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Approach to the inverse problem of superdiffusion on finite systems based on time-dependent long-range navigation

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This work addresses the superdiffusive motion of a random walker on a discrete finite-size substrate. It is shown that, with the inclusion of suitably tuned time-dependent probability of large distance jumps over the substrate, the mean square displacement (MSD) of the walker has a power-law dependence on time with a previously chosen exponent $\gamma > 1$. The developed framework provides an exact solution to the inverse problem, i.e., an adequate jump probability function leading to a preestablished solution is evaluated. Using the Markov Chain (MC) formalism, an exact map for the time dependence of the probability function is derived, which depends on the topology of the substrate and on the chosen value of γ. While the formalism imposes no restriction on the substrate, being applicable from ordered Euclidean lattices to complex networks, results for the cycle graph and two-dimensional torus are highlighted. It is also shown that, based on the previously derived probability function, MSD values resulting from direct numerical simulations agree quite well with those solely obtained within the MC framework.

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