Optimal Control of Superconducting Xmon Qubit

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With the improvement of experiment and theory, we can now build a bit quantum mechanically. The control of the quantum bit (qubit) is then an essential issue. In this work, we apply optimal control theory on superconducting Xmon qubit proposed by Martinis' group in 2013 [R. Barends et al., PRL 111, 080502 (2013)]. However, the artificial atom is not ideal and includes some leaking probabilities to higher energy levels. In this work, we can reduce the error rate due to the leakage and make a spin-flip operation by applying specific electromagnetic pulses.

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[1] R. Barends, J. Kelly, A. Megrant, D. Sank, E. Jeffrey, Y. Chen, Y. Yin, B. Chiaro, J. Mutus, C. Neill, P. OMalley, P. Roushan, J. Wenner, T. C. White, A. N. Cleland, and John M. Martinis *Coherent Josephson Qubit Suitable for Scalable Quantum Integrated Circuits*, Phys. Rev. Lett. **111**, 080502 (2013).