

Robustness and Vulnerability of Interdependent Infrastructure Networks: Mathematical Modeling and Optimization Aspects

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Interdependent networks arise in many application domains associated with infrastructure systems, such as electric power, telecommunication, and transportation networks. In a real-world setup, these systems interact with each other, so that disruptions/failures of components in one of the systems may affect the performance of other systems that depend on those components. Thus, failures can propagate through interdependent networked systems in a cascading fashion, where a failure of a component in one system may cause a failure of multiple components in another system, and so on. Important research issues that need to be addressed in studying such interdependent networks include developing mathematical models of cascading failures, as well as assessing robustness/vulnerability of these networks via appropriate quantitative metrics. Furthermore, these mathematical representations may allow one to formulate and solve optimization problems that can potentially reveal interesting properties of the underlying systems and optimal strategies for enhancing their resilience. In this presentation, we will discuss some of our recent results and identify challenges and potential future research directions in this area.