

## **Master Thesis:**

### Data-Driven Technique for Dynamic States Estimation Using Gaussian Processes

#### **Brief Background:**

States estimation routine is one of the first routine to run at the control center of transmission or distribution systems, which then provides state of the grid for use in other operational applications such as contingency analysis, congestion management and optimal power dispatch. The once passive distribution grid is becoming more dynamic in nature which arises the need for estimating the states of the grid dynamically to be able to monitor the dynamics of the system. In literature, the dynamic states estimation is performed using Kalman Filtering (KF) techniques, which make use of the known equations for states transition and measurements model. However, sometimes these equation-based models may not be available due to several reasons, such as restrictions due to intellectual property or unknown underlying dynamics of the devices. As a first step to overcome this challenge, this thesis work will model the measurement and state transition model as Gaussian processes (GP), and employ these models into Kalman filter formulations for grid dynamic states estimation.

The student will make use of existing theoretical framework to implement the KF-GP for states estimation for power system monitoring and analyze its performance under different operating conditions.

#### **Your Tasks:**

- Literature review on data-driven techniques for states estimation.
- Familiarization with Gaussian process modeling and Kalman filtering techniques.
- Implementation of Gaussian process based Kalman filter algorithm(s) using python programming language.
- Select an appropriate test case to test the implemented algorithm(s) and justify the selection
- Analyse the accuracy and computational challenges of the implemented states estimation algorithm(s) under various operating conditions
- Outline the challenges of using this method for real-time application.

The scope of the work can be extended based on the progress.

#### **Your Profile:**

- Master student in electrical engineering

- Background on power system monitoring, concepts on statistics and machine learning are desirable
- Good programming skill in Python is mandatory
- Interest in inter-disciplinary research topics
- Critical thinking and enjoys working independently

Supervision will be done in English.

If this position sparks your motivation and you are interested to apply, please send an email with your CV and current grades to the contact below.

**Contact:**

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