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(1) $\dfrac{d^3y}{dt^3} + 3\dfrac{d^2y}{dt^2} + 6\dfrac{dy}{dt} + 4y = \dfrac{d^2r}{dt^2} + 2\dfrac{dr}{dt} + r$

$\Rightarrow s^3 Y(s) + 3s^2 Y(s) + 6s Y(s) + Y(s) = s^2 R(s) + 2s R(s) + R(s)$ (الشرط الابتدائية تساوي) $\Leftarrow$

$\Rightarrow (s^3 + 3s^2 + 6s + 1) Y(s) = (s^2 + 2s + 1) R(s)$

$\Rightarrow \dfrac{Y(s)}{R(s)} = \dfrac{s^2 + 2s + 1}{s^3 + 3s^2 + 6s + 4} = \dfrac{(s+1)^2}{(s+1)(n^2 + 2n + 4)}$

(2) $\begin{aligned} \dot{X} &= An + Bu \\ Y &= Cn + Du \end{aligned} \Big\}$ بحيث $\Rightarrow \begin{cases} n_1 = y - B_0 u \\ n_2 = \dot{n}_1 - B_1 u = \dot{y} - B_0 \dot{u} - B_1 u \\ n_3 = \dot{n}_2 - B_2 u = \ddot{y} - B_0 \ddot{u} - B_1 \dot{u} - B_2 u \end{cases}$

$\Rightarrow \dddot{y} = -3\ddot{y} - 6\dot{y} - 4y + \ddot{r} + 2\dot{r} + r$

$\dddot{n}_1 = \dddot{y} - 3\ddot{y} - 6\dot{y} - 4y + \ddot{u} + 2\dot{u} + u$

$\dot{n}_3 = \dddot{y} - B_0 \dddot{u} - B_1 \ddot{u} - B_2 \dot{u} \Rightarrow \dddot{y} = \dot{n}_3 + B_0\dddot{u} + B_1\ddot{u} + B_2\dot{u}$

$\dot{n}_2 = \ddot{y} - B_0 \ddot{u} - B_1 \dot{u} \Rightarrow \ddot{y} = \dot{n}_2 + B_0\ddot{u} + B_1\dot{u}$

$\dot{n}_1 = \dot{y} - B_0 \dot{u} \Rightarrow \dot{y} = \dot{n}_1 + B_0 \dot{u}$

صفر بحسب
6 نقاط

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07 $\dot{x}_3 = (-3\dddot{y} - 6\ddot{y} - 4y + \dddot{u} + 2\ddot{u} + u) - B_0\dddot{u} - B_1\ddot{u} - B_2\dot{u}$

08 $\dddot{y}, \ddot{y}, \dot{y}$

09 $\ddot{y}, \dot{y}, y$

11 $\Rightarrow \dot{x}_3 = -3(x_3 + B_0\ddot{u} + B_1\dot{u} + B_2 u) - 6(x_2 + B_1\dot{u} + B_1 u)$

12 $\qquad - 4(x_1 + B_0 u) + \dddot{u} + 2\ddot{u} + u - B_0\dddot{u} - B_1\ddot{u} - B_2\dot{u}$

ضریب‌های $\dddot{u}$ و بقیه مشتقات

13 $\dddot{u} \Rightarrow \boxed{B_0 = 0}$

14 $\ddot{u} \Rightarrow -3B_0 + 1 - B_1 = 0 \Rightarrow \boxed{B_1 = 1}$

15 $\dot{u} \Rightarrow -3B_1 - 6B_0 + 2 - B_2 = 0 \Rightarrow \boxed{B_2 = -1}$

16 $\qquad\qquad -3$

ضریب $u \leftarrow$

17 $u \quad -3B_2 - 6B_1 - 4B_0 + 1 = \boxed{-2}$

18 $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -6 & -3 \end{bmatrix} + \begin{bmatrix} 1 \\ -1 \\ -2 \end{bmatrix} r$

روز دامپزشکی

2   1

4) ب)

$$\frac{dx}{dt} = x(x+y-1) = F_1(x,y) \Rightarrow \begin{cases} \frac{\partial F_1}{\partial x} = 2x+y-1 \\ \frac{\partial F_1}{\partial y} = x \end{cases}$$

$$\frac{dy}{dt} = (x^2-y-1) = F_2(x,y) \begin{cases} \frac{\partial F_2}{\partial x} = 2x \\ \frac{\partial F_2}{\partial y} = -1 \end{cases}$$

$$\Rightarrow \frac{dx}{dt} = 0 \Rightarrow \begin{cases} x=0 \Rightarrow \frac{dy}{dt} = 0 = -y-1 \Rightarrow \boxed{y=-1} \quad \boxed{x=0} \\ y=1-x \end{cases} \Rightarrow 1-x = x^2-1$$

$$\frac{dy}{dt} = 0 \Rightarrow y = x^2-1 \qquad x^2+x-2=0 \begin{cases} x=1 \\ x=-2 \end{cases}$$

$$x=1 \Rightarrow 1-y=0 \Rightarrow \boxed{y=0 \quad x=1}$$

$$x=-2 \Rightarrow -y+3=0 \Rightarrow \boxed{y=3 \quad x=-2}$$

۳ نقطه تعادل داریم

1)	$x_1=0$	$y_1=-1$
2)	$x_2=1$	$y_2 = 0$
3)	$x_3=-2$	$y_3=3$

$$\frac{dm}{dt} = \left[x_n(x_n + y_n - 1) + (2x_n + y_n)(x - x_n) + x_n(y - y_n) \right]$$

$$\frac{d\vartheta}{dt} = \left[(x_n^2 - \vartheta_n - 1) + (2x_n)(x - x_n) + (-1)(y - y_n) \right]$$

1) $x_1 = 0$
   $y_1 = 1$
   $$\begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

2) $x_2 = 1$
   $y_2 = 0$
   $$\begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} -1 \\ -2 \end{bmatrix}$$

3) $x_3 = -2$
   $y_3 = 3$
   $$\begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix} = \begin{bmatrix} -2 & -2 \\ -4 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 2 \\ -5 \end{bmatrix}$$

$-2(x+2) + -2(y-3)$

$x - 4 + 6$

$-1(x+2) + (-1)(y-3)$

$-8 \qquad +3$