$$\dot{x} = 2x + 4u \qquad z = x \qquad \dot{\hat{z}} = 2\hat{z} + 4u + K(y-\hat{y})$$

$$y = x$$

$$\dot{\hat{z}} = 2\hat{z} + 4u + \underbrace{K}_{KC_0}(\underbrace{x}_{z} - \underbrace{\hat{x}}_{\hat{z}})$$

$$\dot{\hat{z}} = 2\hat{z} + KC_0 z - KC_0\hat{z} + 4u$$

$$\dot{e} = \overset{\circ}{\overbrace{z - \hat{z}}}$$

$$= \underset{A}{2}\cancel{z} + \cancel{4u} - (\underset{A}{2}\hat{z} + KC_0 z - KC_0\hat{z} + \cancel{4u})$$

$$= (2 + KC_0)(z - \hat{z}) = \overbrace{(2 + KC_0)}^{<0} e$$

$$\begin{cases} \dot{x} = [A]x + Bu \\ y = Cx + Du \end{cases} \xrightarrow{z = Tx}$$

$$\boxed{A_z = \begin{bmatrix} -a_{n-1} & 1 & & \\ \vdots & & \ddots & \\ \vdots & & & 1 \\ -a_0 & 0 & \text{—} & 0 \end{bmatrix} \qquad C_z = [1 \; 0 \; \circ \; 0]}$$

$$\dot{z} = T\dot{x} = \underbrace{TAT^{-1}}_{A_z} z + TBu$$

$$C_z = \underbrace{CT^{-1}}_{C_z} z \quad , D_z \cdots$$

$y = z_1$ forma can. OSSERVAT.

$$\dot{z} = \begin{bmatrix} -a_{n-1} z_1 + z_2 & + B_{1z} u \\ -a_{n-2} z_1 + z_3 & + B_{2z} u \\ & \\ -a_0 z_1 & + B_{nz} u \end{bmatrix}$$

$$\det(\lambda I - A_z) = \lambda^n + a_{n-1}\lambda^{n-1} + \quad + a_0$$

$$\mathcal{O} = \begin{bmatrix} C \\ CA \\ \vdots \\ CA^{n-1} \end{bmatrix} = \begin{bmatrix} 1 & 0 & - & & 0 \\ -a_{n-1} & 1 & 0 & \cdots & 0 \\ * & & 1 & & \\ & & & & 1 \end{bmatrix} \Rightarrow \text{rank}(\mathcal{O}) = n$$

$y - \hat{y}$ $\qquad z_1 = Cz$

$z_1 - \hat{z}_1$

$$\dot{\hat{z}} = A_z \hat{z} + B_z u + L\, C_z (z - \hat{z})$$

$$\dot{e} = \dot{\overline{z - \hat{z}}} = A_z e + L C_z e = (A_z + L C_z)\, e$$

$$= \begin{bmatrix} -a_{n-1} - K c_{n-1} & 1 & 0 & \cdots & 0 \\ -a_{n-2} - K^2 c_{n-2} & 0 & \ddots & & 0 \\ \vdots & \vdots & & \ddots & 1 \\ -a_0 - K^n c_0 & 0 & \cdots & & 0 \end{bmatrix} e$$

$= A_e$

$a_i = ?$

$$P_{A_e}(\lambda) = \lambda^n + (a_{n-1} + K c_{n-1})\lambda^{n-1} + \quad + (a_0 + K^n c_0)$$

c_{n-1} $\qquad c_0$

$K = 1$

$\triangleq P_{A_e}$ desiderato

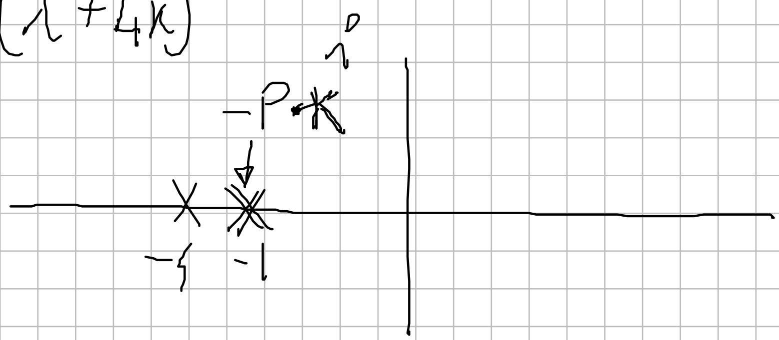
Se $a_i = 0 \Longrightarrow \lambda^n + K c_{n-1}\lambda^{n-1} + K^2 c_{n-1}\lambda^{n-2} + \dots + K^n c_0$

$P = -2K$ $\qquad K = 1$

$$(\lambda + 2k)^2 = \lambda^2 + 4K\lambda + 4K^2$$

$$(\lambda + 2k)^3 = \lambda^3 + c_{n-1} K\lambda^2 + c_{n-2} K^2 \lambda + c_0 K^3$$

$$(\lambda + 1k)(\lambda + 4k)$$



$$\underline{\lambda}_s \|\tilde{e}\|^2 \leq \frac{V(\tilde{e})}{\bar{\lambda}_s} = \tilde{e}' S \tilde{e} \leq \bar{\lambda}_s \|e\|^2$$