Nome: Matheus Rodrigues da Cunha

Matrícula:1520050232

Curso: Engenharia Eletrônica

Turma: Sistemas de Controle 2

1 – A)

$$i = \frac{V}{R} \quad V = R \cdot i$$

① a)

$$y = V_0(t) = V_{C_1}(t) = X_1 \qquad \boxed{u = V_i(t)}$$

$$i_L(t) = i_{C_1}(t) + i_{R_1}(t)$$

$$i_L(t) = C_1 \frac{dV_{C_1}(t)}{dt} + \frac{V_{C_1}(t)}{R_1}$$

$$C_1 \frac{dV_{C_1}(t)}{dt} = \frac{-V_{C_1}(t)}{R_1 C_1} + \frac{i_L(t)}{C_1}$$

$$\dot{X}_1 = -\frac{1}{R_1 C_1} X_1 + \frac{1}{C_1} X_3$$

$$V_L(t) = V_{C_2}(t) - V_{C_1}(t)$$

$$L \frac{di_L(t)}{dt} = -V_{C_1}(t) + V_{C_2}(t)$$

$$\frac{di_L(t)}{dt} = -\frac{V_{C_1}(t)}{L} + \frac{V_{C_2}(t)}{L}$$

$$\dot{X}_3 = -\frac{1}{L} X_1 + \frac{1}{L} X_2$$

$$i_{R_2}(t) = i_{C_2}(t) + i_L(t)$$

$$\frac{V_i(t) - V_{C_2}(t)}{R_2} = C_2 \frac{dV_{C_2}(t)}{dt} + i_L(t)$$

$$\frac{C_2 \, dV_{C_2}(t)}{dt} = \frac{-V_{C_2}}{R_2} - i_L(t) + \frac{V_i(t)}{R_2}$$

$$\frac{dV_{C_2}(t)}{dt} = \frac{-V_{C_2}(t)}{R_2 C_2} - \frac{i_L(t)}{C_2} + \frac{V_i(t)}{R_2}$$

$$\dot{X}_2 = -\frac{1}{R_2 C_2} X_2 - \frac{1}{C_2} X_3 + \frac{1}{R_2 C_2} u$$

$$\dot{X} = \begin{bmatrix} \frac{-1}{e_1 C_1} & 0 & \frac{1}{C_1} \\ 0 & \frac{-1}{R_2 C_2} & \frac{-1}{C_2} \\ \frac{-1}{L} & \frac{1}{L} & 0 \end{bmatrix} \cdot \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{R_2 C_2} \\ 0 \end{bmatrix} u$$
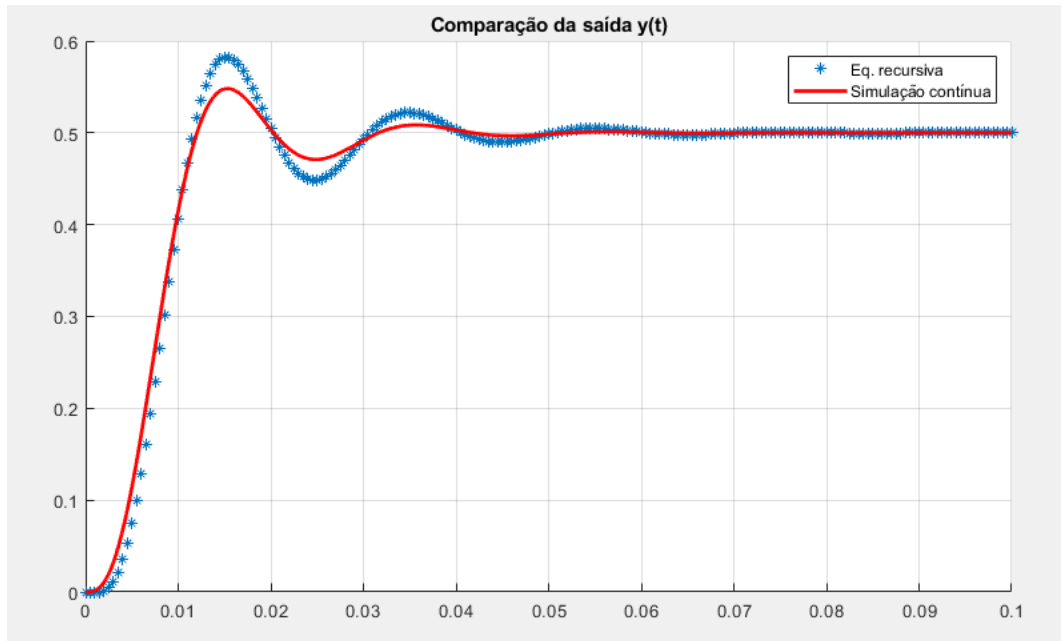
$$y = Cx + Du$$
$$y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x + 0u \quad y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x$$

