

Control methods for future power networks

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Abstract (250 to 500 words)

Growing concerns about environmental impacts of conventional power plants drive a worldwide expansion of renewable energy sources such as photovoltaic power plants and wind turbines. This leads to a structural change in electric power networks: from a small number of large-scale generators to a large number of distributed small-scale ones. Moreover, the increasing use of renewable sources leads to a significant growth of uncertainty in the operation of such networks. In light of these challenges, automatic control plays a central role to run future power systems in a reliable, economically and ecologically meaningful way.

The talk puts a spotlight on different control applications in the domain of complex power networks with a large share of decentralized, uncertain renewable generation. The overall objective of all applications is to enable future low-carbon energy systems. In detail, the following questions will be discussed.

- How to operate islanded grids with a very high renewable share, i.e., how to decide when to charge or discharge storage units and when to enable or disable conventional generators?
- How to enable optimal trading among a network of interconnected microgrids using techniques from distributed optimization?
- How can a safe and reliable operation of power systems be obtained using distributed and decentralized control?

About the author (200 words)

Christian A. Hans is a postdoctoral researcher with the Control Systems Group, Electrical Engineering and Computer Science Department, Technische Universität (TU) Berlin, Germany. He received a PhD degree (Dr.-Ing., with distinction) from TU Berlin in 2021 and a Diploma from RWTH Aachen University in 2011. During his doctoral studies, he was a visiting scholar with the Dynamical Systems, Control, and Optimization Research unit at the IMT School for Advanced Studies Lucca, Italy. Before joining TU Berlin, he worked from 2011 to 2015 as an engineering expert at Younicos AG, Berlin, Germany, developing control algorithms for low-inertia microgrids. He is a member of IEEE as well as the Energy System Transition Network. His research focuses on the application of control and optimization methods to power systems with very high share of renewable energy sources. Here, he is especially interested in model

predictive operation control and time-series forecasting as well as distributed and decentralized control.