문제 3 RLC 와 MCK 유사관계.

1. MCK 시스템

1) 외부에서 주어진 입력 f(t), 출력은 거리 x.

$$ma + f(t) = Kx + D\dot{x}$$

$$s^2 m x + f(t) = Kx + sDx$$

$$s^2 m x - sDx - Kx = -f(t)$$

$$s^2 x - s\frac{D}{m}x - \frac{K}{m}x = -\frac{1}{m}f(t)$$

$$\begin{bmatrix} \ddot{x} \\ x \end{bmatrix} = \begin{bmatrix} \frac{D}{m} & \frac{K}{m} \\ 1 & 0 \end{bmatrix} \begin{bmatrix} \dot{x} \\ x \end{bmatrix} + \begin{bmatrix} -\frac{1}{m} \\ 0 \end{bmatrix} f(t)$$

2. RLC 시스템

입력 : E(t) 출력은 $V_c(t)$

$$E(t) = sL\,i(t) + \underbrace{\frac{1}{sC}i(t)}_{V_c(t)} + R\,i(t)$$

$$E(t) = i(t)\left\{sL + \frac{1}{sC} + R\right\}$$

E(t)

입력 $E(t)$. 출력?

$$E(t) = sL\,i(t) + \frac{1}{sC} i(t) + R\,i(t)$$

$$sE(t) = s^2 L\,i(t) + \frac{1}{C} i(t) + Rs\,i(t)$$

$$i(t)\left(s^2 L + Rs + \frac{1}{C}\right) = sE(t)$$

$$\frac{i(t)}{E(t)} = \frac{s}{s^2 L + Rs + \frac{1}{C}}$$

출력: $s\,i(t) = \dot{i}(t)$

$$\begin{bmatrix} \ddot{i}(t) \\ \dot{i}(t) \end{bmatrix} = \begin{bmatrix} -\frac{R}{L} & -\frac{1}{LC} \\ 1 & 0 \end{bmatrix} \begin{bmatrix} \dot{i}(t) \\ i(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} E(t)$$

$$s^2 i(t) = -\frac{R}{L} s\,i(t) - \frac{1}{LC} i(t)$$

$$y(t) = s\,i(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} \dot{i}(t) \\ i(t) \end{bmatrix}$$

$L \leftrightarrow m \qquad D \leftrightarrow R \qquad \frac{1}{C} = K.$