Peng, Junhao; **Xiong, Jian**; **Xu, Guoai**

Analysis of diffusion and trapping efficiency for random walks on non-fractal scale-free trees.

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Summary: In this paper, the discrete random walks on the recursive non-fractal scale-free trees (NFSFT) are studied, and a kind of method to calculate the analytic solutions of the mean first-passage time (MFPT) for any pair of nodes, the mean trapping time (MTT) for any target node and mean diffusing time (MDT) for any starting node are proposed. Furthermore, we compare the trapping efficiency and diffusion efficiency between any two nodes of NFSFT by using the MTT and the MDT as the measures of trapping efficiency and diffusion efficiency respectively, and find the best (or worst) trapping sites and the best (or worst) diffusion sites. The results show that the two hubs of NFSFT are not only the best trapping site but also the worst diffusion site, and that the nodes which are the farthest nodes from the two hubs are not only the worst trapping sites but also the best diffusion sites. Furthermore, we find that the ratio between the maximum and minimum of MTT grows logarithmically with network order, but the ratio between the maximum and minimum of MDT is almost equal to 1. The results imply that the trap's position has great effect on the trapping efficiency, but the position of starting node has little effect on diffusion efficiency. Finally, the simulation for random walks on NFSFT is done, and it is consistent with the derived results.

MSC:

60K35 Interacting random processes; statistical mechanics type models; percolation theory

05C82 Small world graphs, complex networks (graph-theoretic aspects)

Full Text: DOI

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