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Optimizing the Josephson Parametric Amplifier - A numerical study ZLATKO MINEV, RAJAMANI VIJAYARAGHAVAN, IRFAN SIDDIQI, QNL, UC Berkeley — Recent progress in quantum information processing using superconducting circuits has stimulated interest in low noise amplifiers which operate at the quantum limit. Josephson parametric amplifiers (paramp) based on low quality factor (Q) non-linear resonators are a promising candidate for quantum state readout. We present a numerical study to optimize the paramp for dynamic range and bandwidth by investigating the lowest resonator Q compatible with high gain and low noise performance in the 4– 8 GHz range. We also investigate designs involving multiple junctions and weak-link junctions to further optimize the dynamic range. Such an amplifier can be used for single shot readout of superconducting qubits and real time detection of the quantum state—crucial developments for implementing quantum feedback and error correction.

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