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Quantum Approximate Optimization Algorithm (QAOA) for a Bosonic System

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Pulse-level control of variational algorithms can be used to design hardware-efficient ansatzes capable of implementing Quantum Approximate Optimization Algorithms (QAOA) [1]. We study the framework in the context of qudits which are defined as controllable modes on superconducting radio frequency (SRF) 3D cavity-qubit systems. The SRF cavities have long coherence time and can support manipulations of thousands of photons in interaction with qubits [2]. Starting from the universal control of single qudit operations, which has already been proven and experimentally demonstrated [3, 4, 5], we study the case of how to implement multiqudit gates via numerical pulse engineering [6, 7, 8], and we discuss the indicative expectations of fidelity and algorithmic performance for a 3D SRF-cavity-transmon quantum computer.

References

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