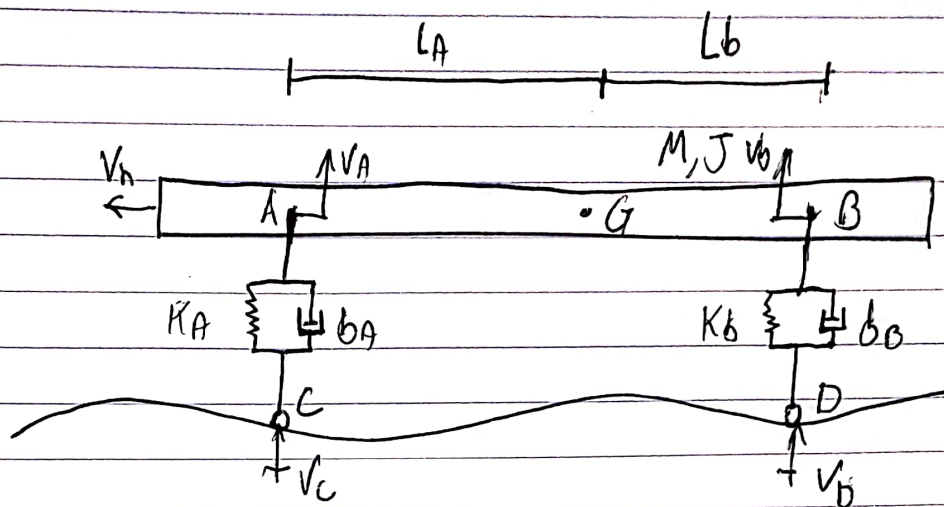


Lista G

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$$\begin{aligned} M &= 200 \text{ kg} & J &= 512 \text{ kg m}^2 \\ L_A &= 0.8 \text{ m} & L_B &= 0.8 \text{ m} \\ K_A &= 10000 \text{ N/m} & K_B &= 10000 \text{ N/m} \\ b_A &= 200 \text{ Ns/m} & b_B &= 200 \text{ Ns/m} \\ V_H &= 10 \text{ m/s} \end{aligned}$$

$$L_A = 0.8 \text{ m}$$

$$LB = 0.8m$$

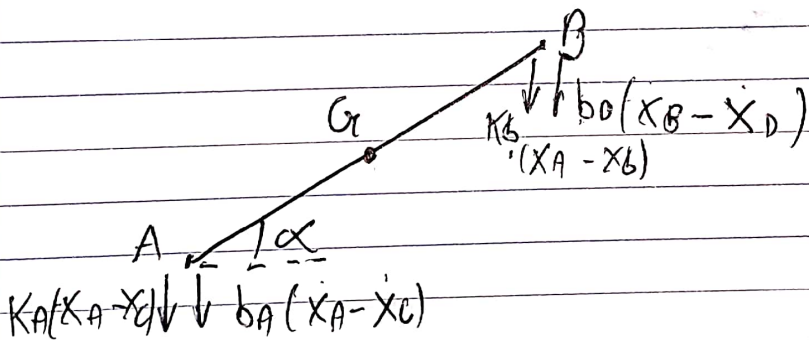
$$K_A = 10000 \text{ N/m}$$

$$K_b = 10000 \text{ N/m}$$

$$b_A = 200 \text{ N/m}$$

$$b_b = 200 \text{ Ns/m}$$

$$V_H = 10 \text{ m/s}$$



$$\vec{M}_G^{\text{ext}} = m \cdot (0) \wedge \vec{a}_g + J \vec{\omega} \vec{k}$$

$$\Rightarrow \vec{M}_G^{\text{ext}} = L_A K_A (\vec{x}_A - \vec{x}_G) \vec{K} + L_{AB} A (\vec{x}_A - \vec{x}_G) \vec{K} - L_B K_B (\vec{x}_B - \vec{x}_G) \vec{K} - L_B B_B (\vec{x}_B - \vec{x}_G) \vec{K}$$

$$\ddot{W} = L_A K_A (\dot{x}_A - \dot{x}_C) - L_B K_B (\dot{x}_B - \dot{x}_D) + L_{AB} (\dot{x}_A - \dot{x}_C) - L_{BD} (\dot{x}_B - \dot{x}_D)$$

$$\vec{R} = m \cdot \vec{a}_g \Rightarrow m \dot{V}_a = -k_A(x_A - x_C) - b_A(\dot{x}_A - \dot{x}_C) - k_B(x_B - x_D) - b_B(\dot{x}_B - \dot{x}_D)$$

