting and business
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of accounting and ESG
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About TalTech and about the department

Tallinn University of Technology (TalTech) is an international scientific community with approximately 9,000 students and 2,000 employees; it is one of the largest universities in Estonia, the leading EU country in digitalisation. The university's strengths are broad multidisciplinary study/research interests, a modern research environment, and strong collaboration with international educational and research institutions. TalTech is aiming to be an organisation leading the way to a sustainable digital future.

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Additional information

For further information, please contact Merle.Ojasoo@taltech.ee and Jiri.Strouhal@taltech.ee and visit https://taltech.ee/en/department-business-administration and https://taltech.ee/en/phd-admission

A list of potentially relevant authors and theoretical approaches to be considered for the specified PhD research plan:

List of cited references:

Arvidsson, S., & Dumay, J. (2023). Corporate ESG reporting quantity, quality, and performance: Where to now for environmental policy and practice? Business Strategy and the Environment, 32(7), 1091-1110. https://doi.org/10.1002/bse.2937

Gholami, M., Murray, J., & Sands, A. (2022). ESG disclosures and firm size: Challenges for SMEs in sustainability reporting.

Business Ethics Quarterly, 32(1), 65-89. https://doi.org/10.1007/s10551-022-05048-5

Liu, S., & Jin, H. (2023). ESG performance and financial irregularities: The role of corporate governance. Corporate Governance Journal, 41(2), 203-225. https://doi.org/10.1108/CGJ-09-2023-0112

Nicolò, G., Zampone, G., Sannino, G., & De Iorio, S. (2023). Sustainable corporate governance and non-financial disclosure in Europe: Does gender diversity matter? Journal of Applied Accounting Research, 24(1), 227-249. https://doi.org/10.1108/JAAR-04-2022-0100

Rabaya, A. J., & Saleh, N. M. (2023). The moderating effect of IR framework adoption on the relationship between environmental, social, and governance (ESG) disclosure and a firm's competitive advantage. Environment, Development and Sustainability, 25(3), 2037-2055. https://doi.org/10.1007/s10668-022-01519-5

Toscano, A., Balzarotti, M., & Re, I. (2022). Sustainability practices and greenwashing risk in the Italian poultry sector: A grounded theory study. Sustainability, 14(21), 14088. https://doi.org/10.3390/su142114088

Zahid, R. M. A., Saleem, A., & Maqsood, U. S. (2023). ESG performance, capital financing decisions, and audit quality: Empirical evidence from Chinese state-owned enterprises. Environmental Science and Pollution Research, 30, 44086–44099. https://doi.org/10.1007/s11356-023-25345-6

Privacy-Preserving Transformer-Based Federated Learning AI Models for Power Systems

Summary

The Department of Electrical Power Engineering and Mechatronics at TalTech invites applications for a fully-funded PhD position in the field of AI applications in electric power systems. This project aims to develop privacy-preserving, transformer-based federated learning models tailored for power systems. As smart grids increasingly depend on data-driven intelligence, preserving data privacy across distributed sources like smart meters and substations is a growing challenge. Federated learning allows collaborative model training without centralising sensitive data, but integrating complex architectures such as Transformers while maintaining privacy and efficiency requires further research. This project will explore secure and scalable AI techniques that enhance grid analytics without compromising user confidentiality.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Dr. Tarmo Korõtko
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

This PhD position offers an exciting opportunity to conduct cutting-edge research in AI applications in electric power systems, with a special focus on privacy-preserving applications.

The need for secure, decentralised learning mechanisms grows as digitalisation transforms power systems into data-rich environments. Traditional AI methods rely heavily on centralised data collection, risking user privacy and data breaches. Federated learning presents a decentralized solution, yet including high- performing architectures like Transformers introduces challenges in computational load, training convergence, communication overhead, and privacy risks.

This PhD research focuses on building and evaluating transformer-based AI models within a federated learning framework specific to smart grid applications. Emphasis will be placed on privacy-enhancing technologies (e.g., differential privacy, secure multiparty computation), efficient model aggregation techniques, and real-world data from smart meters and substations.

The goal is to develop scalable, secure, high-performing AI systems that operators can adopt to enhance grid analytics without compromising customer privacy. Results will be validated through simulations and prototype deployments in smart grid testbeds.

Responsibilities and (foreseen) tasks

- Research and development of federated learning frameworks tailored to smart grid data structures.
- Design and implementation of transformer architectures suitable for distributed energy environments.
- Integration of privacy-preserving mechanisms such as differential privacy and secure aggregation.
- Simulation and evaluation of proposed models using synthetic and real-world energy datasets.
- Collaboration with cybersecurity and power system researchers to ensure practical applicability.
- Preparation of scientific publications and participation in conferences.
- Assistance in organizing workshops and dissemination events related to the research topic.

Applicants should fulfil the following requirements:

- Master’s degree in electrical engineering, computer science or applied informatics from the last 5 years
- a clear interest in the topic of the position
- principal understanding of electric power systems and a strong background in AI technology

- Strong programming skills (e.g., Python, TensorFlow, PyTorch)
- excellent command of the English language
- profound writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to aid in relevant organisational tasks

The following experience is beneficial:

- (co-)authored published scientific papers
- practical experience in working with large datasets, databases and data science
- operations systems engineering

The candidate should submit a research plan for the topic, including the overall research and data collection strategy.The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading microgrids research group in the region with an extensive portfolio of pan-European and national research and development, and study projects, mainly concerned with renewable energy integration and digital and AI applications in electric power systems.
- The opportunity to conduct high-level research in AI applications in energy systems.
- Access to state-of-the-art research facilities for smart grids and power system digitalisation.
- Opportunities for student exchange through EuroTeQ and Erasmus+ programmes, visits to research conferences and laboratory facilities and networking with leading universities and research centres.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research centre focusing on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in national and international cooperation networks and organizations. The department has coordinated and partnered in several international projects, including Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within 7 research groups. It operates state-of-the-art laboratories with high-end equipment, offering accredited services in lighting and different electrical measurements. The department's focus areas are domestic and global challenges related to increasing digitalisation, decarbonisation and decentralisation of electric power systems and increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- Optimisation of electric power systems and system analysis to find possibilities for electrification and decarbonisation
- diagnostics and monitoring of equipment and systems
- cyber-security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, and IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, and machine vision
- Implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimise systems and reduce energy consumption
- developing smart city solutions, including environmentally friendly and self-driving vehicles/drones, and digital twin applications.

Additional information

For further information, please contact Dr. Tarmo Korõtko tarmo.korotko@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/986 or scan the the code on the left with your smartphone.

Development of synergy-based antimicrobial nanocomposites for biomedical applications

Summary

The PhD project aims to design and synthesize innovative nanocomposite materials tailored for antimicrobial applications in biomedical fields, including wound dressings, implants, and surface coatings. This research will focus specifically on creating novel nanomaterials by combining metal-based antimicrobial nanoparticles (e.g. Ag, CuO, ZnO) with biologically active organic compounds (e.g., chitosan) to achieve synergistic antimicrobial effects. The most promising combinations will undergo comprehensive assessment for human and environmental safety. The central research question guiding this doctoral thesis is: how do specific combinations of metal-based nanoparticles and organic compounds influence their antimicrobial effectiveness and safety?

Research field:	Chemistry and biotechnology
Supervisors:	Mariliis Sihtmäe Dr. Kaja Kasemets
Availability:	This position is available.
Offered by:	School of Science National Institute Of Chemical Physics And Biophysics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The emergence and rapid spread of antibiotic and drug-resistant bacterial and fungal infections represent a significant challenge to public health, contributing to mortality rates comparable to those of cancer. Efforts to address this issue require a multi-faceted approach, including research into new antimicrobial agents. This *PhD* project addresses this issue by designing and synthesizing novel synergy-based antimicrobial nanocomposites (NCs) for biomedical applications, including wound dressings, medical implants, and surface coatings in healthcare settings. Synergy, in this context, implies that the combined antimicrobial activity of these materials exceeds the sum of their individual effects (i.e., 1 + 1 > 2).

The research will focus on synthesizing multifunctional nanocomposites by integrating antimicrobial metal-based nanoparticles (e.g., Ag, CuO, ZnO, and their doped versions) with biologically active organic compounds, such as chitosan. These combinations are expected to enhance antimicrobial performance through complementary mechanisms of action. Both individual components and their combinations will be studied to identify the most effective formulations. The most promising antimicrobial combinations will undergo comprehensive assessment for both human (*in vitro*) and environmental safety.

The goals of the PhD project are to:

- Synthesize and characterize a library of nanocomposites by combining antimicrobial nanoparticles (NPs) (e.g., CuO, ZnO, Zn-doped CuO NPs) with chitosan of varying molecular weights.
- Propose antimicrobial-by-design and safe-by-design strategies to develop synergy-based antimicrobial nanocomposites for biomedical applications (e.g. wound dressings, surface coatings).

Responsibilities and (foreseen) tasks

- Synthesis of CuO, ZnO and Zn-CuO NPs functionalized with different chitosan formulations
- Physicochemical characterization of NPs using DLS, XRD, EDX, SEM, TEM and FTIR
- Evaluation of NCs' antimicrobial efficiency to bacteria (e.g., *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*) and fungi (*Candida* spp)
- Assessment of NCs cytotoxicity *in vitro*
- Assessment of NCs environmental safety
- Data analysis

- Manuscript writing

Applicants should fulfil the following requirements:

- A master's degree in biology, chemistry or a related discipline
- Clear interest in the topic of position
- Ability to plan and conduct laboratory experiments
- Strong and demonstrable writing and analytical skills
- Solid teamwork and independent work skills
- Excellent knowledge of English (both verbal and written)

(The following experience is beneficial:)

- Synthesis and characterization of nanoparticles
- Working with microbes
- Working with mammalian cells *in vitro*
- Working knowledge of statistics

The candidate should submit a motivation letter justifying their interest in this position and explaining their suitability (in terms of skills, experience, and background) for the PhD project.

We offer:

- 4-year PhD position in one of the leading (nano)toxicology research laboratories in Tallinn, Estonia.
- Opportunities for conference visits, research stays, and networking with leading experts to develop antimicrobial nanomaterials for biomedical applications.

About the department

The Laboratory of Environmental Toxicology, headed by Dr Anne Kahru, contributes to the following strategic programs of the National Institute of Chemical Physics and Biophysics (NICPB): environmental toxicology, chemistry and macromolecular interactions, *in vitro* toxicology, and the 3Rs. Strong emphasis is placed on environmental toxicology, nanotoxicology, and the design of antimicrobial nanomaterials. The research activities range from studying fundamental aspects of biology to applications. The lab's high scientific research level has led to several previous and currently funded EU and other International cooperation projects. The Laboratories have up-to-date facilities in chemistry, microbiology, cell culture, and ecotoxicology.

(Additional information)

For further information, please contact Dr Kaja Kasemets, kaja.kasemets@kbfi.ee and Dr Mariliis Sihtmäe, mariliis.sihtmae@kbfi.ee or visit https://kbfi.ee/environmental-toxicology/?lang=en

To get more information or to apply online, visit https://taltech.glowbase.com/positions/985 or scan the the code on the left with your smartphone.

Development of Kesterite-based Technology for Indoor Photovoltaic Applications

Summary

Indoor photovoltaics (IPV) have significant market potential as the demand for constantly available energy sources grows, especially for small electronic devices and Internet of Things (IoT) devices. The project focuses on developing flexible, kesterite-based monograin layer solar cells specifically designed for indoor photovoltaic applications. The objective is to customize the optical and electronic properties of the absorber material, as well as the device architecture, to better align with indoor light sources such as cool and warm LEDs.

Research field:	Chemical, materials and energy technology
Supervisors:	Prof. Dr. Maarja Grossberg-Kuusk Dr. Marit Kauk-Kuusik
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

In today's interconnected world, the demand for sustainable and efficient energy sources has never been greater. With the number of Internet of Things (IoT) devices projected to reach 125 billion by 2030, powering these devices sustainably has become a critical challenge. Traditional batteries are not a viable long-term solution due to their limited lifespan. Replacing or recharging billions of batteries would cause service interruptions, incur high maintenance costs, and generate substantial toxic waste. Grid-connected electricity is another option, but wiring large number of wireless sensors is impractical and would require extensive restructuring of existing infrastructure. Remarkably, IoT devices operate at power levels ranging from µW to mW—up to 1000 times less than required for charging a typical mobile phone. This makes indoor energy harvesting a promising and sustainable alternative.

The aim of this PhD project is to advance the development of sustainable, flexible kesterite-based monograin layer solar cells with enhanced configurations, specially designed for IPV applications. The research will focus on tuning the absorber bandgap to match indoor light spectra and optimizing charge carrier density to maximize power output under low-light conditions. Additionally, the interface properties will be enhanced by restructuring the absorber surface layer and introducing a novel buffer layer. The project will also assess device performance under both diffuse ambient and artificial lighting to determine their effectiveness for IPV applications.

The results will be disseminated through at least three high-impact journal publications and presentations at international conferences. TalTech's advanced infrastructure and trained personnel are in place to support successful implementation of the project.

Responsibilities and (foreseen) tasks

- The successful candidate will develop wider bandgap kesterite materials using both solid state and molten salt synthesis methods, with a focus on optimizing the bandgap properties for efficient energy harvesting under low ambient light conditions. An additional objective is to develop an alternative, non-toxic buffer layer to achieve improved band alignment.
- The synthesized materials will be characterized in-depth using various techniques such as XRD, Raman, SEM, EDX and photoluminescence measurements.
- The candidate will fabricate photovoltaic devices based on these materials and evaluate their performance through J-V and EQE measurements.
- The PhD student will collaborate closely with colleagues in the Laboratory of Photovoltaic Materials and benefit from the group's extensive expertise in molten salt synthesis, as well as in the preparations and characterization of related solar cells technologies.

Applicants should fulfil the following requirements:

- A Master's degree in physics, chemistry, materials science, or a related discipline;
- A demonstrated interest in the topic of the position;
- Previous research experience in solar cell technologies, particulary in the fabrication and characterization of materials and devices. Knowledge of various physical and chemical deposition techniques, processing equipment and characterization tools is highly valued;
- A very high level of motivation and independent thinking abilities;
- Excellent communication and academic writing skills in English;
- Strong analytical skills and competencies in using data analysis & graphing software, including MS Office (Word, Excel, and PowerPoint) and Origin.
- Ability to work both independently and as part of an international research team;
- Willingness and capacity to contribute to organizational tasks relevant to the project.

The candidate must submit a research plan that demonstrates a solid understanding of the current state of kesterite solar cell technology. The plan should also include a detailed proposal outlining proposed research activities aimed at utilizing kesterite materials for indoor photovoltaic applications.

We offer:

- A 4-year PhD position within an internationally recognized photovoltaic research group, engaged in a diverse portfolio of ongoing European and national research and development projects;
- Opportunities to attend international conferences, participate in research stays and network with leading universities and research centers worldwide in the fields of photovoltaics.

(Additional information)

For further information, please contact Prof Marit Kauk-Kuusik marit.kauk-kuusik@taltech.ee and or visit https://taltech.ee/en/laboratory-photovoltaic-materials

To get more information or to apply online, visit https://taltech.glowbase.com/positions/984 or scan the the code on the left with your smartphone.

Satellite Observations of Atmosphere-Sea Interaction in the Coastal Ocean

Summary

Wind induced surface-wave breaking injects bubble plumes that mediate key air–sea exchanges, yet their subsurface structure is presently sampled only at limited locations by acoustic instruments. Measuring on the large scale is often impractical due to high maintenance costs. Alternatively, satellite Synthetic Aperture Radar (SAR) offers high-resolution spatial overview independently from daylight or cloud coverage. This PhD will develop and benchmark machine-learning models—from classical methods to deep networks—to translate SAR imagery into quantitative bubble-plume properties and establish the spatial and temporal limits of these retrievals. Outcomes will support a broader effort to derive air–sea fluxes from remote sensing observations.

Research field:	Earth sciences
Supervisors:	Sander Rikka Dr. Sven Nõmm
Availability:	This position is available.
Offered by:	School of Science Department of Marine Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Global observations highlight the pivotal role of surface waves in mediating ocean–atmosphere exchanges. When waves break, they inject subsurface bubbles that organise into vertical plumes, extending from a few metres under moderate conditions to more than 30#m during severe storms. Plume depth and concentration covary with wind and wave parameters. In-situ measurements with Acoustic Doppler Current Profilers (ADCPs) and high-frequency echosounders provide quantitative information on plume geometry and dynamics. At the sea surface, satellite Synthetic Aperture Radar (SAR) offers a synoptic view of sea state—delivering bulk wave parameters and even spectrum—independent of daylight or cloud cover.

The overarching goal of this PhD project is to evaluate a suite of machine-learning approaches—from classical statistical learning to deep neural networks (DNNs)—for mapping SAR imagery to subsurface bubble-plume properties. The project will also define the spatio-temporal bounds within which robust estimation is feasible, and assess whether multi-modal fusion (e.g., integrating measurements, or reanalysis data) can enhance predictive skill. The results will feed into a larger goal that seeks to quantify air–sea exchanges from satellite-derived wave information.

The thesis should address the following questions: 1) How successful have previous or ongoing attempts been at estimating subsurface bubble-plume characteristics via remote sensing? 2) Which processing workflows yield the most accurate subsurface estimates? 3) What capabilities are required to extract reliable subsurface parameters from historical and contemporary SAR missions? 4) Where and when do bubble plume events occur in the Baltic Sea?

Responsibilities and (foreseen) tasks

- Compile datasets for different open-source C and X-band SAR data, in situ and numerical model parameters
- Develop and validate analytical, empirical or machine learning based methodology to derive bubble plume characteristics
- Spatio-temporal analysis of bubble plume depths estimated from SAR data
- Support teaching activities of Dr. Sander Rikka

Applicants should fulfil the following requirements:

- A master’s degree in one of the following subjects: Natural Sciences (Earth Sciences, Oceanography, Physics etc.) or Computer Science.
- A clear interest in the topic of the position

- Good skills in one of the following computer languages – Python, MatLab, R.
- Excellent communication of English
- Strong and demonstrable writing and analytical skills
- Capacity to work both as an independent researcher and as part of an international team

The following experience is beneficial:

- Knowledge about Linux/Unix systems, High Performance Computing (HPC) environments.
- Previous experience with data bases (i.e., Copernicus), data mining, implementation of machine learning methods.
- Previous experience in analyzing geospatial data (remote sensing imagery, structured- and unstructured model fields).
- It is desirable if candidate can share some of their GitHub projects to demonstrate programming skills.

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year full time (fully funded) PhD position in an outstanding Baltic Sea research institution with a large portfolio of ongoing pan-European and national public sector applied research projects
- Opportunity to participate in applied research projects funded by European Commission (e.g. LIFE program), European Space Agency (ESA)
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of applications of machine learning, satellite data processing and oceanography

About the department

Tallinn University of Technology (TalTech), the only technological university in Estonia, is the flagship of Estonian engineering and natural sciences. Here the synergy between different fields (technological, natural, exact, economic and health sciences) is created and new ideas are born.

The Department of Marine Systems at TalTech is a leading oceanographic and meteorological R&D unit in the Baltic Sea region. We focus (1) on oceanographic process research based on scientific analysis to find cause-and-effect relationships and (2) on developing marine monitoring and forecasting services. The implemented methods include machine learning based algorithms for satellite image processing and for model data analysis as well as development of innovative (operational) methods for monitoring the marine environment and analyzing the changes. We have long-term experience in developing applications and methods for operational oceanography, the outputs of which are information products provided to the public and to various authorities on water level variability, ice conditions and other parameters of marine physics. We are contributing significantly to the pan-European Copernicus program (CMEMS) and Destination Earth (DestinE) initiative.

(Additional information)

For further information, please contact Sander Rikka (sander.rikka@taltech.ee) or Sven Nõmm (sven.nomm@taltech.ee).

To get more information or to apply online, visit https://taltech.glowbase.com/positions/983 or scan the the code on the left with your smartphone.

Skew monoidal categories and related structures: theory and applications

Summary

This objective of this position is to advance the theory and applications of skew monoidal categories, variations and specializations thereof, related structures such as skew multicategories and higher-dimensional generalizations.

Research field:	Information and communication technology
Supervisor:	Dr. Tarmo Uustalu
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Software Science
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Supervisor: Tarmo Uustalu

Co-supervisor: Nathanael Amariah Arkor

Name of the department/research group: Department of Software Science / Laboratory for High-Assurance Software

Description:

Monoidal categories are a classical and very important structure category theory, with many uses also in theoretical computer science. Skew monoidal categories are a weakening of monoidal categories. Although first isolated as a concept of any interest only around 2010, skew monoidal categories have turned out be a very natural structure, they are well-behaved with abundant useful examples, and with applications in both theoretical computer science and category theory. They have therefore become a subject of quite active research

This objective of this position is to advance the theory and applications of skew monoidal categories, their specializations and variations (such as skew braided monoidal, skew monoidal closed, skew non-monoidal closed categories), related structures (such as skew multicategories, skew promonoidal categories) and higher-dimensional generalizations (such as skew bicategories). The specific research questions to address, chosen during the project, can range from very well-defined basic questions about skew (braided) monoidal categories to highly open-ended exploration concerning higher-dimensional generalizations.

Responsibilities and tasks:

The student's primary responsibility is research on this PhD project. The student may have contribute to the teaching activities of the lab as a course assistant.

Qualifications:

- A MSc degree in computer science or mathematics
- Applicants should fulfill the following requirements:
- Solid knowledge in at least a few and interested in all of the following: algebra, logic, category theory

To get more information or to apply online, visit https://taltech.glowbase.com/positions/982 or scan the the code on the left with your smartphone.

Design, development, and laser powder bed fusion of Ni#Al intermetallic-based superalloys

Summary

A fully funded four-year PhD position is available for an Early-Stage Researcher in the field of additive manufacturing, with a specific focus on the design, development, and laser powder bed fusion (LPBF) of Ni#Al intermetallic-based superalloys. Ni#Al-based superalloys offer superior mechanical performance compared to conventional Ni-based superalloys due to their extra high content of strengthening intermetallic phase. These materials are particularly well-suited for high-temperature applications, such as components in the hot sections of aero engines, where mechanical strength, thermal stability, and low density are essential. However, the additive manufacturing of these alloys presents processing challenges -such as cracking and defects - that require a careful and comprehensive approach to overcome.

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisors:	Prof. Dr. Irina Hussainova Dr. Tatevik Minasyan
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Project goals

The core aim of this PhD project is to design and develop novel Ni#Al intermetallic-based superalloys for high-temperature applications, particularly in the hot sections of small engines. By developing new alloy chemistries, the project aims to achieve a combination of appropriate processability and high mechanical strength which are critical challenges in additive manufacturing of these materials.

A huge portion of the work will involve the use of thermodynamic simulations and calculations to guide alloy design and predict cracking susceptibility. These simulations will provide insights to narrow down suitable compositions for the LPBF process.

Once the compositions are selected, the project will focus on optimizing the LPBF process, including parameter development and optimization of multi-stage heat treatments. The goal is to achieve controlled microstructural evolution that ensures desired mechanical properties at elevated temperatures. Finally, the PhD researcher will be involved in the design, fabrication, and performance evaluation of prototype components demonstrating the alloy's potential for use in high-temperature environments.

What we offer

- A four-year PhD position at one of the most international and research-intensive technical universities in Estonia
- Participation in pan-European and national research projects
- The opportunity to conduct interesting research in a highly collaborative, international environment
- Access to advanced LPBF systems and post-processing facilities
- Opportunities for international conference participation, research exchanges, and networking with well-known universities and research centers
- Active collaboration with industrial and academic partners

Candidate requirements

- A Master's degree in Materials Science, Metallurgy, Mechanical Engineering, or a related field
- A strong interest in additive manufacturing, alloy design, and laser processing technologies (prior research experience materials characterization, mechanical testing, alloy development or metallurgy will be advantageous)
- Solid understanding of thermodynamic calculations

- Strong analytical thinking and problem-solving abilities
- Motivation to engage in both computational modeling and experimental research

About the department

The Department of Mechanical and Industrial Engineering at TalTech focuses on practical engineering challenges, including self-driving vehicle technologies, development of new coatings, and additive manufacturing of various alloy systems. Our Bachelor's, Master's, and PhD programs graduate hundreds of students each year, and we also work closely with industry by providing engineering services - from simulation and modeling to production process optimization.

TalTech is equipped with modern laboratories for powder metallurgy, additive manufacturing, laser processing, and materials testing, including optical, metrology, and chemical analysis. This provides a strong foundation for advanced research and development in materials engineering.

Additional information

For further information, please contact Dr Tatevik Minasyan (tatevik.minasyan@taltech.ee) and Prof Irina Hussainova (Irina.hussainova@taltech.ee) or visit https://taltech.ee/en/department-mechanical-and-industrial-engineering

Main supervisor: Tatevik Minasyan

Co-Supervisor: Irina Hussainova

Co-Supervisor: Pablo Daniel Enrique

To get more information or to apply online, visit https://taltech.glowbase.com/positions/981 or scan the the code on the left with your smartphone.

Advancing the Electric Distribution Systems for higher Flexibility and Reliability through Real-Time State Awareness Determination

Summary

Renewables have turned the tables in the electric distribution networks (DNs), where already today strict limitations are in effect to limit the actual renewable-produced energy infeed. Significant proportion of these limits are imposed due to classical approach to low-voltage distribution systems, where the network operates in a static, unobserved realm. This project aims to widen the DN actual performance characteristics through a more massive operating state observation leading through to impressive range of smarter-grid applications, such as enchanced true renewable hosting capacity, intra-community energy delivery provisions, greater and more effective flexibility of the grid etc. In this stage, emphasis will be put on aspects of general power delivery reliability and network topology identification thorugh operation characteristics modeling. The range of questions leading the path could be: how to implement measured data for network physical characteristics determination? where to set up the measurement systems and how many of units there would need to be? how to determine the actual loading and load carrying capability based on measured data?, and many others.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Dr. Lauri Kütt
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Distribution networks are under pressure to accommodate the high penetration of renewable energy produced, for example, by private household customers. All over Europe, last 5 – 7 years mark a drastic increase in the photo-voltaic (PV) installations regading both high and low power systems. The range of problems imposed by such high infeed of power at the time when load is at minimum, has led to multiple locations and areas to witness higher-than-standard-10% voltage elevation during sunny days. In order to limit the potential negative implications, and breach of contractual power delivery service terms, DN operators have already or are very close to cut down the´permitted power infeed levels. This is imposed without valid real-time data of the actual network state. In very many cases, the local overloading avoidance strategy is based on assumptions only, playing it double-safe.

Some assumptions on power delivery capability and capacity can be derived from planning-era data and load char-acterization. New and renewed infrastructure could be built to support perspective local-level planned power streams. However, with a planning span of 40 years, majority of the DN infrastructure could be struggling with present-day operating goals. Given that building up the actual power line imposes a huge price tag, there is a prominent perspec-tive to implement smart(er) grid methods and achieve higher power delivery capability without physical power lines' rebuilding. A huge perspective lies in providing the unobserved and unsupervised DN an added layer of capabilities through better self-awareness, helping to improve the local (individual connection based) response to power delivery cpacity demand.

While major DN flexibility provisions address full real-time data availability it is seldom so. The data gathered imposes a practically inefficient burden on the classical control system. With the address on data sampling, storing and trans-mitting efficiency from a supporting research project, the present project aims here to provide an appropriate set of methods to extract the real-time operating state definitions from the dataset. The state definitions would be developed based on trends recorded on actual power lines. In turn, the physical DN model can be derived, and this would help to serve the favourable operating conditons forecast, referring to any party in the grid supplying or loading.

The thesis should address the following questions:

1) Which aspects of measurement and quantification of the DN state variables monitoring from present best practices is appropriate to be used for electrical grids on-line monitoring?

2) Which limitations arise from the known proposed methods of measurement of electric power quality monitoring?

3) How to assess the potential loading and infeed consequences from customer connection points and disturbance sources from the grid using the monitoring data gathered?

Responsibilities and (foreseen) tasks

- Compile a critical practical case based listing of usable methods for distribution networks (DN) on-line / real-time measurements, addressing the opportunities, challenges and shortcomings;
- Extract practical data from the measurements done applying different signal processing and statistical processing methods;
- Configure the measurement setups, measurement devices and required auxiliary equipment for the on-line measurements of AC and DC power delivery systems:
- Formulate the proposals of methods in form of scientific publications, report on the applicability of the methods using the scientific expression;
- Contribute to the organization of research and practitioner workshops where project findings are presented.

