Discrete and Continuous Dynamical Systems

Tutorial,   2020.03.11.

1. We are given the following differential equation:
$$\ddot{y}(t) + 5\dot{y}(t) + 6y(t) = \dot{u}(t) + 5u(t)$$

   (a) Give a possible state-space representation of the system!

   (b) Is the system controllable and/or observable?

   (c) Is the transfer function of the system irreducible?

2. Given the following CT LTI SISO system:
$$\dot{x} = \begin{bmatrix} -3 & 0 \\ 2 & -1 \end{bmatrix} x + \begin{bmatrix} q \\ 1 \end{bmatrix} u$$
$$y = \begin{bmatrix} r & 2 \end{bmatrix} x$$

   (a) Give the values of parameters q and r so that the system is minimal!

3. **Homework:**

   (a) Is the continuous-time version of your system minimal? Why?

   (b) Give the state space model of your continuous time system in controller form!

4. **Supplementary Homework:** Given the following DT-LTI SISO system:
$$x(k+1) = \begin{bmatrix} 0.1 & p \\ q & 0.3 \end{bmatrix} x(k) + \begin{bmatrix} 2 \\ 1 \end{bmatrix} u(k)$$
$$y(k) = \begin{bmatrix} 5 & 2 \end{bmatrix} x(k)$$

   (a) Determine the values of parameters p and q if we know that the system is jointly reachable and observable!

Deadline of submission: 2020.03.18. 8am

Submit your homework as an email attachment (`hangos.katalin@virt.uni-pannon.hu`, subject: DCDS) in a hand written scanned pdf format! Please, write your name and neptun ID on the paper!