Robust and Resilient Critical Infrastructure Systems

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Critical infrastructure such as transportation systems, communication networks, electric power grids, and health delivery systems are highly networked and interdependent systems. Such systems are characterized by complex nonlinear behavior, and experience uncertainty both in their internal description and in external disturbances/environments.

Large-scale disasters can introduce unforeseen disruptions into infrastructure systems, creating the need to restore not only individual systems such as water supplies but also interdependencies between multiple systems. Critical infrastructure interdependencies naturally arise, for instance, when two or more infrastructures must act in concert to provide a service. An example is the need for both electric power and transportation infrastructures for the provision of mass transportation. The robust design, assessment of reliability and survivability of such infrastructures present many analytical and computational challenges.

Seven papers are included in this minitrack, presented in two sessions. First session concentrates on the modeling and analysis of some specific networked systems. Topics include system trustworthiness in information warfare environment, fault tolerant design for mobile wireless networks, and system reliability analysis for electric power distribution systems. All critical infrastructure systems (including defense) are networked systems (physical, informational, software). Decision-making in such environments is a challenging problem. The last paper in this session addresses issues related to design of robust decision strategies that take into account concerns of uncertainty, incompleteness or lack of information.

The second session continues with a comprehensive overview of a framework for robust and resilient architecture of many civilian infrastructure systems that are critical for nation's economy and quality of life. Taking the need for information dominance in national security systems as an exemplar of a complex networked system, the second paper in this session introduces a rigorous modeling framework based on the concepts of modern control theory and system partitioning. The final paper develops a model for the emergence and diffusion of software standards with a view towards enhanced business productivity and economic welfare analysis.

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