Global first passage time for random walks in complex networks and Explosive percolations

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The first passage time (FPT) for random walks is a key indicator of how fast information diffuses in a given system. Despite the role of FPT as a fundamental feature in transport phenomena, its behavior, particularly in heterogeneous networks, is not yet fully understood. Here, we study, both analytically and numerically, the scaling behavior of the FPT distribution to a given target node, averaged over all starting nodes, called the global first passage time distribution. We find that random walks arrive quickly at a local hub, and therefore, the FPT distribution shows a crossover with respect to time from fast decay behavior (induced from the attractive effect to the hub) to slow decay behavior (caused by the exploring of the entire system). Moreover, the mean FPT is independent of the degree of the target node in the case of compact exploration. These theoretical results justify the necessity of using a random jump protocol (empirically used in search engines) and provide guidelines for designing an effective network to make information quickly accessible.

Recent research results for the explosive percolation problem would be shortly presented if time is allowed.

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