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Tunable, Flexible and Efficient Optimization of Control Pulses for Superconducting Qubits, part II - Applications ELIE ASSMAT, SHAI MACHNES, Saarland University, DAVID TANNOR, Weizmann Institute of Science, FRANK WILHELM-MAUCH, Saarland University — In part I, we presented the theoretic foundations of the GOAT algorithm [1] for the optimal control of quantum systems. Here in part II, we focus on several applications of GOAT to superconducting qubits architecture. First, we consider a control-Z gate on Xmons [2] qubits with an Erf parametrization of the optimal pulse. We show that a fast and accurate gate can be obtained with only 16 parameters, as compared to hundreds of parameters required in other algorithms. We present numerical evidences that such parametrization should allow an efficient in-situ calibration of the pulse. Next, we consider the flux-tunable coupler by IBM [3]. We show optimization can be carried out in a more realistic model of the system than was employed in the original study, which is expected to further simplify the calibration process. Moreover, GOAT reduced the complexity of the optimal pulse to only 6 Fourier components, composed with analytic wrappers. [1] S. Machnes et al., ArXiv 1507.04261v1 (2015) [2] R. Barends et al., Phys. Rev. Lett. **100**, 080502 (2013) [3] D. C. McKay et al., ArXiv 1604.0307v2 (2016)

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