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Quantum Control of Cavity Resonators, Part I: Control Algorithms PHILIP REINHOLD, REINIER HEERES, NISSIM OFEK, KATRINA SLIWA, Yale University, MICHAEL HATRIDGE, University of Pittsburgh, STEFAN KRASTANOV, LIANG JIANG, LUIGI FRUNZIO, MICHEL DEVORET, ROBERT SCHOELKOPF, Yale University — Harmonic oscillators are linear systems with equally spaced energy levels, which makes them hard to control. We have previously explored a constructive control approach mediated by a far off-resonantly coupled two-level ancilla. Here we present an extension to that method which relies on optimal control algorithms to allow much more efficient quantum control of a combined resonator ancilla system. We show that full control of the resonator is possible on a time-scale of order 1/chi, the dispersive shift. In practice this means that a unitary operation on the Hilbert space of our superconducting resonator truncated to 8 levels can be performed using a pulse of around a microsecond.

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