Micro Homework 8

Isak Åslund (isakas) Group: 14 2020-02-17

Question 1. *Consider a constraint RHC problem with x_0 as the system initial condition. Assume that the optimization problem is feasible for the initial condition. How can we guarantee that the optimization problem will remain feasible for future time instants, i.e., how to guarantee recursive feasibility?*

Question 2. *What are the pros and cons of having a really small terminal set, like $\mathbb{X}_f = 0$, versus a large terminal set, like $\mathbb{X}_f = \mathbb{R}^n$.*

Question 3. *Consider a constraint RHC problem with $x(0)$ as the system initial condition and $\mathbb{X}_f$ as the terminal constraint. Assume that the optimization problem is feasible for the initial condition. Can you guarantee that $x(k) \in \mathbb{X}_f$ at time $k = N$? if not, suggest another strategy that insures $x(N) \in \mathbb{X}_f$.*

Q1:

If we assume perfect model and no disturbances we can garantee recursive feasability if the terminal constraint set $\mathbb{X}_f$ is control invariant.
In practice this will probably not be possible and hence we need back up solutions.

Q2:

Large $\mathbb{X}_f$:

Pro: Large feasable set
Con: Larger tolerance & large control horizon

Small $\mathbb{X}_f$:

Pro: "Higher performance" (Smaller tolerances in e.g set point tracking), smaller tolerance.
Con: Small feasable set

Q3: If we assume perfect model, no disturbances, too strict performance req or unstable sys. we can guarantee it.
If it isn't the case (probably the case) we can "soften" up the constraints (give the MPC oppertunity to violate constraints if necessary to solve the opt. problem)