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Title: Quantum computing with qudits

Abstract:

In this work, we consider a model of quantum computing based on qudits -- finite-dimensional quantum systems with the number of levels greater than 2. Within this model, qudits can be employed in two ways. The first one involves using additional levels of qudit for substituting ancillary qubits, and the second one consists of an allocation of multiple logical qubits inside a single qudit. We demonstrate that each of the two approaches allows us to significantly reduce the number of two-qubit operations in implementations of quantum algorithms. We demonstrate the advantage of using qudits over qubits by an example of Grover's algorithm.