

**ESCOLA POLITÉCNICA DA UNIVERSIDADE DE SÃO PAULO**

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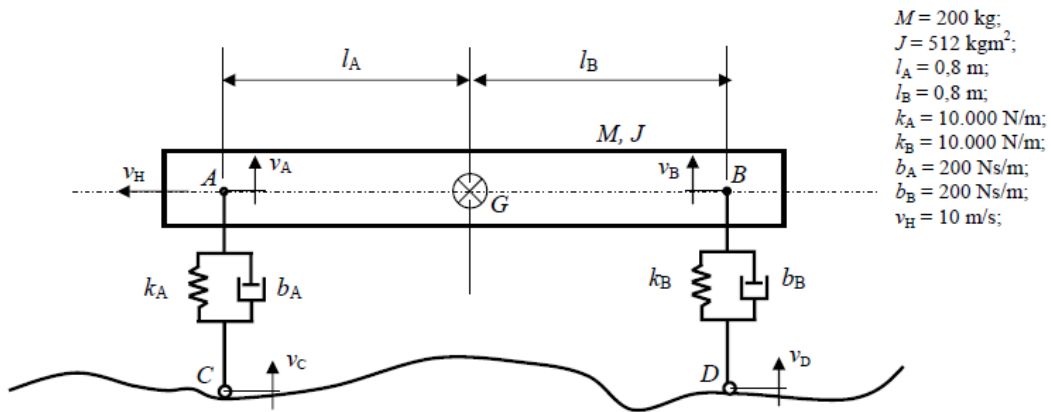
**PME3380 – MODELAGEM DE SISTEMAS DINÂMICOS**

(LISTA G)

**SÃO PAULO, SP**

**2020**

## 1. Obtenha o modelo de 1/2 carro:



Para a modelagem pedida, foram obtidas as seguintes relações:

$$F_A = -k_A y_A - b_A (v_A - v_C)$$

$$F_B = -k_B y_B - b_B (v_B - v_D)$$

$$x_A = x_G - l_A \theta_G$$

$$x_B = x_G + l_B \theta_G$$

$$v_A = v_G - l_A w$$

$$v_B = v_G + l_B w$$

Escrevendo na forma:

$$\dot{x} = Ax + Bu$$

$$y = Cx + Du$$

Chega-se a:

$$A = \begin{bmatrix} 0 & 0 & 1 & -l_A \\ 0 & 0 & 1 & l_B \\ \frac{k_A}{M} & \frac{k_B}{M} & -\frac{(b_A + b_B)}{M} & \frac{(b_A l_A + b_B l_B)}{M} \\ \frac{l_A k_A}{J} & \frac{l_B k_B (b_A l_A - b_B l_B)}{J} & -\frac{(b_A l_A^2 + b_B l_B^2)}{J} & \end{bmatrix}$$

$$B = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ \frac{b_A}{M} & \frac{b_B}{M} \\ -\frac{b_A l_A}{J} & \frac{b_B l_B}{J} \end{bmatrix}$$

$$C = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$D = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

