PSERC Power Systems Engineering Research Center

PSERC WEBINAR

Opportunities and challenges for probabilistic models of cascading line outages driven by historical utility data

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Electric power transmission networks are occasionally subject to cascades of outages that lead to blackouts. The larger blackouts are rare, but have high impact and substantial risk. The cascades of outages are complicated combinations of many different phenomena, and pose challenges to modeling, analysis, and mitigation. I will discuss high-level probabilistic models describing the cascading that are driven by utility data. We can describe the spread of outages in number and on the network, and form a Markovian influence graph that describe the statistics of how successive line outages interact.
The influence graphs are different than the physical network topology, and outages propagate to neighbors in the influence graph (this is not generally the case in the physical network). Analysis of the influence graph suggests which transmission lines contribute most to large blackouts, showing where mitigation efforts can be directed. The work arises from collaborations with many other researchers, including Kai Zhou, Zhaoyu Wang, Paul Hines, Alex Roitershtein, Arka Ghosh, Ben Carreras, and David Newman

MARCH 26, 2019 | **2:00-3:00 P.M. EDT**

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11:00-12:00 P.M. PDT)

Ian Dobson was educated at Cambridge and Cornell, worked in British industry as an operations analyst and at University of Wisconsin-Madison as a professor, and is currently Sandbulte professor of electrical engineering at Iowa State University.
His interests include risk analysis, nonlinear dynamics, and complex systems applied to electric power systems