(The following experience is beneficial:)

- Experimental and/or theoretical electromagnetic analysis, electromagnetic compatibility
- Programming in C / C++ / Python
- Working knowledge of statistics and signal processing
- Working knowledge of mathematical data analysis software, such as Matlab, NI Labview

The candidate should submit a research interest and motivation and motivation for the topic, including the expression of interest in the particular aspects of measurement, data processing of physical phenomenon research. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading engineering science research centers in Estonia with a large portfolio of ongoing pan-European and national R&D projects in the field of electric engineering;
- The chance to do high-level research in one of the fast developing laboratories in the field of applied electromagnetics with direct hands-on approach;
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of electrical engineering.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations.

The department educates future electrical and power engineering leaders and engineers at the bachelor's, master's and doctoral level. Through training courses, the department ensures lifelong learning and continuous development.

The department carries out large-scale interdisciplinary scientific research, development and professional projects, thanks to which the competence in the field of electrical energy and mechatronics continues to grow. With research, application and development services, the department increases the competitiveness of companies in both the domestic and international markets, keeping knowledge in Estonia. The department has coordinated or been a partner in numerous international projects, such as Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements.

The departments' focus areas are related to both domestic and global developments, such as increasing digitalization and decarbonization, decentralization and decentralization of electricity generation, and the increasing use of renewable energy sources. The department conducts research in the following relevant areas tackling the energy transition:

- optimization of electrical systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, machine vision
- implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- development of smart city solutions, including environmentally friendly and self-driving vehicles / drones, digital twin applications.

(Additional information)

For further information, please feel free to contact Prof. Lauri Kütt at lauri.kutt@taltech.ee for further details on the subjects associated with this position offer.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/980 or scan the the code on the left with your smartphone.

Modelling biogeochemical processes in the Baltic Sea

Summary

Aim of the PhD project is to develop a setup of ocean models for modelling the biochemical processes in the Baltic Sea, including the coastal waters of Estonia. Successful PhD applicant will be working with numerical ocean models at HPC centers in TalTech and EuroHPC machine LUMI and collaborate with other ocean modellers around Baltic Sea.

Research field:	Earth sciences
Supervisors:	Dr. Germo Väli Dr. Taavi Liblik
Availability:	This position is available.
Offered by:	School of Science Department of Marine Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The continuation of eutrophication and extension of the hypoxic areas and oxygen debt in the Baltic Sea is among one of the biggest human induced environmental stressors in the region. Numerical simulations provide a perfect tool to estimate the possible impacts of applied measures (such as BSAP) and activities reducing the eutrophication in the sea. The aim of the proposed PhD project is to model the biogeochemical processes in the Baltic Sea using the state-of-the-art hydrodynamic models GETM (General Estuarine Transport Model) and MOM (Modular Ocean Model) on various spatiotemporal scales (from synoptic variability to inter-annual changes and regional domain to overall Baltic Sea).

Within the project, the PhD student will prepare a MOM based model setup for the GoR/GoF that is applicable for studying the biogeochemical processes in the region, while continuing developing the existing GETM based model setups for the Baltic Sea. Multi-year simulations will be performed either at TalTech HPC (High-Performance Computing Centre) or at LUMI machine available from EuroHPC.

The student will analyze the model results and observational data to enhance the knowledge on the biogeochemical processes in the Baltic Sea. He/She will also participate in monitoring cruises to collect data and use the existing datasets for validation of the model.

The main aims of this PhD project are: 1) developing and calibrating GETM-ERGOM model for the eastern part of the Baltic Sea 2) setting up MOM-ERGOM model for the eastern part of the Baltic Sea 3) analyzing the biogeochemical processes in the simulations

The thesis should address the following questions: 1) Which numerical model is the most promising to use for Estonian coastal waterbodies? 2) How do submeso- and mesoscale processes affect biochemistry in the eastern part of Baltic Sea? 3) What are the future perspectives for applying BSAP for Estonian coastal waterbodies?

Responsibilities and (foreseen) tasks

- Developing and calibrating further the existing model systems for the Baltic Sea based on GETM model
- Setup and usage of MOM-ERGOM model for the Baltic Sea and regional high-resolution setups for the Gulf of Finland and Gulf of Riga
- Analysis of the model simulations
- Participation in and data collection during monitoring cruises
- Writing scientific papers

Applicants should fulfil the following requirements:

- a master’s degree in natural sciences (physics or mathematics, geosciences, environmental sciences or similar field)

- a clear interest in the topic of the position
- excellent command of English
- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of a team
- capacity and willingness to provide assistance in organizational tasks relevant to the project

(The following experience is beneficial:

- Experimental and/or theoretical oceanography
- Programming in Fortran and Python/MatLab/R
- Experience in HPC systems and/or Linux machines
- Working knowledge of numerical modelling
- Working knowledge of statistics
- Working knowledge of netCDF and grib format and oceanographic databases

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest marine physics research centers in Estonia
- The chance to participate in research and applied science projects
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of Baltic Sea research and marine science

About the department

Tallinn University of Technology (TalTech), the only technological university in Estonia, is the flagship of Estonian engineering and natural sciences. Here the synergy between different fields (technological, natural, exact, economic, and health sciences) is created and new ideas are born.

The Department of Marine Systems at TalTech is a leading oceanographic and meteorological R&D unit in the Baltic Sea region. We focus (1) on marine physics research, (2) on oceanographic process research based on scientific analysis to find cause-and-effect relationships, and (3) on developing marine monitoring and modelling services. We have long-term experience in numerical modelling of the circulation of the Baltic Sea along with the biogeochemical processes. We collaborate closely with researchers from other research centers around Baltic Sea, such as FMI (Finnish Meteorological Institute), IOW (Institute for Baltic Sea Research), SMHI (Swedish Meteorological and Hydrological Institute).

(Additional information)

For further information, please contact Germo Väli (germo.vali@taltech.ee) and Taavi Liblik (taavi.liblik@taltech.ee) or visit https://taltech.ee/en/department-marine-systems

To get more information or to apply online, visit https://taltech.glowbase.com/positions/979 or scan the the code on the left with your smartphone.

Empirical Investigation of Behavioral Drivers in Financial Decision-Making

Summary

This research project aims to explore how individual psychological traits interact with external conditions to shape financial and consumption behaviors. Using validated survey tools linked to extensive Estonian registry and transaction data, the study will provide empirical insights into real-world decisions related to investment, risk-taking, saving, and spending. Key themes include the role of cognitive and attitudinal factors, behavioral biases, social influences, and responses to income shocks, with the goal of bridging behavioral finance theory and household finance models.

Research field:	Economics and finance
Supervisors:	Dr. Karin Jõeveer Prof. Dr. Tõnn Talpsepp
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Economics and Finance
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The proposed research topic will deepen understanding of how individual psychological traits (such as financial self-efficacy, time preference, impulsivity, and overconfidence) interact with contextual factors to influence real-world financial and consumption behaviors. We expect to use validated survey measures which will be linked to large-scale, anonymized transaction and registry data. The project seeks to observe actual decisions under varying economic condition with an overarching aim to bridge behavioral-finance theory and household finance models with empirical evidence on how people navigate investment entry, risk management, saving, and spending. Estonian registry data will be used to conduct the research.

Building on this framework, the successful candidate will propose a research plan from a suite of guiding themes: the influence of cognitive and attitudinal profiles on market timing and performance; the manifestation of biases like the disposition effect across asset classes; the role of social and peer networks in amplifying or mitigating behavioral tendencies; and the mechanisms of precautionary saving and consumption smoothing in response to income shocks. The candidate will be expected to develop empirical and scientifically justified research plan for the chosen questions.

Responsibilities and (foreseen) tasks

- Design and execute an empirical research plan in collaboration with the supervisors
- Clean, manage and analyze longitudinal data and link with survey data
- Select and implement appropriate identification strategies to isolate behavioral effects
- Interpret results in light of behavioral–finance and household-finance theories
- Prepare and disseminate research outputs (working papers, conference presentations, journal articles)
- Contribute to other research and teaching activities of the research group

Applicants should fulfil the following requirements:

- a master’s degree in in Finance or Economics
- demonstrated quantitative aptitude (econometrics, statistics, data analysis)
- proficiency in a scientific programming language (Python, R, Stata, or similar)
- excellent command of English
- strong and demonstrable writing and analytical skills
- commitment to independent, rigorous empirical research
- a clear interest in the topic of the position

- 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:)

- prior involvement in empirical financial-market research or econometric studies
- hands-on experience with data extraction and analysis
- practical skills in building and querying large datasets (SQL, pandas, etc)
- experience with financial or economic modelling

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year funded PhD position in the largest, most internationalized and leading Business School in Estonia with a large portfolio of ongoing pan-European and national research projects;
- Active involvement in research projects of the assigned research group;
- The chance to do high-impact research in one of the most dynamic digital settings globally;
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the BEG fields;
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the school

TalTech School of Business and Governance is the leading provider of higher education in the fields of economics, business administration, law and public administration in the Baltic States. Our faculty includes internationally recognised top scientists and outstanding practitioners not only from Estonia but also from abroad - we have 34% international faculty members from 33 countries. About 23% of international students from over 60 countries confirm the attractiveness of the School in the international education landscape.

(Additional information)

For further information, please contact Prof Tonn Talpsepp, tonn.talpsepp@taltech.ee or visit: https://taltech.ee/en/department-economics-and-finance

To get more information or to apply online, visit https://taltech.glowbase.com/positions/978 or scan the the code on the left with your smartphone.

Systematic approach towards high-level protein production in yeast

Summary

Recent developments in enzyme engineering have leveraged advances in machine learning, directed evolution, and synthetic biology to design more efficient and specific biocatalysts. These innovations have significantly enhanced the ability to tailor enzymes for industrial processes, from pharmaceutical synthesis to sustainable biofuel production. The importance of enzyme engineering lies in its potential to replace harsh chemical processes with greener, more sustainable alternatives, contributing to cleaner manufacturing and environmental preservation. Despite progress in enzyme engineering, a systematic approach to analyzing enzyme production—spanning construction, expression, and activity—remains underdeveloped. To address this gap, the PhD project plans to implement a high-throughput platform that enables rapid construction, expression, and screening of enzyme variants for comprehensive performance analysis. The project is carried out in close collaboration with AS TFTAK - an independent Research Institute in Tallinn, Estonia.

Research field:	Chemistry and biotechnology
Supervisors:	Prof. Dr. Petri-Jaan Lahtvee Srđan Gavrilović Steven Axel van der Hoek
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Supervisors: Petri-Jaan Lahtvee, Srđan Gavrilović, Steven van der Hoek

To get more information or to apply online, visit https://taltech.glowbase.com/positions/977 or scan the the code on the left with your smartphone.

Financial and Investment Aspects of Tokenized Real Estate

Summary

This PhD project examines real estate tokenization—using blockchain-based digital tokens to enable fractional property ownership, reduce intermediaries, and enhance market access and transaction efficiency—by filling the gap in empirical research on its practical performance. Leveraging on-chain transaction data, it will analyze investor behavior (trading frequency, holding periods, diversification), assess secondary-market liquidity through trading volumes and bid-ask spreads across platforms, and investigate price discovery and volatility in response to economic events to determine whether token prices track underlying real estate values or resemble more volatile crypto assets. The goal is to evaluate tokenization's impact on market efficiency and inclusiveness while identifying persistent challenges in liquidity and price stability.

Research field:	Economics and finance
Supervisor:	Prof. Dr. Tõnn Talpsepp
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Economics and Finance
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Tõnn Talpsepp

Co-supervisor: Syed Jawad Hussain Shahzad

The research

Real estate is the largest asset class globally, valued at over $300 trillion. However, traditional real estate markets are costly, slow, and difficult for most individual investors to access. High transaction costs, limited liquidity, and legal complexities make real estate one of the least flexible financial sectors.

This PhD project focuses on real estate tokenization, where property ownership is represented as digital tokens on the blockchain. Tokenization enables fractional ownership, reduces intermediaries, and can improve market access and transaction efficiency. Despite these advantages, there is limited empirical research on how tokenized real estate performs in practice.

The research will analyze investor transaction patterns in tokenized real estate, including trading frequency, holding periods, and diversification strategies, to understand how investors behave in these new markets. It will also examine whether tokenization improves secondary market liquidity by comparing trading volumes, bid-ask spreads, and market activity across different platforms. Additionally, the project will study price discovery and volatility by investigating how token prices react to economic events and whether they reflect the underlying real estate values or show characteristics similar to more volatile crypto-assets. By using blockchain transaction data, this research aims to assess the true impact of tokenization on market efficiency and inclusiveness, identifying remaining challenges in liquidity and price stability.

Responsibilities and (foreseen) tasks

- Collect and process blockchain transaction data for tokenized real estate
- Analyze investor behavior metrics (trading frequency, holding periods, diversification)
- Measure and compare secondary-market liquidity (trading volumes, bid–ask spreads, platform activity)
- Investigate price discovery and volatility dynamics in response to various events
- Synthesize findings to assess impacts on market efficiency and inclusiveness
- Prepare and disseminate research outputs (working papers, conference presentations, journal articles)
- Contribute to other research and teaching activities of the research group

Applicants should fulfil the following requirements:

- a master's degree in in Finance, Economics, Computer Science, Statistics, or a closely related field with at least minoring in Finance
- demonstrated quantitative aptitude (econometrics, statistics, data analysis)
- familiarity with blockchain concepts and tokenization mechanisms
- proficiency in a scientific programming language (Python, R, or similar)
- excellent command of English
- strong and demonstrable writing and analytical skills
- commitment to independent, rigorous empirical research
- a clear interest in the topic of the position
- 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:)

- prior involvement in empirical financial-market research or econometric studies
- hands-on experience with on-chain/blockchain data extraction and analysis
- practical skills in building and querying large datasets (SQL, pandas, data-wrangling tools)
- exposure to market-microstructure analysis or liquidity modelling
- experience with financial modelling

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year funded PhD position in the largest, most internationalized and leading Business School in Estonia with a large portfolio of ongoing pan-European and national research projects;
- Active involvement in research projects of the assigned research group;
- The chance to do high-impact research in one of the most dynamic digital settings globally;
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the BEG fields;
- All PhD positions are guaranteed a gross income of at least 2300 EUR and Estonian national health insurance.

About the school

TalTech School of Business and Governance is the leading provider of higher education in the fields of economics, business administration, law and public administration in the Baltic States. Our faculty includes internationally recognised top scientists and outstanding practitioners not only from Estonia but also from abroad - we have 34% international faculty members from 33 countries. About 23% of international students from over 60 countries confirm the attractiveness of the School in the international education landscape.

(Additional information)

For further information, please contact Prof Tonn Talpsepp, tonn.talpsepp@taltech.ee or visit: https://taltech.ee/en/department-economics-and-finance

To get more information or to apply online, visit https://taltech.glowbase.com/positions/976 or scan the the code on the left with your smartphone.

Development of Control Methodology for Additively Manufactured Electrical Machines

Summary

Electrical machines are the workhorses of modern industry. Thus, electrical machines are facing challenges in meeting very demanding performance metrics, for example, high specific power, customization, etc. This provides clear motivation to explore the impact of new manufacturing methodologies and its possibilities to enhance electrical machine performance. The use of additive manufacturing to produce electrical machines gives several new possibilities how to design more efficient and higher power density machines. However, to achieve the maximum effect in the design of the machine, it is necessary to consider also the control methods through which it is possible to increase both machine efficiency and controller efficiency. The overall goal of the project is to develop the control methodology for additively manufactured switched reluctance machines. The project focuses on optimizing the selection control method according to the machine design. Also, the control method will be used as an input on the electrical machine optimization to achieve high energy-efficient drive system. The practical part of the work will be testing the control model with a prototype machine in the research laboratory.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Anton Rassõlkin Prof. Dr. Ants Kallaste
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Ants Kallaste

Co-supervisor: Anton Rassõlkin

The research

Within this thesis, the PhD candidate will learn about the control and application of additively manufactured special types of electrical machines, like switched reluctance machines. The main emphasis will be on the development of switched reluctance machine control methodology, which will consider additively manufacturing machine advantages. We will provide the necessary hardware and software for the real-time control of the machine, but the candidate will be responsible for developing and implementing the control algorithms. A working demonstrator will be built and tested at the end of the thesis. The candidate will present his/her work at international conferences and publish journal papers required to complete the thesis within the PhD studies.

Responsibilities and tasks

- Design of control algorithms for additively manufactured machines
  - Additive manufacturing, also known as 3D printing, is opening up new ground for innovations in low-volume production. Today, the technology is still not widely used in industrial production, but it is gaining more and more popularity. The main challenges for control algorithms for additively manufactured machines are the non-linearity and saturation of the materials used in 3D printing.
- Design of loss reduction control algorithms for switched reluctance machines
  - Usually, the optimization concerns only the motor losses, whereas the converter losses are often neglected. An effective loss minimization strategy will require considering motor and converter losses. Achieving this objective for the novel permanent magnet-assisted reluctance machine could help to improve existing control strategies.
- Real-time simulations
  - Design control algorithms, vision, or plant models in MATLAB/SIMULINK
  - Build a real-time application from MATLAB/SIMULINK for the target machine
  - Set up and tune signal parameters from within MATLAB/SIMULINK during real-time execution

- Practical tests on the test bench

- • The test bench, combining the advantages of real-time software models and real equipment, contributes to the reduction of the number of test runs and safe maintenance. Test benches cover many different areas like energy management, optimal configuration, a combination of different energy sources, etc. Research goals will be achieved by proper verification of the model.

Applicants should fulfill the following requirements:

- a master's degree in electrical engineering (preferably with a focus on electrical machines or electrical drives)
- a clear interest in the topic of the position
- 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 research team
- capacity and willingness to help in organizational tasks relevant to the project

The following experience is beneficial:

- Theoretical and experimental basics of electrical machines
- Advanced knowledge in electrical machine control
- Knowledge of advanced electrical machine control theory
- Programming in MATLAB, Python, C++
- Working knowledge of optimization theory
- Knowledge of vector calculus and linear algebra

The candidate should submit a research proposal for the topic, including the overall state of research, identifying blind spots, open and real research questions, theoretical and methodical approaches and concepts, giving reasons for choosing these approaches., detailed research and time plan (laboratory work, data gathering, data analysis, interpretation of findings, writing up plan), and expected outcomes. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading electrical machines research group in Estonia with a large portfolio of dedicated research, industrial and study-oriented projects
- The chance to do high-level research in one of the most dynamic universities and research groups in the region
- Opportunities for conference visits, research stays, and networking with globally leading universities and research centers in the fields of electrical machines and diagnostics

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations.

The department educates future energy leaders and engineers at the bachelor's, master's, and doctoral level. Through training courses, the department ensures lifelong learning and continuous development.

The department carries out large-scale interdisciplinary scientific research, development, and professional projects, thanks to which the competence in the field of electrical energy and mechatronics continues to grow.

With research, application, and development services, the department increases the competitiveness of companies in both the domestic and international markets, keeping knowledge in Estonia. The department has coordinated or been a partner in numerous international projects, such as Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements.

The departments' focus areas are related to both domestic and global developments, such as increasing digitalization and decarbonization, decentralization, and decentralization of electricity generation, and the increasing use of renewable energy sources. The department conducts research in the following relevant areas tackling the energy transition:

- optimization of electrical systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications, and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, machine vision
- implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- development of smart city solutions, including environmentally friendly and self-driving vehicles, drones, and digital twins applications.

Additional information

For further information, please contact Prof. Ants Kallaste ants.kallaste@taltech.ee and Prof. Anton Rassõlkin anton.rassolkin@taltech.ee or visit https://taltech.ee/en/electrical-machine-group

To get more information or to apply online, visit https://taltech.glowbase.com/positions/975 or scan the the code on the left with your smartphone.

Topology Optimized Heat Exchangers for Additively Manufactured Electrical Machines

Summary

Additive manufacturing (AM) is evolving rapidly, and it is seen as an important step towards the next industrial revolution, being one of the key requirements for the decentralized production of highly complex structures. The flexibility of AM technology also allows the production of electromechanical components and electrical machines, which can have significantly better properties compared to conventionally manufactured devices. AM opens the possibility to utilize unconventional three-dimensional topology optimized structures, which allow the production of novel heat exchangers (HE) for electrical machines. However, currently there is no existing well-developed design methodology to realize these advantages. Therefore, this project focuses on the development of a design methodology for topology optimized HEs considering the advantages of AM. The objective of the project is the selection of an innovative electrical machine HE design, and the development of the optimization methodology. The practical part of the work involves validating the methodology in the lab by additively manufacturing (3D printing) the developed cooling solution and performing real-world measurements.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Prof. Dr. Ants Kallaste
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Within this thesis, the PhD candidate will learn about the design and optimization of electrical machine cooling solutions. The main emphasis will be on the development of a design methodology based on topology optimization that considers the advantages of AM. We will provide the necessary software for numerical analysis, but the candidate will be responsible for developing and implementing the design procedure. A working prototype will be built and tested at the end of the thesis. The candidate will present his/her work at international conferences and publish journal papers required to complete the thesis within the PhD studies.

Responsibilities and tasks

- Selection the most suitable cooling method for AM
  - There are several different cooling system solutions for electrical machines. The task of the work is to select the one that benefits the most from AM's capabilities.
- Design methodology for electrical machine cooling
  - The possibilities of 3-dimensional geometrical freedom for building the HE will be studied, and the most effective solution will be chosen. The task is to work out the design principles of HEs and develop an effective design methodology.
- Topology optimization of the cooling system
  - Generating the geometry of the HE through numerical simulations and topology optimization algorithms. The task is to work out the design principles for numerical topology optimization and construct an effective simulation model.
- Practical tests on physical prototypes
  - Based on the developed design methodology a cooling solution will be manufactured and tested. The research goal will be the real-world verification of the developed methodology.

Applicants should fulfil the following requirements:

- A master's degree in electrical (preferably with focus on electrical machines) or thermal engineering, applied physics or mathematics.

- A clear interest in the topic.
- Excellent command of English.
- Strong writing and analytical skills.
- Capacity to work both as an independent researcher and as part of an international team
- Capacity and willingness to help with organizational tasks relevant to the project

The following experience is beneficial:

- Theoretical and experimental basics of heat transfer and electrical machines.
- Experience with computational fluid dynamics and numerical thermal models.
- Knowledge of mathematical optimization methods.
- Programming (e.g. Python, C, MATLAB).

The candidate should submit a research plan for the topic, including the overall research strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading electrical machines research group in Estonia with a large portfolio of dedicated research, industrial and study-oriented projects
- The chance to do high-level research in one of the most dynamic Universities and research groups in the region
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of electrical machines and diagnostics

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations.

The department educates future energy leaders and engineers at the bachelor's, master's and doctoral level. Through training courses, the department ensures lifelong learning and continuous development.

The department carries out large-scale interdisciplinary scientific research, development and professional projects, thanks to which the competence in the field of electrical energy and mechatronics continues to grow. With research, application and development services, the department increases the competitiveness of companies in both the domestic and international markets, keeping knowledge in Estonia. The department has coordinated or been a partner in numerous international projects, such as Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements.

The departments' focus areas are related to both domestic and global developments, such as increasing digitalization and decarbonization, decentralization and decentralization of electricity generation, and the increasing use of renewable energy sources. The department conducts research in the following relevant areas tackling the energy transition:

- optimization of electrical systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, machine vision
- implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- development of smart city solutions, including environmentally friendly and self-driving vehicles / drones, digital twin applications.

Additional information

For further information, please contact Prof. Ants Kallaste ants.kallaste@taltech.ee or visit https://taltech.ee/en/electrical-machine-group

To get more information or to apply online, visit https://taltech.glowbase.com/positions/974 or scan the the code on the left with your smartphone.

Valorisation of glauconitic sandstones – from waste to resource

Summary

Glauconitic sandstones, with K- and Fe-rich complex clay mineral glauconite, are widespread, albeit heterogeneous, lithologies. The PhD project focuses on finding innovative industrial usage, such as alternative green fertilisers, for those materials based on an interdisciplinary study combining applied mineralogy, geochemistry, and mineral processing. The study involves characterising mineral features, crystallochemistry and textural properties of glauconitic sandstones with various routine and state-of-the-art technologies. The other part of the project is based on experiments on the mechanical activation of glauconite. The main targets will be Ordovician glauconitic sandstones from Estonia. The study aligns with the zero-waste mining concept, as in Estonia, the glauconitic sandstone is a potential waste rock of phosphorite mining. The project is jointly supervised by the TalTech Department of Geology and the Geological Survey of Estonia. It will be carried out under the research project TEMTA100.

Research field:	Earth sciences
Supervisor:	Rutt Hints
Availability:	This position is available.
Offered by:	School of Science Department of Geology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Rutt Hints

Co-supervisor: Lauri Joosu

The research

Several favourable features of glauconite, such as high potassium content, micronutrient binding, high adsorption, and cation exchange properties, along with its wide geological distribution, make it a promising resource for various sustainable industrial applications, including green fertilisers and water purification. However, these authigenic clay phases are chemically and texturally complex and heterogeneous at different scales, depending on their formation environment. Therefore, advanced characterisation and tailored testing experiments are necessary to develop viable industrial solutions. Such studies are also essential to identify potential deleterious compounds or effects related to the processing of glauconite.

The planned PhD project aims to collect state-of-the-art information on the physicochemical characteristics and variability of extensive Ordovician glauconitic sandstone complexes from Estonia. This will be based on multi-instrumental studies, including XRD with Rietveld refinement, SEM-EDX with automated mineralogy applications, and textural analyses. Systematic geochemical-mineralogical research has yet to address those glauconite-rich deposits formed in shallow marine settings of the Baltic Palaeobasin. However, those resources have gained novel interest recently as they are stratigraphically bound to extensive shelly phosphorite deposits.

The project's second objective is to investigate potential valorisation pathways for glauconite resources, focusing primarily on novel mechanical activation routes and the potential production of alternative green fertilisers.

Jointly supervised by the TalTech Department of Geology and the Geological Survey of Estonia, the project also involves collaboration with the TalTech Laboratory of Inorganic Materials and the private sector.

Responsibilities and foreseen tasks

- Collect representative samples from drill cores based on an understanding of glauconite natural variability
- Perform qualitative and quantitative crystallochemical, mineralogical and textural investigations using XRD and various microanalytical techniques
- Design and execute a series of lab-scale experiments on the comminution, classification and activation of glauconite-rich mineral matter
- Analyse multi-instrumental data sets obtained from raw materials and processing products
- Interpret and model the results of mineral processing tests

- Contribute to the organisation of research and practitioner workshops where project findings are presented

Applicants should fulfil the following requirements:

- a master's degree in Earth or mineral sciences
- a clear interest in the topic of the position
- a strong background in mineralogy, geochemistry and an interest in related analytical techniques
- relevant experience in executing laboratory studies
- readiness to work on multidisciplinary research problems
- 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 organisational tasks relevant to the project

The following experience is beneficial:

- working with fine-grained siliciclastic sedimentary deposits
- working knowledge of relevant analytical techniques

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research tasks and propose theoretical lenses to be used.

We offer:

- 4-year fully funded PhD position in one of the leading geo-research centres in Estonia with a considerable portfolio of European and national research projects on mineral resources
- The chance to do high-level research in a quickly developing field utilising in-depth mineralogical and particle properties knowledge to develop innovative pathways for sustainable mineral applications
- Opportunities for conference visits, research and lab stays in various partner institutions across Europe

About the department

The Department of Geology (https://taltech.ee/en/department-geology) is the centre of expertise in geology, mineral resources, and mining at TalTech. Our researchers focus on bedrock geology, paleoenvironments, mineral resources, mining engineering and circular economy. We are responsible for study programmes on Earth systems and georesources, host various labs and the largest geocollections in Estonia.

Additional information

For further information, please contact Rutt Hints at rutt.hints@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/973 or scan the the code on the left with your smartphone.

Financial vulnerability interlinkages with financial knowledge and behaviour

Summary

Financial vulnerability can refer to the difficulties people face in everyday life to pay bills (Loke, 2017) , cover unexpected expenses (Lusardi et al., 2011) or to maintain their lifestyle (O'Connor et al., 2019) . Irrespective of the precise definition, financial vulnerability can have adverse impact on the financial well-being of individuals.

Research field:	Economics and finance
Supervisors:	Prof. Dr. Tõnn Talpsepp Laivi Laidroo
Availability:	This position is available.
Offered by:	School of Business and Governance Department of Economics and Finance
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Laivi Laidroo

Co-supervisor: Tõnn Talpsepp

Financial vulnerability has been shown to be driven by different factors with financial knowledge and behaviour being one of these (Salignac et al., 2019). This highlights the role of properly designed educational interventions in improving the financial knowledge of more financially vulnerable groups. Although previous research has shown that the effectiveness of financial education programs is often disappointing (Holzmann et al., 2013) or may be less efficient in low-income groups (Kaiser & Menkhoff, 2017), the recent emergence of digital financial tools is changing the situation. Some studies also indicate that both financial literacy and digital literacy are needed to bridge the financial knowledge gaps (Kass-Hanna et al., 2022).