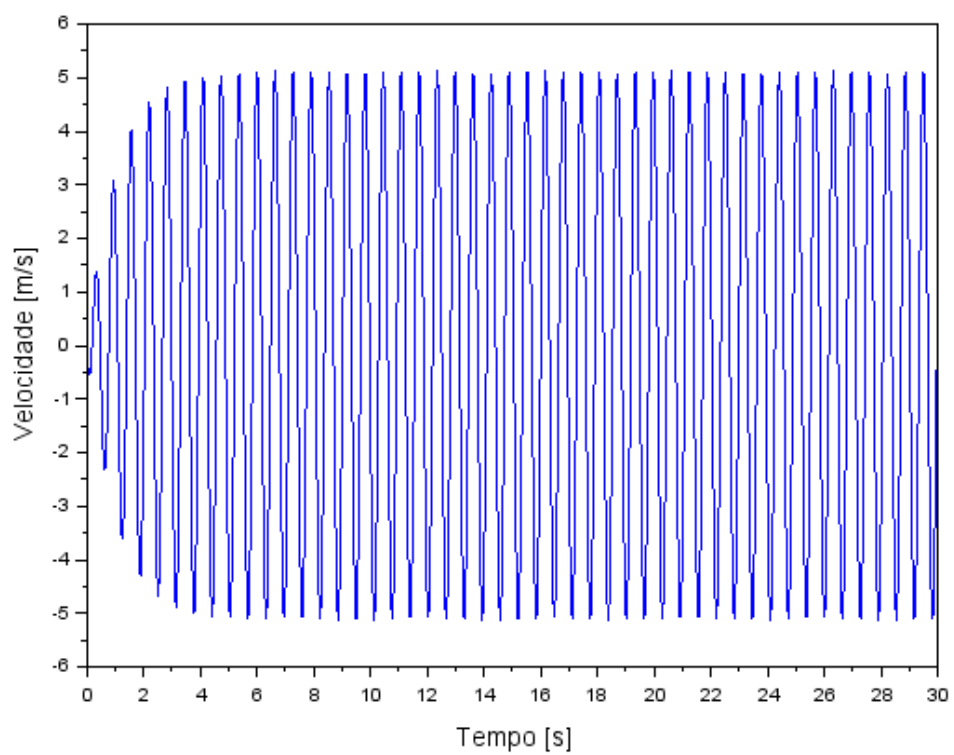
## Simulação

- Caso 1

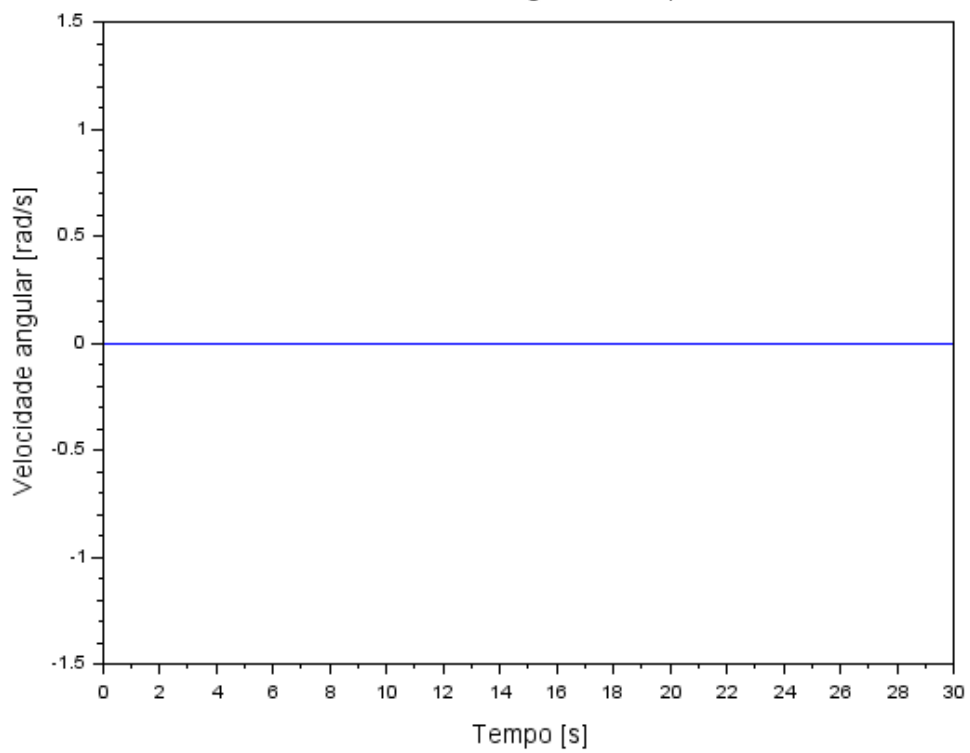
$$v_C = \text{sen}(9,8995t)$$

$$v_D = \text{sen}(9,8995t)$$

Velocidade do centro de massa



