Discrete-Time Quantum Walks on Oriented Graphs

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The interest in quantum walks has been steadily increasing during the last two decades. It is still worth to present new forms of quantum walks that might find practical applications and new physical behaviors. In this work, we define discrete-time quantum walks on arbitrary oriented graphs by partitioning a graph into tessellations, which is a collection of disjoint cliques that cover the vertex set. By using the adjacency matrices associated with the tessellations, we define local unitary operators, whose product is the evolution operator of our quantum walk model. We introduce a parameter, called α, that quantifies the amount of orientation. We show that the parameter α can be tuned in order to increase the amount of quantum walk-based transport on oriented graphs.

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