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No. _____
Date: _____

$$G(s) = C(sI - A)^{-1}B + D$$

$$= [1 \ 0] \left\{ \begin{bmatrix} s & 0 \\ 0 & s \end{bmatrix} - \begin{bmatrix} 0 & 1 \\ -\frac{k}{m} & -\frac{b}{m} \end{bmatrix} \right\}^{-1} \begin{bmatrix} 0 \\ \frac{1}{m} \end{bmatrix} + 0$$

$$= [1 \ 0] \begin{bmatrix} s & -1 \\ \frac{k}{m} & s + \frac{b}{m} \end{bmatrix}^{-1} \begin{bmatrix} 0 \\ \frac{1}{m} \end{bmatrix}$$

$$\begin{bmatrix} s & -1 \\ \frac{k}{m} & s + \frac{b}{m} \end{bmatrix}^{-1} = \frac{1}{s^2 + \frac{b}{m}s + \frac{k}{m}} \begin{bmatrix} s + \frac{b}{m} & 1 \\ -\frac{k}{m} & s \end{bmatrix}$$

$$G(s) = \frac{1}{ms^2 + bs + k}$$

$$y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} \quad u = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_m \end{bmatrix}$$

$$y(s) = G(s) U(s)$$

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} = \frac{1}{ms^2 + bs + k} \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_m \end{bmatrix}$$

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} = \begin{bmatrix} \frac{1}{ms^2 + bs + k} u_1 \\ \frac{1}{ms^2 + bs + k} u_2 \\ \vdots \\ \frac{1}{ms^2 + bs + k} u_m \end{bmatrix}$$

ex(2-3) $G(s) = C (sI - A)^{-1} B + D$

$$\frac{y(s)}{u(s)} = \left(\begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 3 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix} - \begin{bmatrix} -11 & -56 & -160 \\ 1 & 0 & 0 \\ 6 & 1 & 0 \end{bmatrix}^{-1} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + 10 \right)$$

$$\frac{y(s)}{u(s)} = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 3+14 & 56 & 160 \\ 1 & 5 & 0 \\ 0 & -1 & 3 \end{bmatrix}^{-1} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + 10$$

$$\frac{y(s)}{u(s)} = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \frac{1}{(s^3 + 19s^2 - 60s) - (ccs)} \begin{bmatrix} s^2 + 19s - 56 & -s & -1-s \\ -56s - 160 & s^2 + 19s & s+9 \\ -60s & -160 & s^2 + 19s - 56 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + 6$$

$$\frac{y(s)}{u(s)} = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \frac{s^2 + 19s - 56}{s^3 + 19s^2 - 56s - 160} \\ \frac{-56s - 160}{s^3 + 19s^2 - 56s - 160} \\ \frac{-60s}{s^3 + 19s^2 - 56s - 160} \end{bmatrix}$$

$$\frac{y(s)}{u(s)} = \frac{-56s - 160}{s^3 + 19s^2 - 56s - 160}$$