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Hamiltonian-Based Model to Describe the Nonlinear Physics of Cascading Failures in Power-Grid Networks YANG YANG, ADILSON MOTTER, Department of Physics and Astronomy, Northwestern University — A local disturbance to the state of a power-grid system can trigger a protective response that disables some grid components, which leads to further responses, and may finally result in large-scale failures. In this talk, I will introduce a Hamiltonian-like model of cascading failures in power grids. This model includes the state variables of generators, which are determined by the nonlinear swing equations and power-flow equations, as well as the on/off status of the network components. This framework allows us to view a cascading failure in the power grid as a phase-space transition from a fixed point with high energy to a fixed point with lower energy. Using real power-grid networks, I will demonstrate that possible cascade outcomes can be predicted by analyzing the stability of the system's equilibria. This work adds an important new dimension to the current understanding of cascading failures.

Yang Yang
Northwestern University

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