Universidad de Guadalajara
Centro Universitario de los Valles

Ingeniería en Electrónica y Computación

Reporte del proyecto:

Tarea 3

Presentado por:

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Profesor

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Ameca, Jalisco, 14 de octubre del 2023

1. Simplifique los siguientes diagramas de bloques

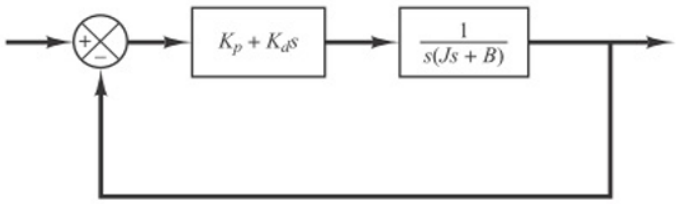
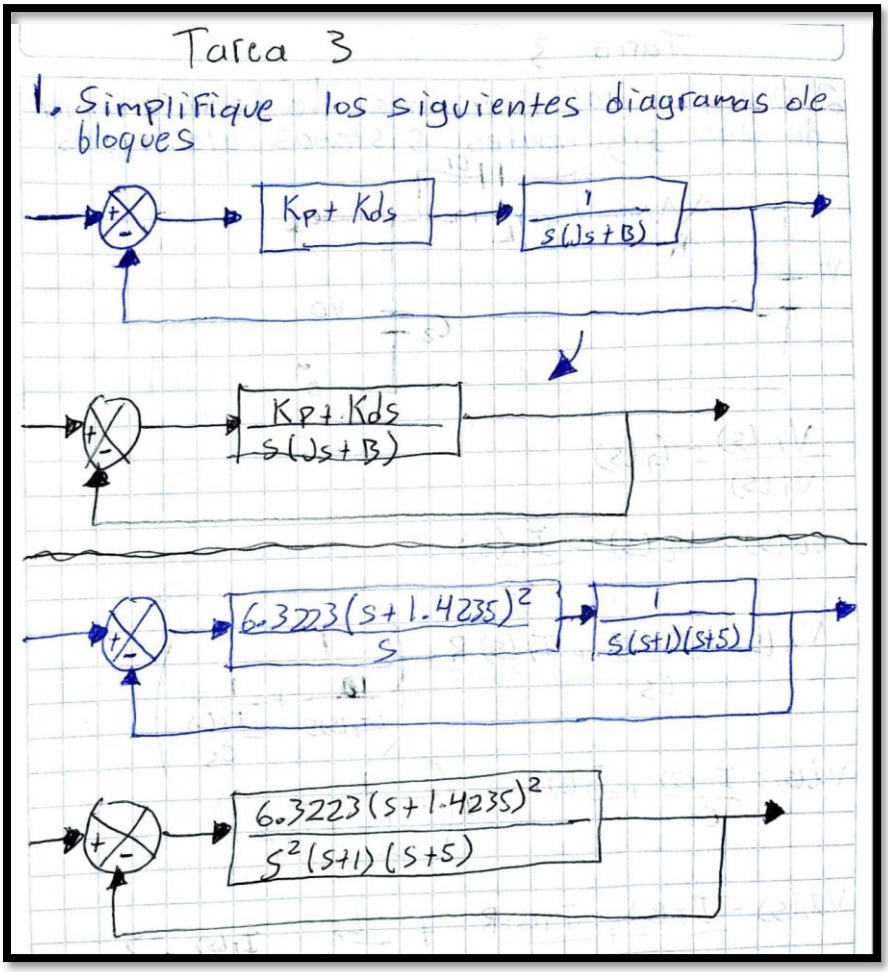


