SSY281 Model Predictive Control

Micro-homework 4

MPC practice. Set points, disturbances and observers

Deadline: February 5, 10:00

Systems & Control

Department of Electrical Engineering

Chalmers University of Technology

January 2019

Instructions

This assignment is **individual** and must be solved according to the following rules and instructions:

- Written report:

  - It should be one page with pdf format.
  - The report should be uploaded *before the deadline* to your project document area in PingPong.
  - Name the report as MA4_XX.pdf, where XX is your *group* number.

- Grading:

  - This assignment is *pass* or *fail*.

Question 1. *Consider the following system.*

$$x^+ = Ax + Bu$$
$$y = Cx$$

$$A = \begin{bmatrix} 0.5 & 1 \\ -1 & 0.5 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \quad C = Q = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Assume that the system's desired steady state output is

$$y_{sp} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}.$$

Find the steady state (x_s, u_s) that minimizes the error between the steady state output and its desired value in sense of the Q-norm.

Question 2. *Consider the system model:*

$$x(k+1) = Ax(k) + Bu(k),$$
$$y(k) = Cx(k),$$

and the observer

$$\hat{x}(k+1|k) = A\hat{x}(k|k-1) + Bu(k) + L(y(k) - C\hat{x}(k|k-1)).$$

What condition allows to arbitrarily assign the eigenvalues of the error dynamics matrix $(A - LC)$?