Previous research by Goyal et al. (2022) also emphasizes the role of behavioural and psychological factors, like impulsiveness and financial anxiety, in intermediating the relationship between financial literacy and financial vulnerability. Indicating that further research on the behavioural financial vulnerability determinants is needed.

The context of the study would be Estonia as these interlinkages remain especially topical in the Estonian context. According to Statistics Estonia in 2023 20.2% of Estonian were at-risk-of poverty. The OECD INFE 2023 survey results also show that while there appeared to be no significant association between financial vulnerability and financial knowledge, superior financial behaviour appeared to be related with lower financial vulnerability. Therefore, addressing the financial behaviour of financially vulnerable groups may enable to reduce their financial vulnerability.

References

Goyal, K., Kumar, S., Xiao, J. J., & Colombage, S. (2022). The psychological antecedents of personal financial management behavior: a meta-analysis. *International Journal of Bank Marketing*, *40*(7), 1413-1451. https://doi.org/10.1108/IJBM-02-2022-0088

Holzmann, R., Mulaj, F., & Perotti, V. (2013). Financial capability in low-and middle-income countries: measurement and evaluation. http://documents1.worldbank.org/curated/en/347991468331161428/pdf/798050W-P010Fin0Box0379791B00PUBLIC0.pdf

Kaiser, T., & Menkhoff, L. (2017). Does Financial Education Impact Financial Literacy and Financial Behavior, and If So, When? *The World Bank Economic Review*, *31*(3), 611-630. https://www.jstor.org/stable/48557255

Kass-Hanna, J., Lyons, A. C., & Liu, F. (2022). Building financial resilience through financial and digital literacy in South Asia and Sub-Saharan Africa. *Emerging Markets Review*, *51*, 100846. https://doi.org/https://doi.org/10.1016/j.ememar.2021.100846

Loke, Y. J. (2017). Financial vulnerability of working adults in Malaysia. *Contemporary Economics*, *11*(2), 205-218.

Lusardi, A., Schneider, D. J., & Tufano, P. (2011). *Financially fragile households: Evidence and implications*.

Data-driven real-time bathing water quality monitoring system development

Summary

This PhD position is part of the UrbanSplash project under the Smart City initiative, aims to revolutionize the monitoring of bathing water quality (BWQ) by addressing critical limitations in current systems. Existing methods for detecting faecal indicator bacteria (FIB), such as E. coli and enterococci, are slow, often taking 18–72 hours or more, which delays risk mitigation and fails to protect public health effectively. The research focuses on developing innovative solutions combining low-cost sensors with advanced machine learning (ML) and physics-informed neural network (PINN) models to provide real-time, high-resolution BWQ data and spatial predictions. By integrating multiple data sources, including real-time sensor readings, meteorological forecasts, and hydrometric data, this work will enable rapid detection and forecasting of pollution events, improve public health safety, and promote sustainable use of urban water bodies. RQ1) What is the most reliable and accurate calibration relationship between the laboratory analysis and the hourly sensor measurements? RQ2) Which machine learning models are suitable for hourly and daily forecasting of microbiological water quality including sensor measurements and site specific physical environmental and weather data? RQ3) How does the new modelling platform improve and inform public health protection measures as they relate to European Bathing Water Directive?

Research field:	Information and communication technology
Supervisors:	Jeffrey Andrew Tuhtan Dr. Uljana Reinsalu
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Computer Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The research topic is part of the Smart City project UrbanSplash (One-stop shop for the management of outdoor bathing water quality). The project aims to revolutionize the monitoring of Bathing Water Quality (BWQ) by addressing several deficiencies in data acquisition and communication found in current monitoring programs. The goal is to improve and accelerate the monitoring of bathing water quality. The current European Bathing Water Directive (BWD, Article 12) explicitly demands warning about present and predicted pollution events to prevent bathers from being exposed to contaminated water. In the EU the BWD proscribes monitoring of bathing waters with a new classification into: Poor, Sufficient, Good or Excellent. This classification is based on the enumeration faecal indicator bacteria (FIB), E. coli and enterococci. There is no fit-for-purpose solution that can provide microbiological water quality data in a time-frame that enables rapid decision-making and risk mitigation. Standard culture-based methods, although highly standardized are time-consuming and have a time to results ranging from 18 to 72 h, which makes same-day sampling and action impossible; in certain circumstances it could take up to 7 days for laboratory results, during which time users at risk. Low sampling frequency does not provide a representative picture of bathing water quality at sites that are frequently affected by pollution events and thus cannot provide public health protection.

UrbanSplash seeks to develop and implement a comprehensive solution that overcomes these limitations. By combining real-time, high-resolution data with rapid pollution event detection and source identification, the project will enable timely interventions, protect public health, and support the sustainable use of urban water bodies. Ultimately, this approach will unlock the full economic, recreational, and social value of these vital urban resources.

The goal of this PhD project is to developed machine learning ML models capable of providing real-time predictions of faecal indicator bacteria (FIB) at critical fixed points, using input from low-cost sensors (RQ1). In parallel, physics-informed neural network (PINN) models will be developed to generate spatial predictions and forecasts of FIB levels. The envisioned long-term solution relies on a limited number of strategically placed, low-cost sensors combined with advanced ML and PINN models. In addition to delivering real-time bathing water quality data, the system will include forecasting capabilities based on multiple integrated data streams. These will include real-time or near-re-

al-time sensor data, meteorological observations and forecasts, hydrometric information, and land-use data, among others (RQ2). This integrated modelling approach aims to enable timely, accurate, and cost-effective monitoring and forecasting of bathing water quality, improving public health protection and supporting sustainable urban water management (RQ3).

Responsibilities and (foreseen) tasks

- Conducting a comprehensive literature review: The student will conduct a comprehensive literature review on existing approaches to provide real-time, high-resolution BWQ data and spatial predictions.
- Researching and developing algorithms for fix-point real-time FIB predictions using data inputs from low-cost sensor; spatial FIB predictions and forecast.
- Helping to conduct real-world data collection experiments.
- Testing and validating proposed methods in chosen pilot places.
- Collaborating with other researchers and companies to align research goals with practical applications in bathing water quality analysis.
- Documenting and publishing research findings in peer-reviewed journals and present at conferences.
- Capacity to work both as an independent researcher and as part of an international team
- Capacity and willingness to aid in organizational tasks relevant to the project

Applicants should fulfil the following requirements:

- A master's degree in computer engineering or computer science, environmental engineering/environmental science
- A one page written a letter of interest outlining the candidates motivation for the position
- Excellent command of English
- Excellent programming skills (especially in Python)
- Previous course work in statistics and/or time-series analysis

The following experience is beneficial:

- Previous work experience in the field of artificial intelligence, IoT
- Previous experience in working with physics informed neural network-based models PINNs
- Previous work experience in the field of bacterial analysis

We offer:

- A fully funded 4 year PhD position researcher in different fields on the development of revolutionized monitoring of Bathing Water Quality (BWQ) by addressing several deficiencies in data acquisition and representation.
- Access to research infrastructure (test basin), sensors, data etc.
- Opportunities for visiting conferences, research stays and networking with globally leading universities and research centers.

Employment:

The position is at the School of Information Technology at Tallinn University of Technology. The expected duration of doctoral studies is four years. Following the standard practice in the School of Information Technology, 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 filled 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 Tallinn, Estonia.

For additional information, please contact

Main supervisor: Jeffrey Andrew Tuhtan (email: jeffrey.tuhtan@taltech.ee)

Co-supervisor: Uljana Reinsalu (email: uljana.reinsalu@taltech.ee)

Co-supervisor: Muhammad Intizar Ali (email: ali.intizar@dcu.ie)

To get more information or to apply online, visit https://taltech.glowbase.com/positions/971 or scan the the code on the left with your smartphone.

Retrofitting existing fossil fuel-fired CFB boiler with a high-temperature thermal energy storage

Summary

Retrofitting existing fossil-fired fluidized bed power plants with high-temperature thermal energy storage systems is a promising approach for the flexible CO2-free provision of electricity and heat. This however, requires the modification of the existing fossil-fired fluidized bed power plants to be identified. The best approach for identification of the necessary modifications is to use the numerical methods, including computational fluid dynamics (CFD) and semi-empirical dynamic models based on the 1.5-D approach. The main aim of the PhD project is to develop different numerical models and validate these models using experimental data. The PhD project is supervised by Senior Researcher Dmitri Nešumajev and co-supervised by Professor Oliver Järvik (Department of Energy Technology, Tallinn University of Technology, Estonia).

Research field:	Chemical, materials and energy technology
Supervisors:	Dmitri Nešumajev Dr. Oliver Järvik
Availability:	This position is available.
Offered by:	School of Engineering Department of Energy Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

A promising approach for redeployment existing and decommissioned fluidized-bed combustion (CFBC) power units operating on solid fossil fuels – but which have not yet reached the end of their operational lifetime – is their retrofit into high-temperature thermal energy storage (HT-TES) systems. One of the key objectives is to evaluate the efficiency and necessary modifications of existing circulating fluidized bed (CFB) boilers and units, as the heat source will undergo a fundamental change. According to this concept, the heat source will be hot air supplied from a high-temperature thermal energy storage system. The aim of this PhD project is to analyse the performance of circulating fluidized bed (CFB) systems using numerical methods, including computational fluid dynamics (CFD) and semi-empirical dynamic models based on the 1.5-D approach, across different scales.

Key responsibilities and (foreseen) tasks

- Numerical simulation of two-phase flow in CFB systems at different scales using CFD codes.
- Develop a dynamic process simulation model of a circulating fluidized bed (CFB) power unit, incorporating all major components, using a semi-empirical 1.5D modelling approach.
- Contributing to analysing, publishing and dissemination of the results of the study as a member of the research team.
- Publication of research results in high-impact journals and presentation at international conferences.
- Supervision of BSc and MSc students.

Applicants should fulfil the following requirements:

- A master’s degree in thermal engineering, chemical engineering, mechanical engineering or other engineering subjects related to the PhD project topic.
- A clear interest in the topic of the position.
- Proficient in modelling and simulations of energy/chemical/mechanical processes using CFD.
- Strong written and verbal communication skills in English.
- Capacity to work both as an independent researcher and as part of the research team.
- Capacity and willingness to provide assistance in organizational tasks relevant to the project and teaching and/or supervision activities.

- Programming skills.

Applicants should submit:

- A cover letter outlining the motivation and relevant experience.
- A research plan for the topic, including the overall research and data collection strategy.
- Possible titles of at least three articles to be published on the project topic.
- Previous work (e.g. thesis/dissertion, scientific articles, conference communications) that demonstrate proficiency in the PhD topic.

We offer:

- 4-year PhD position in the Department of Energy Technology in Tallinn University of Technology.
- A stimulating research environment with access to state-of-the-art facilities.
- Opportunities for professional development and networking.
- Full-time paid employment with competitive salary and benefits.
- Support for conference travel and research dissemination.

About the department

The Department of Energy Technology is a research-focused department with robust connections to the Estonian chemical industry as well as the heat and power sectors. Our areas of expertise encompass chemical engineering, environmental engineering, thermal engineering, thermal power plants, heat economy, and thermal energy.

Additional information

For further information, please contact Dr. Dmitri Nešumajev (dmitri.nesumajev@taltech.ee) or Prof. Oliver Järvik (oliver.jarvik@taltech.ee).

To get more information or to apply online, visit https://taltech.glowbase.com/positions/970 or scan the the code on the left with your smartphone.

Development of binary and ternary Sb-chalcogenide based thin film solar cells for indoor PV applications

Summary

The R&D portfolio of the research group focuses on the development of emerging inorganic chalcogenide thin-film photovoltaic (PV) technologies for specialty PV markets, including building-integrated photovoltaics (BIPV), product-integrated photovoltaics (PIPV), PV-powered IoT applications, and future green responsible optoelectronics. This PhD research topic focuses on indoor PV applications, as one of the fastest growing PV market among non-conventional PV markets. This PhD research topic explores the effect of Ag concentration in the precursor solution, from the doping side (Ag-Sb2S3) to the ternary compound (AgSbS2) formation, to the formed thin film properties. Sb2S3 is an emerging inorganic PV material that have drawn much interest in recent years due to its excellent stability, suitable bandgap (Eg=1.7 eV), relatively high absorption coefficient (ca104 cm-1 at 450 nm), earth abundance, environmentally benign characteristics and low-cost. Due to its unique properties Sb2S3 could be applied in semi-transparent, tandem, and indoor solar cells. This research topic foresees characterisation of material and device properties at TalTech and at research group collaboration partners (e.g., Liverpool University, or Czech Technical University or University of Verona or Helmholtz Centrum Berlin). We offer an opportunity to be part of the COST action CA21148 - Research and International Networking on Emerging Inorganic Chalcogenides for Photovoltaics, RENEW-PV, https://renewpv.eu/

Research field:	Chemical, materials and energy technology
Supervisors:	Prof. Dr. Ilona Oja Acik Prof. Dr. Malle Krunks
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

We have established baseline technology platform based on Sb-chalcogenide thin film solar cell fabrication by ultrasonic spray pyrolysis (USP) technology and were the first to demonstrate semi-transparent Sb2S3 solar cell fabricated by USP. In the current stage of the development, Sb2S3 thin film solar cells show efficiency of ca 7.5 % under 1 Sun and exceed 15% efficiency under a 5000K LED source. The key for further increasing the efficiency of the solar cells relays on optimization of the optoelectronic properties of Sb2S3 absorber layer.

In the frame of this research topic, we will explore the effect of Ag concentration in the precursor solution, from the doping side to the ternary compound formation, to the formed Sb-chalcogenide binary and ternary thin film properties. In this PhD thesis, antimony chalcogenide and metal oxide thin films will be fabricated by robust, resource saving, and easily scalable method such as ultrasonic spray pyrolysis. Spray deposition has great potential to become front-line technology for rapid, cost-effective, large-area and high yield mass production of solar cell.

The project will involve identification of suitable precursors for USP deposition, synthesis of precursors for Ag- doped Sb2S3 and AgSbS2 this film fabrication, fabrication of thin films and solar cells, characterization of materials and devices.

Responsibilities and (foreseen) tasks

- Identification of suitable USP precursors, incl. component complexation, solubility, and thermal decomposition profile by means of TG/DTG/DTA methods.
- Developing the fabrication protocol and engineering the device quality properties of Ag-Sb2S3 and AgSbS2 thin films deposited by chemical spray pyrolysis method.
- Development and optimization of solar cells and its constituent layers (absorber layer, electron transport layer, hole transport layer) by chemical deposition methods.

- Characterisation of material and device properties at home institution and at research group collaboration partners (COST action CA21148, RENEW-PV partners)
- Analysis of the research data, preparing reports, oral and/or poster presentations at conferences, publishing research articles.

Applicants should fulfil the following requirements:

The successful applicant will hold a master's degree in Chemistry, Materials Science, Physics or a related field. Previous research experience in thin film technologies and material characterization will be an advantage. Excellent team working attitude and communication skills in English (both written and oral) are an essential requirement. Competences in using data analysis and graphing software: Microsoft Office (Word, Excel and PowerPoint), Origin.

The candidate should submit a research plan for the topic, describing the understanding of the current state of the art of Sb2S3 thin films and solar cells development and propose the research activities plan for the Ag- doping of Sb2S3 and AgSb2S3 ternary compound development.

We offer:

- 4-year PhD position in one of the most internationalized and leading PV research groups in Estonia
- The chance to do high-level research in one of the most booming emerging photovoltaic field.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centres in the fields of material science.
- Opportunity to be part of the COST action CA21148 - Research and International Networking on Emerging Inorganic Chalcogenides for Photovoltaics, RENEW-PV, https://renewpv.eu/

About the research group

The main research topic of the Laboratory for Thin Film Energy Materials is the development of metal oxide and sulphide thin films and nanostructured materials for solar cells, electronics and environmental applications by chemical technologies such as spray pyrolysis, chemical bath deposition and sol-gel. The technologies that are developed in the laboratory are simple, inexpensive, and easily transferrable to industrial scale. A new type of ultra-thin absorber based solar cell design and its component layers were developed in the laboratory and secured by several international patents. Over the last 25 years the main topics in the research group has been development of emerging thin film photovoltaic materials such as CuInS2, Sb2S3, Sb2Se3, Sb2(S,Se)3 and Sb-Bi alloys, and the fabrication of solar cells based on them. The research group has extensive knowledge on development of CdTe thin film solar cells by close spaced sublimation. The laboratory staff is coordinating or being involved in several international and national research projects and are the grant holders of the COST action project RENEW-PV. RENEW-PV is a joint network of more than 200 researchers and industry partners from more than 30 countries worldwide developing emerging inorganic PV materials and devices.

(Additional information)

For further information, please contact Prof Ilona Oja Acik Ilona.oja@taltech.ee, Prof Malle Krunks malle.krunks@taltech.ee or visit https://taltech.ee/en/laboratory-thin-film-energy-materials

To get more information or to apply online, visit https://taltech.glowbase.com/positions/969 or scan the the code on the left with your smartphone.

Development of an Energy-Efficient, Sustainable Low Temperature Wood Densification Process for Enhanced Material Performance

Summary

The overall goal of the project is to improve the mechanical and physical characteristics of low-quality hardwood species by the densification process, thereby increasing their value. Sustainable chemical modifications and energy efficient low temperature methods will be investigated for densification process and properties will be evaluated. As a result, more low-quality underutilized wood species will be used to create innovative engineered wood products. The project addresses the following research questions: What are the suitable green chemistry approaches for wood densification? How low temperatures can be used for wood densification? Does all the wood species behave the same way in densification process? What are the effects of dedication to wood structure and properties? How to enhance the wood densification process for more efficiency?

Research field:	Chemical, materials and energy technology
Supervisors:	Dr. Heikko Kallakas Triinu Poltimäe
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

This PhD project focuses green chemistry pretreatment of wood before densification to optimize the densification process and lower the densification temperature. The aim is to develop sustainable wood densification method for underutilized wood species and evaluate densified wood properties through dimensional stability, surface properties, mechanical properties and bonding quality.

The project will address the following key areas:

1. Green Chemistry Pretreatment – Developing environmentally friendly pretreatment methods to enhance the wood densification process.
2. Optimization of Densification Process – Reducing the densification temperature while maintaining or improving efficiency.
3. Sustainable Utilization of Underutilized Wood Species – Expanding the potential of lesser-used wood species through densification.
4. Dimensional Stability – Evaluating how well the densified wood resists swelling and shrinking, and spring back.
5. Surface Properties – Investigating changes in texture, roughness, and wettability after densification.
6. Mechanical Properties – Assessing improvements in strength, hardness, and durability of densified wood.
7. Bonding Quality – Analyzing the adhesion performance of densified wood for veneer-based procuts.

The outcomes of this research are expected to valorize underutilized wood species through energy efficient densification process. By providing environmentally friendly densification process, this project aims to drive innovation in the field of veneer-based products and contribute to the sustainable materials industry.

Responsibilities and (foreseen) tasks

- Compile an analytical framework for examining experimental approaches to analyze green chemistry wood pretreatment methods before densification.
- Study and test the low temperature densification process technologies.
- Test and characterize the structure, moisture resistance, dimensional stability, surface and properties.
- Study and characterize the bonding quality of densified wood suitable for veneer-based products.

- Writing and publishing scientific papers for the project results in peer-reviewed journals and conference presentations.
- Contribute to the organization of research and practitioner workshops where project findings are presented

Applicants should fulfil the following requirements:

- Master´s degree in the field of wood technology, wood science, materials technology and science, wood chemistry, forestry.
- Familiar with methods, procedures and safety of wood chemistry, wood technology or composite material technology, materials technology and science which allows to work independently
- Excellent communication skills (written and spoken) in English
- A clear interest in the topic of the position
- 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 assists in organizational tasks relevant to the project

(The following experience is beneficial:)

- Previous experience in wood technology or materials technology and science would be highly appreciated.
- Previous experience in the most relevant characterization methods (surface roughness, contact angle measurement, tensile and flexural tests) is also expected.
- Previous knowledge about durability testing of the materials.
- Previous knowledge of material structural characterization.
- Working knowledge of data analysis and statistics.
- Data visualization and analysis in R

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading engineering and technology research centers in Estonia.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of wood and composite materials technology and wood chemistry.

About the department

Department of Materials and Environmental Technology is an interdisciplinary research center of Tallinn University of Technology that focuses to lead the high-level, internationally recognized teaching, research and development in Estonia in the field of materials and environmental technology.

(Additional information)

For further information, please contact Prof. Heikko Kallakas heikko.kallakas@taltech.ee or visit https://taltech.ee/en/department-materials-and-environmental-technology

To get more information or to apply online, visit https://taltech.glowbase.com/positions/968 or scan the the code on the left with your smartphone.

Non-Thermal Plasma Treatment for Safe Agricultural Reuse of Municipal Wastewater and Urine: Contaminant Removal and Resource Recovery

Summary

This PhD project aims to develop a sustainable, energy-efficient treatment process for removing contaminants of emerging concern (CECs) from municipal wastewater and urine for safe agricultural reuse. The research focuses on gas-phase pulsed corona discharge (PCD), a non-thermal plasma technology with superior energy efficiency compared to conventional advanced oxidation processes. Key objectives include optimizing selective CECs degradation, achieving effective bacterial control, and assessing the environmental and economic feasibility of the process. The position offers the opportunity to work on innovative plasma-based water treatment technologies within a wider initiative promoting sustainable water reuse and circular nutrient management in agriculture.

Research field:	Chemical, materials and energy technology
Supervisors:	Niina Dulova Sergei Preis
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The presence of contaminants of emerging concern (CECs) such as pharmaceuticals, personal care products, and pesticides in wastewater poses growing environmental and health risks. These compounds, often toxic, carcinogenic, and endocrine-disrupting, resist removal by conventional wastewater treatment methods. This issue obstructs safe reuse of nutrient-rich waste streams like municipal wastewater and source-separated urine in agriculture - a practice essential for advancing sustainable nutrient and water recycling. The European Commission highlights the dual challenges of water scarcity and priority pharmaceuticals control, calling for affordable, effective tertiary treatment solutions. Existing chemical, biological, and physical methods have yet to provide a practical answer, particularly regarding pharmaceutical residues and microbial safety in treated wastewaters intended for farmland application.

The doctoral project aims to develop an energy-efficient sustainable treatment process based on gas-phase pulsed corona discharge (PCD), a non-thermal plasma technology. The technology demonstrated superior energy efficiency among advanced oxidation processes (AOPs) through the generation of highly reactive short-living oxidants at the gas-liquid interface. The specific objectives include:

- achieving selective energy-efficient PCD-based degradation of priority pharmaceuticals in urine and municipal wastewater;
- ensuring bacterial inactivation with simultaneous removal of priority pharmaceuticals from municipal wastewater for safe agricultural reuse;
- environmental sustainability assessment of the proposed treatment process.

The doctoral research project will deliver a validated PCD treatment protocol capable of efficient removal of pharmaceuticals, CECs, and bacteria from complex aqueous matrices. The research will address key questions regarding the optimization of operational parameters for selective oxidation, the mechanisms of pollutant degradation via short-living oxidants, and the environmental sustainability of the technology at scale. The outcomes are expected to support the integration of sustainable, cost-effective treatment solutions into wastewater and nutrient management systems, promoting circular economy principles in the sector.

Responsibilities and (foreseen) tasks

- Planning and conducting treatment experiments with municipal wastewater and source-separated urine.

- Performing analytical characterization of wastewater and urine samples.
- Collecting foreground and background data for environmental sustainability assessments using the Life Cycle Assessment (LCA) approach.
- Analyzing experimental and assessment data, and preparing scientific publications independently and in collaboration with co-authors.

Applicants should fulfil the following requirements:

- A Master's degree (or equivalent) in a relevant field such as environmental engineering, chemical engineering, materials technology, or a related discipline.
- A strong interest in the application of advanced oxidation processes (AOPs) to the treatment of water-based matrices.
- Proven writing, analytical, and data interpretation skills.
- Very good/Excellent proficiency in spoken and written English.
- The ability to work both independently and collaboratively within a research team.

The following experience is beneficial:

- Prior experience in application of advanced oxidation processes (AOPs).
- Previous experience in environmental LCA (E-LCA) and carbon footprint calculations.
- Very good to excellent command of the Estonian language.

We offer:

- A fully funded 4-year PhD position focused on the application of advanced oxidation processes (AOPs) for municipal wastewater and source-separated urine treatment, with the aim of enabling reuse and nutrient recovery.
- The opportunity to work in an interdisciplinary research environment, integrating engineering, analytical chemistry, and environmental sustainability assessment.
- Opportunities to participate in conferences, undertake research internships and networking with partner universities and research centers in the field of environmental engineering and sustainable technology.

About the department

The Department of Materials and Environmental Technology is a national leader in high-level, internationally recognized teaching, research, and development in materials and environmental technology. Within the Department, the Laboratory of Environmental Technology (LET) focuses on applied sustainability and environmental research, addressing key topics such as:

- Water and wastewater treatment
- Contaminated soil remediation
- Air pollution abatement
- Degradation and removal of contaminants of emerging concern in aqueous matrices
- Valorization, processing, and recycling of solid waste
- Life cycle assessment and carbon footprint calculation

LET has extensive experience in managing and participating in national and international projects, including BSR/Central Baltic INTERREG, ERA-MIN, Erasmus+, and LIFE programs, with a strong emphasis on advanced treatment of environmental matrices, sustainable waste management, and circular economy.

Additional information

For further information, please contact: Dr. Niina Dulova (e-mail: niina.dulova@taltech.ee) and Prof. Sergei Preis (e-mail: sergei.preis@taltech.ee)

To get more information or to apply online, visit https://taltech.glowbase.com/positions/967 or scan the the code on the left with your smartphone.

Mobile Sensing Systems for Urban Infrastructure and Environment Monitoring

Summary

The PhD candidate will participate (together with the supervisors and project team) in the research and design of a prototype of a next-generation mobile sensing platform tailored for environmental monitoring in urban areas. The platform will integrate multi-modal sensors, on-device signal processing, and lightweight anomaly detection algorithms for real-time operation on mobile assets (e.g., public transport vehicles or garbage trucks). The final system will seamlessly integrate into the digital infrastructure supporting smart city data governance.

Research field:	Information and communication technology
Supervisors:	Olev Märtens Jaanus Kaugerand
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Software Science
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Background and Motivation

This doctoral project is supported by the CitySense project. A modular, mobile urban sensing network deployed on public service vehicle fleets. The sensor platform supports real-time monitoring of road surface conditions, traffic infrastructure, and urban environmental parameters such as air quality, city noise or thermal (heat islands) anomalies. The system emphasizes sensor modularity, data- and AI-driven analytics, and interoperability to create actionable insights for urban planning.

Cities across Europe are implementing digital twin systems and smart infrastructures to improve urban resilience. Mobile sensing provides high-resolution, real-time data that complements static infrastructure sensors, enabling dynamic monitoring of pollution, noise or environmental events.

Research Tasks

Edge computing platform:

- Research and design of the modular, mobile sensing platform suited for deployment on moving platforms under real-world urban conditions.
- Integrate multi-modal sensor suites (e.g., CO, temperature, sound, vibration, GNSS, camera, IMU).
- Address environmental resilience, power optimization, and sensor calibration procedures.

Edge level Signal Processing and Anomaly detection:

- Develop embedded software for real-time data acquisition, preprocessing, and compression.
- Implement signal processing routines (e.g., FFT, STFT, filtering, noise reduction) optimized for edge hardware.
- Fuse multi-modal sensor data from both local and distributed sensors (e.g., CO, temperature, sound, vibration, GNSS, camera, IMU) to enhance detection of events like road damage, pollution spikes, abnormal noise levels or heat islands.
- Important research and development challenge could be providing all sensor data with accurate time and location stamps also at the high speed of the mobile platform.
- Compare and optimize edge-based anomaly detection against cloud-based processing approaches.

Field Testing and Validation

- Collaborate with the City of Tallinn for real-world deployment and system testing.
- Benchmark the mobile system’s outputs against static infrastructure and manual ground truth datasets.

- Perform validation studies in Tallinn city with a focus on robustness, usability, and operational effectiveness.

Applicants should fulfil the following requirements:

- A master’s degree in computer science, data science or engineering, with a focus on edge computing.
- Interest in Edge computing hardware, electronics and sensors.
- Interest in sensor data analysis and computational modelling.
- Very good proficiency in spoken and written English language.
- Basic skills or willingness to learn Estonian language.
- Willingness to travel to international and domestic project meetings.

