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High robustness discrete time quantum random walk search algorithm without marking coin

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Discrete Time Quantum Random Walk Search (DTQRWS) is quantum search algorithm that is quadratically faster than its classical counterpart. It can be used to search on graphs with arbitrary topology. Some structures, like Hypercube offer potential for practical applications. This quantum algorithm is very sensitive to the precision of constructing the operators of both mark and traversing coins. However, a walk coin consisting of generalized Householder reflection and additional phase multiplier allows DTQRWS algorithm to become more robust against inaccuracies in phases. To achieve such stability, a certain relation between coin parameters should be maintained. However, this method only treats the problem of constructing the walk coin, but not the marking coin.

Here, we present a simplification of the DTQRWS with high robustness. Namely, removing the need of marking coin in such way, that preserves all advantages that come from walk coin build by Generalized Householder reflection and additional phase multiplier. This simplifies the quantum circuit.

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