Abstract Submitted
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Robustness of a Network of Networks[1] JIANXI GAO[2], Boston University, SERGEY V. BULDYREV[3], Department of Physics, Yeshiva University, H. EUGENE STANLEY, Boston University, SHLOMO HAVLIN[4], Department of Physics, Bar-Ilan University, Israel — Network research has been focused on studying the properties of a single isolated network, which rarely exists. We develop a general analytical framework for studying percolation of n interdependent networks. We illustrate our analytical solutions for three examples: (i) For any tree of n fully dependent Erdős-Rényi (ER) networks, each of average degree $\bar{k}$, we find that the giant component $P_\infty = p[1 - \exp(-\bar{k}P_\infty)]^n$ where $1 - p$ is the initial fraction of removed nodes. This general result coincides for $n = 1$ with the known second-order phase transition for a single network. For any $n > 1$ cascading failures occur and the percolation becomes an abrupt first-order transition. (ii) For a starlike network of n partially interdependent ER networks, P_∞ depends also on the topology–in contrast to case (i). (iii) For a looplike network formed by n partially dependent ER networks, P_∞ is independent of n.

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