The following experience is beneficial:

- Proficiency in Python, MATLAB, R, or other languages for data processing and statistical analysis.
- Basic knowledge of web/cloud platforms for sensor data visualization or dashboards
- Interest in sustainability, smart cities, and urban systems.
- Demonstrated ability to work independently and collaboratively in interdisciplinary environments.
- Proficiency in scientific communication and writing.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/964 or scan the the code on the left with your smartphone.

Materials and Device modelling in Emerging Inorganic Chalcogenides for Photovoltaics

Summary

Defects have a strong impact on the performance of thin film absorber materials and solar cells. We are looking for a candidate to work on the theoretical modeling of materials (Sb2Se3, Sb2S3, Bi2S3, and their related alloys) and solar cell devices, with the goal of supporting, guiding, and accelerating experimental development. This work will require the use of ab initio density functional theory (DFT) techniques, as well as drift-diffusion models for simulating charge transport in thin-film solar cell structures, along with other relevant modeling approaches. As the research group currently lacks dedicated expertise in theoretical modeling, the successful candidate will become the in-house expert in this area, offering a unique opportunity to establish an independent research platform while working closely with the experimental team and gaining hands-on experience with a range of physical and chemical thin-film deposition techniques. The candidate will join a diverse and collaborative research environment, with the opportunity to be actively involved in the COST Action CA21148 – ReNewPV. Through this network—and specifically via the dedicated Materials and Device Modeling Working Group in ReNewPV—we will ensure strong collaborative ties (including potential joint supervision) between the Laboratory for Thin Film Energy Materials at TalTech (Tallinn, Estonia), the Photovoltaic Group (Prof. Dr. Zacharie Jehl Li-Kao) at the Department of Electronic Engineering, Polytechnic University of Catalonia (UPC – BarcelonaTech), and the group of Prof. Keith McKenna at the University of York, UK, who also leads Working Group 2 in ReNewPV. The successful applicant will have a unique opportunity to conduct research visits (Short-Term Scientific Missions) at UPC, the University of York, and other collaborating institutions.

Research field:	Chemical, materials and energy technology
Supervisor:	Dr. Nicolae Spalatu
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Eligibility / Qualifications- The research group *Laboratory for Thin Film Energy Materials* at TalTech is seeking excellent and highly motivated candidates who hold, or are about to complete, a Master's degree in Physics, with a strong background in Materials Science, Solid-State Physics, and Computational Physics. Previous experience in thin-film and solar cell characterization, as well as materials and device modeling, will be considered a big advantage. An excellent team-working attitude and strong communication skills in English (both written and oral) are essential requirements. Competence in data analysis and graphing software—such as Microsoft Office (Word, Excel, and PowerPoint) and Origin—is also expected.

Research Profile of the Group - The R&D portfolio of the research group focuses on the development of emerging inorganic chalcogenide thin-film photovoltaic (PV) technologies for specialty PV markets, including building-integrated photovoltaics (BIPV), product-integrated photovoltaics (PIPV), PV-powered IoT applications, and future green responsible optoelectronics. During the last years, the group's primary research has centered on the development of novel thin-film PV materials and solar cells based on, Sb_2S_3, Sb_2Se_3, $Sb_2(S,Se)_3$, Bi_2S_3 and their related solid solutions/alloys, using both physical vapor deposition (PVD) and chemical methods. These include close-spaced sublimation, vapor transport deposition, spray pyrolysis, chemical bath deposition, and sol-gel processing. The technologies developed in the laboratory are designed to be simple, cost-effective, and readily scalable for industrial implementation.

The laboratory team actively coordinates and participates in several international and national research projects. They are also the Grant Holder institution for the COST Action *RENEW-PV*—a global network of over 400 researchers and industrial partners from more than 50 countries, dedicated to the advancement of emerging inorganic PV materials and devices, https://renewpv.eu/.

Responsibilities and (foreseen) tasks

- Identify problematic intrinsic and extrinsic defects in device layers, giving relevant information for the design of defect passivation strategies for device performance optimization.
- Provide analysis of performance limiting effects at interfaces including mitigation strategies.
- Perform device level simulations based on simulated and experimentally determined materials properties to predict device performance optimisation routes and identify bottlenecks.
- Analysis of the research data, preparing reports, oral and/or poster presentations at conferences, publishing research articles.

How to Apply- Applications should include a motivation letter, the contact details of two references, a full curriculum vitae (CV), and copies of relevant diplomas with transcripts of grades. Applicants should also submit a brief research plan related to the topic, demonstrating their understanding of the current state of the art in the proposed field and outlining a proposed plan of research activities.

Main supervisor: Prof. Nicolae Spalatu

Co-supervisor: Prof. Zacharie Victor Samuel Nathanaël Jehl

We offer:

- 4-year PhD position in one of the most internationalized and leading PV research groups in Estonia
- The chance to do high-level research in one of the most booming emerging photovoltaic field.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centres in the fields of material science.
- Opportunity to be part of the COST action CA21148 - Research and International Networking on Emerging Inorganic Chalcogenides for Photovoltaics, RENEW-PV, https://renewpv.eu/

Contact – For further information, please contact Prof. Nicolae Spalatu nicolae.spalatu@taltech.ee and Prof. Ilona Oja Acik Ilona.oja@taltech.ee, or visit https://taltech.ee/en/laboratory-thin-film-energy-materials

To get more information or to apply online, visit https://taltech.glowbase.com/positions/962 or scan the the code on the left with your smartphone.

Assimilation of satellite and tide gauge sea level measurements into forecasting numerical models and reanalysis products

Summary

The Baltic Sea is a semi-enclosed sea whose water levels are influenced by a mix of global and regional factors, making it an ideal natural laboratory for sea level studies. This PhD project aims to develop and test methods for assimilating satellite altimetry and tide gauge sea level data into state-of-the-art ocean models, with a focus on the Baltic Sea region. The overall goal is to improve the accuracy of sea level forecasts and reanalysis by optimally merging observational data with numerical simulations. The candidate will work in an exciting international research context that addresses both fundamental science (sea level variability and climate change impacts) and practical needs (better storm surge and sea level rise predictions). The position offers extensive collaboration opportunities – including potential internships at leading European marine forecasting centers – and a chance to contribute to the Copernicus Marine Service, the European operational ocean monitoring program. This is a fully-funded 4-year PhD where the student will benefit from a multidisciplinary environment, combining oceanography, data science, and AI, while engaging with top researchers across Europe.

Research field:	Earth sciences
Supervisors:	Prof. Dr. Urmas Raudsepp Priidik Lagemaa
Availability:	This position is available.
Offered by:	School of Science Department of Marine Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

In the Baltic Sea, sea level variations are of great scientific and societal importance, ranging from short-term storm surges to long-term changes due to climate warming. Sea level change is a major concern under ongoing climate change, with rising oceans leading to increased flooding and extreme events globally. The Baltic Sea, being nearly tideless and semi-enclosed, experiences water level

fluctuations dominated by weather, hydrological inflows, and internal dynamics rather than tides. Accurate monitoring and forecasting of Baltic sea level is vital for coastal communities and infrastructure. However, achieving accuracy is challenging because the Baltic's sea level responds to a complex mix of processes and its narrow straits and coastline make coastal measurements and model predictions sometimes diverge.

This PhD project addresses these challenges by improving how observational data are merged with numerical models to produce the best possible representation of the Baltic Sea's sea level at any given time. Data assimilation – the process of combining observations with model output to obtain an optimal estimate of the ocean state – lies at the heart of this research. In operational forecasting, data assimilation takes the latest measurements and a short-range model forecast, and blends them to produce the best estimate of current conditions. This project will explore how to assimilate two key sources of sea level observations into Baltic Sea models: satellite altimetry (which provides wide-area sea level measurements from space) and coastal tide gauges (which provide continuous high-precision sea level records at specific locations). Each data source has strengths and limitations – satellite altimeters offer broad coverage but lower frequency (and historically had larger uncertainty near the coast), while tide gauges give reliable local sea level but at sparse points and relative to local vertical datums. A core question is how to effectively bring these datasets together in a model framework to capitalize on their synergy. Recent studies have shown that using both altimetry and tide-gauge data together can yield significantly better sea level analyses than either data source alone.

This PhD will build on such insights, aiming to develop assimilation techniques that harness the complementary nature of satellite and in situ sea level observations to improve model skill. Numerical modeling and assimilation techniques: The student will work with advanced general circulation models (e.g.

NEMO-based models or similar) configured for the Baltic Sea, which simulate the ocean's behavior under various forces (winds, pressure, inflows, etc.). The research involves implementing and testing different data assimilation methodologies within these models. We will investigate both traditional and novel assimilation schemes. Traditional techniques include variational methods (like 3DVAR/4DVAR, which adjust the model state by minimizing differences from observations over time windows) and

ensemble-based methods (like the Ensemble Kalman Filter or simpler Ensemble Optimal Interpolation, which use an ensemble of model states to estimate flow-dependent error statistics). Each approach comes with advantages and trade-offs: for instance, ensemble methods can capture the actual day-to-day uncertainty structure and have been shown to markedly improve forecast skill by leveraging

flow-dependent error covariances. In one study, an ensemble scheme reduced forecast errors by over 40% compared to a static 3DVAR method. Variational methods, on the other hand, are deterministic and can assimilate data smoothly in time, but may require more complex adjoint models and can be less adaptive to rapidly changing conditions.

The Baltic Sea's unique dynamics (e.g. narrow straits, occasional seiches, strong wind setup events) provide a testing ground for these methods. The PhD research will pose questions such as: which assimilation technique (or hybrid thereof) best handles Baltic Sea level features? How do we deal with biases in models or data – for example, the offset between model sea level "zero" and real-world vertical datum used by tide gauges? By systematically comparing assimilation approaches (e.g. testing a 3DVAR vs an Ensemble Kalman approach in identical conditions), the project seeks to elucidate the strengths and limitations of different techniques in the Baltic Sea context. Integration of AI methods: A cutting-edge component of the project is the application of AI and machine learning to augment the data assimilation workflow. AI is increasingly recognized as a powerful tool in Earth system science, capable of uncovering complex patterns and even accelerating parts of the modeling process.

In this PhD, we will explore how machine learning can enhance sea level data assimilation in two possible ways: (1) Bias correction and model error learning, and (2) Hybrid assimilation approaches. For bias correction, recent research in our department has demonstrated the use of deep learning to identify and quantify biases in a Baltic Sea model by comparing it with tide gauge and altimeter data. In fact, a multivariate deep neural network (inspired by WaveNet architecture) was able to learn the model's systematic errors and reduce sea level prediction error to about 4 cm (RMSE) when validated against satellite altimetry, achieving near-perfect correlation (0.98) with independent tide gauge measurements.

This novel approach effectively integrated model outputs with observations using AI, pointing to a new way to correct model forecasts and align them with absolute sea level reference frames. Building on such findings, the PhD student might train AI models (e.g. deep neural networks or other ML algorithms) on historical model-observation mismatches to predict and remove biases or to infer unobserved variables that improve assimilation. The second avenue is using AI as part of the assimilation cycle itself. For example, recent work in ocean forecasting has shown that convolutional neural networks (CNNs) can be trained to replicate the actions of a data assimilation update. In a Gulf of Mexico study, a CNN learned from an existing assimilation system's outputs to directly compute corrections to the model's sea surface height and temperature, effectively emulating the data assimilation step and speeding up the process. We will investigate whether a similar concept can be applied for the Baltic Sea: can an AI system learn from many assimilation cycles how to inject sea level observations into the model state, potentially providing a fast approximation to traditional assimilation algorithms? Such AI-assisted or hybrid methods could enhance assimilation by either expediting computations or by capturing nonlinear relationships that classical methods might miss. The outcome would not replace traditional data assimilation but rather complement it – for instance, an AI model could provide an initial guess or bias correction that makes the assimilation of altimetry and tide gauges more effective.

Research significance and context: Improving sea level forecasts and reanalysis in the Baltic has both regional and broader implications. Regionally, better short-term sea level forecasts (e.g. storm surge warnings) will directly benefit coastal hazard management in Baltic countries. On longer timescales, an improved Baltic Sea reanalysis (a historical reconstruction of the ocean state) contributes to understanding climate variability and trends, providing a baseline for detecting changes in mean sea level and extreme events. Importantly, this PhD project is aligned with and will contribute to the Copernicus Marine Service Baltic Sea forecasting activities, which currently provide operational analyses and forecasts for the Baltic Sea. The Copernicus Marine Environment Monitoring Service is Europe's flagship program for delivering

regular, systematic information on the marine state. By focusing on data assimilation of sea level – a parameter of high relevance to Copernicus – the research will feed into the next generation of Baltic Sea operational models. For example, if successful, the techniques developed could be adopted by national agencies or Copernicus partners to enhance their forecasting systems. The candidate will thus be working on a project with real-world impact, at the intersection of academic research and operational oceanography. The project's international collaborations (with part-

ners in Europe such as marine research institutes and forecasting centers) will ensure that the developed methods are tested on real datasets and possibly integrated into pre-operational trials. The student will have opportunities to present findings in major conferences and to interact with the wider ocean modeling and satellite observation community. In summary, this PhD research addresses a pressing scientific and operational challenge – how to optimally merge multi-source sea level observations into numerical models – by combining rigorous oceanographic modeling with innovative data science (AI) techniques. The knowledge gained will advance our ability to monitor and predict sea level changes in the Baltic Sea, contributing to better climate resilience and marine services in the region and beyond.

Research Questions:

How can satellite and tide gauge sea level data be effectively assimilated into numerical forecasting models? – Exploring methods to integrate these observations, dealing with differences in data coverage, frequency, and reference levels, to improve model accuracy.

What are the comparative strengths and limitations of different data assimilation techniques in the Baltic Sea context? – Evaluating approaches (variational, ensemble, hybrid methods) for Baltic Sea level forecasting, and understanding which techniques perform best under various scenarios (e.g. storm surges, seasonal variations).

How can AI methods enhance traditional data assimilation workflows for sea level prediction? – Investigating the use of machine learning to complement or improve assimilation, such as by correcting model biases, accelerating the assimilation process, or uncovering nonlinear relationships in the sea level data that can refine forecasts.

Responsibilities and (foreseen) tasks

Data analysis: Collect, process, and analyze sea level observations, including satellite altimetry data (from missions like Sentinel-3, etc.) and long-term tide gauge records around the Baltic Sea. Ensure quality control and prepare these datasets for assimilation experiments.

Learn and apply data assimilation methods: Acquire a strong working knowledge of data assimilation techniques relevant to oceanography. Implement assimilation algorithms (e.g. optimal interpolation, Ensemble Kalman Filter, 3DVAR) within a Baltic Sea modeling framework, with guidance from supervisors and collaborators.

Numerical modeling: Use general circulation models for the Baltic Sea to run simulations and forecasting experiments. This includes setting up model scenarios for hindcasts (reanalysis) and forecasts, and modifying the model configuration as needed for assimilation runs.

Develop AI-enhanced techniques: Incorporate artificial intelligence or machine learning components into the workflow. For example, develop a prototype neural network to predict model bias corrections or to emulate the data assimilation update step, and test its impact on forecast skill.

Collaborative research: Work closely with European project partners and marine institutions. This may involve short research visits or remote collaboration with groups such as national oceanographic agencies or the Copernicus Marine Service team to exchange knowledge and co-develop tools.

Dissemination: Present research progress and results at international conferences and workshops. Contribute to writing scientific publications in peer-reviewed journals, showcasing findings on Baltic sea level data assimilation and the novel AI applications.

Internships: Participate in short- and mid-term internships at leading marine forecasting centers (e.g., national institutes or operational centers in Europe). During these internships, the candidate will gain hands-on experience with operational oceanography systems and ensure the research is aligned with practical needs.

Reporting and academic duties: Prepare progress reports and a doctoral thesis documenting the research. Engage with the Department of Marine Systems' academic community, including attending doctoral seminars, and possibly assisting in some teaching or mentoring of undergraduate projects related to the research topic.

Applicants should fulfil the following requirements:

Educational Background: A Master's degree (or equivalent) in a relevant field – e.g. oceanography, physics, applied mathematics, data science, or Earth system sciences. A solid foundational knowledge in dynamics of fluid or Earth systems is expected.

Relevant Skills: Background in one or more of the following areas is highly beneficial: **Earth system or ocean models** (experience with numerical modeling, CFD, or ocean circulation models), **big data analysis** (handling and analyzing large geophysical datasets), or **AI/machine learning for environmental data** (experience with Python/R, neural networks, etc. applied to scientific data).

Programming and Tools: Strong analytical and programming skills are required. Proficiency in programming languages or environments used in modeling (such as Python, MATLAB, or Fortran/C++ for model code) and data analysis is important. Familiarity with Linux-based HPC environments, version control (git), and data formats like NetCDF will be useful.

Analytical Aptitude: Ability to independently solve problems, statistically analyze results, and iterate on experimental setups. An interest in both the theoretical and practical aspects of data assimilation is key.

Language: Good command of written and spoken English is required, as it's the working language of the research group and collaborators.

Soft Skills: The ideal candidate is **team-oriented** and willing to collaborate and share knowledge, while also capable of independent research and self-motivation. Good communication skills are expected for interaction with the international team and for presenting work. A proactive attitude towards learning new methods (be it an algorithm or an AI technique) and integrating them into the project is highly appreciated.

We offer:

- **Four-year funded PhD position:** Full-time employment with a competitive stipend/study allowance, health insurance, and other benefits as per Tallinn University of Technology (TalTech) regulations. The position is funded as part of a research project, so the student can devote themselves entirely to research activities.
- **Top-tier research environment:** The student will join the Department of Marine Systems at TalTech, which has a strong track record in Baltic Sea research and operational oceanography. The group is involved in multiple international projects, providing access to a network of experts in ocean modeling and remote sensing.
- **Collaboration with leading European centers:** The project involves collaboration with some of Europe's top oceanographic institutions (including partners contributing to the Copernicus Marine Service). The PhD candidate will have opportunities to work with and learn from these experts, gaining exposure to the European marine research landscape.
- **International internships and visits:** We encourage the PhD student to undertake research visits or internships at renowned marine forecasting and research centers (for example, national marine institutes or Mercator Ocean International, etc.). These exchanges will provide practical training in an operational setting and foster networking with professionals in the field.
- **Conferences and training:** Funding is available for the PhD student to attend major international conferences (e.g. EGU, AGU, coastal engineering or oceanography conferences) to present their work. The student can also attend specialized training courses or summer schools (for instance, on data assimilation, ocean modeling, or machine learning in geosciences) to build their skill set.
- **Dynamic and supportive academic setting:** The student will be part of TalTech's graduate school, with access to courses and seminars to support their academic development. The Department offers a multidisciplinary atmosphere, and the student will collaborate with peers working on related topics (e.g. ocean modeling, marine climate studies, remote sensing). We provide modern computing facilities, including access to high-performance computing for model simulations.

About the department

The Department of Marine Systems at Tallinn University of Technology (TalTech) is a leading center for marine science and technology in the Baltic Sea region. As part of TalTech's School of Science, the department is dedicated to advancing knowledge and practical solutions related to the physical, chemical, and ecological dynamics of marine environments, with a particular emphasis on the Baltic Sea.

The department's mission is to conduct interdisciplinary research that supports sustainable marine management, enhances forecasting capabilities, and informs policy decisions at national and international levels. Its scientific work integrates field observations, remote sensing, numerical modeling, and data assimilation to study marine processes across multiple spatial and temporal scales.

Key research domains include:

Marine physics and hydrodynamics, particularly circulation, sea level variability, and mixing processes in the Baltic Sea;

Operational oceanography, including the development and application of high-resolution forecasting systems;

Marine biogeochemistry and ecosystem modeling;

Marine information systems and decision-support tools for environmental monitoring and management; Coastal zone dynamics and the impacts of climate change on marine systems.

The department operates modern infrastructure, including the research vessel SALME, FerryBox systems for real-time environmental measurements aboard commercial ships, and autonomous observation platforms such as buoys and gliders. These facilities support continuous in situ data collection and complement satellite-based Earth observation.

International collaboration is a core pillar of the department's activity. It actively participates in regional and European initiatives, including:

The Baltic Operational Oceanographic System (BOOS); EuroGOOS, the pan-European ocean observing system;

The Copernicus Marine Environment Monitoring Service (CMEMS);

The HELCOM framework for protecting the marine environment of the Baltic Sea; Multiple EU-funded research projects (e.g., Horizon 2020, Interreg, BONUS).

The department also contributes to academic training through its involvement in graduate and postgraduate education, including Master's and PhD programs in marine science and engineering. It offers students a research-intensive environment and access to international scientific networks.

Through its integrated approach to research, education, and operational development, the Department of Marine Systems plays a critical role in advancing scientific understanding of the Baltic Sea and supporting regional efforts toward sustainable and resilient marine governance.

(Additional information)

This PhD project is closely **aligned with the Copernicus Marine Service** activities for the Baltic Sea. This means the candidate may engage with Copernicus-related projects, data, and experts, ensuring that the research is oriented towards operational applications and impact. The university and department host a number of ongoing projects in marine science, providing a rich collaborative environment.

For more information about Tallinn University of Technology (TalTech) and the Department of Marine Systems, please visit the official TalTech website. The university is an equal opportunity employer and a vibrant international community located in Estonia's capital, Tallinn. We look forward to receiving applications from motivated candidates eager to contribute to advancing ocean forecasting and climate science in the Baltic Sea region.

Priidik Lagemaa – Senior Researcher at the Department of Marine Systems, Tallinn University of Technology. Contact: priidik.lagemaa@taltech.ee

Urmas Raudsepp – Tenured Full Professor at the Department of Marine Systems, Tallinn University of Technology. (Prof. Raudsepp will co-supervise and provide expertise in physical oceanography and Baltic Sea dynamics.)

Prospective applicants are encouraged to reach out to the supervisors via email for any informal inquiries about the position or research topic.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/960 or scan the the code on the left with your smartphone.

Water, Heat and Salt Fluxes Between the North Sea and the Baltic Sea

Summary

The quantification of volume, heat, and salt fluxes between the ocean (North Sea) and a marginal sea (Baltic Sea) remains one of the most challenging and critical problems in regional oceanography. The dynamics of this exchange govern the salinity, stratification, and deepwater ventilation of the Baltic Sea, with far-reaching implications for its biogeochemistry and ecosystem health. This PhD project will focus on quantifying these fluxes through the narrow and topographically complex Danish Straits (Øresund, Great Belt, Little Belt), combining high-resolution observations and state-of-the-art ocean modeling. The project contributes to ongoing national and international research collaborations and provides opportunities for advanced training in ocean physics, climate impact studies, and numerical modeling.

Research field:	Earth sciences
Supervisor:	Prof. Dr. Urmas Raudsepp
Availability:	This position is available.
Offered by:	School of Science Department of Marine Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

This PhD research will investigate the physical exchange processes of water, heat, and salt between the North Sea and the Baltic Sea via the Danish Straits. Using a combination of long-term observational datasets (e.g., moorings, ADCPs, satellite data) and high-resolution 3D hydrodynamic modeling tools (such as GETM, HBM, or NEMO-Baltic), the student will:

- Quantify volume fluxes through the straits under varying meteorological and oceanographic conditions.
- Analyze episodic events such as Major Baltic Inflows and their contributions to salinity and thermal budgets.
- Assess the role of baroclinic and barotropic forces, wind forcing, and large-scale atmospheric patterns (e.g., NAO) on the flux variability.
- Investigate trends under climate change scenarios, including changes in sea level, precipitation, and stratification.

The project will include the development or refinement of coupled physical-biogeochemical model components as needed and will contribute to regional climate adaptation strategies.

Responsibilities and (foreseen) tasks

- Perform literature review and synthesis on North Sea–Baltic Sea exchange dynamics.
- Process and analyze observational datasets from multiple sources (moorings, satellites, etc.).
- Set up and calibrate 3D hydrodynamic models for the study region.
- Conduct sensitivity and scenario analyses of exchange processes under various forcing conditions.
- Present findings at international conferences and publish results in peer-reviewed journals.
- Collaborate with other project partners within international research networks.

Applicants should fulfil the following requirements

- MSc degree (or equivalent) in physical oceanography, marine science, applied physics, or environmental engineering.
- Strong background in fluid dynamics, thermodynamics, and numerical modeling.
- Good programming skills (e.g., MATLAB, Python, Fortran).
- Proficiency in written and spoken English.
- Motivation and ability to work both independently and as part of a multidisciplinary team.

The following experience is beneficial

- Experience with ocean model setups (GETM, HBM, NEMO, or similar).
- Familiarity with data assimilation techniques.
- Prior experience in working with large observational datasets (e.g., Copernicus, CMEMS, FerryBox).
- Background in climate variability and air-sea interaction processes.

We offer

- A 4 year fully funded PhD position in a dynamic research environment.
- Access to national and international datasets and computing resources.
- Supervision from leading experts in physical oceanography and coastal dynamics.
- Support for professional development including conference travel and courses.
- A competitive salary and social benefits according to university regulations.

About the department

The PhD candidate will be hosted by the [Department of Marine Systems at TalTech or relevant university], which has long-standing expertise in the physical oceanography of the Baltic Sea and North Sea regions. The department participates actively in international research consortia such as Baltic Earth, EuroSea, and CMEMS. The candidate will have access to high-performance computing facilities, state-of-the-art instrumentation, and opportunities for collaboration with partners across Europe.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/959 or scan the the code on the left with your smartphone.

Intelligent Diagnostics of Electrical Machines through AI-Enabled IoT Systems: Design of Custom Embedded Hardware and Protocol-Aware Architectures for Industrial Applications

Summary

The main objective of this research project is to develop an integrated diagnostic system for electrical machines based on custom-designed embedded hardware and edge-deployable AI models. Building upon prior work that established basic IoT connectivity and AI-based fault detection methods, this research will advance toward a deployable industrial solution by developing a custom PCB platform for real-time condition monitoring, on-device inference, and industrial communication. The system will incorporate optimized machine learning algorithms, support standardized IoT protocols, and be validated in laboratory and semi-industrial environments. The project contributes to smart maintenance strategies within the broader context of Industry 4.0 and is part of an ongoing initiative to enable predictive diagnostics for electrical machines.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Dr. Toomas Vaimann Hadi Ashraf Raja
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The increasing need for predictive maintenance in industrial applications has accelerated the development of AI- and IoT-enabled condition monitoring systems. Previous research in this domain has successfully demonstrated the feasibility of IoT-based data acquisition and AI-based fault detection for electrical machines. This PhD project will build upon that foundational work by focusing on the **design, implementation, and validation of a custom embedded diagnostic platform**—bridging the gap between proof-of-concept and industrial deployment.

The hardware component of the research will involve the **development of a custom PCB**, integrating sensing modules (e.g., vibration, current, voltage), analog and digital signal processing circuits, microcontrollers or SoCs, and power management systems. The board will be optimized for **industrial environments**, addressing constraints such as electromagnetic interference (EMI), thermal stability, and mechanical durability.

In parallel, the project will refine and optimize existing machine learning models for fault detection and prediction, focusing on **efficient edge deployment** (e.g., through model pruning, quantization, or TinyML techniques). The embedded system will be designed to perform local inference in real-time, minimizing latency and network dependency.

On the communication side, the system will utilize standardized industrial **IoT protocols** such as **MQTT**, **OPC-UA**, and **Modbus TCP** to enable efficient, secure, and low-latency transmission of diagnostic data to **cloud-based platforms** for further analysis, visualization, and integration with digital maintenance workflows. Particular attention will be given to **data security**, **integrity**, and **communication reliability** under industrial operating conditions.

Key research questions:

1. How can a custom embedded platform be designed for reliable, real-time diagnostics in industrial settings?
2. Which sensing modalities and signal processing techniques are optimal for machine condition monitoring?
3. How can existing AI models be adapted for resource-constrained edge inference?
4. What are the trade-offs between communication bandwidth, inference latency, and diagnostic accuracy?
5. How can the developed system be validated and benchmarked in representative environments?

Responsibilities and (foreseen) tasks

- Review of embedded system design principles for industrial condition monitoring
- Design, simulation, and fabrication of a custom PCB for edge AI diagnostics
- Optimization of ML models for real-time inference (using Python, C++, TinyML)
- Integration of sensing, signal processing, and communication subsystems
- Implementation and testing of industrial IoT communication protocols
- Experimental validation in laboratory testbeds or pilot industrial deployments
- Contribution to academic publications and collaboration with partner organizations

Applicants should fulfil the following requirements:

- Master's degree in electrical engineering, embedded systems, or a related field
- Clear interest in industrial diagnostics, AI, and hardware/software co-design
- Good command of English (spoken and written)
- Strong analytical and documentation skills
- Experience with PCB design (e.g., Altium Designer, KiCad, Eagle)
- Programming experience in Python and embedded C/C++

(The following experience is beneficial:)

- Familiarity with AI/ML frameworks (e.g., TensorFlow Lite, Edge Impulse)
- Experience working with microcontrollers or SoCs (e.g., STM32, ESP32, ARM Cortex-M)
- Understanding of industrial communication protocols and automation systems
- Prior work with condition monitoring or predictive maintenance
- Experience publishing or presenting technical or scientific work

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading social science research centers in Estonia with a large portfolio of ongoing pan-European and national public administration, digital governance and innovation studies projects
- The chance to do high-level research in one of the most dynamic digital government contexts globally
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of public administration, innovation studies and digital government

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations.

