Introduction to model-predictive control

$$\dot{x} = f(x,u) \qquad\qquad x_{k+1} = f(x_k, u_k)$$

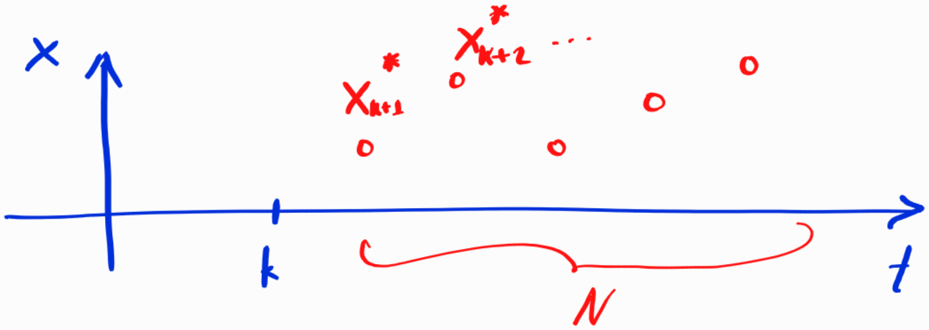
$x \in \mathcal{X} = \mathbb{R}^n$

$u \in \mathcal{U} = \mathbb{R}^m$

Safe state set: $S_x \subset \mathcal{X}$

Safe action set: $S_u \subset \mathcal{U}$

State safety: $\forall t \quad x(t) \in S_x$



$$\min_{\{u_k, u_{k+1}, \dots, u_{k+N-1}\} \in S_u^N} \sum_{i=k+1}^{k+N} \| x_i - x_i^* \|^2$$

or $J\left(\{u_i\}_{i=k}^{k+N-1}\right)$

$u_{k:k+N}$

s.t. $x_i \in S_x, \; \forall i \in [k+1, \dots, k+N]$

$x_{i+1} = f(x_i, u_i)$ - dynamics

$i \in [k+1 : k+N+1]$

(i) $J(a)$

$J : \mathbb{R}^m \to \mathbb{R}$

$\min_a J$

a — decision variable

J — cost function