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Optimizing control for implementing error correction in superconducting quantum circuits

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Fault-tolerant quantum computing hinges on implementing gates and measurement with fidelities above the threshold for error correction schemes. We have constructed a nine qubit device with integrated control and readout to implement the repetition code error correction scheme, a one-dimensional version of the surface code. We show how rapid scans, randomized benchmarking, and the error correction code itself can be used to optimize gates in this complex quantum device to fidelities which allow for protecting states from environmentally-induced bit errors.