Cascading failures in interdependent networks: from infrastructures to economic systems

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Abstract

Many real-networks, such as economic, social, power grid, protein networks, transportation and communication infrastructures, economic systems interact and depend on other networks. I will present a framework for studying cascading failures in interdependent networks. In interdependent networks, when nodes in one network fail, they cause dependent nodes in other networks to also fail. This may occur recursively and can lead to a cascade of failures and to a sudden fragmentation of the system.

Analytical solutions for the critical threshold and the giant component of a network of n interdependent networks will be presented. It will be shown that near criticality the system fail with time in a plateau form, the origin of which can be understood. It will be also show that interdependent networks embedded in space are significantly more vulnerable compared to non-embedded networks.

Finally, an example of cascading failures in economic network of countries industrial networks will be presented from which one can quantify and rank the impact of different industries in different countries on the stability of the global economy.

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