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Optimal arbitrarily accurate composite pulse sequences GUANG HAO LOW, THEODORE YODER, Massachusetts Institute of Technology — Implementing a single qubit unitary is often hampered by imperfect control. Systematic amplitude errors ϵ, caused by incorrect duration or strength of a pulse, are an especially common problem. But a sequence of imperfect pulses can provide a better implementation of a desired operation, as compared to a single primitive pulse. We find optimal pulse sequences consisting of L primitive π or 2π rotations that suppress such errors to arbitrary order $\mathcal{O}(\epsilon^{\backslash})$ on arbitrary initial states. Optimality is demonstrated by proving an $L = \mathcal{O}(\backslash)$ lower bound and saturating it with $L = 2n$ solutions. Closed-form solutions for arbitrary rotation angles are given for $n = 1, 2, 3, 4$. Perturbative solutions for any n are proven for small angles, while arbitrary angle solutions are obtained by analytic continuation up to $n = 12$. The derivation proceeds by a novel algebraic and non-recursive approach, in which finding amplitude error correcting sequences can be reduced to solving polynomial equations.

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