Figura 1. Diagrama de bloques 1

Figura 2. Diagrama de bloques 2



2. Obtenga las funciones de transferencia de los siguientes sistemas electricos

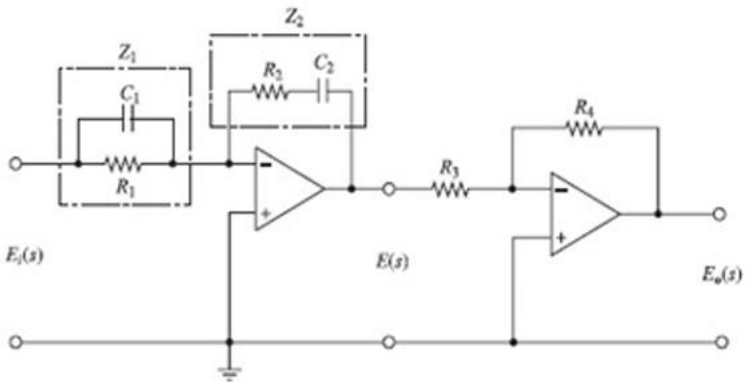
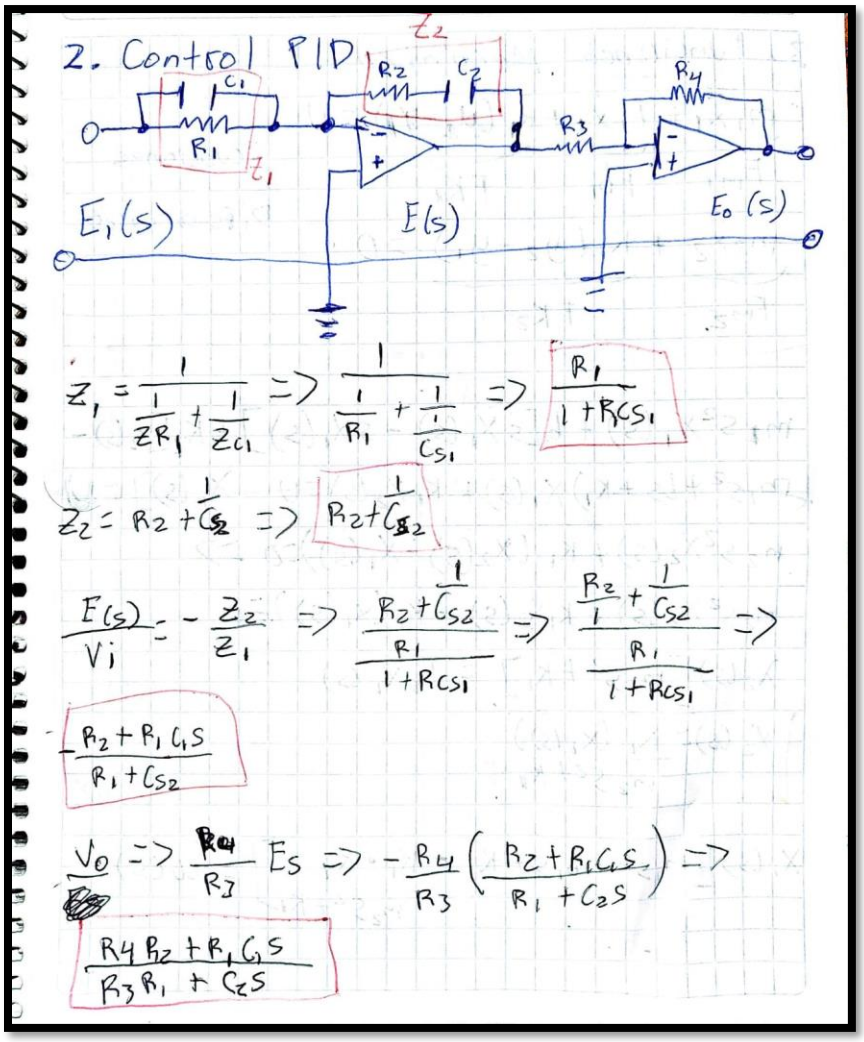
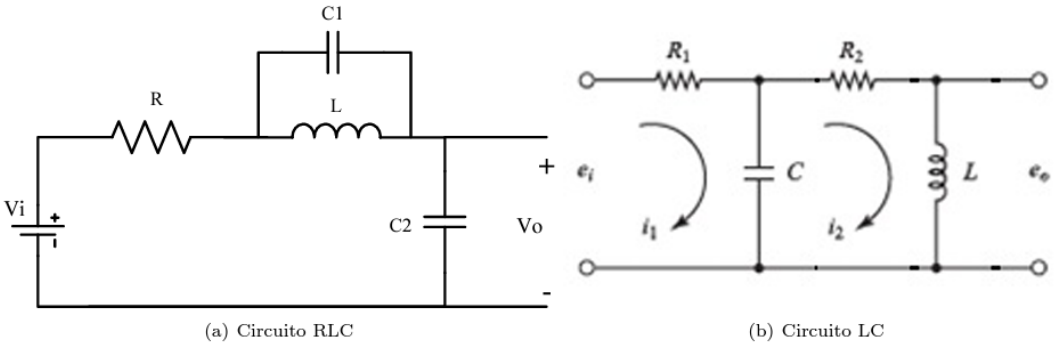


