علی قمیشلو

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1

$$G_3G_2\left(G_1G_cE_{(s)}+D_{(s)}\right)=C_{(s)}$$

معادله خروجی سیستم

$$H_2G_1G_cE_{(s)}-H_1C_{(s)}-R_{(s)}=E_{(s)}$$

$$H_1C_{(s)}-R_{(s)}=E_{(s)}(1+H_2G_1G_c)$$

$$\frac{R_{(s)}-H_1C_{(s)}}{H_2G_1G_c+1}=E_{(s)}$$

$$G_3G_2\left(G_1G_c\frac{R_{(s)}-H_1C_{(s)}}{H_2G_1G_c+1}\right)=C_{(s)}$$

$$\frac{R_{(s)}}{H_2G_1G_c+1}G_3G_2G_1G_c=C_{(s)}(1+H_1G_3G_2G_1G_c)$$

$$\frac{G_3G_2G_1G_c}{(1+H_2G_1G_c)(H_1G_3G_2G_1G_c+1)}=\frac{C_{(s)}}{R_{(s)}}$$

$\cancel{G_3G_2D_{(s)}=D}$ $\quad G_3G_2\left(G_1G_cE_{(s)}+D_{(s)}\right)=C_{(s)}$

$$\frac{R_{(s)}-H_1C_{(s)}}{H_2G_1G_c+1}G_3G_2G_1G_c+G_3G_2D_{(s)}=C_{(s)}$$

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$$G_3 G_2 D_{(s)} = C_{(s)} \left(1 + H_1 G_3 G_2 G_1 G_c\right)$$

$$\frac{G_3 G_2}{H_1 G_3 G_2 G_1 G_c + 1} = \frac{C_{(s)}}{D_{(s)}}$$

$$\frac{G_3 G_2 G_1 G_c}{(1 + H_2 G_1 G)(H_1 G_3 G_2 G_1 G_c + 1)} = \frac{C_{(s)}}{R_{(s)}}$$

$$\frac{G_3 G_2}{H_1 G_3 G_2 G_1 G_c + 1} = \frac{C_{(s)}}{D_{(s)}}$$

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(2

$Bu + Ax = \dot{x}$

$Du + Cx = y$

$x = [u \cdot w \cdot q \cdot \theta]^T$

$u = [E \ \delta]$

$y = [\theta - w \cdot q + u)^T$

$$\begin{bmatrix} a_{14} & a_{13} & a_{12} & a_{11} \\ a_{24} & a_{23} & a_{22} & a_{21} \\ a_{34} & a_{33} & a_{32} & a_{31} \\ 0 & 1 & 0 & 0 \end{bmatrix} = A$$

$$\begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ 0 \end{bmatrix} = B \qquad \begin{bmatrix} 0 & 0 & 1 & 1 \\ -1 & 1 & 0 & 0 \end{bmatrix} = C$$

$$\begin{bmatrix} 0 \\ 0 \end{bmatrix} = D$$

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3)

الف)

$$\left(\frac{-K_A(1+T_{As})}{s^2{}_{sp}{}^2+2\zeta\omega_{ps}+\omega}\right)\times\left(\frac{10}{s+10}\right)\times\left(\frac{K_1}{s}\right)=G_{(s)}$$

$$\frac{10K_1K_A(1+T_{As})}{s(s+10)(s^2+2\zeta_{sp}\omega_{sp}s+\omega^2_{sp})}=G_{(s)}$$

با در نظر گرفتن فیدبک $\frac{G_{(s)}}{K_q \cdot G_{(s)}+1}=G_{(cl)}(s)$ ← تابع تبدیل

ب)

$$\frac{q_{(s)}}{q_{comm_{(s)}}}=G_{cL}(s)$$

$$b_0 q_{comm}+\frac{dq}{dt}b_1+\dots+\frac{d^n q_{comm}}{dt}b_m=a_0 q+\frac{dq}{dt}a_1$$

$$+\dots+\frac{d^{1-m}q}{dt^{n-1}}a+\frac{d^n q}{dt^n}a^n$$

ج)

$x=x_1$ $\quad q=2q$ $\quad x=x_3$ $\quad q_c=4\delta E$

$Bu+eAx=x$ $\qquad Du+Cx=y$

(4

$y = 2y \qquad x = 1x \qquad x_1 = x_2$

$3u + 5\dot{u} + 2\ddot{u} + 4x_1 - 2x_2 = \dot{x}_2$

$Bu + Ax = \dot{x} \qquad Du + Cx = y \qquad x_2 = \dot{x}_1$

$3u + 5\dot{u} + 2\ddot{u} + 4x_1 - 2x_2 = \dot{x}_2$

$$\begin{matrix} u \\ \dot{u} \\ \ddot{u} \end{matrix} \begin{bmatrix} 0 & 0 & 0 \\ 3 & 5 & 2 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -2 & -4 \end{bmatrix} = \begin{bmatrix} 1\dot{x} \\ 2\dot{x} \end{bmatrix}$$

$x_1 = y$

$0 = D \qquad [0, 1) = C$

$$u \begin{bmatrix} 0 & 0 & 0 \\ 3 & 5 & 2 \end{bmatrix} + x \begin{bmatrix} 1 & 0 \\ -2 & -4 \end{bmatrix} = \dot{x}$$

$x[0\ 1] = y$