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Interdependent complex systems and critical infrastructures

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Collections of networks are at the core of modern society, spanning technological, biological and social systems. Understanding the network structure of individual systems has lead to tremendous advances in the past decade. Yet, in reality, none of these individual networks lives in isolation and the consequences of interdependence can be surprising. Here we present results from random graph models of interacting networks. First, from a structural perspective, we show that interactions between different types of networks can enhance or delay the onset of large scale connectivity. Second, we consider a dynamical process on coupled networks. We use the classic Bak-Tang-Wiesenfeld sandpile model as an abstraction for cascades of load shedding and show that their can exist optimal levels of interconnectivity between networks that provide stabilizing effects with respect to cascades. We will also discuss recent advances in understanding interdependent social and technological networks which rely on coupling game theory to statistical physics and spatial models of random graphs that attempt to capture interdependencies in critical infrastructure systems.