CH5120: Assignment 5

Modern Predictive Control

Note

- Submit the assignment on or before **November 5th 2022**
- Submission link for assignment 5 will be open in Moodle.
- Ensure the filename is in the format **<Rollno.pdf>**
- Attach the codes and results, if MATLAB or any software is used.

Problem Statement

Discretized state-space model of a system is represented below.

$$Am = \begin{bmatrix} 2 & 0 \\ 6 & 1 \end{bmatrix} \qquad\qquad Cm = \begin{bmatrix} 0 & -1 \end{bmatrix}$$

$$Dm = [0]$$

$$Bm = \begin{bmatrix} -1 \\ -3 \end{bmatrix}$$

$$x_0 \text{ (initial states)} = [0\ 0]$$

The closed loop poles for the initial values of the discritized system (Control move penalty – 5, Prediction horizon – 4, Control horizon – 1) are $0.0017, 0.8845 \pm 0.1957i$
The set point of the system is 1.5 $\qquad$ K_obj = [109.32 $\qquad$ 1960.4 $\qquad$ 5.1848]

(i) Build a suitable predictive controller such that all the stable closed-loop poles of the system are located inside the circle of radius 0.25 units to attain the set point by making suitable adjustments to the parameters (say Prediction, control horizon, penalty)

(ii) Describe the process of shifting the system from initial to the desired pole values and their dependence on the parameters (like horizons, penalties) that were modified to achieve it.

(iii) Compute the energy input for the control moves.