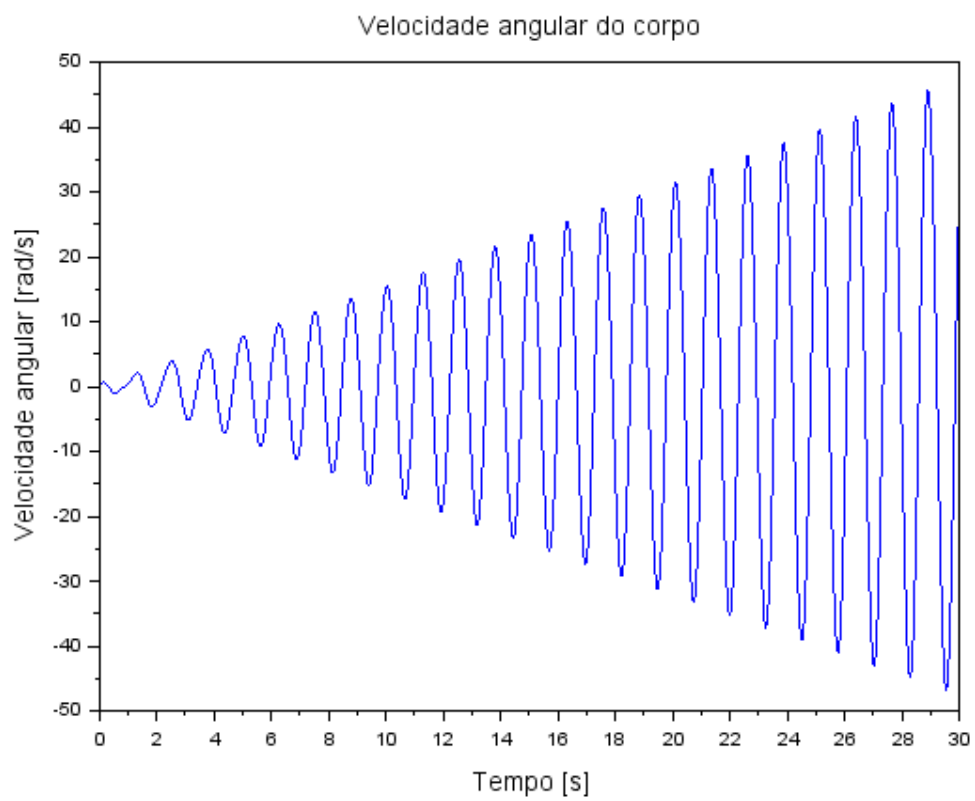
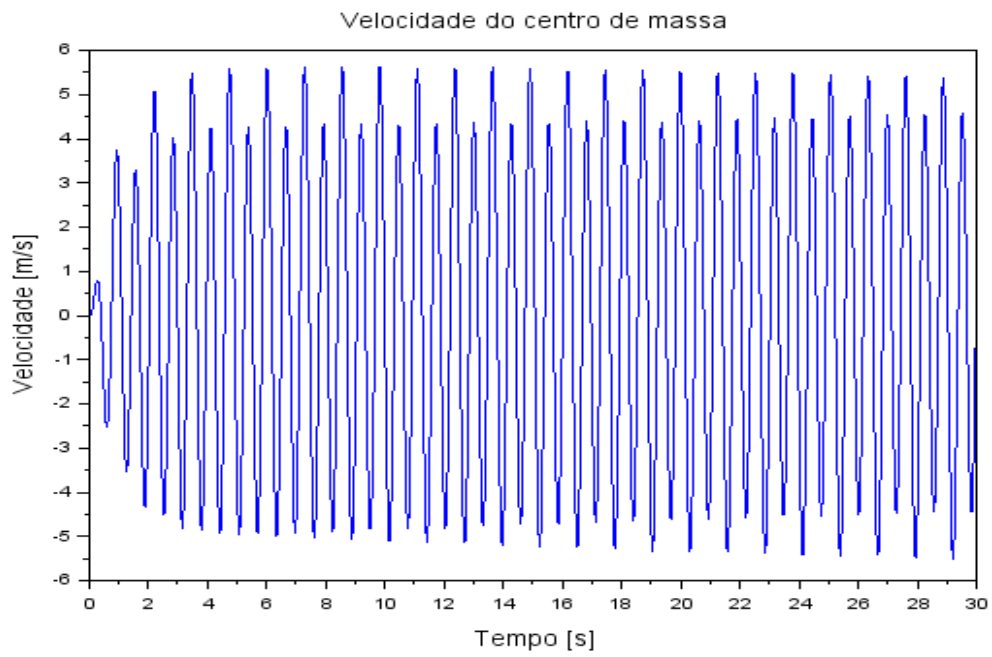
Velocidade angular do corpo



- Caso 2

$$v_C = \text{sen}(4,9875t)$$

$$v_D = -\text{sen}(4,9875t)$$



# Diagramas de Bode