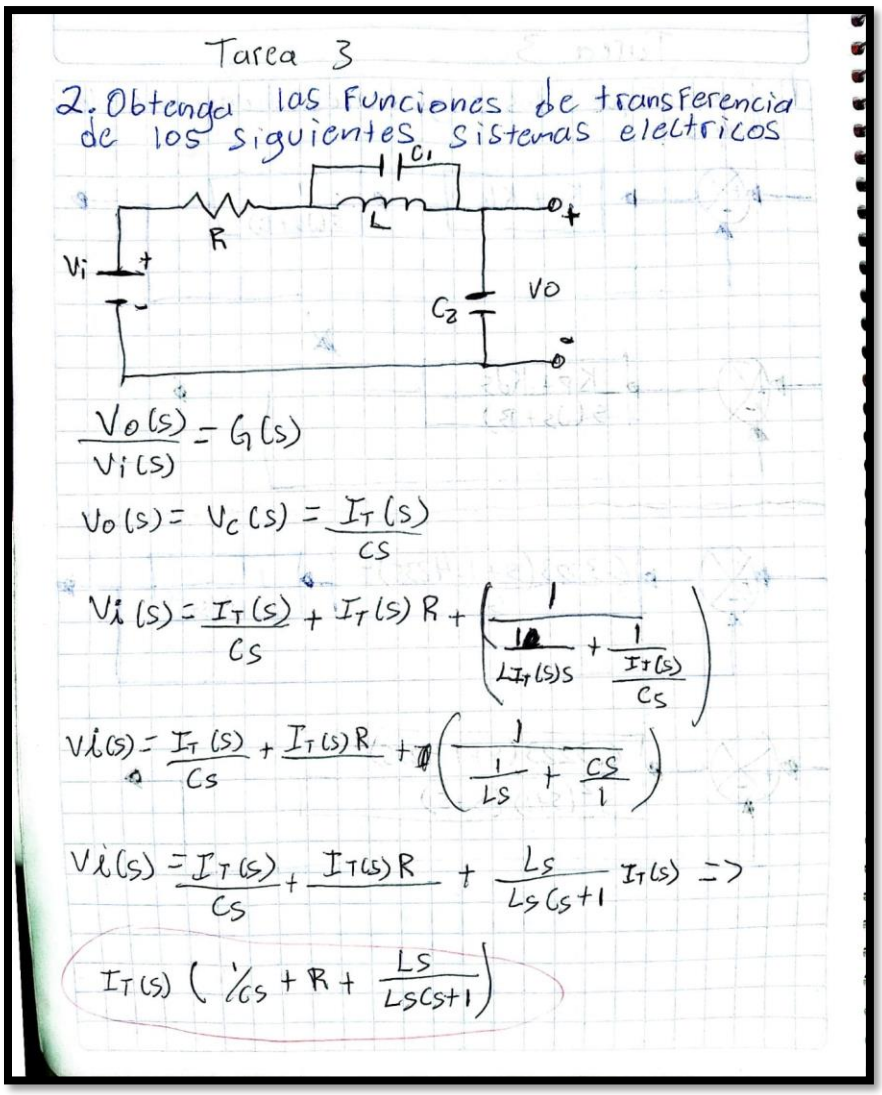
Figura 3. Control PID





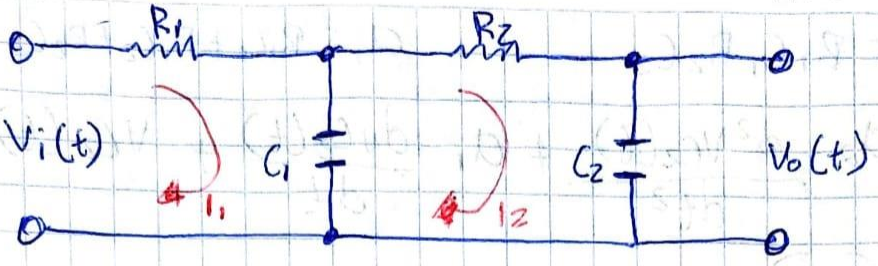
(a) Circuito RLC (b) Circuito LC

Figura 4. Ejemplos de circuitos eléctricos



Circuito Rc de Segundo Orden

11/10/2023



$$V_{R_1}(t) = R_1 i_1(t) \qquad V_{R_2}(t) = R_2 i_2(t)$$

$$i_1(t) - i_2(t) = C_1 \frac{dV_{C_1}(t)}{dt} \qquad i_2(t) = C_2 \frac{dV_{C_2}(t)}{dt}$$

