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High-fidelity gates towards a scalable superconducting quantum processor JERRY M. CHOW, ANTONIO D. CORCOLES, JAY M. GAMBETTA, CHAD RIGETTI, IBM TJ Watson Research Center, BLAKE R. JOHNSON, BBN Raytheon Technologies, JOHN A. SMOLIN, SETH MERKEL, STEFANO POLETTO, JIM ROZEN, MARY BETH ROTHWELL, GEORGE A. KEEFE, MARK B. KETCHEN, MATTHIAS STEFFEN, IBM TJ Watson Research Center — We experimentally explore the implementation of high-fidelity gates on multiple superconducting qubits coupled to multiple resonators. Having demonstrated all-microwave single and two qubit gates with fidelities $> 90\%$ on multi-qubit single-resonator systems, we expand the application to qubits across two resonators and investigate qubit coupling in this circuit. The coupled qubit-resonators are building blocks towards two-dimensional lattice networks for the application of surface code quantum error correction algorithms.

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