

Abstract Submitted
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Graph isomorphism and adiabatic quantum computing FRANK GAITAN, Laboratory for Physical Sciences, LANE CLARK, Southern Illinois University — In the Graph Isomorphism (GI) problem two N -vertex graphs G and G' are given and the task is to determine whether there exists a permutation of the vertices of G that preserves adjacency and maps $G \rightarrow G'$. If yes (no), then G and G' are said to be isomorphic (non-isomorphic). The GI problem is an important problem in computer science and is thought to be of comparable difficulty to integer factorization. We present a quantum algorithm that solves arbitrary instances of GI, and which provides a novel approach to determining all automorphisms of a graph. The algorithm converts a GI instance to a combinatorial optimization problem that can be solved using adiabatic quantum evolution. Numerical simulation of the algorithm's quantum dynamics shows that it correctly distinguishes non-isomorphic graphs; recognizes isomorphic graphs; and finds the automorphism group of a graph. We also discuss the algorithm's experimental implementation and show how it can be leveraged to solve arbitrary instances of the NP-Complete Sub-Graph Isomorphism problem.

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