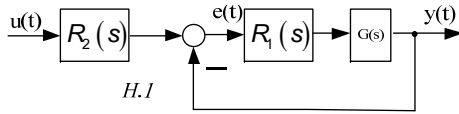


School of Electrical Engineering, Hanoi University of Science and Technology	EXAM OF CONTROL THEORY (EE3359) Exam Number: 01 Time: 90 Minutes	Signature of Lecturer
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1. Consider the System $G(s)$ and two Controllers are described by $R_1(s)$, $R_2(s)$ (Fig. 01).



- a. We assume $u(t) = a1(t)(a: \text{Const}); G(s) = \frac{k}{s(1+T_2s)^2}$; $k = 0,5$; $T_2 = 2$ and

$R_1(s) = k_1$, $R_2(s) = k_2$ (k_1, k_2 are constant numbers). Please to find k_1, k_2 based on Nyquist property to ensure the stability of Closed system and static error equals to 0 ?;

- b. We assume

$$u(t) = a1(t)(a: \text{Const}); G(s) = \frac{k}{s(1+T_2s)}; k = 0,5; T_2 = 2; R_1(s) \text{ is PID}$$

Controller and $R_2(s)$ is the first order inertia block. Please to find all of parameters $R_1(s)$, $R_2(s)$ to obtain the Stable System. Please to find the stability reserve of closed system.

2. Consider the System as follows:

$$\frac{dx}{dt} = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 2 & 1 \\ 0 & 1 & 1 \end{pmatrix} x + \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} u, \quad y = a x_1 + x_3$$

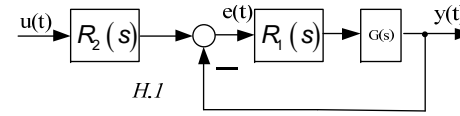
- a) Please to check the Stability Property and Controllability Property?
b) Please to consider the Observability Property?
c) Cho $a = 1$, Please to find state feedback controller satisfying the convergence speed of free state trajectory is slower than e^{-3t} and observer error is faster than e^{-3t} ;
d) Drawing the control system using state feedback control law and observer. Please to check the Controllability Property? Analysis?

- e) Consider the systems $\frac{dx}{dt} = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 2 & 1 \\ 0 & 1 & 1 \end{pmatrix} x + \begin{pmatrix} 1 & 1 \\ 0 & 2 \\ 1 & 2 \end{pmatrix} u$. Applying the previous contents to find state feedback controller to stabilize System.

Notice: Students are able to use documents .

School of Electrical Engineering, Hanoi University of Science and Technology	EXAM OF CONTROL THEORY (EE3359) Exam Number: 02 Time: 90 Minutes	Signature of Lecturer
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1. Consider the System $G(s)$ and two Controllers are described by $R_1(s)$, $R_2(s)$ (Fig. 01).



- a. We assume $u(t) = a1(t)(a: \text{Const}); G(s) = \frac{k}{s(1+T_2s)^2}$; $k = 10$; $T_2 = 1$

and $R_1(s) = k_1$, $R_2(s) = k_2$ (k_1, k_2 are constant numbers). Please to find k_1, k_2 based on Nyquist property to ensure the stability of Closed system and static error equals to 0 ?;

- b. We assume

$$u(t) = a1(t)(a: \text{Const}); G(s) = \frac{k}{s(1+T_2s)}; k = 0,5; T_2 = 2; R_1(s) \text{ is PID}$$

Controller and $R_2(s)$ is the first order inertia block. Please to find all of parameters $R_1(s)$, $R_2(s)$ to obtain the Stable System. Please to find the stability reserve of closed system.

2. Consider the System as follows:

$$\frac{dx}{dt} = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 2 & 2 \end{pmatrix} x + \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} u, \quad y = x_1 + ax_2$$

- a) Please to check the Stability Property and Controllability Property?
b) Please to consider the Observability Property?
c) Cho $a = 1$, Please to find state feedback controller satisfying the convergence speed of free state trajectory is slower than e^{-3t} and observer error is faster than e^{-3t} ;
d) Drawing the control system using state feedback control law and observer. Please to check the Controllability Property? Analysis?

- f) Consider the systems $\frac{dx}{dt} = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 2 & 2 \end{pmatrix} x + \begin{pmatrix} 1 & 1 \\ 0 & 2 \\ 1 & 2 \end{pmatrix} u$. Applying the previous contents to find state feedback controller to stabilize System.

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