The department educates future electrical and power engineering leaders and engineers at the bachelor's, master's and doctoral level. Through training courses, the department ensures lifelong learning and continuous development.

The department carries out large-scale interdisciplinary scientific research, development and professional projects, thanks to which the competence in the field of electrical energy and mechatronics continues to grow. With research, application and development services, the department increases the competitiveness of companies in both the domestic and international markets, keeping knowledge in Estonia. The department has coordinated or been a partner in numerous international projects, such as Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements.

The departments' focus areas are related to both domestic and global developments, such as increasing digitalization and decarbonization, decentralization and decentralization of electricity generation, and the increasing use of renewable energy sources. The department conducts research in the following relevant areas tackling the energy transition:

- optimization of electrical systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, machine vision
- implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- development of smart city solutions, including environmentally friendly and self-driving vehicles / drones, digital twin applications.

(Additional information)

For further information, please contact Prof Toomas Vaimann toomas.vaimann@taltech.ee and Dr. Hadi Ashraf Raja hadi.raja@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/955 or scan the the code on the left with your smartphone.

Automated Monitoring Using an Underwater Multicamera System for Real-Time Object Detection, Classification and Tracking

Summary

The main objective of this project is to develop, test and implement a real-time multicamera system including computer vision algorithms for the detection, classification and tracking of underwater objects. This work will include both living and nonliving biological entities (e.g. fish, woody debris) as well as non-biological objects (e.g. refuse) in order to automate environmental monitoring in shallow (< 30 m) freshwater, brackish and saltwater environments. Specifically, this project addresses three research questions, where the first two questions address technology and knowledge gaps and the third question is designed to guide and inform future works: RQ1) What multicamera configurations are most suitable for computer vision pipelines considering real-time detection, classification and tracking tasks? RQ2) What are the most effective combinations of hardware and algorithms for enabling real-time freshwater fish counting and coastal pollution monitoring, considering power efficiency, size constraints, and computational performance? RQ3) What are the hardware (high performance desktop vs. embedded), software, environmental, human resource and financial requirements to develop automated real-time monitoring systems based on the best available technologies?

Research field:	Information and communication technology
Supervisor:	Jeffrey Andrew Tuhtan
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Computer Systems
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Jeffrey Andrew Tuhtan

Co-supervisor: Shujaat Khan (King Fahd University of Petroleum and Minerals (KFUPM))

Background on the need for this research

Underwater cameras are used to manually monitor fish biodiversity and migration because they provide non-invasive, continuous, and when water conditions are suitable, highly detailed observations of both individuals and groups. Recent advances in machine learning applied to computer vision systems over the last decade now allow for new and improved possibilities to replace the use of human experts to detect fish, identify their species, size and classify their up- and downstream migration behaviour. In addition to fish biodiversity, there is a growing demand for underwater cameras capable of monitoring of critical infrastructure such as water supply intakes, underwater cables and aqueducts to detect and track of debris, plastic waste and other potentially undesirable foreign objects. The main objective of this work is to develop, test and implement updated camera hardware with real-time computer vision algorithms to address two major gaps which hinder the widespread implementation of automated monitoring systems capable of replacing human experts.

Gap 1: Multicamera systems optimized for underwater computer vision monitoring are unavailable

Currently, the largest gap in the European context is that commercially-available underwater camera systems are designed for human expert assessments of imagery and video. Commercially available systems are typically designed for marine videography applications and thus tend to be costly and over-engineered for shallower riverine and coastal environments. Furthermore, as these systems are designed for human assessments, they typically record imagery using a single camera at low frame rates suitable for humans (e.g. 5-30 fps) and at high image resolution (e.g. 3840 x 2160 px). Although excellent videos can be produced, the technical needs for robust computer vision systems are quite different than those of humans. For example, computer vision systems with multiple lower-resolution, higher speed (e.g. 60 fps) cameras are more suitable for detection and tracking tasks, whereas a single higher resolution camera operating at low speed (e.g. 5 fps) may be best-suited for classification tasks. The lack of multicamera systems

optimized specifically for underwater computer vision applications is therefore a substantial bottleneck for researchers, who need to evaluate computational performance and model accuracy, for commercial developers, who would benefit from optimized camera hardware, and for regulators who need robust and maximally reliable computer vision methods which are automated to the greatest extent possible to decrease monitoring costs.

Gap 2: Lack of benchmark datasets and training, testing and validation guidelines for underwater camera systems which use computer vision for underwater monitoring

Although there has been a large body of academic and commercial research on the topic of underwater camera-based monitoring, there are only a few datasets with multiple fish species and non-ideal environmental conditions including low-light, overexposure, biofouling, air bubbles and turbidity. Many small-bodied fish such as dace, goby and gudgeon are missing from openly available datasets, and invasive species such as pumpkinseed or Asian carp are also missing. In the last decade, the presence of plastics and other harmful debris in waterways has grown as a topic of research interest as well as becoming subject to local, regional, national and international regulations. Therefore, new benchmark datasets covering a wider range of European species and non-biological objects are urgently needed, as identifying small endemic fish as well as invasive species and plastics are of high interest to regulators due to their roles and potential negative impacts on local ecosystems. The significance and impact of addressing this gap is expected to be large in the European context, as existing openly available datasets are taken using legacy camera systems developed for human experts, are several years old, and accordingly their frame rates, image resolution and the overall image quality are lower than the multicamera system developed in this project.

This PhD project aims to bridge these gaps and advance the state-of-the-art by developing, testing, and validating an optimized multicamera system for real-time computer vision applications. This PhD project will have high impact on the European technical landscape, and provide a scientifically-tested and commercially-viable system for the automated object detection, classification and tracking of biological and non-biological objects in shallow river and coastal environments. Specifically, this project will provide the first real-time underwater camera monitoring solution capable of reliably replacing human experts at fish biodiversity monitoring as well as detecting unwanted foreign objects near critical water infrastructure.

Responsibilities and main tasks of this PhD position

- Perform a literature review of existing camera hardware and computer vision methods for fish detection, species classification and size estimation, with a focus on riverine and coastal environments.
- Test and evaluate new and state-of-the-art camera configurations and computer vision models for fish detection, species, size and counting individual fish with different swimming behaviour. Data will be collected at test sites in Europe within the first two years of the research project.
- Prepare and publish an open access journal paper focused on comparing camera designs and computer vision models for underwater object detection, classification and tracking of fish and debris.
- Collaborating with junior and senior researchers to learn how to prepare news articles, press releases and open house events disseminating the research outcomes from this PhD.
- Aid in the preparation of research proposals related to automated camera-based underwater monitoring for fish and critical water infrastructure.
- Participate in workshops, conferences and public events as a representative of the Tallinn University of Technology to share, improve and grow your knowledge on the topic of computer vision methods for underwater camera-based monitoring.

Applicants should fulfil the following requirements:

- a master’s degree in computer science, with an emphasis on computer vision
- a clear and related interest in the topic of the position based on their previous experience
- excellent command of English
- strong and demonstrable software development, writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to aid in organizational tasks relevant to the project
- be able to travel within Europe for up to two weeks per year for collaboration and training events

The following experience is beneficial:

- Programming in Python
- Experience in training, testing and validation of machine learning models

- Solid foundation in frequentist statistics
- Working knowledge of video and image annotation processes for classification
- Demonstrated skill in convolutional neural networks applied to image classification tasks
- Code documentation and the use of shared repositories
- Basic understanding of aquatic ecosystems and/or hydraulics in rivers and coastal regions

To be considered for evaluation, a candidate must submit a two-page research plan for the topic, including the overall research strategy. Here it is strongly encouraged to elaborate on their choices of suitable computer vision methods, based on those available in the literature. The format of the research plan is up to the candidate, but should include references to relevant books, journal and conference publications to highlight the candidate's ability to independently source references.

We offer:

- 4-year PhD position in the leading environmental sensing research center in Estonia with a large portfolio of ongoing pan-European, regional, national and local projects.
- The chance to do high-level research in a leading international group on underwater sensing
- Opportunities for conference, research stays and networking with globally leading universities and researchers in the fields of computer vision, underwater sensing and critical infrastructure monitoring.

About the research group

The Centre for Environmental Sensing and Intelligence is an internationally-recognized and highly interdisciplinary research group at the Tallinn University of Technology focusing on environmentally relevant and future-oriented research and teaching topics:

- Data-driven modelling of large-scale environmental sensing networks
- Computer vision applications for fish monitoring in freshwater environments
- Development of rugged and robust underwater sensors for extreme physical environments
- Human kinematic measurement systems for underwater and microgravity environments
- Environmental technology innovation with small to medium enterprises
- Teaching large-scale environmental sensor development (MSc) and academic writing (PhD)

Additional information

For further information, please contact:

Assoc. Prof. Jeffrey A. Tuhtan

Email: jetuht@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/954 or scan the the code on the left with your smartphone.

Co-Simulation Platform with AI-Based Decision Making for Digital Twins of Autonomous Vessels

Summary

The plan is the development of a co-simulation platform that integrates AI-based decision-making modules into the digital twins of autonomous vessels. The co-simulation platform will enable real-time interaction between AI models, environmental simulators, and vessel behavior models using standard communication protocols such as FMI and RESTful APIs. By replacing rule-based trajectory planning tools with machine learning models, the platform will support dynamic and context-aware decision-making. These AI models will be trained using simulation scenarios, historical maritime data, and behavior patterns to predict optimal navigation strategies in various situations. The digital twin will continuously update based on AI-driven decisions and environmental feedback, allowing it to adapt in real time. The co-simulation environment will validate the AI system through multiple scenarios, including collision avoidance, course keeping, and obstacle detection. By enabling modular integration of AI components, the platform will also support scalability and extensibility for diYerent vessel types and environments

Research field:	Environmental, marine and coastal technology
Supervisor:	Pentti Jouko Sakari Kujala
Availability:	This position is available.
Offered by:	School of Engineering Estonian Maritime Academy
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

1. Motivation: What is the Problem?

The maritime industry is entering a new era of automation and digitization. With the growing push toward autonomous shipping, the need for vessels that can make intelligent, real-time decisions is more demanding than ever. These autonomous systems must be able to navigate safely, comply with international regulations like COLREG, and respond to dynamic changes in their environment. However, traditional rule-based navigation systems are rigid and often fall short in handling the complexity of real-world maritime operations. While simulation environments and digital twins have become useful tools for testing autonomous systems, they are still limited by static decision-making logic and lack integration with intelligent, adaptive algorithms. This results in digital twins that do not fully reflect the behavior of vessels in uncertain and changing conditions.

During my Master's thesis at Åbo Akademi University, I developed a modular co-simulation platform that connects external decision-making tools to maritime simulation environments using a client-server architecture. The platform was designed to allow dynamic waypoint updates and real-time interaction with vessel models. This foundational work demonstrated the feasibility and flexibility of building co-simulation environments that support real-time communication and control. However, the decision-making component in that system relied on a rule-based trajectory planner, which limited its ability to handle complex and unpredictable navigation scenarios.

Building on this foundation, my proposed PhD research seeks to extend this co-simulation platform by integrating AI-based decision-making modules, transforming the system into a truly intelligent digital twin framework for autonomous vessels. This advancement will allow the simulation platform not only to execute pre-planned behaviors but also to make informed, adaptive decisions in real-time. Such a system can better simulate real-world conditions and support testing and development of more reliable autonomous navigation solutions.

2. How to Solve It?

To address this problem, I propose the development of a co-simulation platform that integrates AI-based decision-making modules into the digital twins of autonomous vessels. The co-simulation platform will enable real-time interaction between AI models, environmental simulators, and vessel behavior models using standard communication protocols such as FMI and RESTful APIs. By replacing rule-based trajectory planning tools with machine learning models, the platform will support dynamic and context-aware decision-making. These AI models will be trained using simulation

scenarios, historical maritime data, and behavior patterns to predict optimal navigation strategies in various situations. The digital twin will continuously update based on AI-driven decisions and environmental feedback, allowing it to adapt in real time. The co-simulation environment will validate the AI system through multiple scenarios, including collision avoidance, course keeping, and obstacle detection. By enabling modular integration of AI components, the platform will also support scalability and extensibility for different vessel types and environments.

3. Why is It Important?

This research is important because it bridges the gap between static digital twin models and intelligent real-world autonomous operations. By enabling AI-based decision-making within a co-simulation environment, it enhances the effectiveness of digital twins in maritime applications. Autonomous vessels require decision-making systems that can understand and respond to rapidly changing situations at sea, something traditional approaches struggle with. The proposed solution not only advances simulation technology but also supports the development of safer and more efficient autonomous maritime systems. This has significant implications for industries aiming to reduce human error, fuel consumption, and operational risks. Furthermore, this research aligns with the global trend of digital transformation and green shipping, providing a foundation for smarter and more sustainable marine operations. As regulations and demand for autonomous systems grow, the integration of AI with digital twins will become increasingly critical.

4. What Are the Research Questions?

This research will address the following key questions:

1. How can AI-based decision-making be effectively integrated into co-simulation platforms for autonomous vessels?
2. What machine learning approaches are most suitable for dynamic trajectory planning under maritime constraints like COLREG?
3. How does the integration of AI influence the usefulness of digital twins in maritime simulation?
4. What are the key challenges in testing and validating AI-based navigation systems using simulation-based methods?

5. Major Research Activities

The project will begin with literature review and requirement analysis, focusing on existing research in co-simulation, digital twins, autonomous vessels, and AI-driven control systems. The review will identify gaps in adaptability, interoperability, and uncertainty handling in current maritime simulation platforms. This stage will also outline the key architectural requirements for enabling dynamic AI control in a modular simulation environment.

"Navigating the future: AI and Co-Simulation for Green Shipping" [1] explores how co-simulation and AI can work together to create more energy-efficient maritime systems. It highlights the importance of modular simulation environments and their role in developing sustainable shipping solutions.

"Maritime Digital Twin Architecture: A Concept for Holistic Digital Twin Application for Shipbuilding and Shipping" [2] outlines a comprehensive digital twin architecture relevant to ship behavior and simulation frameworks.

"Digital Twin for Autonomous Surface Vessels: Enabler for Safe Maritime Navigation" [3] proposes a level-based classification and application of digital twins for ASVs with real-time.

"Deep reinforcement learning based collision avoidance system for autonomous ships" [4] demonstrates the application of RL in COLREG-compliant ship navigation.

Following the review, the second major activity will involve the design of the co-simulation platform architecture. This includes defining communication protocols and modular interfaces between the AI module, digital twin, and simulation environment. Components will be designed to support asynchronous communication and real-time data flow, ensuring the system is scalable and flexible for future integration with physical testbeds or extended maritime environments.

The third activity will focus on the development of the AI-based decision-making system. Techniques such as deep reinforcement learning, probabilistic decision trees, and fuzzy control will be explored to create navigation strategies that can adapt to environmental uncertainty while maintaining COLREG compliance. These AI models will be developed and trained initially in isolation using controlled datasets, and then gradually integrated into the full simulation loop.

In parallel, the fourth activity involves building and integrating the digital twin of the autonomous vessel. The twin will replicate vessel state variables, environmental inputs, and sensor behaviors in real time. It will be connected to the AI module to allow continuous feedback, enabling the system to respond to environmental changes dynamically.

The fifth major activity is testing and evaluation through simulation-based experiments. A series of real-world inspired scenarios will be developed to test the performance of the full system in complex and uncertain maritime environments. A web-based interface will be developed for visualization and interaction with the co-simulation platform. Evaluation criteria will include decision-making latency, navigational accuracy, adaptability to uncertainty, and robustness in degraded data scenarios. Performance will also be benchmarked against existing rule-based systems to quantify the benefits of learning-based decision frameworks.

Finally, the sixth activity will be dedicated to validation and dissemination. This includes refining the platform based on experimental feedback, conducting final case study simulations, and publishing results in peer-reviewed journals and conferences. The platform will be prepared for potential open-source release with clear documentation and modular design to facilitate adoption and future development.

6. Time Division

The figure illustrates the timeline of my PhD research. The phase is divided into subphases as per years. Each year is structured to generate substantial outcomes, which will result in publication to be submitted to high-ranking conferences.

7. References

[1] Iancu, B., Lafond, S., & Rexha, H. (2024). *Navigating the future: AI and co-simulation for green shipping*. Port Technology International, (140), 42–45.
[2] Giering, Jan-Erik & Dyck, Alexander. (2021). *Maritime Digital Twin architecture: A concept for holistic Digital Twin application for shipbuilding and shipping.* at - Automatisierungstechnik. 69. 1081–1095. 10.1515/auto-2021-0082.
[3] Menges, D., & Rasheed, A. (2024). *Digital Twin for Autonomous Surface Vessels: Enabler for Safe Maritime Navigation.* arXiv preprint arXiv:2411.03465.
[4] Wang, Y., Xu, H., Feng, H., He, J., Yang, H., Li, F., & Yang, Z. (2024). *Deep reinforcement learning based collision avoidance system for autonomous ships.* Ocean Engineering, 292, 116527.

CO#-derived carbon as a platform for precious metal electrocatalysts: synthesis, mechanistic insights, and fuel cell applications

Summary

The National Institute of Chemical Physics and Biophysics (NICPB) invites applications for a PhD position within a multidisciplinary research team investigating carbon-negative routes to advanced electrocatalysts. This position will focus on the synthesis of CO2-derived carbon via molten salt electrolysis (CO2MSE), doping the carbon either in situ or after the synthesis, integration with precious metal nanoparticles (e.g., Pt, Pt-alloys), and its application in fuel cell or electrolyzer devices. Emphasis will be placed on enhancing catalyst durability, optimizing carbon supports, and probing reaction mechanisms for both the carbon deposition and low temperature electrochemistry via spectroelectrochemical techniques. The successful candidate will address the following research questions: 1. How can the structure, porosity, and graphitization of CO2-derived carbon supports be tailored to improve dispersion, activity, and durability of precious metal nanoparticles? 2. What synthesis routes and post-treatments enable the formation of stable Pt and Pt-alloy nanoparticles with optimal size, morphology, and interparticle spacing for long-term electrocatalytic activity? 3. How can operando spectroelectrochemistry elucidate degradation mechanisms and catalyst/support interactions in molten salt-derived electrodes?

Research field:	Chemical, materials and energy technology
Supervisors:	Kätlin Kaare Sander Ratso
Availability:	This position is available.
Offered by:	School of Engineering National Institute Of Chemical Physics And Biophysics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

This PhD project will focus on integrating carbon synthesis with state-of-the-art strategies in precious metal electrocatalyst development for polymer electrolyte fuel cells. Building on recent advances in the CO2MSE process, the candidate will engineer CO_2-derived carbons with tunable graphitization, porosity, and surface functionality. These materials will serve as sustainable and corrosion-resistant alternatives to fossil-derived carbons in Pt- and Pt-alloy catalysts.

Key strategies will involve:

- Controlling catalyst particle size (~3–4 nm) and spacing to mitigate Ostwald ripening and agglomeration.
- Utilizing post-treatment methods or catalytically active substrates to introduce surface defects that enhance nanoparticle dispersion, lower necessary Pt loadings, and increase electrochemically active surface area (EASA).
- Developing Pt intermetallic catalysts (PtCo, PtNi) to reduce Pt loadings necessary for high activity.

Parallel to material synthesis, the project will develop and apply in situ/operando spectroelectrochemical methods track the growth of carbon structures and monitor degradation pathways in real time. Mechanistic insights will guide material optimization, including the stability of Pt–carbon interfaces and catalyst-ionomer interactions.

The research will directly contribute to understanding durability constraints in heavy-duty fuel cell applications, addressing system-level challenges (catalyst corrosion, voltage cycling, and particle migration) that are exacerbated under long-haul conditions. The final aim is to benchmark these CO#-derived electrocatalysts against commercial Pt/C systems, with a focus on lifetime performance, power density, and sustainability.

Responsibilities and (foreseen) tasks

- Synthesize and post-treat CO#-derived carbon supports tailored for precious metal nanoparticle deposition

- Fabricate Pt and Pt-alloy catalysts
- Characterize catalysts using electrochemical and physical characterization methods
- Evaluate catalyst performance in PEMFC-relevant ORR conditions using RDE and MEA testing
- Design and carry out spectroelectrochemical studies to understand catalyst/support interaction and degradation
- Present research results in international journals and conferences.

Applicants should fulfil the following requirements:

- MSc in natural sciences, preferably in chemistry, materials science, chemical engineering, or a related field.
- Strong interest in electrochemistry, carbon materials, and sustainable energy technologies.
- Excellent level of English and a collaborative spirit
- Ability to work independently and as part of an interdisciplinary research team.

(The following experience is beneficial:)

- Previous experience with electrochemical methods, fuel cell or battery systems is highly desirable.
- Proven track record of independently designing experiments and/or instrumentation.
- Experience in the physical characterization of carbon materials.
- Experience in working with molten salts or high-temperature chemical equipment.

We offer:

- A 4-year PhD position in a lab with cutting-edge infrastructure (including a new operando Raman spectroscopy lab).
- Active participation in multiple international collaborations.
- Work with unique molten salt electrolysis systems and energy devices.
- Opportunities for conference visits, research visits to partnering institutions.
- A dynamic, innovative research environment focused on real-world CO# mitigation technologies.

About the department

The **National Institute of Chemical Physics and Biophysics (NICPB)** in Tallinn, Estonia is an independent research institute, which carries out basic and applied research in materials science, genetic engineering and biotechnology, environmental technology, in the field of particle physics and informatics, employing researchers from all over the world. The **Energy Technologies Laboratory (ETL)** at NICPB focuses on furthering fundamental understanding of electrochemical processes both at low and high temperatures, recycling of Li-ion batteries and developing novel functional materials with a minimal CO_2 equivalent. Key aspects of the research at ETL include the synthesis of carbon nanomaterials from CO_2 and biomass, battery recycling and advanced electrochemical testing, physical characterization and production scale-up. Our core aim is to replace the high CO_2 equivalent carbon materials in fuel cells, batteries and supercapacitors with sustainable alternatives.

(Additional information)

For further information, please contact Sander Ratso sander.ratso@kbfi.ee

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Additive Manufacturing of Functional Materials

Summary

This PhD project focuses on the fabrication of functional materials with enhanced properties for industrial applications using the laser powder-bed fusion (LPBF) process. Particular attention will be paid to alloy design, parameter optimization, and the interplay between microstructure properties and the LPBF technique. Key aspects of the project will include the: (1) Development of novel and next generation functional materials for LPBF process (process-specific design) (2) Optimization of the LPBF process parameters to achieve desired microstructure and material properties, (3) In-depth materials, and property testing and (4) Prototype development and integration of functional materials in real-world applications. Fundamentals of the microstructural development will be studied in detail to fabricate sustainable and high-performance functional materials by the LPBF process.

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisor:	Prashanth Konda Gokuldoss
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

- A detailed literature survey on the different functional materials, their metallurgy, microstructure, and processability via LPBF process.
- Functional materials alloy design for the LPBF process.
- Functional material feedstock preparation for the LPBF process
- Process optimization for the fabrication of functional materials by LPBF with the desired microstructure and without defects
- A detailed microstructural characterization, property testing, and failure analysis on the LPBF-processed functional materials
- A detailed investigation on the post-processing necessity and thermal treatment of the LPBF-processed functional materials
- Use of AI/ML and numerical simulation to optimize the microstructure-properties in the functional materials fabricated by the LPBF process
- Optimization of microstructure and properties based on the studies carried out
- Function material prototype development with desired functional properties

The applicants should fulfil the following requirements:

- Master's degree in Metallurgy / Materials Science / Mechanical or equivalent
- Experience in any/all of the following fields: alloy design, powder metallurgy, additive manufacturing, thermodynamics, materials characterization, and materials testing
- High level of scientific integrity, rigor, and excellence in experimental methodology, analysis of data, and scientific/technical reporting.
- Ability to work autonomously while being a good team player willing to perform and develop with the team.

- Creative and innovative mindset

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Integrating Life Cycle Assessment and Circularity Metrics in Sector-Specific Sustainability Models for Materials

Summary

This PhD project focuses on advancing circular economy (CE) practices in the engineered wood products and electronics sectors to support EU decarbonization and industrial sustainability goals. The research will develop integrated materials sustainability assessment frameworks using life cycle assessment and circularity indicators. Key questions include how to assess materials' circularity and redesign value chains for improved resource efficiency and resilience. Embedded within a broader European sustainability initiative, the project offers opportunities for industrial collaboration and applied research. The candidate will help operationalize CE strategies, promoting sustainable product design and supporting companies in adopting circular business models aligned with EU policy targets.

Research field:	Environmental, marine and coastal technology
Supervisors:	Viktoria Voronova Niina Dulova
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The implementation of a circular economy (CE) in industrial sectors such as engineered wood products (EWP) and electronics is increasingly recognized as a critical strategy for mitigating environmental impacts associated with resource depletion, greenhouse gas emissions, and waste generation. In the electronics industry, the accelerating consumption of finite materials and the rising volumes of e-waste necessitate innovative approaches that promote material recycling, reuse, and product life extension. Similarly, the EWP sector faces sustainability challenges linked to deforestation, biodiversity loss, and resource inefficiency. While existing European frameworks - including the European Green Deal, the Clean Industrial Deal, and sector-specific directives such as WEEE and the Renewable Energy Directive - provide policy direction, practical tools and integrated models for operationalizing CE principles within these industries remain limited. Addressing these gaps is essential for achieving the EU's decarbonization and industrial sustainability targets.

The primary objective of this doctoral research is to accelerate decarbonization and enhance advanced manufacturing capabilities in the EWP and electronics sectors through the development of integrated sectoral sustainability models. These models will utilize life cycle assessment (LCA) methodologies and circularity indicators to support evidence-based decision-making in material selection, product design, and value chain optimization. Specifically, the project aims to:

- Develop and validate sector-specific materials sustainability assessment frameworks.
- Promote circular product design by encouraging the use of recyclable, bio-based, and durable materials.
- Facilitate the development of circular value chains through supply chain mapping, identification of inefficiencies, and sustainability strategy integration.
- Collaborate with industry partners to pilot and refine sustainable and circular product innovations.

The expected outcomes of the doctoral project include a comprehensive materials evaluation framework and a pilot database of primary, substitute, and secondary raw materials for use in the targeted sectors. These tools will assess materials based on CE principles, including recyclability, reusability, repairability, and life cycle extension potential. The research will address key questions such as:

- How can materials sustainability be systematically assessed in the context of CE principles for electronics and EWP?

- What indicators most effectively measure circularity and decarbonization potential in these industries?
- How can value chains be redesigned to optimize resource efficiency, resilience, and profitability within CE frameworks?

The project will contribute to the operationalization of circular economy practices, support companies in achieving stable decarbonization, and promote the adoption of advanced, sustainable manufacturing strategies across EU industry sectors.

Responsibilities and (foreseen) tasks

- Develop and validate sector-specific sustainability assessment frameworks using life cycle assessment (LCA) and circularity indicators for the electronics and engineered wood products (EWP) industries.
- Build a comprehensive materials database covering primary, substitute, and secondary raw materials, evaluated for recyclability, durability, and life cycle extension.
- Analyze and optimize value chains through supply chain mapping, identification of inefficiencies, and integration of circular and decarbonization strategies.
- Collaborate with industry stakeholders to pilot and refine sustainable product innovations and advanced manufacturing practices.
- Propose and evaluate circular product design approaches, emphasizing bio-based, recyclable, and repairable materials and components.
- Contribute to the development of circularity and decarbonization indicators, supporting EU policy goals such as the European Green Deal and Clean Industrial Deal.
- Disseminate research outcomes through academic publications, and participation in conferences and stakeholder workshops.

Applicants should fulfil the following requirements:

- Master's degree (or equivalent) in a relevant field such as environmental engineering, industrial ecology, sustainable manufacturing, materials science, circular economy, or a related discipline.
- Strong interest in LCA, EIA, or sustainability metrics.
- Passionate about data analysis and computational modeling, focusing on materials life cycles.
- Very good proficiency in spoken and written English language.
- Willingness to travel to international and domestic project meetings.

