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Improving quantum gate fidelities by using a qubit to measure microwave pulse distortions SIMON GUSTAVSSON, OLGER ZWIER, JONAS BYLANDER, FEI YAN, Massachusetts Institute of Technology, Cambridge, MA 02139, FUMIKI YOSHIHARA, The Institute of Physical and Chemical Research (RIKEN), Wako, Saitama 351-0198, Japan, YASUNOBU NAKAMURA, Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Komaba, Meguro-ku, Tokyo 153-8904, Japan, TERRY ORLANDO, Massachusetts Institute of Technology, Cambridge, MA 02139, WILLIAM OLIVER, MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA 02420, USA — We present a new method for determining pulse imperfections and improving the single-gate fidelity in a superconducting qubit. By applying consecutive positive and negative π pulses, we amplify the qubit evolution due to microwave pulse distortions, which causes the qubit state to rotate around an axis perpendicular to the intended rotation axis. Measuring these rotations as a function of pulse period allows us to reconstruct the shape of the microwave pulse arriving at the sample. Using the extracted response to predistort the input signal, we are able to improve the pulse shapes and to reach an average single-qubit gate fidelity higher than 99.8%.

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