

i -esimo osservatore
per l' i -esima uscita y_i
è l'osservatore progettato
delle matrici (A, B, c_i, D)

$$C = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} \begin{matrix} \leftarrow y_1 \\ \leftarrow y_2 \\ \leftarrow y_3 \end{matrix}$$

$$\hat{x}^i(t+1) = A \hat{x}^i(t) + B U(t) +$$
$$+ K_i \left(y_i(t) - C_i \hat{x}^i(t) \right)$$

$$\hat{y}_i(t) = C_i \hat{x}_i(t)$$

$$z_i(t) = y_i(t) - \hat{y}_i(t)$$

Matrice dinamica
dell' i -esimo osservatore è

$$(A - K_i C_i)$$

- determinare K_i tale che
autovalori di $(A - K_i C_i)$ siano
quelli desiderati v

$$K_i = \text{place}(A', C_i', v)'$$

Nota: la coppia (A, C_i) è osservabile | n è la dim. di A

$$\text{rank}(\text{obsv}(A, C_i)) \equiv n$$

U/O

$$\begin{cases} x(t+1) = Ax(t) + Bu(t) + \underbrace{Ed(t)} \\ y(t) = Cx(t) \end{cases} \quad \hat{x}(t) \xrightarrow{\text{red X}} x(t)$$

$$\begin{cases} \hat{x}(t+1) = A\hat{x}(t) + Bu(t) + \\ \quad + \textcircled{K}(y - C\hat{x}(t)) \\ \hat{y}(t) = C\hat{x}(t) \end{cases}$$

$$\begin{cases} z(t+1) = F z(t) + T B u(t) + K y(t) \\ \hat{x}(t) = z(t) + H y(t) \end{cases}$$

$$\begin{cases} \checkmark (HC - I)E = 0 \Rightarrow H = E(CE)^+ \\ \checkmark \begin{cases} I - HC = T \\ A - HCA - K_1 C = F \\ FH = K_2 \end{cases} \quad K = K_1 + K_2 \end{cases}$$

Condiz. esistenza UIO

1) $\text{rank}(E) = \text{rank}(CE)$

n. uscite > n. disturbi

2) (A, C) osservabile

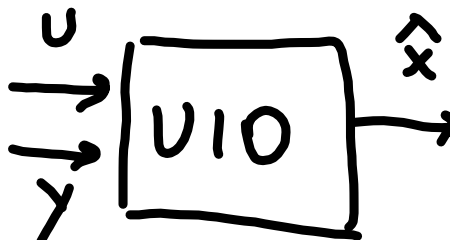
$$\boxed{A - HCA} - K_1 C = F$$

$$\text{place} \rightarrow A - K \cdot C$$

$$\text{place} \left((A - HCA)', C', v \right)' = K_1$$

UIO in Simulink

$$\begin{cases} z(t+1) = Fz(t) + TBu(t) + ky(t) \\ \hat{x}(t) = z(t) + Hy(t) \end{cases}$$

$$\begin{cases} z(t+1) = Fz(t) + \begin{bmatrix} TB \\ \vdots \\ k \end{bmatrix} \begin{bmatrix} u(t) \\ y(t) \end{bmatrix} \\ \hat{x}(t) = Iz(t) + \underbrace{\begin{bmatrix} 0 \\ \vdots \\ H \end{bmatrix}}_{m \times l} \begin{bmatrix} u \\ y \end{bmatrix} \end{cases}$$


The diagram illustrates the implementation of the UIO equations. The input vector $\begin{bmatrix} u \\ y \end{bmatrix}$ is fed into a block labeled "UIO". The output of this block is the estimated state \hat{x} . The matrix $\begin{bmatrix} 0 \\ \vdots \\ H \end{bmatrix}$ is highlighted in red, and its dimensions are indicated as $m \times l$ in blue.