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Resilience of Complex Networks JIANXI GAO, Northeastern University, BARUCH BARZEL, Bar-Ilan University, ALBERT-LASZLO BARABASI, Northeastern University — Resilience, a systems ability to adjust its activity to retain its basic functionality when errors, failures and environmental changes occur, is a defining property of many complex systems. Despite widespread consequences for human health, the economy and the environment, events leading to loss of resilience-from cascading failures in technological systems to mass extinctions in ecological networksare rarely predictable and are often irreversible. These limitations are rooted in a theoretical gap: the current analytical framework of resilience is designed to treat low-dimensional models of a few interacting components, and is unsuitable for multi-dimensional systems consisting of a large number of components that interact through a complex network. Here we bridge this theoretical gap by developing a set of analytical tools with which to identify the natural control and state parameters of a multi-dimensional complex system, helping us derive an effective one-dimensional dynamics that accurately predicts the systems resilience. The proposed analytical framework allows us systematically to separate the roles of the systems dynamics and topology, collapsing the behavior of different networks onto a single universal resilience function.

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