MATTER AND TECHNOLOGIES

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FPGA-based platform to control and readout superconducting qubits

A typical measurement setup for superconducting quantum bits (qubits) consists of arbitrary waveform generators, signal recorders, and vector network analyzers. Although sufficient for simple experiments, its applicability is limited due to long data communication delays, poor scalability, and static pulse sequences. A faster, more integrated and more flexible solution for qubit readout and control is FPGA-based custom hardware. It not only reduces costs and space requirements but also simplifies measurements and enables customized control schemes like quantum feedback where a low response time is critical.

A flexible FPGA-based integrated control and readout platform for experiments with superconducting qubits is presented which also enables fast feedback loops to control qubits depending on their measured state. Thus, it provides the basis for experiments and algorithms like quantum error correction or active reset. We demonstrated arbitrary qubit rotations around X and Y axis and can perform all standard measurements for qubit characterization. Furthermore, we present experimental results on quantum feedback.

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