$$\vec{V}_P = \vec{V}_O + \vec{\omega} \wedge (P-O)$$

$$V_A \vec{j} = V_O \vec{j} + \omega \vec{k} \wedge (-l \cos \alpha \vec{i} - l \sin \alpha \vec{j})$$

$$V_A = V_O - \omega l_A \Rightarrow \dot{x}_A = V_O - l_A \omega$$

$$\therefore V_B \vec{j} = V_O \vec{j} + \omega \vec{k} \wedge (l_B \cos \alpha \vec{i} + l_B \sin \alpha \vec{j})$$

$$\Rightarrow V_B = V_O + \omega l_B \Rightarrow \dot{x}_B = V_O + l_B \omega$$

$$\dot{x}_A = V_O - l_A \omega$$

$$\dot{x}_B = V_O + l_B \omega$$

$$V_A = -\frac{K_A}{M} x_A - \frac{K_B}{M} x_B - \frac{b_A}{M} (V_O - l_A \omega) - \frac{b_B}{M} (V_O + l_B \omega) \\ + \frac{K_A}{M} x_C + \frac{K_B}{M} x_D + \frac{b_A}{M} \dot{x}_C + \frac{b_B}{M} \dot{x}_D$$

$$J \omega = \frac{l_A K_A}{J} x_A - \frac{l_B K_B}{J} x_B + \frac{l_A b_A}{J} (V_O - l_A \omega) - \frac{l_B b_B}{J} (V_O + l_B \omega) \\ - \frac{l_A K_A}{J} x_C + \frac{l_B K_B}{J} x_D - \frac{l_A b_A}{J} \dot{x}_C + \frac{l_B b_B}{J} \dot{x}_D$$

$$\therefore \begin{bmatrix} x_A \\ x_B \\ v_A \\ \omega \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & -l_A \\ 0 & 0 & 1 & -l_B \\ -K_A/M & -K_B/M & -(b_A + b_B)/M & (b_A l_A - b_B l_B)/M \\ l_A K_A/J & -l_B K_B/J & (l_A b_A - l_B b_B)/J & -(b_A l_A^2 + b_B l_B^2)/J \end{bmatrix} \begin{bmatrix} x_C \\ x_D \\ \dot{x}_C \\ \dot{x}_D \end{bmatrix}$$

$$\bullet \begin{bmatrix} x_A \\ x_B \\ v_A \\ \omega \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ K_A/M & K_B/M & b_A/M & b_B/M \\ -l_A K_A/J & l_B K_B/J & -l_A b_A/J & l_B b_B/J \end{bmatrix} \begin{bmatrix} x_C \\ x_D \\ \dot{x}_C \\ \dot{x}_D \end{bmatrix}$$

$$\tau_D = \frac{l_A + l_B}{V_H}$$

Simulação 1:

$$U = \begin{bmatrix} v_c \\ v_d \end{bmatrix} ; v_c = \begin{cases} 0, & \text{se } t < 0 \\ 1, & \text{se } t \geq 0 \end{cases} ; v_d = \begin{cases} 0, & \text{se } t < t_0 \\ 1, & \text{se } t \geq t_0 \end{cases}$$