$$\begin{bmatrix} \dfrac{-1}{C1*R1} & 0 & \dfrac{1}{C1} \\ 0 & \dfrac{-1}{C2*R2} & \dfrac{-1}{C2} \\ \dfrac{-1}{L} & \dfrac{1}{L} & 0 \end{bmatrix}_{3x3} * \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} + \begin{bmatrix} 0 \\ \dfrac{1}{C2*R2} \\ 0 \end{bmatrix} * u$$
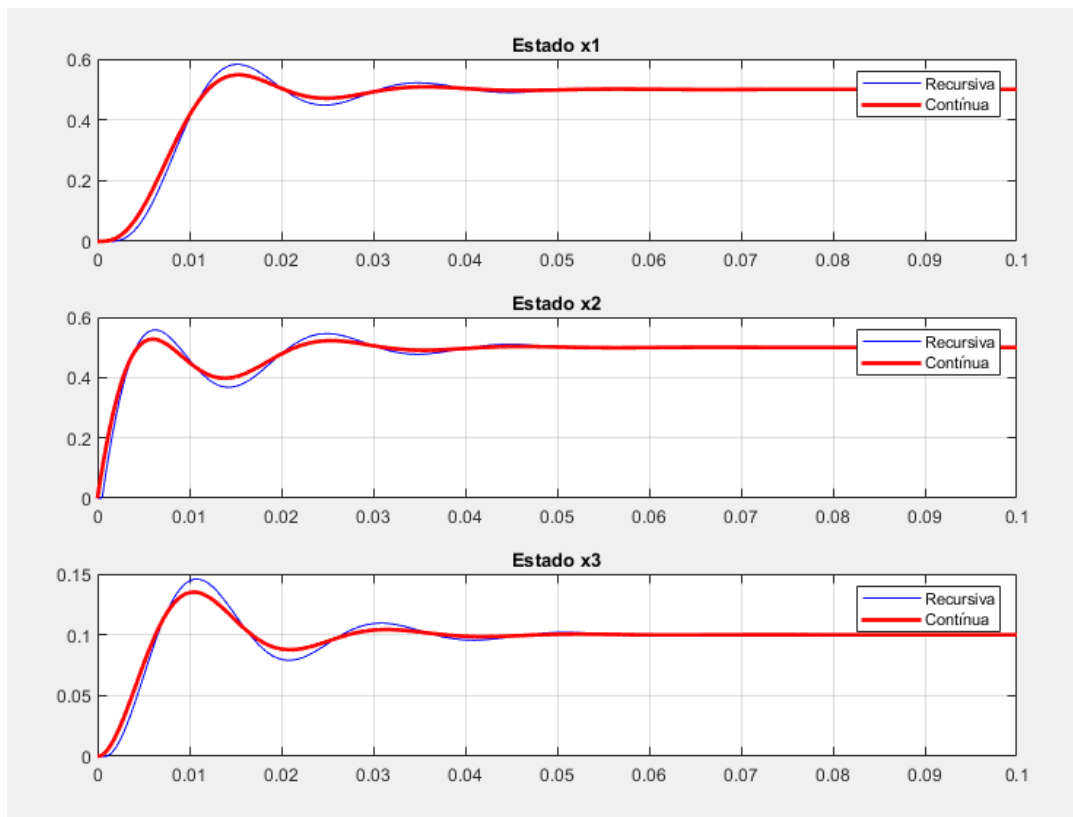
$$y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} * x$$

1 – B)

Gráfico Vo(t) e Vo(Kt)

Estados Observados

1 – C)

$$Ke = \begin{bmatrix} -0.8 \\ 0 \end{bmatrix}$$

$$Achapeu = \begin{bmatrix} -200 & -200 \\ 50 & 0 \end{bmatrix}$$

$$Bchapeu = \begin{bmatrix} 0 \\ -90 \end{bmatrix}$$

$$Fchapeu = \begin{bmatrix} 200 \\ 0 \end{bmatrix}$$

$$Cchapeu = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$$
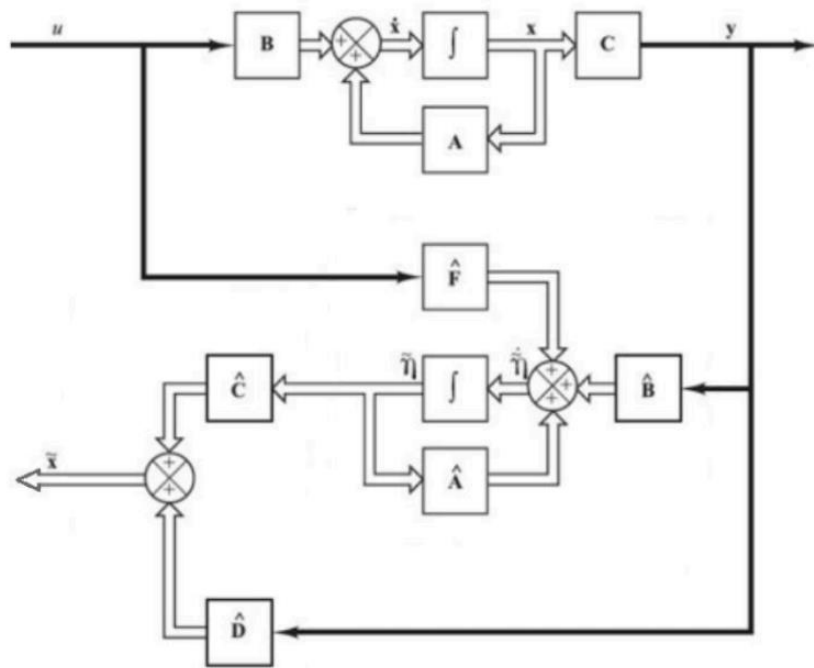
$$Dchapeu = \begin{bmatrix} 1 \\ -0.8 \\ 0 \end{bmatrix}$$

1 – D)

$$\tilde{\eta}(k) = T * \dot{\tilde{\eta}}(k-1) + \tilde{\eta}(k-1)$$
$$\tilde{\eta}(k) = \hat{F} * U(k) + \hat{B} * Amostras(k) + \hat{B} * \tilde{\eta}(k)$$

$$\tilde{x}(k) = \hat{C} * \tilde{\eta}(k) + \hat{D} * Amostras(k)$$

1 – E)

$$\zeta = 0.7$$

$$wn = 500 \frac{rad}{s}$$

$$S1,2 = -\zeta * wn + j * wn * \sqrt{1 - \zeta^2} = -350 \pm 357.07j$$

Para encontrar os polos s3 e s4 foi utilizado um valor 10 vezes maior que a parte real do polo
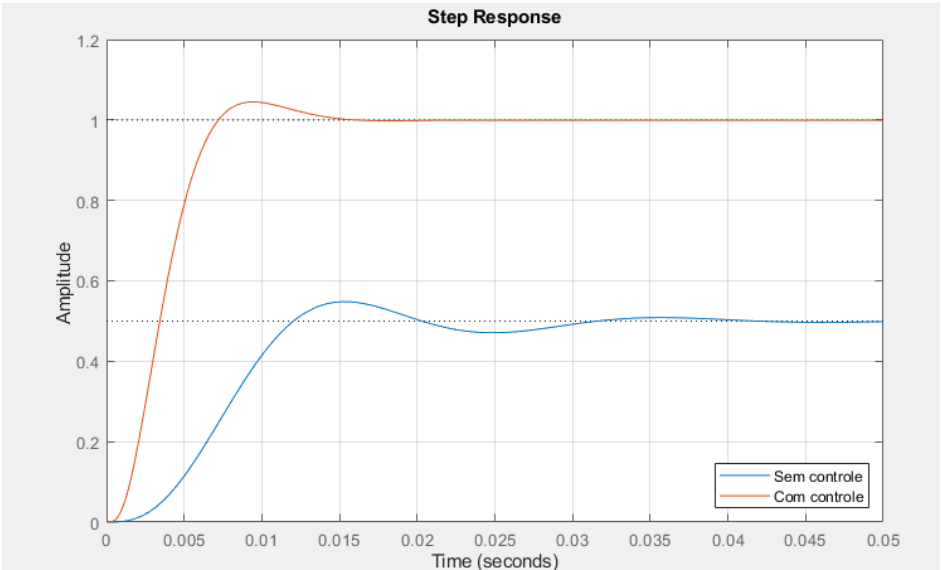*s1, sendo:*   *S3,4 = -3500*

$$K = [6780 \quad 36.5 \quad 1580]$$

1 – F)

Valores teóricos:

$$Mp = e^{\frac{\pi * \zeta}{\sqrt{1 - \zeta^2}}}$$

$$tp = \frac{\pi}{wn * \sqrt{1 - \zeta^2}}$$

Resposta com e sem controle

	Teórico	Simulação
Mp	4.5988%	4.4927%
Tp	0.0087982s	0.0094209s