The following experience is beneficial:

- Experience with LCA tools and software (e.g., SimaPro, LCA for Experts, openLCA).
- Familiarity with EIA processes, sustainability indicators, or environmental reporting.
- Previous experience working on international projects
- Proficiency in written and spoken Estonian to communicate effectively with local stakeholders.

We offer:

- A fully funded 4-year PhD position focused on advancing circular economy and sustainability in the electronics and engineered wood products sectors.
- Joint supervision by two leading departments at TalTech – the Department of Civil Engineering and Architecture (Environmental Engineering focus) and the Department of Materials and Environmental Technology.
- Opportunity to work in an interdisciplinary research environment, combining engineering, materials science, and environmental sustainability.
- Participation in a collaborative international research project funded by the INTERREG Baltic Sea Region (BSR) Programme, with opportunities for regional networking and impact.

About the department(s)

This PhD project involves cooperation between two departments at TalTech: the Department of Civil Engineering and Architecture, and the Department of Materials and Environmental Technology.

The Department of Civil Engineering and Architecture, within the School of Engineering covers research and education in the fields of architecture, building structures, construction processes, near zero energy buildings, structural and fluid mechanics, road construction, geodesy and water and environmental engineering. Within the Department,

the Water and Environmental Engineering (WEE) research group performs research on life cycle assessment (LCA), impacts of climate change, water quality and treatment of municipal and industrial waste and waste waters. The WEE research group has long-term experience in conducting life cycle assessments and calculating the carbon footprint of various products and materials. The WEE laboratory offers the capability to measure the physical and chemical parameters of wastewater and assess the biodegradability of various bioplastics. The research group has developed several educational materials on LCA and sustainability topics in waste management. The research group actively participates in national and European Union research projects, including Horizon Europe, Interreg, Erasmus+, LIFE, and EuropeAid.

The Department of Materials and Environmental Technology is a national leader in high-level, internationally recognized teaching, research, and development in materials and environmental technology. Within the department, the Laboratory of Environmental Technology (LET) focuses on applied sustainability and environmental research, addressing key topics such as:

- Water and wastewater treatment
- Contaminated soil remediation
- Air pollution abatement
- Abatement of emerging contaminants
- Valorization, processing, and recycling of solid waste
- Life cycle assessment and carbon footprint calculation
- Circular management of industrial and municipal waste

LET has extensive experience in managing and participating in national and international projects, including BSR/Central Baltic INTERREG, ERA-MIN, Erasmus+, and LIFE programmes, with a strong emphasis on advanced environmental matrices treatment, sustainable waste management, circular economy, and ESG solutions.

Additional information

For further information, please contact:

1. Dr. Viktoria Voronova (e-mail: viktoria.voronova@taltech.ee)
2. Dr. Niina Dulova (e-mail: niina.dulova@taltech.ee)

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Measurement electronics solutions to characterize soft tissues

Summary

The overall goal of the Thesis project is to examine and develop the measurement techniques to characterize statically or dynamically.soft tissues (eg heart muscle, lungs, overall body composition, skin etc) in clinical environment, in co-operation with Tartu University Hospital. Methods under interest could include using of the electrical bio-impedance (EBI) and electrical impedance tomography (EIT), but can consider also using of the magnetic induction and other sensors with related signal processing. Modelling and digital twinning could be considered as a promising option to go beyond the state of the art, while of course inventing and developing of the advanced instrumentation is a great challenge. Also, classical instrumentation challenges – in improved calibration, accuracy, resolution, frequency range – are in place. Also basic image processing and machine learning could complement the developed measurement techniques.

Research field:	Information and communication technology
Supervisor:	Olev Märtens
Availability:	This position is available.
Offered by:	School of Information Technologies Thomas Johann Seebeck Department of Electronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Dr Olev Märtens (TalTech)

Co-supervisor: Dr Arno Ruusalepp (University of Tartu)

The research

The research and development of innovative solutions includes first understanding of the state-of-art of the field. The research itself could be mostly R&D of the original real-time embedded measurement systems and interfaces with corresponding back-end solutions and validation of the proposed technical solutions and intellectual property in the relevant environments

Responsibilities and (foreseen) tasks

1. Compile a good state-of-art (*technology level* -TL) overwiew on the Thesis Topics, with clear indication of the:

1. *Starting points for the technology development for the Thesis;*
2. *Possible places to go beyond TL, by inventing significantly improved technical solutions;*

1. Develop and research of the meaningful original prototypes and demonstrators;
2. Significant participation of the customer-readiness-level (CRL) and Intellectual Property Readiness Level (IPRL) increase activities in the Thesis Topics;

Applicants should fulfil the following requirements:

- a clear interest in the topics of the position;
- a master's degree from the engineering field, eg of electronics engineering, mechatronics, hardware & software development;
- demonstratable skills in the development of the embedded systems;
- additionally basic understanding and skills in image processing and machine learning could be very beneficial;
- at least good-level (if not excellent) demonstrable reading, writing and analytical skills in English and some programming languages (eg C/C++, Python, R);
- Estonian language adds much value (if latest by 2-nd year);
- capacity to work both as an independent researcher and as part of the team(s);

The candidate should submit a research plan for the topic, including the overall research and data collection strategy.

We offer:

- 4-year PhD position at TalTech, in the Thomas Johann Seebeck department of electronics, research group of measurement electronics – worldwide recognized leader in e.g. bio-impedance R&D and related innovative (typically patented) solutions ;
- The chance to do high-level and really innovative and meaningful and applicable research by creating relevant intellectual property in the field;
- Opportunities for conference visits, research stays and networking with leading universities and research centers in the field.

About the department

Thomas Johann Seebeck department of electronics (including the research group of the measurement electronics) was established in 1962 and has been and is still the leading player in the field of electronics, including of measurement electronics – as well as nationwide, as wel as internationally. The department has been characterized over decades by high-quality graduates of electronics engineering, co-operation with R&D units of the electronics and instrumentation industries and nowadays take part also in international R&D projects (Era-Net tand similar, Horizon etc). Staff members are active (and are involving students) in the world's largest and most influential engineering organization IEEE (including the IEEE IMS – instrumentation and measurement society) and these activities have been noticed and highly recognized by IEEE.

(Additional information)

For further information, please contact sr researcher Dr Olev Märtens, olev.martens@taltech.ee

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New Methodology for Distribution Grid Planning Considering Impact of Power Flow Pattern Changes on Coincidence Factor

Summary

The overall goal of the project is to research and develop a new methodology for low voltage distribution grid planning considering the impact of power generation and consumption pattern changes on coincidence factor. The long-term strategy of the European Union is aiming at climate neutrality to be achieved by 2050 poses serious challenges to all branches of the economy, incl. the energy sector. It is expected that 50% of the supplementary renewable energy sources will be connected to the distribution network, of which 25...50% are direct current solutions added to the network through power electronics. The increasing sporadic nature of power generation and consumption and frequent changes in power flows constitute a challenge to the electric power system in several aspects: quality of electricity, supply chain security, reliability of network components, network losses as well as unpredictable end-user price fluctuations etc.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Argo Rosin Vahur Maask
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The goal of the PhD project is to develop an innovative approach for planning distribution grids that consider the impact of changing power flow patterns on coincidence factors. By doing so, the project aims to enhance the efficiency, reliability, and sustainability of electricity distribution systems. The specific objectives include creating a new planning methodology, analyzing its effectiveness, and assessing its economic implications. Ultimately, this research contributes to better grid management and resource allocation in the face of evolving energy demands and generation profiles.

PhD project should address several key research questions to advance our understanding and improve distribution grid planning. Here are some relevant questions:

1. How do changes in power flow patterns impact coincidence factors in distribution grids?
2. What are the limitations of existing distribution grid planning methodologies in accommodating dynamic power flow patterns?
3. How can the proposed methodology proactively incorporate the capabilities of Distributed Energy Resources (DER) into grid planning and operation?
4. What data sources and information from current smart grids can be effectively utilized to enhance distribution grid planning?
5. What are the potential operational services that can optimize network capacity utilization at the distribution level?
6. How does the new methodology compare to traditional approaches in terms of cost-effectiveness, reliability, and sustainability?
7. What are the socio-economic implications of implementing the proposed distribution grid planning methodology?

Research tasks would involve a combination of quantitative and qualitative research methods, including data collection through surveys, simulations, and possibly field studies, followed by data analysis using statistical and computational techniques. The goal would be to enhance the efficiency, reliability, and sustainability of electricity distribution in the face of evolving energy demands and generation profiles.

Supervisors

Main supervisor: Prof. Dr Argo Rosin

Co-supervisor: Researcher Vahur Maask

Responsibilities and (foreseen) tasks

- **Developing a new methodology** for distribution grid planning that can adapt to changes in power flow patterns. Investigate the international and national regulations which could induce developments affecting the coincidence factor in low voltage distribution grid. State of Art study previous scientific studies related PhD thesis topic
- **Analyzing the impact** of these power flow pattern changes on coincidence factors, which are crucial for understanding peak demand and resource allocation. Analyze large-scale data from smart meters, IoT devices, and distributed energy resources to develop models for coincidence factor studies. Develop new scenarios for determination of coincidence factor for different low voltage grid areas, e.g. distributed, mid-dense, dense and super-dense areas simulations
- **Creating models** in DigSILENT to predict and simulate how different scenarios affect the distribution grid
- **Evaluating the effectiveness** of the new planning methodology against current practices. Determine the impact of distribution network changes on the coincidence factor due to the addition of solar parks, EVs, energy storages and aggregated loads using the DigSILENT software
- **Assessing the scalability** of the proposed methodology for different sizes and types of distribution grids.
- **Investigating the economic implications** of the methodology, including cost-benefit analysis.
- **Ensuring compliance** with regulatory standards and environmental considerations.

Applicants should fulfil the following requirements:

- master's degree in electrical engineering, computer science or applied informatics from the last 5 years
- a clear interest in the topic of the position
- principal understanding of electric power systems and a strong background in AI, machine learning
- strong programming skills (e.g., Python, MATLAB)
- proficient English language user (at least CEFR level of C1)
- profound writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to aid in relevant organizational tasks

The following experience is beneficial:

- (co-)authored published scientific papers
- practical experience in working with DigSILENT, RSCAD, and/or MATLAB
- theoretical experience with power grid planning issues
- basic knowledge of machine learning

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading microgrids research group in the region with a large portfolio of pan-European and national research and development, and study projects, mainly concerned with renewable energy integration and digital and AI applications in electric power systems.
- The opportunity to carry out high-level research in the domain of microgrids and metrology.
- Access to state-of-the-art research facilities for microgrids, renewables integration and power system digitalization.
- Opportunities for student exchange through EuroTeQ and Erasmus+ programmes, visits to scientific conferences and laboratory facilities and networking with leading universities and research centres.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research centre that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations. The department has coordinated and partnered with several international projects, including Horizon 2020, INTERREG, 7FP, Nordic Energy Research etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within 7 research groups and operates state-of-the-art laboratories with high-end equipment, offering also accredited services in the fields of lighting and different electrical measurements. The focus areas of the department are related to domestic and global challenges related to increasing digitalization, decarbonization and decentralization of electric power systems and increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- optimization of electric power systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on green technology, including energy storage, renewable energy, hydrogen systems
- supply and demand-side management, IoT applications in energy systems
- implementation of smart industry, including industrial robotics, automation, 3D printing, computer vision, digital twins

Additional information

For further information, please contact Prof. Argo Rosin, argo.rosin@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/945 or scan the the code on the left with your smartphone.

Biomimetic Polymeric Receptors Integrated with a Sensor Array for Environmental Monitoring

Summary

The overall objective of the PhD study is to develop next-generation sensor arrays by implementing Molecularly Imprinted Polymers (MIPs) as robust, low-cost biomimetic receptors for multiplex and/or simultaneous detection of targets that are of significant interest to environmental monitoring. The study addresses overcoming the limitations of current biosensors and point-of-care testing devices, particularly regarding their restricted capability to analyze complex samples and the use of biological receptors as recognition elements. The resulting sensor arrays are expected to provide an affordable and easy-to-use analytical tool capable of accurately analyzing complex environments, such as environmental water, in a multiplexed manner.

Research field:	Chemical, materials and energy technology
Supervisors:	Dr. Vitali Sõritski Dr. Jekaterina Reut
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Nowadays, the detection of environmental pollutants, such as pharmaceuticals and toxins, is a critical concern in various fields, including environmental monitoring and homeland security. Environmental pollutants often coexist at varying concentrations, making the simultaneous detection of multiple analytes, rather than a single analyte, more rational. There is an increasing demand for portable, low-cost analytical devices with enhanced stability capable of delivering rapid and accurate results for complex environments in multiplexed manner. Multiplexed sensing devices have proven highly relevant in this context, particularly concerning the screening of highly toxic and strictly regulated food mycotoxins and water pollutants.

The use of Molecularly Imprinted Polymers (MIPs) as robust biomimetic receptors in sensing devices is an attractive approach to overcome limitations associated with biological recognition elements. Through the process of molecular imprinting, MIPs are designed to bind target molecules by creating specific molecular cavities within a polymeric network. These cavities accurately mimic the size, shape, and chemical functionalities of the target molecules, resulting in a highly specific and efficient binding capability. MIPs offer a unique combination of selectivity and affinity comparable to biological receptors, while also providing additional benefits. These benefits include enhanced chemical and thermal stability, cost-effectiveness, reproducibility, and an animal-free fabrication process. The synergy of MIP strategies for creating robust biomimetic receptors and sensor arrays can further expand the significance and applicability of these technologies, ultimately leading to more efficient and accurate monitoring of environmental hazards.

The objective of this PhD project is to develop affordable synthesis approaches that enable the generation of MIPs with selectivity towards high-priority analytes in environmental monitoring e.g. antibiotics, cyanotoxins etc. These approaches should be compatible with the automated and efficient integration of MIPs into a sensor array (preferably, an electrochemical sensor array), facilitating reproducible and rapid analysis of complex samples in a multiplexed manner. The project also aims to establish appropriate data processing methods enabling efficient interpretation of the data generated by MIP sensor array.

Responsibilities and (foreseen) tasks

- to actively participate in the experimental work:

- the rational selection of functional monomers using computational modeling and spectroscopic analysis;
- finding of an optimal polymerization method and an efficient procedure for target molecule removal to produce MIP;
- adapting the synthesis methods to generate MIP on a sensor array, e.g. electrochemical sensor array;

- rational improvement of MIPs in terms of affinity and selectivity towards the chosen target analytes;
- study of the analytical performance of the prepared MIP sensor array.

- to collaborate with internal and external research groups;
- to communicate results at meetings, conferences, and write reports and publications.

Applicants should fulfil the following requirements:

- MSc in the field of chemistry, analytical chemistry, materials science, or in a related field
- a clear interest in the topic of the position
- excellent command of English (Level B2 or higher)
- strong and demonstrable writing and analytical skills

We are looking for top motivated candidates having practical experience in polymer synthesis, electrochemistry, chemo- or biosensors preparation and study. Furthermore, we expect good laboratory skills and the ability to work independently, the ability to write up results of your own research and prepare for presentations. The top candidates for the post will be interviewed and asked to present their scientific work and experience.

The following experience is beneficial:

- Programming in Matlab, Python
- Working knowledge of data analysis and graphing software Origin (OriginLab Corporation)
- Knowledge of electrochemistry
- Knowledge in the machine learning

Important: The candidate should submit a tentative research plan for the topic, including the overall research objectives. In the plan, the candidate should avoid text with general formulations prepared using AI-assisted tools. The candidate's ability to compose a consistent plan that expands on the listed research questions and tasks and proposes theoretical lenses will be highly valued by us.

About the Laboratory of Biofunctional Materials

The Laboratory of Biofunctional Materials of the Department of Materials and Environmental Technology develops smart sensing functional materials to propose solutions with considerable potential impact on essential areas of human life such as environmental protection and medical diagnostics. Employing the molecular imprinting technology, the group designs and synthesizes polymeric materials so called Molecularly Imprinted Polymer (MIP), which, thanks to their synthetic nature, possess excellent chemical and thermal stability and are associated with reproducible, cost-effective fabrication. MIPs can be easily integrated with a variety of sensor platforms and allow, thus, label-free detection of a target analyte with high sensitivity and selectivity. The laboratory has succeeded in developing the MIP-based sensors capable of determining various antibiotics (sulfamethizole, amoxicillin, erythromycin) in aqueous media as well as clinically relevant compounds such as immunoglobulin G, neurotrophic factors (BDNF, CDNF) and viral proteins (SARS-Cov-2 nucleocapsid and spike proteins).

(Additional information)

For further information, please contact Dr. Vitali Syritski vitali.syritski@taltech.ee and Dr Jekaterina Reut jekaterina.reut@taltech.ee, web: https://taltech.ee/en/laboratory-biofunctional-materials.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/940 or scan the the code on the left with your smartphone.

Development of holistic Life Cycle Assessment (LCA) models of Critical Raw Materials (CRMs) to minimize waste and enhance the sustainability of the raw materials industry

Summary

This PhD project seeks to turn a problem into an opportunity, by developing and applying Life Cycle Assessment (LCA) tools to (1) minimize waste and (2) enhance sustainability and availability of critical raw materials. This PhD project will contribute to the raw materials industry's sustainability by proposing an innovative supply chain approach for strategic raw materials based on the valorization (recycling and secondary re-use) of industrial wastes. In this work, several processing routes of raw material waste (including overburdens and industrial mineral tailings) will be assessed for recycling into construction materials or chemical products. We will include input from several domestic and international industrial partners, who will provide sectoral expertise and share information about company activities in waste management. The research objective is to identify the environmental impact and sustainability potential of selected valorization routes using LCA, hot spot analysis and risk identification, creating a sustainability indicator. This work will significantly contribute to developing a quantitative decision support system for environmental, social and health impact assessment (ESHIA) aligned with the targets of the UN Sustainable Development Goals (SDGs).

Research field:	Environmental, marine and coastal technology
Supervisor:	Viktoria Voronova
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Main supervisor: Viktoria Voronova

Co-supervisor: Alan Henry Tkaczyk (University of Tartu)

The research

The raw materials industry is one of the Europe’s largest waste streams, generating vast quantities at 700 Mton/ year. The 2023 Amendment to the EU Waste Framework Directive requires enhanced recycling and will require the adoption of innovative technologies. Still, the EU industry is heavily reliant on raw material imports, and the energy transitions continue to increase demand for critical raw materials (CRMs).

A Euronews video and more information is available at: youtu.be/M2U9Z_TnyBk and valorwaste.ase.ro.

This project will holistically demonstrate the opportunities and challenges for the valorization of waste from the raw materials industry. This PhD project seeks to turn a problem into an opportunity, by developing and applying Life Cycle Assessment (LCA) tools to (1) minimize waste and (2) enhance sustainability and availability of CRMs. This PhD project will elaborate and assess an innovative supply chain for CRMs based on the valorization (recycling and secondary re-use) of industrial wastes.

In this work, several processing routes of raw material waste (including overburdens and industrial mineral tailings) will be assessed for recycling into construction materials or chemical products. We will include input from domestic and international industrial partners including VKG, Ragn-Sells, and SECIL, who will provide sectoral expertise and share information about company activities in waste management.

The case studies have been chosen to represent the whole stage of mining activities and different types of non-energy raw materials (see Fig. 1). The case studies include construction and demolition waste sites in Estonia, aluminium waste sites in Greece, and raw material and mining sites in Portugal, Türkiye, and Poland. Potential end-users of the recycled waste are also considered, including cement companies in France and Portugal, and chemical companies in Estonia (VKG) and Türkiye. This diversity of input materials and end users presents unique possibilities to achieve truly circular economy with minimized waste, complemented by quantitative LCA analysis.

Research aims

Research objective. Identification of the environmental impact and sustainability potential of selected valorization routes using LCA, hot spot analysis and risk identification, creating a sustainability indicator.

Impact. This work will significantly contribute to developing a quantitative decision support system for environmental, social and health impact assessment (ESHIA) aligned with the targets of the UN Sustainable Development Goals (SDGs).

Research methodology and holistic approach

This work applies LCA as a critical tool to assess the real impact of raw material waste production, prevention and reutilization. System Boundary definition and data quality will be critical, and will be based on analysis of defined waste characterization data, followed by a strict sampling case study, to evaluate valorization potential. A set demonstration scenario with recycled input materials will be implemented. The environmental impacts of the processes will be holistically assessed via LCA according to the ISO 1404x standard and EIA (environmental impact assessment) methodology. Focus on data reproducibility will ensure that the LCA findings are industrially relevant. This will be critical for identifying environmental hotspots along the value chain, for eco-designing the different stages of the valorization routes and solutions (i.e., industrial symbiosis), and ensuring that environmental, social and governance challenges are properly addressed.

Responsibilities and (foreseen) tasks

Applicants should fulfil the following requirements:

- A master's degree in engineering or science, with a focus on environmental, construction, chemical, geological or closely related topics.
- Strong interest in LCA, EIA, or sustainability metrics.
- Interest in data analysis and computational modelling.
- Very good proficiency in spoken and written English language.
- Willingness to travel to international and domestic project meetings.

The following experience is beneficial:

- Experience with LCA tools and software (e.g., SimaPro, GaBi, openLCA).
- Familiarity with EIA processes, sustainability indicators, or environmental reporting.
- Practical or industrial experience in environmental, construction, chemical, geological or closely related sectors.
- Proficiency in computer programming in Python or other languages.
- Proficiency in scientific communication and writing.
- Basic skills or willingness to learn Estonian language.

We offer:

- **The opportunity to work on an interdisciplinary and internationally attractive research topic.**
- **Joint Supervision and Expertise**: The PhD position is offered in cooperation between Tallinn University of Technology (TalTech) and University of Tartu, combining TalTech's strengths in life cycle analysis and industrial engineering with the University of Tartu's expertise in environmental science and sustainable resource management.
- **Access to Dual Research Environments**: Candidates will benefit from access to facilities, research networks, and academic resources at both universities, fostering interdisciplinary collaboration and a broad academic experience.
- **Industry-Linked Research with European Scope**: The project is integrated into a pan-European research network, providing opportunities to collaborate with industry partners and contribute to high-impact case studies across Estonia, Portugal, Türkiye, and Poland.

About the department

This PhD project will include a cooperation between two universities: Tallinn University of Technology (TalTech) and the University of Tartu (UTARTU). The home base for the project will be TalTech, and the PhD degree will be awarded by TalTech upon successful completion of the project and doctoral requirements.

At TalTech, the Department of Civil Engineering and Architecture, within the School of Engineering covers research and education in the fields of architecture, building structures, construction processes, near zero energy buildings, structural and fluid mechanics, road construction, geodesy and water and environmental engineering. Within the De-

partment, the Water and Environmental Engineering (WEE) research group performs research on life cycle assessment (LCA), impacts of climate change, water quality and treatment of municipal and industrial waste and waste waters. The WEE research group has long-term experience in conducting life cycle assessments and calculating the carbon footprint of various products and materials. The WEE laboratory offers the capability to measure the physical and chemical parameters of wastewater and assess the biodegradability of various bioplastics. The research group has developed several educational materials on LCA and sustainability topics in waste management. The research group actively participates in national and European Union research projects, including Horizon Europe, Interreg, Erasmus+, LIFE, and EuropeAid.

At UTARTU, the Institute of Technology focuses on research and education in the following areas: environmental technologies, biomedical technologies, intelligent materials and systems. Within the Institute, the research group of Associate Professor Alan Tkaczyk investigates valorization of industrial residues, environmental impacts, sustainable resource management, and naturally occurring radioactive material. As a cooperation between UTARTU and KTH, the research group developed and implemented a novel NORM-LCA methodology on the topic “A framework for including enhanced exposure to Naturally Occurring Radioactive Materials (NORM) in LCA.” For the last decade, the research group has investigated circular economy issues associated with valorization of bauxite residue, a byproduct of the metals industry. The research group is highly active in international and domestic research, including having participated in ten European Union (Horizon Europe, H2020, FP7) project and three Estonian Research Council projects on environmental topics.

(Additional information)

For further information, please contact:

1. Dr. Viktoria Voronova (e-mail: viktoria.voronova@taltech.ee)
2. Associate Professor Alan Tkaczyk (e-mail: alan@ut.ee)

To get more information or to apply online, visit https://taltech.glowbase.com/positions/939 or scan the the code on the left with your smartphone.

The role of the histone modification H3K27me3 in developing and adult neurons

Summary

Neurons are born early in development and are not replaced during the organism's lifetime. Therefore, once neurons have matured and become functional, they must remain so for a long time—in humans, up to a hundred years or more. Epigenetic regulation plays a crucial role in establishing and maintaining neuronal function by regulating correct gene expression patterns. The overall goal of this PhD project is to understand how histone modifications regulate gene expression and chromatin architecture throughout neuronal development and adulthood. This research will help us understand the fundamental principles of epigenetic regulation in brain development and function.

Research field:	Chemistry and biotechnology
Supervisor:	Kärt Mätlik
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Neuronal development is controlled by epigenetic mechanisms, including modifications of histones and DNA, which regulate gene expression patterns during lineage decisions, differentiation, and maturation. Epigenetic modifications, such as histone methylation, influence chromatin accessibility and interactions with transcription factors. Histone proteins can be methylated at different amino acids, leading to different outcomes on chromatin compaction and gene expression. For example, histone 3 lysine 27 trimethylation (H3K27me3) induces gene expression silencing, whereas H3K4me3 is associated with active gene expression. Histone methylation patterns are tightly regulated during neuronal maturation, ensuring that appropriate genes are expressed at each stage of development.

Using cerebellar granule cells as a model of neuronal development, we have previously found that the genomic localisation of H3K27me3 changes during neuronal maturation. The changes in H3K27me3 during neuronal maturation are associated with two distinct genomic and epigenetic features: a local remodelling of H3K4me3/H3K27me3 bivalent domains at gene promoters, and a global increase in H3K27me3 at broad intergenic regions. The goal of this research is to define the mechanisms of H3K27me3 regulation in neurons and investigate how developmental changes in H3K27me3 regulate gene expression and chromatin structure.

Specifically, the thesis should address the following questions:

1) Which mechanisms regulate the global increase of H3K27me3 during neuronal maturation?

2) What is the function of H3K27me3 developmental accumulation in the adult brain?

3) What is the importance of histone bivalency in mature neurons?

Responsibilities and (foreseen) tasks

- Design and plan experiments
- Collect data using a range of next-generation genomics, molecular biology, biochemistry, microscopy, and cell culture techniques
- Analyse genomic and transcriptomic datasets using bioinformatics tools
- Present data at seminars and conferences
- Write manuscripts on the results of the project

Applicants should fulfil the following requirements:

- a Master's degree in life sciences

- a clear interest in the topic of the position
- experience in molecular and cell biology techniques
- experience in or willingness to learn bioinformatics
- excellent command of English
- capacity to work both as an independent researcher and as part of an international team

The following experience is beneficial:

- Cell culture methods
- Gene expression analysis
- Microscopy
- Programming in R/RStudio

To apply, please submit a research plan on the topic, including the overall research and data collection strategy.

We offer:

- A 4-year PhD position focusing on fundamental mechanisms of gene regulation in the brain
- Opportunities for supervising bachelor's and master's degree students
- Opportunities for conference visits and networking with leading universities in biomedical sciences

About the laboratory

The Laboratory of Neuroepigenetics is located within the Department of Chemistry and Biotechnology and is a member of the Health and Food Technologies Focus Centre at Tallinn University of Technology (TalTech). For further information, please contact Dr. Kärt Mätlik at kart.matlik@taltech.ee or visit the Mätlik lab website at https://matliklab.org.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/937 or scan the the code on the left with your smartphone.

Dataspace for automated driving

Summary

This position aims to advance the field of automated driving through cutting-edge research in utilizing data-driven techniques with our custom automated shuttle, TalTech iseAuto. The focus is on leveraging knowledge coming from data and how to extend the concepts of dataset and dataspace for automated driving. Applied methodologies include perception, machine learning, and sensor fusion to enhance the reliability, robustness, and accuracy of perception modules in autonomous vehicles.

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisors:	Prof. Dr. Raivo Sell Prof. Dr. Mauro Bellone
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Key areas of research include:

- Developing algorithms for environmental understanding using data from LiDAR, cameras, radar, and other sensors.
- Improving object detection, tracking, and semantic segmentation capabilities in diverse driving conditions.
- Addressing challenges related to sensor calibration, occlusion, and dynamic scene interpretation.
- Integrating perception outputs into broader decision-making pipelines for real-time autonomous driving applications.

The candidate will work collaboratively within an interdisciplinary team, contributing to experimental validation and large-scale data analysis while publishing findings in top-tier journals and conferences.

