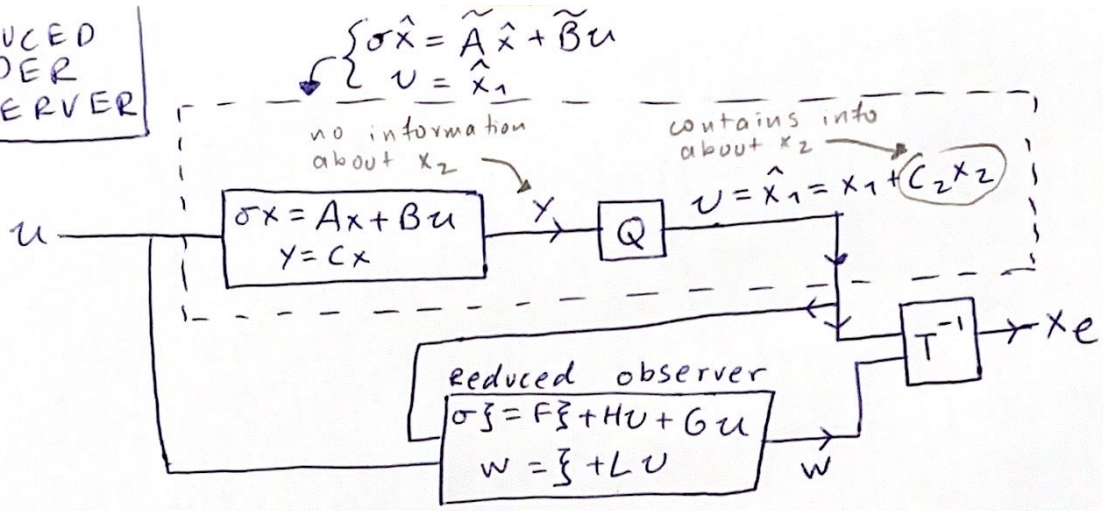
REDUCED ORDER OBSERVER



- to minimise error $(w - x_2)$:

$$F = \tilde{A}_{22} - L\tilde{A}_{12}$$
$$H = FL - L\tilde{A}_{11} + \tilde{A}_{21}$$
$$G = -L\tilde{B}_1 + \tilde{B}_2$$

Appropriate choice of L is needed.

- Q is such that $QC = [I \; C_2]$, Q extracts information about x_2 from y: $v = Qy = x_1 + C_2 x_2$

- $$x_e = \begin{pmatrix} x_{1e} \\ x_{2e} \end{pmatrix} = \begin{pmatrix} v - C_2 w \\ w \end{pmatrix} = \begin{pmatrix} \hat{x}_1 - C_2 w \\ w \end{pmatrix} = \begin{pmatrix} x_1 + C_2 x_2 - C_2 w \\ w \end{pmatrix}$$ (error = 0)

  if error $= w - x_2 = 0$, then: $x_e = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = x$

- $T = \begin{pmatrix} I & C_2 \\ 0 & I \end{pmatrix}$ such that: $\begin{pmatrix} \hat{x}_1 \\ \hat{x}_2 \end{pmatrix} = T \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \Rightarrow \begin{cases} \hat{x}_1 = x_1 + C_2 x_2 \\ \hat{x}_2 = x_2 \end{cases}$

- since $\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = T^{-1} \begin{pmatrix} \hat{x}_1 \\ \hat{x}_2 \end{pmatrix}$

$$\dot{\hat{x}} = TAT^{-1}\hat{x} + TBu$$
$$y = CT^{-1}\hat{x} \Rightarrow v = QCT^{-1}\hat{x}$$
$$\Rightarrow \tilde{A} = TAT^{-1}, \quad \tilde{B} = TB, \quad I = QCT^{-1}$$