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Two-step perfect quantum state transfer on graphs

The criteria for the perfect state transfer (PST) of a quantum state between two vertices of a graph via a continuous-time quantum walk (QW) are now well-established; as these are quite restrictive, only a relatively small number of examples have been found to date. I will discuss an extension of the procedure that allows for perfect transfer between otherwise forbidden vertices, where the QW proceeds in two steps with different choices of edge weights and evolution times for each step. In all cases considered, there exists a specific choice of parameters where edge weights for the second step can be related to those in the first step via switching to a signed graph, equivalent to a unitary transformation on the graph adjacency matrix comprised only of diagonal elements ± 1. Extending the two-step PST to multiple initial and final vertices permits the perfect preparation of maximal eigenstates of the adjacency matrices of induced subgraphs via quantum walk.