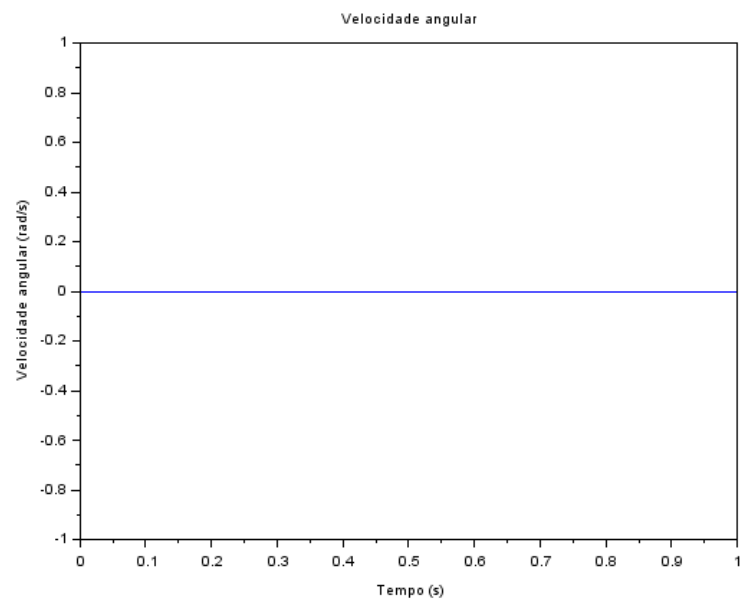
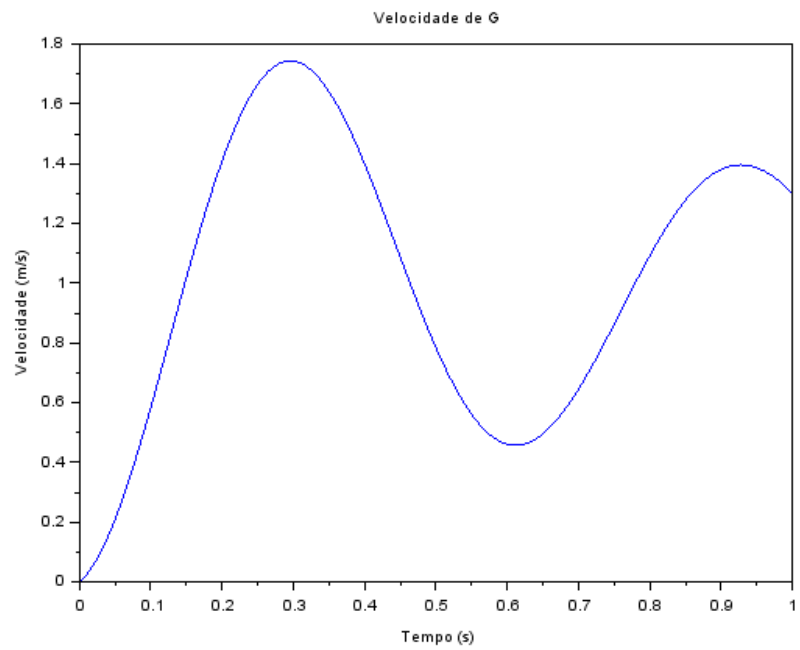
Simulação 2:

$$v_c = \text{sen}(9,8995t) ; v_d = \text{sen}(9,8995t)$$

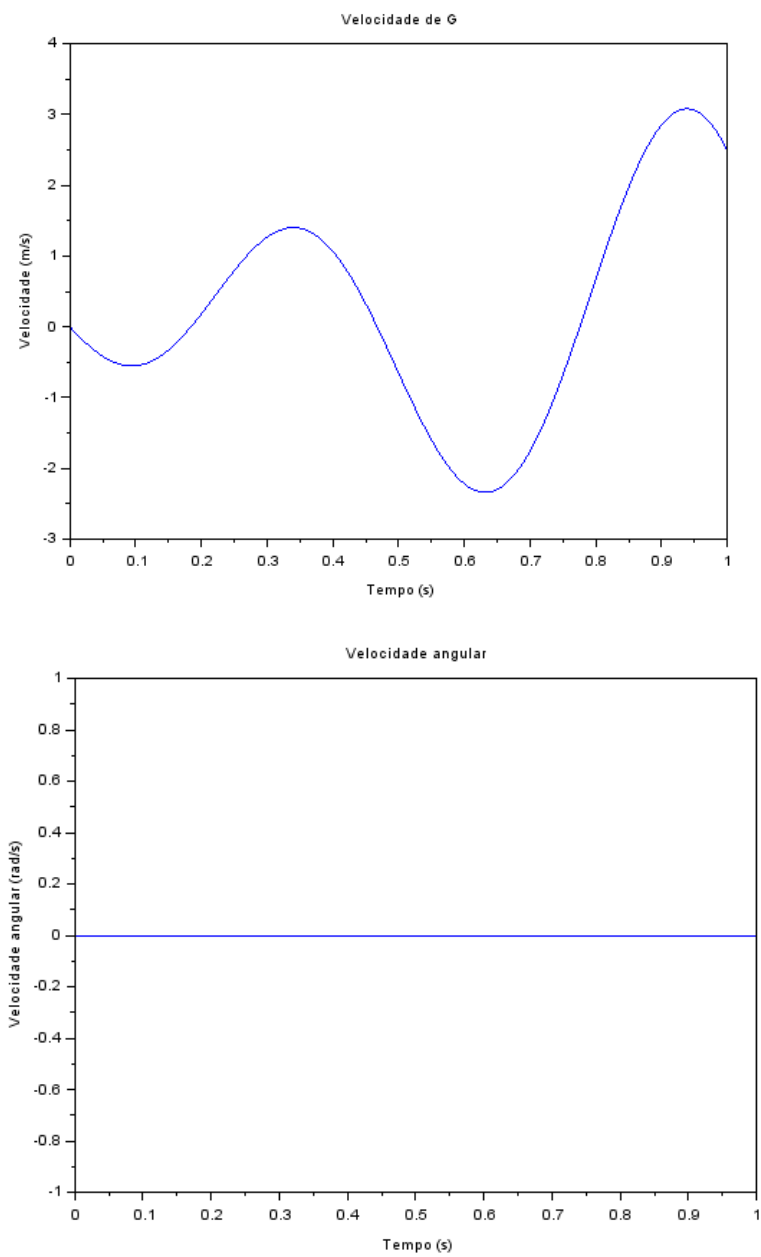
Simulação 3:

