RWTH AACHEN UNIVERSITY

E.ON Energy Research Center
ACS | Institute for Automation of Complex Power Systems

HiWi/WiHi/Master/Bachelor Thesis:

Modelling analysis of singular and cascading failures in interdependent power and communication infrastructures

Context:
The power grid is becoming heavily dependent on the communication infrastructure for its automation, monitoring, control and protection. Failure of the communication infrastructure results in the failure of the grid automation systems hampering the operation of the power grid. Similarly, loss of specific generators, lines and substations due to either faults, natural calamities or targeted attacks can cause some electrical nodes to de-energize which may bring the communication infrastructure down that may further affect the operation of the subsequent healthy power grid. Such strong interdependence between the communication and power grids can potentially propagate singular failures, causing cascading effects in interconnected infrastructures. Therefore, it is important to model the topological interdependence between the communication and power infrastructure, in order to better understand the susceptibility of such systems to propagate failures causing cascaded failures within an infrastructure and to other infrastructures. Appropriate countermeasures could be proposed that can topologically bolster the networks to minimize the impact of targeted and random attacks.

Your tasks:
The major tasks involved in the thesis are as given below.

- The student has to make the topological models for the grid, for the automation systems and the communication infrastructure.
- Modelling using graph theory of power and communication infrastructures
- Investigation of appropriate modeling tools.
- Develop the metrics to quantify the topological vulnerabilities within an individual infrastructure and extended to quantify the interdependence between the infrastructures.

Profile:
The student has to have basic knowledge power system automation systems. A basic knowledge of graph theory would be beneficial. The student is expected to programme in python. A basic knowledge of power system networks and communication infrastructure components is prefered.

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