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Implementing single qubit gates using RSFQ pulses PER LIEBERMANN, FRANK WILHELM, Saarland University — Rapid single flux quantum (RSFQ) pulses are a highly viable candidate for the on-chip generation of control pulses for quantum computers based on Josephson devices. With a switching time in the picoseconds range it is possible to implement fast quantum gates [1]. We show that RSFQ pulses can drive high-fidelity single-qubit rotations in leaky transmon qubits, if the sequence of these restricted digital pulses is suitably optimized compared to an evenly spaced pulse train [2]. Genetic algorithms are used to converge to gate control precision compatible with the requirements of fault tolerant quantum computing. RSFQ shift registers are essential to perform the optimized sequence, limiting the reachable set of gates in a single shot. Timing jitter of the pulses is considered as well, showing the robustness of the optimized sequence. This makes the underlying RSFQ pulse platform an attractive candidate for an integrated control layer in a quantum processor.
[1] R. McDermott and M.G. Vavilov, Phys. Rev. Appl. 2, 014007 (2014)
[2] P.J. Liebermann and F.K. Wilhelm, Phys. Rev. Appl. 6, 024022 (2016)

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