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ECE-320, Quiz #8

1) Consider the following state variable model

$$\dot{q}(t) = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} q(t) + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 3 & 0 \end{bmatrix} q(t)$$

Assume state variable feedback of the form $u(t) = G_{pf} r(t) - Kq(t)$ The closed loop transfer function for this system is which of the following?

a) $G(s) = \dfrac{-6G_{pf}}{s(s-1+2k_2) - 2k_1 + 1}$ b) $G(s) = \dfrac{6G_{pf}}{s(s-1+2k_2) - 2k_1 + 1}$

c) $G(s) = \dfrac{6G_{pf}}{s(s-1+2k_2) + 2k_1 - 1}$ d) $G(s) = \dfrac{-6G_{pf}}{s(s-1+2k_2) + 2k_1 - 1}$

2) Consider the following state variable model

$$\dot{q}(t) = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} q(t) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} q(t)$$

Assume state variable feedback of the form $u(t) = G_{pf} r(t) - Kq(t)$ Is the closed loop transfer function for this system equal to

$$G(s) = \dfrac{G_{pf}}{s + 1 + k_1}$$

a) yes   b) no

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3) Is the following system *controllable*?

$$G(s) = \frac{8G_{pf}}{s^2 + 12s + (k_1 + k_2 + 20)}$$

a) Yes   b) No   c) impossible to determine

4) Is the following system **controllable**?

$$G(s) = \frac{G_{pf}}{s^2 + (k_2 + k_1 - 1)s + (k_2 + 2)}$$

a) Yes   b) No   c) impossible to determine

5) A system with state variable feedback has the following transfer function

$$G(s) = \frac{G_{pf}}{(s - k_1 k_2)^2}$$

Is the system controllable?

a) Yes   b) No   c) impossible to determine

6) Consider a plant that is unstable but is a controllable system. Is it possible to use state variable feedback to make this system stable?

a) Yes   b) No

7) Is it possible for a system with state variable feedback to change the zeros of the plant (other than by pole-zero cancellation) ?

a) Yes   b) No

8) Is it possible for a system with state variable feedback to introduce zeros into the closed loop system?

a) Yes   b) No

9) If a plant has n poles, then a system with state variable feedback with no pole-zero cancellations will have

a) more than n poles   b) less than n poles   c) n poles   d) it is not possible to tell

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