1 Method

In this chapter Krotov's method for quantum optimal control will be briefly introduced and an implementation as a Python package. Then the numerical experiments will be explained.

1.1 Krotov's Method for quantum optimal control

Krotov's method fundamentally relies on the variational principle to minimise a functional

$$J\left[\left\{\left|\phi_k^{(i)}(t)\right\rangle\right\}, \left\{\epsilon_l^{(i)}(t)\right\}\right]$$

where the constraints are included as Lagrange multipliers [1]. A detailed explanation of this functional when the method is applied to quantum systems can be found in [2].

1.2 Krotov: the Python package

A Python implementation of the Krotov package is available at `https://krotov.readthedocs.io/en/latest/`. It provides simple functions and objects to

1.3 Optimisation Experiments

In this chapter the numerical optimisation experiments are presented and motivated.

Optimisation will realise state transfers
4 gigasamples/s
Amplitude constraint (with pi pulse calibration)
Guess pulses half amplitude (actually blackman pulses)
convergence criteria fidelity F change between iterations falls below a certain critera ΔF

1.3.1 $|0\rangle \rightarrow |1\rangle$ state transfer

Pulse shapes were optimised with varying lengths from 4.25 ns to 30 ns with convergence criteria $F > 0.99999$ or $\Delta F < 10^{-7}$. Step size $\lambda = \frac{1}{\frac{1}{2}A_m}$

1.3.2 $|0\rangle \rightarrow |2\rangle$ state transfer

Pulse shapes were optimised with varying lengths from 22 ns to 30 ns with convergence criteria $F > 0.99999$ or $\Delta F < 10^{-9}$. Step size $\lambda = \frac{1}{2A_m}$