



DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

CEVE Seminar Series

Criticality, Self-Organization, and Cascading Failure in Electric Power System Blackouts

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The large-scale electric power transmission networks that underpin our society occasionally fail in spectacular cascading blackouts. The failures propagate in a rich variety of ways, including redistributed network flows surpassing thresholds. Simulations of the cascading failure in blackouts suggest phase transitions in blackout risk as power system loading is increased. Viewing the slow upgrade of the transmission network as complex system dynamics suggests an explanation for the observed power-law distribution of the sizes of North American blackouts. The network upgrade process continually improves the components that fail in blackouts so that the network engineering is viewed as part of the complex dynamics. We propose to efficiently determine blackout risk from cascading failure simulations by estimating how much failures propagate. This is joint work with Benjamin Carreras at Oak Ridge National Laboratory, Tennessee, David Newman at the University of Alaska-Fairbanks and Kevin Wierzbicki at the University of Wisconsin.

Bio

Dr. Ian Dobson earned his Ph.D. in Electrical Engineering at Cornell University in 1989. He obtained his BA in Mathematics from Cambridge University in 1978. He has been recipient of numerous distinctions including the NSF Presidential Young Investigator, and appointed as IEEE Fellow.

Dr. Dobson's research activities started with the simulation of switching circuits, and understanding fractal structures in a chaotic oscillator. He worked extensively on applying bifurcations to understand and avoid voltage collapse blackouts and various other engineering applications of nonlinear dynamics. More recently, Dr. Dobson has been interested in understanding and quantifying the risk of blackouts using ideas of cascading failure and self-organized criticality from probability, physics and engineering. He is also working on the prevention of electric power systems oscillations by studying how modes of oscillation interact near resonances. Complex and nonlinear systems with interesting instabilities, dynamics, phase transitions and variable structure abound in engineering, and he has a broad interest in applying new theory so that these systems can be better understood and their performance improved.

Friday, October 27, 2006
3:00 PM
Ryon Lab, Room 201
Refreshments will be served at 2:45 PM