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Control Optimization for Parametric Hamiltonians by Pulse Reconstruction

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Optimal control techniques provide a means to tailor the control pulse sequence necessary for the generation of customized quantum gates, which help enhancing the resilience of quantum simulations to gate errors and device noise. However, the substantial amount of (classical) computing required for the generation of customized gates can quickly spoil the effectiveness of such an approach, especially when the pulse optimization needs to be iterated. We present the results of device-level quantum simulations of the unitary (real) time evolution of two neutrons interacting, based on superconducting qudit, and propose a method to reduce the computing time required for the generation of the control pulses for the neutrons interaction Hamiltonian depending parametrically on the time-varying relative position of the two particle. We use a simple interpolation schemes to accurately reconstruct the control pulses sequence starting from a set of pulses obtained for a discrete set of pre-determined neutrons relative positions. The reconstruction so obtained achieves very high fidelity and a substantial reduction of the computational effort.

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