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Speed limits for quantum gates in multiqubit solid-state systems SAHEL ASHHAB, The Institute of Physical and Chemical Research (RIKEN), Wako-shi, Japan; and The University of Michigan at Ann Arbor, USA, PIETER DE GROOT, Delft University of Technology, The Netherlands; and Max Planck Institute for Quantum Optics, Garching, Germany, FRANCO NORI, The Institute of Physical and Chemical Research (RIKEN), Wako-shi, Japan; and The University of Michigan at Ann Arbor, USA — We derive speed limits for various unitary quantum operations in multiqubit systems under typical experimental conditions, using parameters and constraints that are commonly encountered with superconducting qubits. In particular we focus on two- and three-qubit gates. We find that simple methods for implementing two-qubit gates generally provide the fastest possible implementations of these gates. We also find that the three-qubit Toffoli gate time varies greatly depending on the type of interactions and the system's geometry, taking only slightly longer than a two-qubit controlled-NOT (CNOT) gate for a triangle geometry.

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