SISTEMAS DINAMICOS TALLER 5 – Sistemas Hidráulicos y Térmicos Docente: César A. Romero B.

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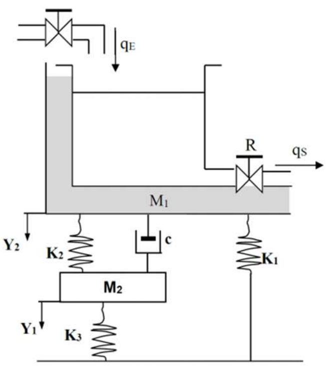
Grupo:1001

Hallar la ecuación dinámica del sistema y su función de transferencia (Y1/QE) mecánico – hidráulico que se observa en la figura.



Sistema Hidráulico

$q_{s=\frac{h}{R}}$	$C\dfrac{dh}{dt} = \Delta q = q_E - q_s$
$C\dfrac{dh}{dt} = q_E - \dfrac{h}{R}$ $q_E = C\dfrac{dh}{dt} - \dfrac{h}{R}$	
$\mathcal{L} \rightarrow Q_E(s) = C_s H(s) + \dfrac{H(s)}{R}$ $Q_E(s) = H(s)\left[C_s + \dfrac{1}{R}\right]$ $Q_E(s) = H(s)\left[\dfrac{CRs+1}{R}\right]$	

$$H(s) = \frac{Q_E(s)}{\left[\frac{CRs+1}{R}\right]}$$

$$H(s) = \frac{Q_E(s)R}{CRs+1}$$

Sistema Mecánico

Ecuación 1	Ecuación 2
$\sum f = m1 - g2$ $fk1 + fk2 + fc - f(t) = -m1 * g2$ $k1y2 + k2(y2 - y1) + C(\dot{y}2 - \dot{y}1) - f(t) = -m1\ddot{y}2$	$\sum f = m2 - g1$ $fk3 + fk2 + fc - f(t) = -m2 * g1$ $k3y1 - k2(y1 - y2) - C(\dot{y}1 - \dot{y}2) = -m2\ddot{y}1$

Despejar y2 en ecuación 2

$$k3y1 - k2y1 + k2y2 - C\dot{y}1 + C\dot{y}2 = -m2\ddot{y}1$$

$$\mathcal{L} \;\rightarrow\; k3y1(s) - k2y1(s) + k2y2(s) - Csy1(s) + Csy2(s) = -m2s^2y1(s)$$

$$k2y2(s) + Csy2(s) = -m2s^2y1(s) - k3y1(s) + k2y1(s) + Csy1(s)$$

$$y2(s)(k2 + Cs) = -m2s^2y1(s) - k3y1(s) + k2y1(s) + Csy1(s)$$

$$y2(s) = y1(s)\left[\frac{-m2s^2 - k3 + k2 + Cs}{k2 + Cs}\right]$$

Ecuación 1

$$k1y2 + k2(y2 - y1) + C(\dot{y}2 - \dot{y}1) - f(t) = -m1\ddot{y}2$$

$$k1y2 + k2y2 - k2y1 + C\dot{y}2 - C\dot{y}1 - f(t) = -m1\ddot{y}2$$

$$\mathcal{L} \;\rightarrow\; k1y2(s) + k2y2(s) - k2y1(s) + Csy2(s) - Csy1(s) - f(s) = -m1s^2y2(s)$$

$$f(s) = k1y2(s) + k2y2(s) - k2y1(s) + Csy2(s) - Csy1(s) + m1s^2y2(s)$$

$$f(s) = y2(s)(m1s^2 + k1 + k2 + Cs) - k2y1(s) - Csy1(s)$$

Reemplazar ecuación 2 en ecuación 1

$$y2(s) = y1(s)\left[\frac{-m2s^2 - k3 + k2 + Cs}{k2 + Cs}\right](m1s^2 + k1 + k2 + Cs)$$

$$f(s) = y1(s)\left[\frac{(-m2s^2 - k3 + k2 + Cs)(m1s^2 + k1 + k2 + Cs)}{k2 + Cs}\right] - k2y1(s) - Csy1(s)$$

$$f(s) = y1(s)\left[\frac{(-m2s^2 - k3 + k2 + Cs)(m1s^2 + k1 + k2 + Cs)(-k2 - Cs)}{k2 + Cs}\right]$$

Ecuación dinámica

$$\frac{y1(s)}{f(s)} = \left[\frac{k2 + Cs}{(-m2s^2 - k3 + k2 + Cs)(m1s^2 + k1 + k2 + Cs)(-k2 - Cs)}\right]$$

Ecuación integradora

$$\gamma = \frac{ml * g}{v}$$

$$f(t) = ml * g$$

$$v = Cl * h$$

$$\gamma = \frac{f(t)}{Cl * h}$$

$$\mathcal{L} \ \rightarrow \ \gamma = \frac{f(s)}{Cl * H(s)}$$

$$\gamma = \frac{f(s)}{Cl * \dfrac{Q_E(s)R}{CRs + 1}}$$

$$\gamma = \frac{f(s)(ChRs + 1)}{Cl * Q_E(s)R}$$

$$Q_E(s) = f(s)\,\frac{(ChRs+1)}{\gamma ClR}$$

$$QE(s) = y1(s)\left[\frac{(-m2s^2-k3+k2+C\ \ )(m1s^2+k1+k2+Cs)(-k2-C\ \ )}{k2+Cs}\right]\left(\frac{ChRs+}{\gamma ClR}\right)$$

Función de transferencia

$$\frac{y1(s)}{QE(s)} = \left[\frac{(k2+Cs)(\gamma ClR)}{(-m2s^2-k3+k2+Cs)(m1s^2+k1+k2+Cs)(-k2-Cs)(ChRs+1)}\right]$$