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Core percolation on complex networks YANG-YU LIU, Northeastern University; Dana-Farber Cancer Institute, ENDRE CSÓKA, Eotvos Lorand University, HAIJUN ZHOU, Chinese Academy of Sciences, MÁRTON PÓSFAI, Northeastern University; Budapest University of Technology and Economics; Eotvos Lorand University — As a fundamental structural transition in complex networks, core percolation is related to a wide range of important problems, including combinatorial optimizations and network controllability. Yet, previous theoretical studies of core percolation have been focusing on the classical Erdős-Rényi random networks with Poisson degree distribution, which are quite unlike many real-world networks with scale-free or fat-tailed degree distributions. Here we show that core percolation can be analytically studied for complex networks with arbitrary degree distributions. We derive the condition for core percolation and find that purely scale-free networks have no core for any degree exponents. We show that for undirected networks if core percolation occurs then it is always continuous while for directed networks it becomes discontinuous (and hybrid) if the in- and out-degree distributions differ. We also find that core percolations on undirected and directed networks have completely different critical exponents associated with their critical singularities. Finally, we apply our theory to real-world directed networks and find, surprisingly, that they often have much larger core sizes as compared to random models.

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