$$i_1(t) = C_2 \frac{dV_{C_2}(t)}{dt} + C_1 \frac{dV_{C_1}(t)}{dt}$$

$$V_{R_1}(t) = R_1 \left(C_2 \frac{dV_{C_2}(t)}{dt} + C_1 \left(R_2 C_2 \frac{d^2 V_{C_2}(t)}{dt^2} + \frac{dV_{C_2}(t)}{dt} \right) \right)$$

$$V_i(t) = V_{R_1}(t) + V_{R_2}(t) + V_{C_2}(t)$$

$$V_i(t) = R_1 C_1 R_2 C_2 \frac{d^2 V_{C_2}(t)}{dt} + (R_1 C_1 + R_1 C_2 + R_2 C_2) \frac{dV_{C_2}(t)}{dt} + V_{C_2}(t)$$

3. Obtenga las funciones de los siguientes sistemas mecánicos

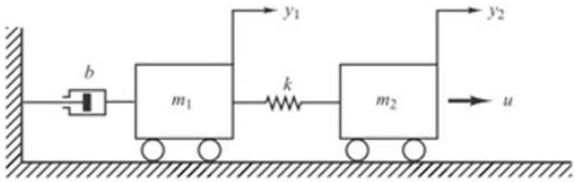


Figura 5. Sistema mecánico 1

3. Funciones Mecánicas

$$m_1\ddot{x}_1 + b_1\dot{x}_1 + K_1(y_2 - y_1) = U$$

F_{m_1} F_{b_1} F_{K_1}

Ecuaciones Diferenciales

$$m_2\ddot{x}_2 + K_1(y_2 - y_1) = 0$$

F_{m_2} F_{K_2}

$$m_1 s^2 X_1(s) + b[sX_1(s) - sX_1(s)] + K_1[X_2(s) - X_1(s)] = U$$

~~$(m_1 s^2 + bs + K_1) X_1(s) + K_1 X_2(s) = U$~~

$$m_2 s^2 X_2(s) + K_1(X_2(s) - X_1(s)) = 0 \Rightarrow$$

$$m_2 s^2 X_2(s) + K_1 X_2(s) - K_1(X_1(s)) = 0$$

$$X_2(s)[m_2 s^2 + K_1] = K_1 X_1(s)$$

$$X_2(s) = \frac{K_1(X_1(s))}{m_2 s^2 + K_1}$$

$$X_1(s)\left[m_1 s^2 + b_1 s + K_1 - \frac{K_1 \cdot K_1}{m_2 s^2 + K_1}\right] = U(s)$$

$$\left[X_1(s)\left[m_1 s^2 + b_1 s + K_1 - \frac{K_1 \cdot K_1}{m_2 s^2 + K_1}\right] = U(s)\right](m_2 s^2 + K_1)$$

$$X_1(s)\left[m_1 m_2 s^4 + m_2 b_1 s^3 + b_1 K_1 s + m_1 K_1 s^2 + K_1 m_2 s^2 + K_1^2 - K_1^2\right] = U(s)$$

$$\frac{X_1(s)}{U(s)} = \frac{m_2 s^2 + K_1}{m_1 m_2 s^4 + m_1 K_1 s^2 + m_2 b_1 s^3 + b_1 K_1 s + K_1 m_2 s^2}$$

$$\Rightarrow \frac{m_2 s^2 + K_1}{m_1 m_2 s^4 + m_2 b_1 s^3 + (m_1 K_1 + m_2 K_1) s^2 + b_1 K_1 s}$$

$$\frac{X_2(s)}{U(s)} = \frac{X_1(s)}{U(s)} \cdot \frac{X_2(s)}{X_1(s)} \qquad \frac{X_2(s)}{X_1(s)} = \frac{K_1}{m_2 s^2 + K_1}$$

$$\frac{X_2(s)}{U(s)} = \frac{K_1}{m_1 m_2 s^4 + m_2 b_1 s^3 + (m_1 K_1 + m_2 K_1) s^2 + b_1 K_1 s}$$

