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Robust Control of a Two-Qubit Operation in 3D Circuit Quantum Electrodynamics JOSEPH ALLEN, ATI, University of Surrey, ROBERT KOSUT, SC Solutions, Inc., JAEWOO JOO, ERAN GINOSSAR, ATI, University of Surrey — Superconducting qubits have shown great improvement in coherence times with the introduction of 3D cavities. In order to control the qubits in 3D a microwave drive is usually coupled to the common mode of the cavity, which makes individual addressability a challenge and causes additional unwanted single and two-qubit dynamics when performing two qubit operations. Quantum information processing requires precise control of the system dynamics in the presence of potential uncertainties in the estimated system parameters. We use optimal control theory to develop pulse shapes that are able to implement an all-microwave two-qubit gate, while mitigating extra unwanted interaction terms, with $\mathcal{F} = \prime.\exists\exists\not\triangle$. In addition we develop pulses which are robust to errors in the two qubit transition frequencies. This is demonstrated with experimentally relevant parameters and includes realistic constraints in the possible pulse shapes, presenting pulses that can be implemented in experiment.

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