

Monitoring and allocation of power system reserves in converter rich power systems

Summary

This PhD project focuses on the challenges posed on monitoring and allocation of power system reserves in case converter based generation is dominant in the power system. The research aims to develop new methods for determining reserve needs of the power system in advance, optimal allocation of reserves, and monitoring the system state. Methods, that would be able to handle changing generation locations and mix introduced by the converter based generation.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Jako Kilter Madis Leinakse
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between October 01, 2024 00:00 and October 25, 2024 23:59 (Europe/Zurich)

Description

The research

The objective of this PhD project is to design and implement cutting-edge methods to determine the reserve needs of a power system with significant level of converter based generation and consumption. Furthermore, also methods for optimal allocation of reserves are developed and implemented. The used methods may take advantage of wide area measurements and other available data in power system. 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, two PhD positions are offered.

Responsibilities and (foreseen) tasks

- **Research and Development:** Investigate and develop methods for monitoring and optimal allocation of power system reserves.
- **Teamwork:** Co-operation with colleagues to develop methods and implement solutions.
- **Lab Work:** Work at a power system laboratory. Including work with different devices and software tools to implement designed solutions.
- **Validation and Evaluation:** Conduct rigorous validation and evaluation of the designed methods to ensure accuracy and reliability.
- **Documentation and Dissemination:** Document research findings, methodologies, and outcomes, and disseminate results through academic publications and presentations.
- **Teaching and supervision:** Supervising BSc and MSc theses related to research subject, teaching in supporting role and limited capacity.

Applicants should fulfill 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 and system stability
- 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. Matlab, Python, C++, C#, Java or similar)
- experience with mathematical optimization, programming, and algorithm development
- hands on experience with lab equipment (RTDS, PMUs, PLCs) and systems (WAMS)
- 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 Dr Madis Leinakse madis.leinakse@taltech.ee and Prof. Jako Kilter jako.kilter@taltech.ee



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