

## Introduction to the Complex Systems Track

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This is the second year of the new Track on Complex Systems. For the purpose of this Track, A complex system may be large or small in scale. A characteristic, however, is that such a system exhibit a behavior under stress that is difficult to predict. This may be because models are not well understood (i.e. load models in electric power systems, behavioral models in social and economic systems). It may be because the number of variables is so large that it is beyond simulation capabilities of current computers, or because the relation between a large number of variables is so complex that current mathematics or simulation methods are inadequate. The electric power system is a worthy example of such a system.

There are five mini-tracks in this Track. The mini-track on Information Management and Visualization in Electric Power Systems seeks to explore techniques for managing and visualizing large-scale models that may be distributed across multiple operating authorities. Papers that cover both distribution and transmission network applications are scheduled for presentation.

Another Mini-track focuses on topics related to the ability of complex systems such as power systems to survive disturbances with minimal impact on performance. Specific topics to be presented are steady-state and dynamic security assessment where the impacts of pre-specified contingencies are analyzed and Available Transfer Capability (ATC) which quantifies the ability of the interconnected system to accept increases in power transfers.

Many large complex systems exhibit evidence of self-organized criticality.

Issues such as the role of network size and topology along with the influence of network loading and operation on self-organized criticality are of interest. Evidence that large network disturbances are of a self-organized type and mechanisms of self-organized behavior in large networks are to be presented.

Critical infrastructures such as transportation systems, communication networks, and electric power grids provide rich examples of hybrid systems. These systems contain interactive sub-systems of continuous-time dynamics, discrete-time events, continuous-time controllers, and discrete-time event controllers. Such systems are characterized by complex nonlinear behavior, and experience uncertainty both in their internal description and in external disturbances/environments. The design, analysis and survivability of such infrastructures present many analytical and computational challenges.

Finally, there are three sessions in the mini-track on Markets and Economics. The aim of this mini-track is to explore the ability of commercial trading models to effectively represent the complex physical behavior of an electricity industry, an issue that is critical to the success of electricity industry restructuring. Important aspects of this issue include the design of efficient spot markets and ancillary service markets, and mechanisms to incorporate network effects in electricity trading models. Papers will be presented that address these and other aspects of this important problem.