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Systematic Design of Tuned Transmon Qubits[1] DAVID ABRAHAM, JAY M. GAMBETTA, JERRY M. CHOW, SRIKANTH SRINIVASAN, MATTHIAS STEFFEN, IBM TJ Watson Research Center — We demonstrate a systematic method for designing two-dimensional superconducting transmon qubits with highly controllable and reproducible properties, including anharmonicity, resonant frequency and the ratio Ej/Ec. The main source of variation in these qubit properties is shown to be due to spreads in the critical current of the Josephson junction connecting the transmon capacitor pads. This technique is illustrated in a series of qubits with a range of properties, culminating in a design which accurately meets the desired operating point for multiqubit operation, and in addition obtains coherence times 2x higher than previously obtained, using conventional materials and fabrication methods.

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