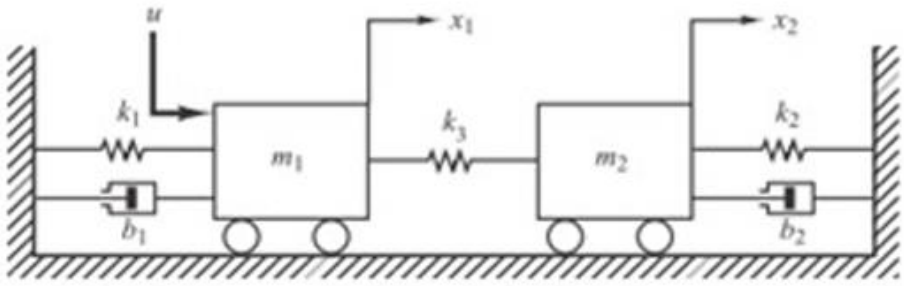


Figura 6. Sistema mecánico 2

$$Fm = ma = m\frac{d^2x}{dt^2}$$

$$Fb = bv = b\frac{dx}{dt}$$

$$FK = Kx$$

$$K_1x_1 + b_1\dot{x}_1 + K_3(x_1 - x_2) + m_1\ddot{x}_1 = u \quad (1)$$

$$K_3(x_2 - x_1) + K_2x_2 + b_2\dot{x}_2 + m_2\ddot{x}_2 = 0 \quad (2)$$

$$K_1X_1(s) + b_1sX_1(s) + K_3(X_1(s) - X_2(s)) + m_1s^2X_1 = U(s)$$

$$(K_1 + b_1s + K_3 + m_1s^2)X_1(s) - K_3X_2(s) = U(s)$$

$$(m_1s^2 + b_1s + (K_1 + K_3))X_1(s) - K_3X_2(s) = U(s) \quad (3)$$

$$K_3(X_2(s) - X_1(s)) + K_2X_2(s) + b_2sX_2(s) + m_2s^2X_2(s) = 0$$

$$K_3 X_2(s) - K_3 X_1(s) + K_2 X_2(s) + b_2 s X_2(s) + m_2 s^2 X_2(s) = 0$$

$$(m_2 s^2 + b_2 s + (K_2 + K_3)) X_2(s) - K_3 X_1(s) = 0 \quad (4)$$

$$X_2(s) = \frac{K_3}{m_2 s^2 + b_2 s + (K_2 + K_3)} X_1(s)$$

Sustituimos en la ecuación (3)

$$(m_1 s^2 + b_1 s + (K_1 + K_3)) X_1(s) - K_3 \frac{K_3}{m_2 s^2 + b_2 s + (K_2 + K_3)}$$

$X_1(s) = U(s) \Rightarrow$

$$\left(m_1 s^2 + b_1 s + (K_1 + K_3) - \frac{K_3^2}{m_2 s^2 + b_2 s + (K_2 + K_3)}\right) X_1(s) = U(s)$$

$$\frac{X_1(s)}{U(s)} = \frac{1}{m_1 s^2 + b_1 s + (K_1 + K_3) - \frac{K_3^2}{m_2 s^2 + b_2 s + (K_2 + K_3)}}$$

$$m_1 s^2 + b_1 s + (K_1 + K_3) - \frac{K_3^2}{m_2 s^2 + b_2 s + (K_2 + K_3)} =$$

$$\frac{(m_1 s^2 + b_1 s + (K_1 + K_3))(m_2 s^2 + b_2 s + (K_2 + K_3)) - K_3^2}{m_2 s^2 + b_2 s + (K_2 + K_3)}$$

$$\frac{X_1(s)}{U(s)} = \frac{1}{\frac{(m_1 s^2 + b_1 s + (K_1 + K_3))(m_2 s^2 + b_2 s + (K_2 + K_3)) - K_3^2}{m_2 s^2 + b_2 s + (K_2 + K_3)}}$$

$$\frac{X_1(s)}{U(s)} = \frac{m_2 s^2 + b_2 s + (K_2 + K_3)}{(m_1 s^2 + b_1 s + (K_1 + K_3))(m_2 s^2 + b_2 s + (K_2 + K_3)) - K_3^2}$$

$$\frac{X_2(s)}{U(s)} \left(\frac{m_2 s^2 + b_2 s + (K_2 + K_3)}{K_3} \right) =$$

$$\frac{m_2 s^2 + b_2 s + (K_2 + K_3)}{(m_1 s^2 + b_1 s + (K_1 + K_3))(m_2 s^2 + b_2 s + (K_2 + K_3)) - K_3^2}$$

$$\frac{X_2(s)}{U(s)} = \frac{K_3}{(m_1 s^2 + b_1 s + (K_1 + K_3))(m_2 s^2 + b_2 s + (K_2 + K_3)) - K_3^2}$$