Previous research and study goals

Recent studies on intelligent transportation systems suggest that the coordination of vehicles in traffic constitutes an important aspect of urban planning, generating significant savings and improving safety in transportation systems. Among the countless open research problems, collective perception is a relevant topic involving artificial intelligence functionalities. The candidate for this position will contribute to the body of knowledge by enhancing the safety, reliability, and efficiency of automated vehicles by developing a collaborative multimodal perception system.

This system leverages data from multiple sources, such as cameras, LiDAR, radar, and V2X (Vehicle-to-Everything) communication, to create a more comprehensive understanding of the vehicle's surroundings. The candidate will work closely with the TelaTech iseAuto (https://iseauto.taltech.ee/) automated shuttle implementing research results on the real vehicle.

By integrating and fusing these diverse data streams, the project aims to improve the vehicle's ability to detect and interpret complex driving environments, including other vehicles, pedestrians, cyclists, and potential obstacles, even in challenging conditions like low light, fog, or heavy traffic.

Additionally, this project focuses on enabling vehicles to share and receive perception data with nearby vehicles and infrastructure, leading to a collective awareness of road situations that individual sensors alone might miss. This collaboration can help anticipate potential hazards, reduce accidents, optimize traffic flow, and enable more coordinated and intelligent decision-making for autonomous driving.

Ultimately, the project aims to advance the development of safer, smarter, and more efficient automated vehicles by creating a robust perception framework that leverages the full spectrum of available data sources.

The study goal is to carry out high-quality research in this domain involving both theoretical and practical aspects of perception systems, with the potential to generate publications in high-ranked journals and conferences using both simulations and robotic vehicles. To this end, the candidate is expected to have a good knowledge of programming tools and acquire knowledge about our custom systems during the initial stage of the doctoral studies.

Responsibilities and (foreseen) tasks

Support laboratory activities to integrate the onboard computing system and sensors on the bus itself, support in pilot preparation processes, and research under the following topics:

- Data-driven methodologies for perception for autonomous vehicles in the context of CCAM
- Self-driving vehicle behaviour in complex urban environments
- Co-operational behaviour based on V2V and V2X communication
- Autonomous driving algorithms and technologies (e.g. vehicle control, path planning, scheduling) and sensors (e.g. lidars, radars, cameras, and GNSS)
- High-level integration of autonomous driving techniques with open-source autonomous driving software (for simulation and testing)

Applicants should fulfil the following requirements:

- a degree in engineering sciences (preferably in computing, robotics, AI)
- a clear interest in the topic of the position
- excellent English communication skill
- computer science skill
- programming in C++ and Python
- 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 aid in organisational tasks relevant to the project

The following experience is beneficial:

- Experience with ROS, Autoware is a plus
- Experience in designing software systems
- General overview and understanding of working principles of sensors and robotics

Applicants are invited to submit a research plan outlining their approach to the topic. This should include strategies for conducting research and collecting data. You’re encouraged to build on the suggested research questions and tasks, as well as propose theoretical frameworks that could guide your work.

What do we offer?

- 4-year PhD position fully funded in one of the largest, most internationalized and leading technical research centers in Estonia with a large portfolio of ongoing pan-European and national research projects
- The chance to do high-level research connected to physical hardware, including the full-scale autonomous shuttle vehicle
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of engineering and ICT
- Competitive salary working in hybrid environment supporting remote work but leveraging laboratory hand-on experience
- Financial support for traveling and conferences

About the departments

The position is supervised in a combination of two units in TalTech.

FinEst Centre for Smart Cities is an independent organisation under the Tallinn University of Technology. FinEst Centre is an international research and development centre, fostering collaboration between researchers, cities and various other partners. https://finestcentre.eu/

Department of Mechanical and Industrial Engineering (EMI) is an engineering and research unit of Tallinn University of Technology, School of Engineering that focuses on mechanical, industrial and robotics engineering in an interdisciplinary way. The research group Autonomous Vehicles https://autolab.taltech.ee/ is a future-oriented research group with the main strengths and focus topics:

- Self-driving vehicles, driving algorithms and cyber-physical system
- Sensor fusion, perception and big data
- Cybersecurity, automotive networking
- Simulations, verifications and validations of autonomous vehicles
- Human-machine interfaces and interactions
- Self-driving shuttle bus deployment and experimentation

Additional information

For further information, please contact Prof. Raivo Sell (raivo.sell@taltech.ee) and Prof. Mauro Bellone (mauro.bellone@taltech.ee).

Visit for more information:
• https://taltech.ee/
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• https://www.youtube.com/watch?v=40eCa5eSEFA&t=4s&ab_channel=Iseauto

To get more information or to apply online, visit https://taltech.glowbase.com/positions/935 or scan the the code on the left with your smartphone.

AI-Driven Battery Life Optimization for V2X-Enabled Software-Defined Vehicles

Summary

The overall goal of the project is to develop AI-driven battery management strategies for V2X-enabled Software-Defined Vehicles (SDVs) to enhance energy efficiency, extend battery lifespan, and optimize power distribution. The project addresses the following research questions: How can artificial intelligence and real-time data analytics be used to predict battery degradation and optimize charging cycles in SDVs? What are the most effective methods for integrating multi-domain battery models into SDV architectures for improved performance and control? How can hybrid AI- and physics-based optimization strategies be designed to support predictive maintenance and adaptive energy management under dynamic driving conditions?

Research field:	Electrical power engineering and mechatronics
Supervisors:	Alar Kuusik Hadi Ashraf Raja
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

This PhD project aims to develop intelligent battery management strategies for V2X-Enabled Software-Defined Vehicles (SDVs) by leveraging artificial intelligence (AI), IoT-based sensors, and real-time data analytics. The goal is to enhance energy efficiency, extend battery lifespan, and optimize power distribution within SDVs by integrating predictive modeling, machine learning, and advanced control strategies.

The research will focus on developing AI-powered algorithms to assess battery health, predict degradation patterns, and optimize charging/discharging cycles based on real-time environmental and operational data. Additionally, the project will incorporate IoT-enabled monitoring to enable adaptive power control and predictive maintenance. The study aims to improve battery performance under dynamic driving conditions while ensuring computational efficiency in software-defined vehicle architectures.

The thesis should address all or some of the following questions: 1) How can artificial intelligence and real-time data analytics be used to predict battery degradation and optimize charging and discharging cycles in Software-Defined Vehicles (SDVs)? 2) What are the most effective methods for integrating multi-domain battery models—encompassing electrical, thermal, electrochemical, and mechanical aspects—into SDV architectures? 3) How can hybrid AI- and physics-based optimization strategies be developed to support predictive maintenance and extend battery life under dynamic operational and environmental conditions? 4) What technical and computational capabilities are required to enable scalable, adaptive energy management in IoT-enabled, V2X-connected vehicle systems?

Responsibilities and (foreseen) tasks

- Understanding of AI-driven energy management in SDVs
- Conduct an extensive literature review on AI-driven energy management, digital twins, and IoT-based battery monitoring in SDVs.
- Analyze the current methodologies and identify gaps to refine research objectives.
- Research into state-of-the-art technologies and methodologies
  - Identify and review existing AI-driven battery management techniques, IoT-based monitoring systems, and SDV architectures.
  - Explore recent advancements in neural networks, reinforcement learning, and predictive modeling techniques for power management.
  - Review existing analytical, numerical, and data-driven models related to battery management in SDVs.
- Multi-domain battery modeling and integration

- Develop multi-domain battery models that capture electrical, electrochemical, thermal, and mechanical interactions.
- Ensure accurate integration of battery models into SDV digital twin frameworks.
- Address cross-domain dependencies and evaluate their effects on battery performance.

- Development of hybrid AI-driven optimization strategies
  - Design and implement hybrid optimization models that combine deep learning and physics-based approaches for battery life extension.
  - Develop AI-based predictive maintenance techniques for early fault detection and anomaly detection in battery systems.
  - Implement multiscale modeling methods to bridge component-level (micro) and system-level (macro) energy management strategies.
- Empirical validation of the proposed models
  - Validate developed battery management models using experimental data from IoT-enabled sensor networks and real-time simulations.
  - Conduct sensitivity analysis under varying operational conditions, including environmental factors such as temperature and load variations.
  - Benchmark model performance against existing battery management solutions to assess improvements in efficiency and longevity.

Applicants should fulfil the following requirements:

- Master's degree in electrical engineering, mechatronics, or a related field.a clear interest in the topic of the position
- Strong programming skills in Python, with experience in machine learning frameworks (TensorFlow, PyTorch, Scikit-learn)
- Familiarity with multi-domain simulation tools (e.g., Matlab, Simulink, Octave) and modeling techniques
- Experience with AI, neural networks, and predictive modeling techniques applied to power systems
- 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:)

- Practical experience with battery management systems, lithium-ion battery modeling, and state-of-health estimation
- Experience with IoT protocols (MQTT, LoRa, BLE) and sensor integration for real-time battery monitoring
- Practical experience in publishing and presenting research work (e.g., conference papers, journal articles)
- Fluent Estonian language skills in written and oral communication are desirable but not mandatory

This PhD opportunity provides a unique chance to work at the forefront of AI-driven battery optimization in software-defined electric vehicles, contributing to the future of energy-efficient and intelligent mobility solutions. The candidate will collaborate with experts in machine learning, power systems, and IoT and gain hands-on experience through simulations, hardware-in-the-loop (HIL) testing, and prototype development.

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading social science research centers in Estonia with a large portfolio of ongoing pan-European and national public administration, digital governance and innovation studies projects
- The chance to do high-level research in one of the most dynamic digital government contexts globally
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of public administration, innovation studies and digital government

(Additional information)

Main supervisor: Hadi Ashraf Raja

Co-supervisor: Alar Kuusik

For further information, please contact Prof Anton Rassõlkin anton.rassolkin@taltech.ee.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/934 or scan the the code on the left with your smartphone.

PhD Candidate in Sustainable and Green Electronics for Biotechnology Instrumentation

Summary

The PhD project aims to develop energy-efficient droplet biotechnology instrumentation for research and development. The project focuses on flow and thermal regulation, light intensity measurement, system integration, and edgeAI control, with a focus on sustainability and green electronics.

Research field:	Information and communication technology
Supervisors:	Dr. Tamas Pardy Rauno Jõemaa
Availability:	This position is available.
Offered by:	School of Information Technologies Thomas Johann Seebeck Department of Electronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

We are looking for a highly motivated and ambitious PhD candidate with experience in either biomedical engineering, mechanical/mechatronics engineering, electrical engineering, technical physics, system integration and/or similar fields, to join our Lab-on-a-chip & Microfluidics team (Website | Facebook) at Tallinn University of Technology (TalTech).

Droplet biotechnology instrumentation is a type of laboratory/liquid handling automation, which helps automate droplet-based biotechnology workflows, be it for analysis or manufacturing. In research, bioanalytical instrumentation is typically a combination of commercial off-the-shelf (COTS) sensors (cameras, photomultiplier tubes etc.) and actuators (pumps, valves, heaters/coolers etc.), integrated for a specific workflow by a highly skilled expert. If the workflow changes, so does the setup. This takes away valuable time and resources from scientifically relevant research. Additionally, a combination of high-end COTS instruments is neither power-efficient, nor compact enough to fit limited lab spaces research teams so often face.

Therefore, the goal of this PhD project is to support research and development efforts in areas such as:

1. energy-efficient flow and thermal regulation
2. light intensity measurement and imaging on low-end hardware
3. system integration and edgeAI control
4. translation to bioanalytical/biomanufacturing applications (e.g. cell/enzyme library preparation)

All the while considering questions related to sustainability of the setup and its outputs, as well as the use of green electronics, i.e. implementation of ecodesign, lifecycle assessment and inventory (LCA/LCI) principles and reusability.

The project is related to Horizon Europe projects #101099125 “3D-BRICKS” and #101046961 “Chiralforce”, as well as national research grants and collaboration projects with Estonian industrial and academic partners.

Possible research questions:

- What is the minimum viable hardware/software configuration for microfluidic droplet sorting?
- What is the most efficient, most scalable and flexible combination of edgeAI algorithms and hardware for bioanalytical instrumentation control?
- What are the possible root causes for droplet instability and variable encapsulation rates in continuous flow microfluidics and how can they be mitigated?
- How and to what extent can ecodesign, LCA/LCI principles be implemented in bioanalytical/biomanufacturing instrumentation?

Applicants should fulfil the following requirements:

- MSc either in biomedical, mechanical/mechatronics, electronics and electrical engineering, technical physics, system integration or related fields
- Have a clear interest in the topic of the position
- Excellent command of English
- Good candidate should like to play for a dynamic, interdisciplinary, and international team
- Successful candidate should have prior experience in at least one of those areas: system integration, hardware-software co-development, laboratory automation, measurement instrumentation

(The following experience is beneficial, but not required):
• Experience with bioanalytical/biomanufacturing workflows

We offer:

- 4-years PhD programme at TalTech Estonia (in the top 2% of global university rankings in related field)
- PhD/early-stage researcher position at TalTech
- Opportunities for conference visits, research stays and interdisciplinary networking with partners both locally and internationally
- Specific trainings taking into account the core skills of the candidate
- Starting salary of 2300 €/month gross, with a possibility to increase
- Position comes with full social and medical benefits in Estonia

In addition to submitting your application before the application deadline on Glowbase, you must fill a pre-application via the following Microsoft Forms: https://forms.microsoft.com/e/j1EAiEfc9r. Top candidates will enter the second round of recruitment and will be notified.

For further information, please contact Dr. Tamas Pardy (tamas.pardy@taltech.ee) and Dr. Rauno Jõemaa (rauno.joemaa@taltech.ee) with “CogniFlow-PhD” in the e-mail title.

About the department
The Thomas Johann Seebeck Department of Electronics at Tallinn University of Technology offers a dynamic and innovative environment for PhD students interested in electronics and communication technologies.

- **Research Focus:** The department specializes in Cognitive Electronics and Communication Technologies, aligning its research with industry interests and future development trends.
- **Laboratory Facilities:** Students have access to a robust laboratory infrastructure, providing practical skills essential for professional careers.
- **Historical Significance:** Named after the renowned physicist Thomas Johann Seebeck, the inventor of the thermoelectric effect, the department carries a legacy of pioneering research in thermoelectricity, magnetics, and optics.
- **Curriculum:** The department is involved in the Communicative Electronics Master’s program, which feeds into the PhD studies, ensuring a comprehensive educational pathway from undergraduate to doctoral levels.
- **Industry Collaboration:** There is a strong emphasis on cooperation with both local and international companies, government bodies, and organizations, enhancing the practical impact and relevance of research.

For detailed information on the PhD program, including specific research projects and opportunities for collaboration, prospective students can visit the department’s official website.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/928 or scan the the code on the left with your smartphone.

Experimental Validation and Data-Driven Integration of Electrical Propulsion Drive System (EPDS) Components for Software-Defined Vehicles (SDV)

Summary

This PhD project focuses on the empirical validation and intelligent data integration of Electrical Propulsion Drive System (EPDS) components in Software-Defined Vehicles (SDVs). Building upon the foundational modeling and digital twin frameworks developed within the realization of the PRG2532 project, this research will deliver comprehensive testing protocols, advanced data pre-processing strategies, and condition monitoring solutions for EPDS subsystems.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Prof. Dr. Anton Rassõlkin
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The main objective of this research is to bridge the gap between model-based development and real-world performance of EPDS components by developing robust methodologies for experimental validation and data acquisition. A particular focus will be placed on integrating sensor-driven data streams and historical datasets into the hybrid digital twin framework, thus enhancing the reliability, safety, and efficiency of SDVs throughout their lifecycle—from design and manufacturing to operation and maintenance.

The PhD candidate will be responsible for experimental setups, in-situ data collection, and model validation processes. The outcome will include technical reports and strategic recommendations for embedding EPDS digital twins within the broader SDV ecosystem.The main tasks of the thesis are:

1. Understanding the role of experimental validation and data integration in EPDS for SDVs

- Conduct a comprehensive literature review focusing on the principles of experimental validation, condition monitoring, and data-driven integration in the context of EPDS for SDV.
- Analyze the theoretical foundations and practical applications of cyber-physical systems (CPS) and digital twins (DT) in EPDS to understand their role in enhancing reliability, safety, and predictive maintenance.
- Identify research gaps, methodological limitations, and opportunities for innovation in validating and integrating EPDS subsystems into SDV architectures.

2. Investigation of state-of-the-art validation methods and data preprocessing techniques

- Identify and review state-of-the-art technologies and methodologies related to CPSs, DTs, and SDVs.
- Explore recent advancements and emerging trends in these areas, including modeling techniques, simulation tools, scaled demonstrators, and integration strategies.
- Review and analyze existing analytical, numerical, and data-driven models from previous PSG453 and ongoing PRG2532 projects.
- Identify limitations of the existing EDPS and propose strategies for improvement.

3. Experimental validation of EPDS components

- Conduct comprehensive experimental testing of EPDS subsystems under varied environmental and operational conditions to validate models developed in previous PSG453 and ongoing PRG2532 projects.
- Analyze component behavior through controlled lab and field tests, comparing performance metrics against simulated outputs.

- Identify discrepancies and feedback results into model refinement to improve accuracy and robustness.

4. Data acquisition, cleansing, and pre-processing for digital twin development

- Identify and gather relevant data sources, including sensor outputs from EPDS systems and historical operation records.
- Apply advanced data cleansing techniques to correct or remove incomplete, corrupted, or duplicate entries and ensure consistency across datasets.
- Pre-process the raw data into a standardized format suitable for integration into data-driven modeling and digital twin frameworks.

5. Integration of condition monitoring into digital twin frameworks

- Integrate real-time and historical component condition monitoring data into the digital twin structure of WP2.
- Utilize sensor-based insights to inform testing strategies, improve operational efficiency, and enhance fault detection and predictive maintenance capabilities.
- Assess the impact of condition monitoring on system-level diagnostics, safety, and overall lifecycle performance of EPDS in SDVs.

The applicants should fulfill the following requirements:

- Master's degree in electrical engineering or mechatronics
- Hands-on experience with motor-drive components such as power electronics, motors, batteries, and sensors.
- Experience with common scientific software (e.g. Matlab, Simulink, Octave, Python, etc.)
- Experience with common research support software (e.g. Office 365, Mendelay, LateX, etc.)
- Practical experience with publishing and presenting research works (e.g. conference papers)
- Very good command of English

Fluent Estonian language skills in written and oral communication are desirable but not mandatory

To get more information or to apply online, visit https://taltech.glowbase.com/positions/927 or scan the the code on the left with your smartphone.

Collaborative multimodal perception for automated vehicles

Summary

The goal of this research is to enhance the safety and efficiency of automated vehicles by developing a collaborative multimodal perception system. This system integrates data from various sources, such as cameras, LiDAR, radar, and V2X communication, to create a comprehensive understanding of the vehicle's surroundings. The research will be run in the Autonomous Vehicles research group within the TalTech facility and using the innovative iseAuto shuttle v.2.0. By sharing perception data with other vehicles and infrastructure. The research aims to improve the detection of complex environments, anticipate hazards, reduce accidents, and optimize traffic flow, ultimately enabling safer and smarter autonomous driving.

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisors:	Prof. Dr. Raivo Sell Prof. Dr. Mauro Bellone
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Recent studies on intelligent transportation systems suggest that the coordination of vehicles in traffic constitutes an important aspect of urban planning, generating significant savings and improving safety in transportation systems. Among the countless open research problems, collective perception is a relevant topic involving artificial intelligence functionalities. The candidate for this position will contribute to the body of knowledge by enhancing the safety, reliability, and efficiency of automated vehicles by developing a collaborative multimodal perception system. This system leverages data from multiple sources, such as cameras, LiDAR, radar, and V2X (Vehicle-to-Everything) communication, to create a more comprehensive understanding of the vehicle's surroundings.

By integrating and fusing these diverse data streams, the project aims to improve the vehicle's ability to detect and interpret complex driving environments, including other vehicles, pedestrians, cyclists, and potential obstacles, even in challenging conditions like low light, fog, or heavy traffic.

Additionally, this project focuses on enabling vehicles to share and receive perception data with nearby vehicles and infrastructure, leading to a collective awareness of road situations that individual sensors alone might miss. This collaboration can help anticipate potential hazards, reduce accidents, optimize traffic flow, and enable more coordinated and intelligent decision-making for autonomous driving.

Ultimately, the project aims to advance the development of safer, smarter, and more efficient automated vehicles by creating a robust perception framework that leverages the full spectrum of available data sources.

The thesis should address the following questions: 1) How can one improve perception systems using data coming from different sources? 2) How to integrate data to realize collective-distributed perception? 3) How to buld reliable navigation solution based on limited sensor data

The study goal is to carry out high-quality research in this domain involving both theoretical and practical aspects of perception systems, with the potential to generate publications in high-ranked journals and conferences using both simulations and robotic vehicles. To this end, the candidate is expected to have a good knowledge of programming tools and acquire knowledge about our custom systems during the initial stage of the doctoral studies.

Responsibilities and (foreseen) tasks

- Investigating the topic of perception for autonomous vehicles in the context of CCAM
- Self-driving vehicle behaviour in complex urban environments
- Co-operational behaviour based on V2V and V2X communication
- Autonomous driving algorithms and technologies (e.g. vehicle control, path planning, scheduling) and sensors (e.g. lidars, radars, cameras, and GNSS)

- High-level integration of autonomous driving techniques with open-source autonomous driving software (for simulation and testing)

Applicants should fulfil the following requirements:

- a master's degree in engineering sciences (preferably in computing, robotics, AI)
- a clear interest in the topic of the position
- excellent English communication skill
- 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 organisational tasks relevant to the project

(The following experience is beneficial:)

- Computer science skill
- Programming in C++ and python
- Experience with ROS, Autoware and Matlab/Simulink recommended
- Experience in designing software systems
- General overview and understanding of working principles of sensors and robotics

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading technical research centers in Estonia with a large portfolio of ongoing pan-European and national research projects
- The chance to do high-level research connected to physical hardware, including the full-scale autonomous shuttle vehicle
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of engineering and ICT

About the department

The position is supervised in a combination of two units in TalTech.

Department of Mechanical and Industrial Engineering (EMI) is an engineering and research unit of Tallinn University of Technology, School of Engineering that focuses on mechanical, industrial and robotics engineering in an interdisciplinary way. The research group **Autonomous Vehicles** is a future-oriented research group with the main strengths and focus topics:

- Self-driving vehicles, driving algorithms and cyber-physical system
- Sensor fusion, perception and big data
- Cybersecurity, automotive networking
- Simulations, verifications and validations of autonomous vehicles
- Human-machine interfaces and interactions
- Self-driving shuttle bus deployment and experimentation

FinEst Centre for Smart Cities (FinEst Centre) is an independent organisation under the Tallinn University of Technology. The aim of the FinEst Centre is to improve urban environments by testing new technologies and thereby grow into an internationally renowned research and development centre. FinEst Centre is an international organisation founded by Tallinn University of Technology, Aalto University, Forum Virium Helsinki and the Estonian Ministry of Economic Affairs and Communications. When FinEst Centre for Smart Cities started, researchers were divided into different streams by topic according to their area of interest. These streams have some level of autonomy and are led by renowned researchers in that field. One of the research streams is Smart Mobility. In order to operate future transport systems safely and efficiently, there is a need to design and implement a collaborative system where (automated) vehicles and infrastructure exchange information and coordinate their actions. This vision requires numerous and significant advances in multiple areas, including traffic flow, control systems, and communication networks.

(Additional information)

For further information, please contact Prof Raivo Sell raivo.sell@taltech.ee and Prof. Mauro Bellone mauro.bellone@taltech.ee or visit https://autolab.taltech.ee/

To get more information or to apply online, visit https://taltech.glowbase.com/positions/926 or scan the the code on the left with your smartphone.

Advanced Hybrid Modeling Techniques for Electrical Propulsion Drive System (EPDS) of Software-Defined Vehicles (SDV)

Summary

This PhD project aims to advance the modeling of Electrical Propulsion Drive System (EPDS) in Software-Defined Vehicles (SDVs) by leveraging hybrid, multi-domain, and multiscale modeling approaches. The project's objective is to develop a unified framework that integrates physics-based and data-driven methodologies to enhance the modeling fidelity of EPDS, bridging the gap between component-level and system-level perspectives. This research addresses the need for more comprehensive and computationally efficient models that account for the interactions between electrical, mechanical, electrochemical, and thermodynamic domains.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Anton Rassõlkin Mahmoud Ibrahim Hassanin Mohamed
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The PhD candidate will build upon pre-existing models from the prior PRG2532 project and introduce advanced modeling techniques to capture complex phenomena affecting EPDS. Empirical data collected from experimental activities will be utilized to validate these models and improve their predictive accuracy. Additionally, the project will explore the impact of environmental factors, such as temperature, humidity, and terrain, on EPDS performance, integrating these effects into the unified modeling framework. This approach will ensure robust, scalable, and computationally efficient models that support the design and control of SDV EPDS.

The main tasks of the thesis are:

1. Understanding of the main concept of cyber-physical systems, digital twins, and SDV

- Conduct a comprehensive literature review in the field of Cyber-Physical Systems (CPS), Digital Twins (DT) use in SDV to gain a deep understanding of the concepts, applications, and integration.
- Analyze current trends, methodologies, and challenges in the field to identify research gaps and potential areas for innovation.

2. Research into state-of-the-art technologies and methodologies

- Identify and review state-of-the-art technologies and methodologies related to CPSs, DTs, and SDVs.
- Explore recent advancements and emerging trends in these areas, including modeling techniques, simulation tools, scaled demonstrators, and integration strategies.
- Review and analyze existing analytical, numerical, and data-driven models from PSG453 and PRG2532 .
- Identify limitations of the existing models and propose strategies for improvement.
- Develop and enhance the models to support component-level (micro) and system-level (macro) perspectives of EPDS in SDVs.

3. Multi-domain modeling and integration

- Incorporate multi-domain modeling techniques that capture the interactions between electrical, mechanical, electrochemical (batteries), and thermodynamic domains.
- Ensure that the models reflect the holistic behavior of EPDS components and subsystems.
- Address cross-domain interactions and their impact on system performance.

4. Development of hybrid modeling approaches

- Develop hybrid modeling techniques that combine physics-based and data-driven approaches.
- Apply multiscale modeling methods to bridge the gap between component-level (micro) and system-level (macro) analysis.
- Develop computationally efficient reduced-order models that maintain a balance between fidelity and speed.

5. Empirical validation of the proposed models

- Validate the developed models using empirical data collected from experimental tests and prior simulation results.
- Conduct sensitivity analysis to evaluate model robustness under varying operational conditions.
- Compare model outputs with real-world data to ensure high predictive accuracy.

The applicants should fulfill the following requirements:

- Master's degree in electrical engineering or mechatronics
- Familiarity with multi-domain simulation tools and techniques.
- Experience with common scientific software (e.g. Matlab, Simulink, Octave, Pyton, etc.)
- Experience with common research support software (e.g. Office 365, Mendelay, LateX, etc.)
- Practical experience with EPDS
- Practical experience with modeling electrical drives, batteries, or other EPDS components.
- Practical experience with publishing and presenting research works (e.g. conference papers)
- Very good command of English

Fluent Estonian language skills in written and oral communication are desirable but not mandatory

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research centre focusing on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The department’s mission is to lead electrical engineering and technical studies and development projects in Estonia, which is known and valued in society and is a respected partner in national and international cooperation networks and organizations. The department has coordinated and partnered with several international projects, including Horizon 2020, INTERREG, 7FP, Nordic Energy Research etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state-of-the-art laboratories with high-end equipment, offering accredited services in lighting and different electrical measurements. The department’s focus areas are domestic and global challenges related to increasing digitalization, decarbonization, and decentralization of electric power systems and the increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- optimization of electric power systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on green technology, including energy storage, renewable energy, hydrogen systems
- supply and demand-side management, IoT applications in energy systems
- implementation of smart industry, including industrial robotics, automation, 3D printing, computer vision, digital twins

To get more information or to apply online, visit https://taltech.glowbase.com/positions/924 or scan the the code on the left with your smartphone.

