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Fast qubit parameter estimation using quantum circuits

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Performing experiments on qubit devices require the implementation of quantum gates, which are prone to errors. It could be stochastic errors introduced by the noisy environment or unitary errors due to miscalibration or drifts in the system, resulting in sub-optimal fidelities. Therefore, we required a formalism to understand the unitary errors as they appear and how the quantum gates are behaving when these errors happen. Mitigating these errors will allow us to achieve high-fidelity quantum gates. Ideally, this should all be done while the experiment is in progress. In this poster, we present a method to analyze the experiments and estimate Rabi and Larmor errors during the experiment. This method provides system parameters that closely approximate the qubit system upon completion. We benchmark the method against both simulations and experiments, where we attempted to verify the output of this method against a known input. We can potentially integrate this with the quantum experiments in real-time closed feedback loops. This could help to track the Rabi and Larmor drifts as they appear and correct them at the same time providing a pathway towards improving the performance of quantum gates.

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