

## Laboratório de Controle 3

1) a)

a)

MECÂNICO

$$\begin{bmatrix} M_2 s^2 + K_2 & -K_2 \\ -K_2 & M_1 s^2 + b s + K_1 + K_2 \end{bmatrix} \cdot \begin{bmatrix} X_2(s) \\ X_1(s) \end{bmatrix} = \begin{bmatrix} F(s) \\ 0 \end{bmatrix}$$

$\downarrow$   $M_1 \rightarrow L$   
 $\downarrow$   $b \rightarrow R$   
 $\downarrow$   $K \rightarrow C$

ELÉTRICO

$$\begin{bmatrix} L_2 s + (C_2 s)^{-1} & -(C_2 s)^{-1} \\ -(C_2 s)^{-1} & L_1 s + R + (C_1 + C_2)^{-1} \end{bmatrix} \cdot \begin{bmatrix} I_2(s) \\ I_1(s) \end{bmatrix} = \begin{bmatrix} V(s) \\ 0 \end{bmatrix}$$

b)

b) RESOLVA P/  $\frac{I_2(s)}{V(s)}$

$\begin{bmatrix} A & B \\ C & D \end{bmatrix} \cdot \begin{bmatrix} I_2(s) \\ I_1(s) \end{bmatrix} = \begin{bmatrix} V(s) \\ 0 \end{bmatrix}$

$A I_2(s) + B I_1(s) = V(s)$   
 $C I_2(s) + D I_1(s) = 0$

$\downarrow$

$Ax + By = V$   
 $(Cx + Dy = 0) \times \frac{B}{D}$

$\Rightarrow (A - \frac{BC}{D}) I_2(s) = V(s)$

$\frac{I_2(s)}{V(s)} = \frac{1}{A - \frac{BC}{D}} = \frac{1}{L_2 s + \frac{1}{C_2 s} - \frac{\frac{1}{C_2 s} \cdot \frac{1}{C_1 + C_2}}{L_1 s + R + \frac{1}{C_1 + C_2}}}$

c)  $K_1 = K_2 \Rightarrow C_1^{-1} = C_2^{-1} = 100 \text{ F}$   
 $M_1 \neq L_1 = 10 \text{ H}$   
 $M_2 = L_2 = 20 \text{ H}$   
 $B = R = 0,5$

$K = 100 = \frac{1}{C}$

$\frac{1}{C_1 + C_2} = \frac{1}{100 + 100} = \frac{1}{200}$

$\frac{1}{20s} + \frac{1}{100s} - \frac{\frac{1}{100s} \cdot \frac{1}{100s}}{10s + 0,5 + \frac{1}{200s}}$

$\frac{1}{20s} + \frac{1}{100s} = \frac{3}{100s}$

$\frac{1}{20s} + \frac{1}{100s} = \frac{3}{100s}$

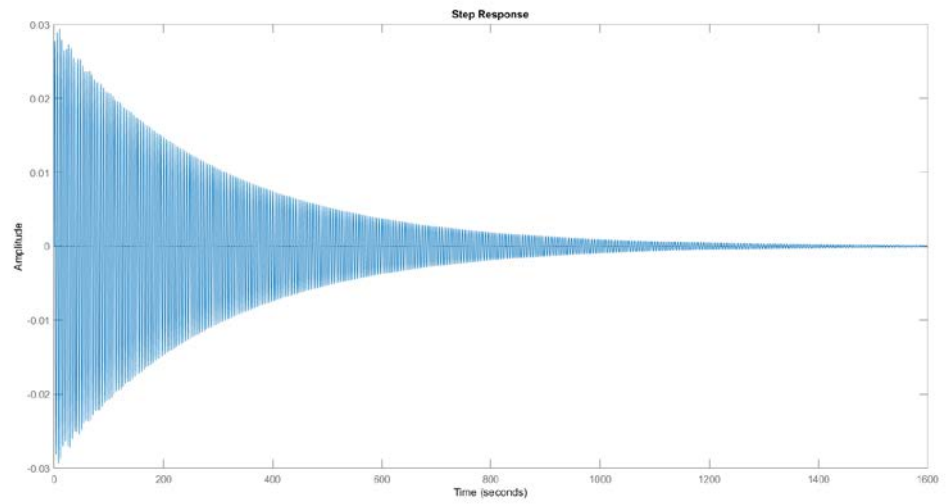
c)

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s = tf([1 0],1);
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L1 = 10; L2 = 20; R = .5; C1 = 1/100; C2 = 1/100;
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```
sys = tf([L1 R (1/C1)+(1/C2) 0],[L1*L2 L2*R (L1/C2 + L2/C1 + L2/C2)  
R/C2 1/(C1*C2)])
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```
step(sys)
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2) ...