Taste of Optimal Control

Techniques for choosing gains

1. Poll Assignment

$$A^{cl} = A - BK$$

solve for entries in K to achieve desired A^{cl} eigenvalues

2. Hand Tuning (often PID)
3. Root Locus
4. Optimal Control →

Optimization Problem

$$\underset{x}{\text{minimize}} \quad f(x) \qquad \leftarrow \text{objective}$$

optimization variables

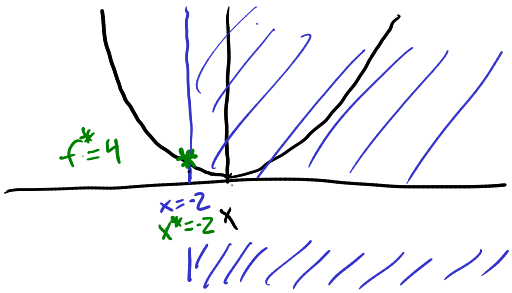
$$\text{subject to} \quad g(x) \leq 0 \qquad \leftarrow \text{constraints}$$

Engineer specifies f and g; computer finds x^* that minimizes $f(x)$

Example

$$\underset{x}{\text{minimize}} \quad x^2$$

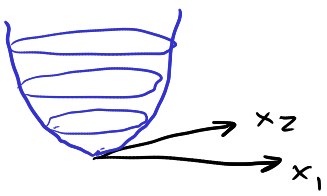
$$\text{subject to} \quad x + 2 \leq 0 \qquad x \leq -2$$



Example

$$\underset{\vec{x}}{\text{minimize}} \quad x_1^2 + x_2^2$$

$$\text{subject to} \quad x_1 - 1 \leq 0$$



$$\nabla f = 0$$

$$\vec{x}^* = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$