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Dynamically Corrected Quantum Gates for Two-Electron Spin Qubits PASCAL CERFONTAINE, MATTHIAS LOEBL, HENDRIK BLUHM, Department of Physics, RWTH Aachen University, D-52074 Aachen, Germany — Two-electron spin qubits in double quantum dots offer the possibility of fast and fully electrical manipulation via the exchange interaction. Arbitrary single-qubit gates have been demonstrated while maintaining a magnetic field gradient. However, simple gate constructions are extremely sensitive to noise in the Hamiltonian and thus incur considerable decoherence. Dynamically corrected gates are first-order insensitive to disturbances and present an appealing solution if slow noise sources are dominant. Using a numerical model that reflects the experimentally important imperfections and hardware constraints, we find control pulses for singlet-triplet qubits in GaAs double quantum dots which decouple in both the electrical control and the hyperfine magnetic field gradient. Additionally, dephasing effects from fast noise sources are minimized by favoring operating points close to a sweet spot. For experimentally determined noise levels the resulting gates feature fidelities as high as 99.9% and are mainly limited by high-frequency noise and nonlinearities.

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