Important relationships to know:

Trajectory physical length:

length = v \* T , where v is the constant speed and T is the time horizon of the problem

A computer cannot think in continuous time. So, it breaks the total time horizon T into a finite number of discrete steps N. For example, if T=30 seconds and you choose N=100 steps, then each time step has a duration of T/N = 0.3 seconds.

The optimization problem finds the best state x(k) and control u(k) for every one of these N steps, from k=0 to k=N-1.

example of a possible scenario:

Task: drill from Point A to Point B, which is 50 meters away.

1. constant speed v = 0.5

2. This implies the journey will take at least 50 meters // 0.5 m/s = 100 seconds. So Time Horizon should be set to T = 100.

3. we choose: N = 200 steps. This means each step k in {0,1, ,N} costs 0.5 seconds

4. The optimizer's job is to find a sequence of 200 controls (u(0), u(1), ..., u(199)) that results in a sequence of 201 states (x(0), x(1), ..., x(200))

5. This sequence must guide the drill from its initial state x(0) at Point A to the final state x(200) at Point B, while minimizing the cost function (minimizing sharp turns and respecting all mechanical constraints).

here the speed is asumed to be constant and equals 10cm per minute which means 0.10m/60s =0.00167 m/s

∫\_{0}^{T} l\_c(x(t),u(t))dt.

T = {distence to target point(straight line distence)}/{average speed}