Development of machine learning methods to identify patterns and forecast ocean dynamics using a synergy of remote sensing, in-situ and marine model data

Summary

The PhD candidate is expected to develop a machine learning method that combines in-situ, hydrodynamic models and remote sensing data to identify and forecast from coast to offshore patterns of the ocean dynamics (sea level, currents, waves etc.). That is essential for engineering and navigation purposes. This research is motivated by the Baltic Sea countries having access to an accurate high-resolution marine geoid model that synergizes different data sources to a common vertical reference datum, thus allowing continuous and accurate marine data from coast to offshore. Also, with the increased proficiency in computing technology and artificial intelligence (machine and deep learning methods) allows the exploration of various methods that synergizes different data sources, identification of patterns and forecasting of marine dynamics Supervisor: Prof. Artu Ellmann Co-supervisor: Prof. Nicole Delpeche-Ellmann Research group of Geodesy and Road Engineering, Dept. of Civil Engineering and Architecture

Research field:	Building and civil engineering and architecture
Supervisors:	Prof. Dr. Artu Ellmann Dr. Nicole Camille Delpeche-Ellmann
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Background

Understanding and prediction of marine dynamics (sea level, circulation, waves etc.) is now more important than ever before, especially for navigation, engineering and climate studies. Several sources such as in-situ (tide gauges (TG), marine buoys meters, drifters), hydrodynamic model (HDM), remote sensing techniques (satellite, Airborne Laser Scanning and GNSS) techniques are often utilized. These sources however suffer from: (i) different spatial and temporal resolutions, (ii) difference in technique of measurements, and (iii) dissimilar or unknown vertical reference datum. The utilization of the geoid (equipotential surface of the earth) allows these sources to now all conform to a common vertical reference datum and as a result a quantitative comparison can be analysed. By synergizing these different data set with their strengths and weaknesses it is now possible to obtain a better understanding of the marine processes in terms of identifying patterns and spatial and temporal scales from the offshore to the coastal areas. Advancements made in computing technology and artificial intelligence (machine and deep learning methods) allows a more strategic approach on synergizing the different data sets and a more accurate analysis. The focus of this study is that by combining different sources the development of a method that allows identifying and predicting real-time forecasting of ocean processes both on the coastal and offshore areas. This can be accomplished by the utilization of statistical and machine learning methods.

Tasks

The PhD candidate shall develop a method that combines in-situ, hydrodynamic models and remote sensing data to identify and forecast patterns of the ocean dynamics (sea level, currents, waves etc.). This development requires: (i) bringing the various data sets to a common vertical reference datum using the geoid; (ii) using machine leaning methods to examine ocean dynamics especially with respect to patterns, spatial and temporal scales and inconsistencies amongst the data sources and (iii) validation (with independent data sources (e.g. field experiments) and sensitivity analysis (e.g. RMS error, and scatter index (SI), error budget) and (iv) using all the sources along with the relevant data on the contributors to perform statistical and machine learning algorithm to forecast the ocean dynamics observed and its associated uncertainty. The candidate is required to perform signal processing, statistical

and computing techniques (in terms of RMS error, stand. dev, uncertainty estimates, error budgets, machine learning techniques etc.). From these results a specific model shall be developed that can forecast the sea level and current patterns that is essential for engineering and navigation purposes. The candidate is expected to assist in project related field campaigns.

Requirements

The call is open for candidates that fulfil the following requirements:

- University degree (M.Sc.) in geodesy. Consideration will be given to applicants whose previous degrees are in appropriate related discipline, such as Earth Sciences, Marine Engineering, Mathematics or Physics.
- A clear interest in the research topic are preferred
- Advanced computer literacy and programming skills (e.g. Python, C++, MATLAB etc.).
- Strong and demonstrable writing and analytical skills
- Skills in data analysis, mathematical and statistics (to be trained), machine learning methods (to be trained)
- Ability for independent research as part of a team, interest in the presentation and publication of scientific results.
- Good command of the English language (speaking and writing).

The shortlisted candidate may be required should submit a research plan for the topic. The candidate can expand on the outlined research scope.

We offer:

- 4-year PhD position (full time) in the Civil Engineering and Architecture that has a sound portfolio of ongoing European and national research projects
- An environment to perform excellent research and publications
- Opportunities for training relevant technical and transferable skills aiming academic or industrial careers
- Opportunities for conference visits, research stays and networking with globally leading companies, universities and research centres in the field of research

The candidate is obligated to participate and fulfil the requirements of Tallinn University of Technology PhD programme. Additional funds will be provided (and whence applicable the associated funding can be applied for) for research trainings, conferences and international mobility/stays abroad with durations of up to 3 months. The research group wishes to increase the number of women interested in Geomatics and Engineering. Qualified women are therefore also encouraged to apply. Do not hesitate to contact us for questions regarding the position. We look forward to receiving your application.

About the department

Department of Civil Engineering and Architecture is an interdisciplinary teaching and research center of Tallinn University of Technology that focuses on various actual research issues. The department consists of several research groups. The geodesy research group has mainly been focused on the national geodetic infrastructure related research (modelling the gravity field and geoid, precise height network, GNSS positioning). Currently the TalTech geodesy group is participating in the international collaboration for implementing the Baltic Sea Chart Datum 2000 by improving the marine geoid modeling. Most of the Baltic Sea countries have agreed to adopt this new marine geoid based vertical datum as initial for the nautical charts, hence also for the maritime and offshore industry. The recent European Space Agency sponsored international project Geodetic SAR for Baltic Height System Unification tested potential of the Interferometric Synthetic Aperture Radar (InSAR) of unification of across-ocean vertical datums. The group has relevant contractual research for industry, environmental and governmental agencies, for the details see A. Ellmann's (head of the group) ETIS account, https://www.etis.ee/CV/Artu_Ellmann/eng.

The Laboratory of Waves Engineering is part of the Department of Cybernetics at TalTech, the focus of this lab has been on complex and nonlinear phenomena in wave dynamics and coastal engineering, and the applications of mathematical methods in wave studies. Recent focus has been one the use of Lagrangian transport of different substances in marine environment for marine and maritime spatial planning, adequate description of hydrodynamic (wave and water level) extremes, and preventive methods for mitigation of marine-induced hazards. The geodesy

group has participated in the wave dynamics for coastal engineering and management related large projects, for the details see N. Delpeche-Ellmann's ETIS account https://www.etis.ee/CV/Nicole_Delpeche-Ellmann/eng/. These projects are relevant to the present research since the results and knowledge acquired contribute toward identifying and quantifying ocean dynamic processes.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/923 or scan the the code on the left with your smartphone.

Developing non-precious transition metal based catalysts for hydrogenation reactions and their use in para-hydrogen induced hyperpolarization based applications

Summary

This PhD research project will focus on designing and synthesizing suitable first row transition metal complexes capable of binding H2 in reversible manner to carry out hydrogenation reactions. While doing so, the successful candidate will dwell into the world of organometallic chemistry to design, synthesize and utilize custom made ligands on the selected non-precious metal salts. These complexes would then be assessed in hydrogenation reactions to evaluate their para-hydrogen induced polarization transfer efficiency. This fully funded PhD project will offer the candidate an opportunity to learn the skills necessary to carry out air- and moisture sensitive chemistry using organometallic complexes, and secondly it will expand the application of these complexes into solution NMR to increase the signals of low concentration analytes in a mixture of interest. The overall goal of the project is to test and find the structurally simplest non-precious metal complex capable of inducing NMR signal enhancement in presence of para-hydrogen (p-H2) and suitable selection of substrates. The project addresses the following research questions: Which non-precious metal based system is suitable for redox chemistry application? Which types of ligands have an important effect of the reversible binding of H2? How different types of substrates of interest interact with these metal complexes?

Research field:	Chemistry and biotechnology
Supervisor:	Dr. Martin Jakoobi
Availability:	This position is available.
Offered by:	School of Science National Institute Of Chemical Physics And Biophysics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

While non-destructive as an analytical technique, NMR analysis of complex mixtures (petrochemical fractions, biofluids, soil samples etc.) is cumbersome due to limited sensitivity of NMR samples under thermal equilibrium conditions. However, where there is a scientific problem, there is a scientific solution to overcome this issue of NMR insensitivity. Namely, various research groups have reported more than 1000-fold sensitivity gains by employing cleverly designed experiments under para-hydrogen induced polarization (PHIP) conditions. Our colleagues at KBFI, among other research groups, have demonstrated the possibility of detecting sub-micromolar quantities of metabolically relevant analytes and even oligopeptides [1]. As the field is still developing and trying to break through the academic boundaries to become a day-to-day analytical technique, the affordability of the most studied iridium based catalytic systems in the long run needs to be addressed. First promising steps to employ non-precious metal based PHIP catalysts have been developed Fout's group [2,3], which has inspired us to investigate this angle even further.

The aim of the PhD project is to develop and synthesize non-precious transition metal complexes capable of reversibly binding H2 and carrying out hydrogenation reactions of unsaturated functional groups. The PhD candidate will explore the synthesis and effect of custom-made ligands on the metal center and how these changes will affect the possibility to carry out NMR signal enhancement using PHIP transfer. The outcome of his/her results in developing and applying simple and cheap metal complexes in PHIP signal enhancement process would allow research community to leap forward by making these complexes affordable for daily use in analytical chemistry and reaction mechanism studies.

The project is inherently interdisciplinary and will combine our expertise in several chemistry disciplines. The PhD candidate will be exposed to organic and organometallic chemistry, NMR spectroscopy, and to catalytic processes. Prior exposure to one or more of these disciplines and enthusiasm in learning the handling of organometallic compounds will be seen as a plus.

Responsibilities and (foreseen) tasks

- Getting acquainted with current state-of-the-art research in the field.
- Willingness to deeply dwell into the air and moisture sensitive chemistry of transition metal complexes.
- Being curious to learn more about NMR and the suitable scope of potential target substrates that could be detected under *p*-H_2 induced polarization transfer process.
- Preparing, storing, utilizing correctly sensitive reagents, complexes and different solvents.
- Contribute to departmental seminars and participate at scientific events.
- Develop reform proposals and suggestions for practice
- To obtain teaching experience while supervising BSc/MSc students.

Applicants should fulfil the following requirements:

- a master's degree in chemistry (preferably in organic, inorganic or homogeneous catalysis)
- hands of experience in synthesizing, purifying and characterizing compounds
- a clear interest in the topic of the position
- 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:)

- enthusiasm in learning the handling of organometallic compounds will be seen as a plus
- knowledge and experience in liquid NMR
- independent nature and willingness to test one's ideas
- ability to work in collaboration with other groups and individuals of different seniority in academia

We offer:

- 4-year fully funded PhD position in one of the most internationalized research centers in Estonia at KBFI (Keemilise ja bioloogilise füüsika instituut) where the synergy between chemistry, biology and physics can lead to new frontiers in science.
- Access to modern laboratory equipped with everything needed for carrying out air– and moisture sensitive chemistry.

About the department

As KBFI is research only institution, the PhD candidate will be enrolled as a doctoral student to the nearby Tallinn University of Technology (Taltech). The candidate will have access to Taltech lectures, courses and academic resources at the full PhD curriculum capacity. Funding will be available for 4 years since the start of contract.

The PhD candidate will be integrated into the KBFI Organometallic chemistry research group and will be supervised by Dr Martin Jakoobi. The group maintains facilities for air-/moisture sensitive sample handling, sample preparation and fume hoods equipped with Schlenk lines and appropriate glassware to carry out manipulations with sensitive reagents. This PhD project will take advantage of the availability of various NMR spectrometers (200, 300, 360, 500, 600 and 800 MHz magnets) to assess the synthesis of various reagents, complexes and the outcomes of hydrogenation reactions. Additionally, the laboratory operates in-house developed *p*-H_2 hyperpolarization equipment that allows experimental workflows for which commercial instrumentation is not available.

(Additional information)

Interested candidates should contact Dr Martin Jakoobi at martin.jakoobi@kbfi.ee

References

1) Reimets, N.; Ausmees, K.; Vija, S.; Trummal, A.; Uudsemaa, M.; Reile, I. Parahydrogen hyperpolarized NMR detection of underivatized short oligopeptides. Analyst 2023, 148, 5407–5415, doi:10.1039/D3AN01345F.

2) Tokmic, K.; Markus, C. R.; Zhu, L.; Fout A. R. Well-Defined Cobalt(I) Dihydrogen Catalyst: Experimental Evidence for a Co(I)/Co(III) Redox Process in Olefin Hydrogenation. J. Am. Chem. Soc. 2016, 138, 11907−11913, DOI: 10.1021/jacs.6b07066

3) Najera, D. C.; Fout, A. R. Iron-Catalyzed Parahydrogen Induced Polarization. J. Am. Chem. Soc. 2023, 145 (38), 21086–21095, DOI: 10.1021/jacs.3c07735.

AI for Cumulative Impact Assessment

Summary

The Estonian Maritime Academy, TalTech is inviting applications for a fully funded PhD position in the field of Artificial Intelligence (AI) applied to Cumulative Impact Assessment. The position is part of an interdisciplinary research initiative aimed at developing AI-driven methodologies to extract and analyze impact information from scientific publications, with a particular focus on environmental and marine sciences.

Research field:	Maritime studies
Supervisor:	Jonne Kotta
Availability:	This position is available.
Offered by:	School of Engineering Estonian Maritime Academy
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

Position Overview

The selected candidate will develop a **multi-modal AI model** to process and extract structured impact information from scientific literature. This research will integrate Natural Language Processing with environmental science data to enhance decision-making processes in habitat restoration and ecological assessments.

Key Responsibilities

- Develop and implement multi-modal AI models combining text, images, and tabular data from scientific publications.
- Design NLP-based pipelines for extracting and structuring impact-related information.
- Collaborate with domain experts in marine science to ensure AI models capture relevant ecological and environmental indicators.
- Publish research findings in top-tier conferences and journals.
- Engage in interdisciplinary collaboration within TalTech and external research partners.

Qualifications

The ideal candidate should have:

- A **Master's degree** in Computer Science, Artificial Intelligence, Machine Learning, Computational Linguistics, or a related field.
- Strong knowledge of **AI, NLP, and Machine Learning methodologies**.
- Experience in deep learning frameworks such as TensorFlow, PyTorch, or similar.
- Proficiency in Python and relevant NLP/ML libraries (Hugging Face Transformers, spaCy, Scikit-learn, etc.).
- Experience with information extraction, scientific text processing, or multimodal AI techniques.
- A **background in Marine Science or Environmental Science** is a strong plus.
- Excellent analytical, problem-solving, and communication skills.

What We Offer

- A fully funded PhD position for **four years**.
- A dynamic research environment with access to state-of-the-art computational resources.
- Collaboration with leading experts in AI, NLP, and Marine Science.
- Opportunities for international research exchange and conference participation.

Application Process

To apply, please submit the following:

- A cover letter detailing your research interests and qualifications.

- A CV, including publications (if any).
- Copies of academic transcripts and degrees.
- Contact details for two academic references.

Application Deadline: 30.06.2025
Expected Start Date: 01.09.2025

For inquiries, please contact Prof. Jonne Kotta at jonne.kotta@taltech.ee.

We look forward to receiving your application!

To get more information or to apply online, visit https://taltech.glowbase.com/positions/921 or scan the the code on the left with your smartphone.

New Methodology for Financial and Technical Assessment of Energy Flexibility in Buildings

Summary

The global push towards sustainable development and energy efficiency has led to an increasing interest in flexible energy technologies in buildings. This PhD research aims to develop a robust methodology for the financial and technical assessment of energy flexibility in buildings, addressing the key barriers to implementation. The transition towards energy-efficient and flexible buildings is important in addressing climate changes and optimizing energy usage in urban environments. Energy flexibility in buildings refers to the ability of a building to adjust its energy consumption in response to external conditions, such as energy prices, grid demand, and renewable energy availability. The need for a systematic and data-driven methodology to assess the financial and technical viability of energy flexibility solutions has become increasingly relevant, particularly in smart grids and sustainable urban planning.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Argo Rosin Vahur Maask
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The TEM-TA78 project at TalTech focuses on data-driven assessment of energy-saving and flexibility technologies in buildings, which aligns with this research topic. The project's goal is to support Estonian enterprises in developing and deploying new energy-saving and flexibility-based services. However, several challenges hinder the large-scale implementation of such technologies, including:

- The lack of standardized methods to evaluate the energy-saving potential and financial benefits.
- Issues related to data availability, quality, and integration for modeling and assessment.
- Need for reliable impact assessment methodologies for customers and policymakers.
- Limited skilled workforce in energy flexibility assessment and implementation.
- Low public awareness of available smart energy technologies.

The research
The PhD project aims to create a new, data-driven methodology that integrates financial and technical assessment frameworks for evaluating energy flexibility in buildings. The specific objectives include analyzing the assessment methodology's effectiveness and economic implications using datasets acquired from the TalTech campus and partner buildings. Ultimately, this research contributes to informed decision-making to provide flexibility with buildings and resource allocation in the face of evolving energy demands and generation profiles.
PhD project should address several key research questions to advance our understanding and improve financial and technical assessment of energy flexibility in buildings. Here are some relevant questions:

1. How can a standardized methodology be developed to evaluate the financial and technical feasibility of energy flexibility measures in buildings?
2. What are the key technical parameters and financial indicators that should be included in an assessment model for energy flexibility?
3. How can energy consumption data, predictive analytics, and AI-driven models enhance the accuracy of energy flexibility assessment?

4. What are the economic and environmental trade-offs associated with implementing energy flexibility technologies in different types of buildings?
5. How can energy flexibility assessment be integrated into smart grid frameworks to optimize energy management?
6. What role do policy incentives, market regulations, and stakeholder engagement play in adopting energy flexibility solutions in buildings?
7. How can the proposed assessment methodology be validated and scaled to accommodate various building typologies, climates, and energy market conditions?
   Research tasks involve combining quantitative and qualitative research methods, including data collection through measurements, simulations, and possibly field studies. Followed by data analysis using statistical and computational techniques.

Supervisors
Main supervisor: Researcher Vahur Maask
Co-supervisor: Prof. Dr Argo Rosin

Responsibilities and (foreseen) tasks

- **Development of a Comprehensive Assessment Model:**
  - Establishing a framework that integrates technical, economic, and environmental performance indicators.
  - Utilizing big data and AI-driven analytics to enhance assessment accuracy, such as XGBoost, CatBoost, long-short term memory or time series analysis tools.
  - Investigate the flexibility potential of various flexibility sources in buildings, such as smart HVAC systems, adaptive lighting, and energy storage.
- **Data Collection and Analysis:**
  - Gather extensive datasets from building management systems, smart meters, and other IoT devices to capture energy usage patterns, environmental conditions, and operational parameters.
  - Leveraging historical data from TalTech's campus buildings and industry partners to model energy flexibility potential.
  - Developing benchmark datasets for future research and industry applications.
  - Preprocess the data to handle missing values, outliers and ensure data integrity for accurate analysis.
- **Validation of Assessment Models:**
  - Testing and validating the methodology using real-world pilot projects or experimental results from TalTech's campus.
  - Identifying strategies for cost-effective deployment of energy flexibility measures.
- **Impact Evaluation and Decision Support:**
  - Designing a decision-support framework for policymakers, aggregators, and building owners.
  - Providing guidelines for smart building automation and classification frameworks.
- **Scalability and Policy Recommendations:**
  - Assessing the scalability of the methodology for different building types and urban settings.
  - Evidence-based policy recommendations to promote the adoption of energy flexibility technologies.

Applicants should fulfil the following requirements:

- master's degree in electrical engineering, computer science, or applied informatics from the last 5 years
- a clear interest in the topic of the position
- principal understanding of electric power systems
- strong programming skills (e.g., Python, MATLAB, C++)
- proficient English language user (at least CEFR level of C1)
- profound writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to aid in relevant organizational tasks

The following experience is beneficial:

- (co-)authored published scientific papers

- practical experience in working with SQL database, Jupyter Notebook and/or MATLAB
- theoretical experience with energy flexibility assessment issues
- basic knowledge of machine learning

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading microgrids research group in the region with a large portfolio of pan-European and national research and development, and study projects, mainly concerned with renewable energy integration and digital and AI applications in electric power systems.
- The opportunity to carry out high-level research in the domain of microgrids and metrology.
- Access to state-of-the-art research facilities for microgrids, renewables integration and power system digitalization.
- Opportunities for student exchange through EuroTeQ and Erasmus+ programmes, visits to scientific conferences and laboratory facilities and networking with leading universities and research centres.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research centre focusing on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The department's mission is to lead electrical engineering and technical studies and development projects in Estonia, which is known and valued in society and is a respected partner in national and international cooperation networks and organizations. The department has coordinated and partnered with several international projects, including Horizon 2020, INTERREG, 7FP, Nordic Energy Research etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state-of-the-art laboratories with high-end equipment, offering accredited services in lighting and different electrical measurements. The department's focus areas are domestic and global challenges related to increasing digitalization, decarbonization, and decentralization of electric power systems and the increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- optimization of electric power systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on green technology, including energy storage, renewable energy, hydrogen systems
- supply and demand-side management, IoT applications in energy systems
- implementation of smart industry, including industrial robotics, automation, 3D printing, computer vision, digital twins

Additional information

For further information, please get in touch with Researcher Vahur Maask, vahur.maask@taltech.ee or visit https://taltech.ee/en/department-electrical-power-engineering-mechatronics

To get more information or to apply online, visit https://taltech.glowbase.com/positions/920 or scan the the code on the left with your smartphone.

Real-time and wide-area based power system stability monitoring in converter based systems

Summary

This PhD project focuses on creating a real-time and wide-area measurement based understanding on power system stability in converter based generation dominated power systems. The research aims to develop new methods for determining power system operating conditions and limitations when generation mix and locations are changing. The results of the project will be validated in real power system using available wide-area monitoring system.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Prof. Dr. Jako Kilter
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

The main objective of this PhD project is to design and implement cutting-edge methods to determine the power system condition and states using wide area measurements and other available data in power system with significant level of converter based generation and consumption. This interdisciplinary research will integrate power systems models, electrical grid and power plant constraints, IT infrastructure, advanced forecasting algorithms, and wide-area measurements into advanced algorithms which enable power system operators to understand how far the system is from its stability limits. The research will leverage tools such as RTDS, MATLAB, PSS/E, Python, Wide-Area Monitoring System. The ultimate objective of the research is to increase power system operational awareness and thereby increase system security.

For this project, three PhD positions are offered.

Responsibilities and (foreseen) tasks

- **Research and Development:** Investigate and develop methods for power system stability monitoring.
- **Wide-area platform:** Development of algorithms for use in combination of laboratory based wide area monitoring system and RTDS.
- **Actual system application:** Development of algorithms for actual power system implementation considering the respective limiting constraints.
- **Validation and Evaluation:** Conduct rigorous validation and evaluation of the designed algorithms and optimization methods to ensure accuracy and reliability.
- **Documentation and Dissemination:** Document research findings, methodologies, and outcomes, and disseminate results through academic publications and presentations.

Applicants should fulfil the following requirements:

- a master’s degree in Electrical engineering from last 3-5 years
- a clear interest in the topic of the position
- profound knowledge of electric power systems, wide-area monitoring and machine learning methods.
- 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 aid in relevant organizational tasks

(The following experience is beneficial:)

- (co-)authored scientific papers published in Q1 or Q2 journals
- programming using high-level programming languages (e.g., Python, C++, C#, Java or similar)
- mathematical optimization, programming, and algorithm development
- power system economics and electricity market
- renewable power plants and batteries

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in the leading power system research group in Estonia with a large portfolio of pan-European and national research and development, and study projects, mainly concerned with renewable energy integration and wide-area based applications in electric power systems.
- The chance to do high-level research in the domain of power systems and renewables integration in an international and enabling environment with state-of-the-art research infrastructure.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of power systems monitoring and control

About the department

The Department of electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations.

The Department of Electrical Power Engineering and Mechatronics conducts research within 7 research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements. The focus areas of the department are related to domestic and global challenges related to increasing digitalization, decarbonization and decentralization of electric power systems and increasing use of renewable energy sources. The department carries out research in the following relevant areas:

- Optimization of electric power systems and system analysis to find possibilities for electrification and decarbonization
- Diagnostics and monitoring of equipment and systems
- Cyber security, 5g data communications and artificial intelligence
- Energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, iot applications in energy
- Implementation of smart industry, including industrial robotics, automation, 3d printing, machine vision
- Implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- Development of smart city solutions, including environmentally friendly and self-driving vehicles / drones, digital twin applications.

(Additional information)

For further information, please contact Prof Jako Kilter, jako.kilter@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/919 or scan the the code on the left with your smartphone.

Real-Time Condition Monitoring of Instrument Transformers using Modern Power System Monitoring Data

Summary

The main objective of this research project is to develop methods to assess the actual condition of substation instrument transformers using modern power system monitoring data, e.g., PMUs, PQ meters, TFR, etc. It is of interest to determine which of the available measurement data and how can be used considering the data availability and cost limitations. Within the research it is possible to participate in activities performed in high-voltage laboratory and using RTDS. The research is financed by Estonian TSO. This research project is part of the wider project which objective is to develop methods to assess the condition of Transmission Network substations and determine the optimal approach for equipment maintenance principles.

Research field:	Electrical power engineering and mechatronics
Supervisor:	Prof. Dr. Jako Kilter
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Transmission Network Operators (TSO) around the world are looking various ways to optimize their costs related to maintenance activities. The most implemented approach is to use manufacturers suggestions which indicate the appropriate time interval after what the maintenance should be made. This approach however may lead to use of funds in not so optimal was as the equipment may not need to be maintained after certain time interval. The approach that it is observed in this project is related to risk assessment and probabilities with the objective to determine the probable or actual condition of different substation equipment. For this various existing measurement data can be used or some additional measurements could be implemented if seen viable.

In this research project the main emphasis is on instrument transformers and specifically on their condition monitoring in real-time using all available and appropriate measurement data. This will include various existing measurement solutions, e.g., PMUs, PQ meters, SCADA measurements, partial discharges, etc. If seen appropriate also new approaches are to be developed and checked in actual substations levels.

The thesis should address the following questions: 1) Which online and offline approaches are used for instrument transformers condition monitoring around the world? 2) How condition of instrument transformers can be determined? 3) What measurement solutions are appropriate in general and in actual substation environment 4) How different instrument transformers should be assessed and what parameters should be monitored? 5) What recommendations should be given to TSOs when planning actual condition-based instrument transformers maintenance?

Responsibilities and (foreseen) tasks

- Literature overview on online and offline methods for instrument transformer condition monitoring
- Instrument transformer modelling principles
- Instrument transformer laboratory testing
- Methodology development for instrument transformer condition monitoring
- Framework development for instrument transformer condition monitoring in actual TSO substation

Applicants should fulfil the following requirements:

- a master’s degree in electrical engineering or power systems or physics
- a clear interest in the topic of the position
- excellent understanding and speaking skills 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
- modelling skills related to Matlab or Python

The following experience is beneficial:

- working knowledge of statistics
- working knowledge of stochastic processes
- working in international environment
- publishing academic papers

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading engineering science research centers in Estonia with a large portfolio of ongoing pan-European and national R&D projects in the field of electrical engineering;
- The chance to do high-level research and directly participate in industrial related activities;
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of electrical engineering.

About the department

The Department of Electrical Power Engineering and Mechatronics of Tallinn University of Technology is an interdisciplinary research center that focuses on socially relevant and future-oriented research and teaching issues related to power engineering and mechatronics. The mission of the Department is to be a leader in electrical engineering and technical studies and development projects in Estonia, known and valued in society, and a respected partner in both national and international cooperation networks and organizations.

The department educates future electrical and power engineering leaders and engineers at the bachelor's, master's and doctoral level. Through training courses, the department ensures lifelong learning and continuous development.

The department carries out large-scale interdisciplinary scientific research, development and professional projects, thanks to which the competence in the field of electrical energy and mechatronics continues to grow. With research, application and development services, the department increases the competitiveness of companies in both the domestic and international markets, keeping knowledge in Estonia. The department has coordinated or been a partner in numerous international projects, such as Horizon 2020, INTERREG, 7FP, Nordic Energy Research, etc.

The Department of Electrical Power Engineering and Mechatronics conducts research within seven research groups and operates state of the art laboratories with high end equipment, offering also accredited services in the fields of lighting and different electrical measurements.

The departments' focus areas are related to both domestic and global developments, such as increasing digitalization and decarbonization, decentralization and decentralization of electricity generation, and the increasing use of renewable energy sources. The department conducts research in the following relevant areas tackling the energy transition:

- optimization of electrical systems and system analysis to find possibilities for electrification and decarbonization
- diagnostics and monitoring of equipment and systems
- cyber security, 5G data communications and artificial intelligence
- energy networks and research on hydrogen technologies, including energy storage, renewable energy, low carbon technologies, consumption management, IoT applications in energy
- implementation of smart industry, including industrial robotics, automation, 3D printing, machine vision
- implementation of energy and resource efficiency, including digitization of supply chains, mapping of opportunities to optimize systems and reduce energy consumption
- development of smart city solutions, including environmentally friendly and self-driving vehicles / drones, digital twin applications.

(Additional information)

For further information, please contact Prof Jako Kilter, jako.kilter@taltech.ee

To get more information or to apply online, visit https://taltech.glowbase.com/positions/918 or scan the the code on the left with your smartphone.