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Feasibility of the controlled-NOT gate from certain model Hamiltonians[1] MARK W. COFFEY, GABRIEL G. COLBURN, Colorado School of Mines — There has been much interest of late in characterizing two-qubit operations, optimizing the number of quantum logic gates in small circuits, and developing minimal universal bases of quantum gates. The controlled-NOT (CNOT) gate is widely used in quantum circuits and in current and proposed quantum computing technologies. We investigate the feasibility and minimal implementation of CNOT from specific model Hamiltonian operators that have appeared in the literature. We first address the question whether certain parameterized Hamiltonians can generate a CNOT up to single-qubit gates in a definite time. If so, we determine the time for this unitary evolution. We follow an algebraic approach that provides an analytic solution. Our method has direct relevance to two-qubit Hamiltonians currently being considered for spin-based and superconductivity-based systems for quantum computing as well as to other implementations.

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