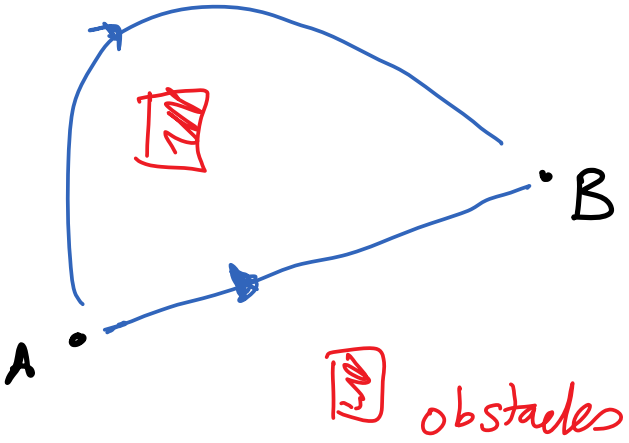
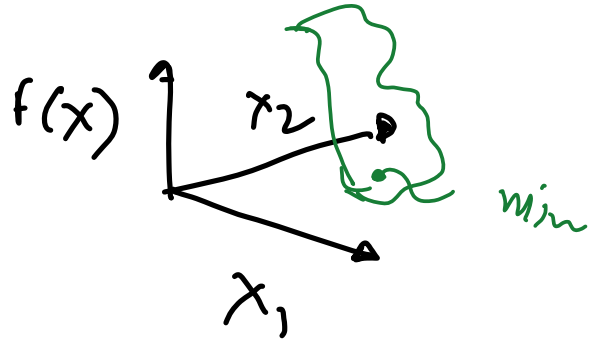
Trajectory Optimization



Optimization

$$\min_{x_1, x_2} \quad f(x) = 100\,(x_2 - x_1^2)^2 + (1 - x_1)^2$$

(1) Graph



(2) Guess: $f(x) = 0$ (guess)

$$(1 - x_1) = 0 \quad = (x_2 - x_1^2)$$

$$x_1 = x_2 = 1$$

(3) Numerically solving for the min

- graphing works 1, 2, 3D
- guessing works for special cases
- numerical (always work)

(I) Unconstrained optimization

(II) Constrained optimization

using scipy.optimize.minimize

Constrained optimization

$$\min \; f(x) = x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2$$ – Cost

x → $\{x_1, x_2, x_3, x_4, x_5\}$ optimisation variables

Subject to:

$$x_1 + x_2 + x_3 = 5$$ — Linear equality constraint

$$x_3^2 + x_4 = 5$$ — non linear equality constraint

Bounds

$0.3 \leq x_1 \leq \infty$ $\quad x_1 \geq 0.3$

$-\infty \leq x_3 \leq 5$ $\quad x_3 \leq 5$

$$x_4^2 + x_5^2 \leq 5$$ — non-linear inequality constraint