$$v_c = \text{sen}(4,9875t) ; v_d = -\text{sen}(4,9875t)$$

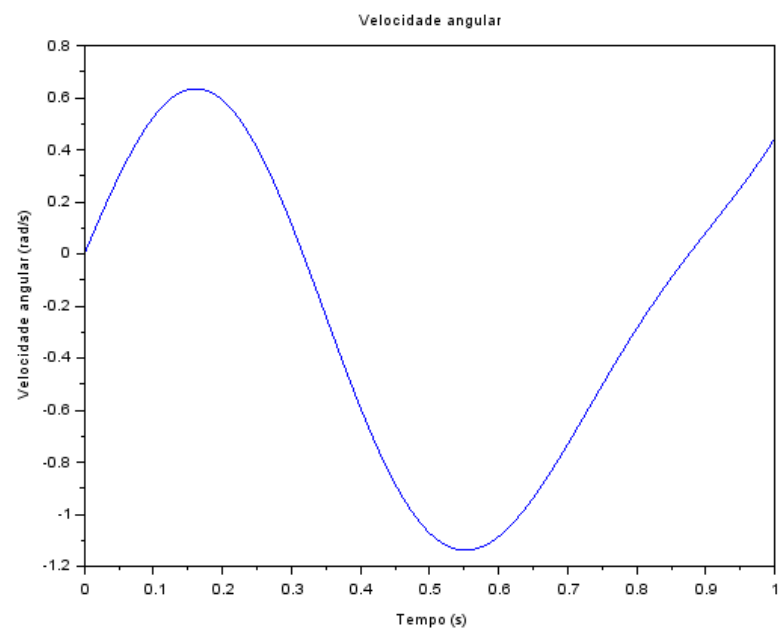
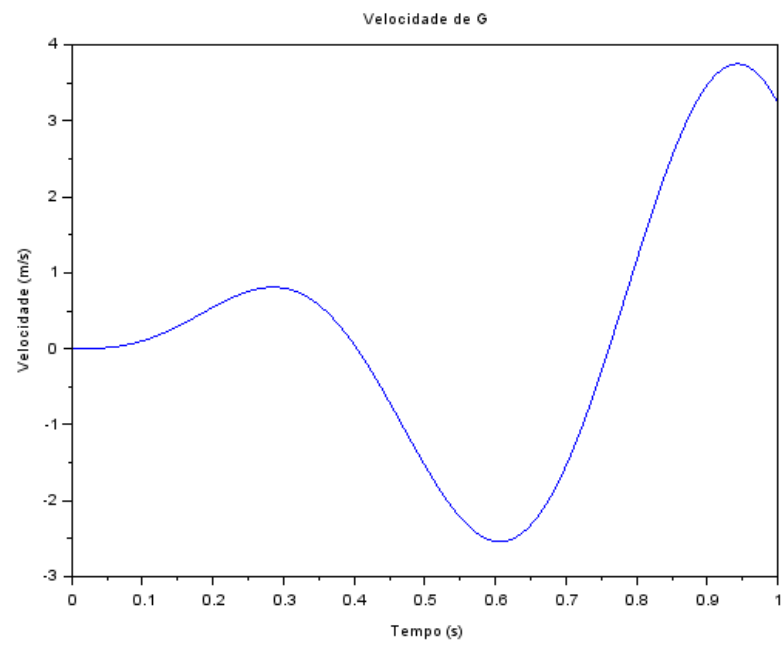
- Simulação 1:



- Simulação 2:



- Simulação 3:



- Diagramas de Bode:

