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Fast Decision Strategies for Power System Operation in Critical Situations

Internship and Master thesis with Siemens Technology in Munich

Contact for applications: amer.mesanovic@siemens.com or johannes.boerner@tu-darmstadt.de

The internship position is in a research group on Autonomous Systems and Control with Siemens Technology in Munich. We are an interdisciplinary group of, among others, electrical engineers, physicists and mathematicians working on control topics with various fields of applications.

The goal of the internship is to work with fast and systematic decision strategies that stabilize a power system after a critical contincency. Today's power systems are typically configured for N-1 security, which ensures that the failure of one component does not impact the security of supply of the entire system. In such manageable cases, contingency strategies exist to bring the system back into normal operation. However, when improbable events with large impact occur, e.g., due to a natural catastrophe or a malicious attack, contingency strategies do not exist, and the system is threatened by a blackout. You will focus on methods that support transmission system operators by suggesting systematic and fast actions to stabilize a power system after a critical contingency and thus avoid a complete blackout.

You will elaborate on modeling power systems as hybrid systems with discrete variables describing, for instance, the settings of phase-shifting transformers, opening breakers, fast load-shedding etc. First, it will suffice to model the power system through (linear) power flow equations and focus on selected decision strategies like load shedding. Later, you will incorporate more modeling details and consider a broader range of possible decision strategies.

After the internship, the work could be continued in greater depth within the scope of a master thesis. The

following three aspects could be examined in more detail therein.

1. **Consider more detailed, practically relevant, modeling approaches** of the power flow, generation and other power system elements.
2. **Extend existing methods** to a broader range of possible countermeasures, for example, adapting setpoints of conventional and phase-shifting transformers, or the setpoints for inverter-based generation.
3. **Analyze and adapt the developed methods** for large power systems including several hundreds or thousands of busses.

Your qualifications:

- You are an excellent student in Electrical Engineering, Physics or a related field.
- You have good knowledge of optimization or static modeling of power systems.
- You are experienced in Python, MATLAB or other programming languages.
- You are fluent in English or German.

More facts about the internship:

- The duration is according to your university's guidelines regarding mandatory internships.
- The application should include a current **CV** and a **transcript of records**.
- The internship and thesis can be done remotely