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Lecture by

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Towards Plug-and-play Architectures for Components of Future Power Systems

Stability assessment of power grids is traditionally done by eigenvalue analysis or dynamic simulations. This approach is reasonable if models for components are available and the system configuration (eg., network topology) and the operating point are known. In the future power systems, the number of components – each having rather complex dynamic properties – will be very high, network topology and operating points will be constantly changing, hence detailed modelling will become a practically infeasible solution. Under these conditions, it is becoming important to develop certain rules for configuring the power system components, that allow for their automatic compatibility under different arrangements. The celebrated *passivity* concept was widely discussed as one of the means to achieve this property, since a parallel interconnection of any number of passive components/subsystem also represent a passive (hence stable) system. However, for realistic power grid components passivity property is almost never satisfied, and some alternative approaches are needed. In my talk I will present a different method, that can be applied to any power system components without imposing strict passivity conditions, yet allowing to come to compatibility property. The talk is based on two published papers:

Vorobev, P., Chevalier, S., & Turitsyn, K. (2019, July). Decentralized stability rules for microgrids. In *2019 American Control Conference (ACC)* (pp. 2596-2601). IEEE.

Chevalier, S., Ibanez, F. M., Cavanagh, K., Turitsyn, K., Daniel, L., & Vorobev, P. (2021). Network Topology Invariant Stability Certificates for DC Microgrids with Arbitrary Load Dynamics. *IEEE Transactions on Power Systems*.

About the author

Petr Vorobev received the PhD degree in theoretical physics from Landau Institute for Theoretical Physics, Moscow, Russia, in 2010. He is currently an Assistant Professor with the Skolkovo Institute of Science and Technology (Skoltech), Moscow, Russia. Before joining Skoltech, he was a Postdoctoral Associate with the Mechanical Engineering Department, Massachusetts Institute of Technology, Cambridge, MA, USA. His research interests include a broad range of topics related to power system dynamics and control, low frequency oscillations in power systems, dynamics of power system components, multitimescale approaches to power system modeling, and development of plug-and-play control architectures for microgrids.