Rotor-angle versus voltage instability in the third-order model for synchronous generators

We investigate the interplay of rotor-angle and voltage stability in electric power systems. To this end, we carry out a local stability analysis of the third-order model which entails the classical power-swing equations and the voltage dynamics. We provide necessary and sufficient stability conditions and investigate different routes to instability. For the special case of a two-bus system, we analytically derive a global stability map. Published by AIP Publishing.
Escape routes, weak links, and desynchronization in fluctuation-driven networks

Shifting our electricity generation from fossil fuel to renewable energy sources introduces large fluctuations to the power system. Here, we demonstrate how increased fluctuations, reduced damping, and reduced inertia may undermine the dynamical robustness of power grid networks. Focusing on fundamental noise models, we derive analytic insights into which factors limit the dynamic robustness and how fluctuations may induce a system escape from an operating state. Moreover, we identify weak links in the grid that make it particularly vulnerable to fluctuations. These results thereby not only contribute to a theoretical understanding of how fluctuations act on distributed network dynamics, they may also help designing future renewable energy systems to be more robust.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, Jacobs University Bremen, Technische Universität Darmstadt, Technische Universität Dresden, University of Cologne, Max Planck Institut für Dynamik Und Selbstorganisation Göttingen, Research Centre Julich (FZJ)
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Number of pages: 5
Publication date: 9 Jun 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Physical Review E
Volume: 95
Issue number: 6
Article number: 060203
ISSN (Print): 2470-0045
Ratings:
BFI (2018): BFI-level 1
Optofluidics for the Analysis of Turbid Liquids

Department of Micro- and Nanotechnology

Period: 01/12/2015 → 30/11/2018
Number of participants: 4

Phd Student:
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Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD