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$$A = \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ \frac{327 \sin(x_3)}{50} \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 0 \end{bmatrix} \qquad D = [0]$$

Linealización

$$Af = \begin{bmatrix} \dot{x}_1 f \\ \dot{x}_2 f \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 f \\ x_2 f \end{bmatrix} \qquad Bf = \begin{bmatrix} 0 \\ \frac{327 \cos(x_3)}{50} \end{bmatrix}$$

$$Cf = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 f \\ x_2 f \end{bmatrix}$$

$$\dot{x}_1 = \dot{x}_2 = 0$$

$$0 = x_2$$

$$0 = \frac{327}{50} \sin(x_3) \rightarrow x_3 = \emptyset$$

Ackermann

$$C_o = \begin{bmatrix} \hat{B} & \hat{A}\hat{B} & \hat{A}^2 \cdot \hat{B} \end{bmatrix} = \begin{bmatrix} 0 & 6.54 & 0 \\ 6.54 & 0 & 0 \\ 0 & 0 & -6.54 \end{bmatrix}$$

$$Ph_i = \hat{A}^3 + 9{,}6\hat{A}^2 + 14{,}106\hat{A} + 10{,}45 \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$Ph_i = \begin{bmatrix} \frac{209}{20} & \frac{7053}{500} & 0 \\ 0 & \frac{209}{20} & 0 \\ -\frac{7053}{500} & -\frac{48}{5} & \frac{209}{20} \end{bmatrix}$$

$K = [0\ 0\ 1] \cdot C_o^{-1} \cdot phi$

$$K = \begin{bmatrix} 2,1569 \\ 14679 \\ 1,579 \end{bmatrix}$$

observada.

$\zeta = 0,025$

$\omega_n = 320$

pol des = $S^2 + 320 + 102400$

Phi ob = $A^2 + 320A + 102400 \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

$$Li = Phi\ obs \cdot O^{-1} \cdot \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 320 \\ 102400 \end{bmatrix}$$