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, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

Description

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/818 or scan the the code on the left with your smartphone.