Master-Thesis / Diplomarbeit:

Distributed Control for Transient Stability in Microgrids

Context:
The power grid, as a whole, is composed of heterogeneous power generators and loads. In steady state, the frequency and voltage of the grid are constant, with all the power produced being consumed. If a mismatch between the produced and consumed power occurs, the system deviates from the synchronized steady state. During such transients, a control is required to maintain the network equilibrium state within a tight margin. The main goal here is transient stability. The transient stability characteristics can be improved by applying distributed communication and cooperative control. Distributed architectures are flexible, versatile, reliable and to a certain extent robust to failures of individual units. Endowing each power-generating unit with communication and computation capabilities turns it into an intelligent agent, which can implement multi-agent distributed control to achieve common goals of maintaining the voltage and frequency reference in spite of varying loads and possible failures of individual power generating units.

Your tasks:
The student should work on the design of distributed control aimed at achieving transient stability (in terms of frequency) in power systems such as microgrids. Microgrids are technical systems composed of diverse power generation units (often associated with renewable power sources), and energy storage technologies which supply a group of local consumers. These systems can operate in grid-connected mode, when connected to a functioning power-grid, and in islanded mode, when disconnected from it. A distributed control should be designed assuming communication and physical interconnection topology do not necessarily coincide. Finally, the candidate will assess the potential of the developed distributed control concept and its impact on system’s stability during transients in the direct simulative comparison with the use case in which the transients in the microgrid are uncontrolled. A suitable candidate should have a solid background in control theory.

Further information:
The work is jointly supervised by Czech Technical University Prag (Kristian Hengster-Movric, Ph.D, Group Advanced Algorithms for Control and Communication) and RWTH Aachen (Dr. -Ing. Martina Josevski, Institute Automation of Complex Power Systems). The candidates participating the Double Degree Program (T.I.M.E) are especially encouraged to apply.

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