$\dot{x} = f(x, u)$

liniar $\rightarrow f(x,u) = ax + bu + \cancel{c}$

$\Delta(x_1, u_1)$

↓

(vecinătate)

$$f(x,u) = f(x_1,u_1) + \underbrace{\left.\frac{\partial f}{\partial x}\right|_{\Delta}}_{m_1} \underbrace{(x-x_1)}_{\Delta x} + \underbrace{\left.\frac{\partial f}{\partial x}\right|_{\Delta}}_{m_2} \underbrace{(u-u_1)}_{\Delta u} \underbrace{+ \left.\frac{\partial^2 f}{\partial x^2}\right|_{\Delta} (x-x_1)^2 - - - - -}_{\text{TOS} \approx 0}$$

$$\boxed{\begin{aligned} f(x,u) - f(x_1,u_1) &= \Delta f \\ \Delta f &= m_1 \Delta x - m_2 \Delta u \end{aligned}}$$

Aproximarea liniară

→ superpoziție

→ omogenitate

Modele cu funcții de transfer

$$H(s) = \frac{N(s)}{\Delta(s)}$$

order of $\Delta(s) \geq$ order of $N(s)$

roots → poles ($\Delta(s)$) zeros ($N(s)$)

grad $\Delta(s)$ → gradul sistemului

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$\mathring{x}_1 = 5x_1 - 2x_2 + u$$

$$\mathring{x}_2 = -6x_1 + 3x_3 - 5u$$

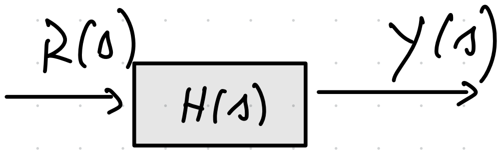
$$\mathring{x}_3 = 6x_2 - 4x_3$$

$$y = 5x_3$$

$$\begin{cases} s\,x_1 = 5x_1 - 2x_2 + u \\ s\,x_2 = -6x_1 + 3x_3 - 5u \\ s\,x_3 = 6x_2 - 4x_3 \end{cases} \Rightarrow x_3$$

$$\boxed{y = \underbrace{\text{-------}}_{H} \cdot u}$$

Funcții de transfer

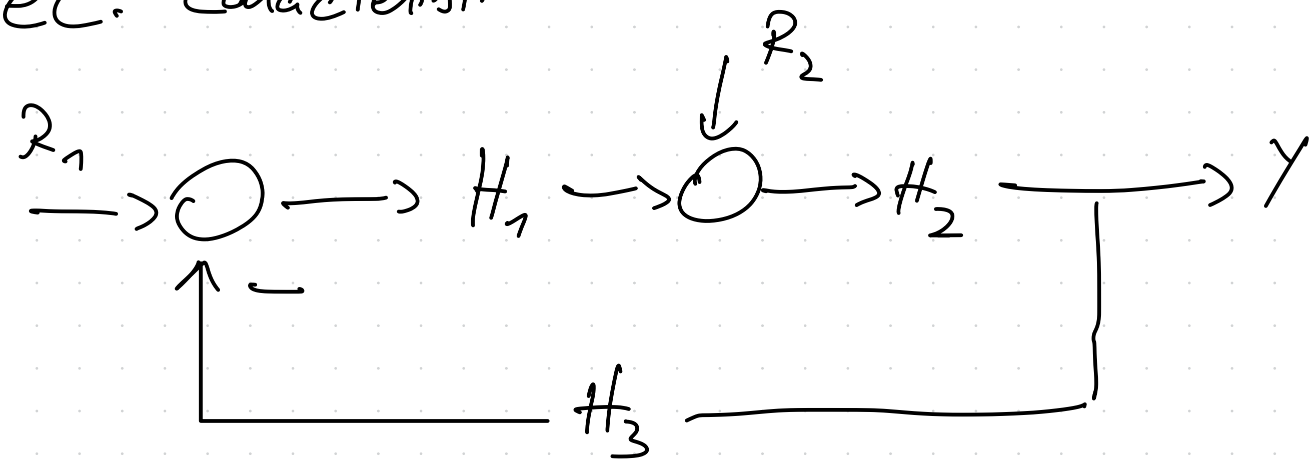


$$y(t) = \mathcal{L}^{-1}\left[H(s) \cdot R(s)\right]$$

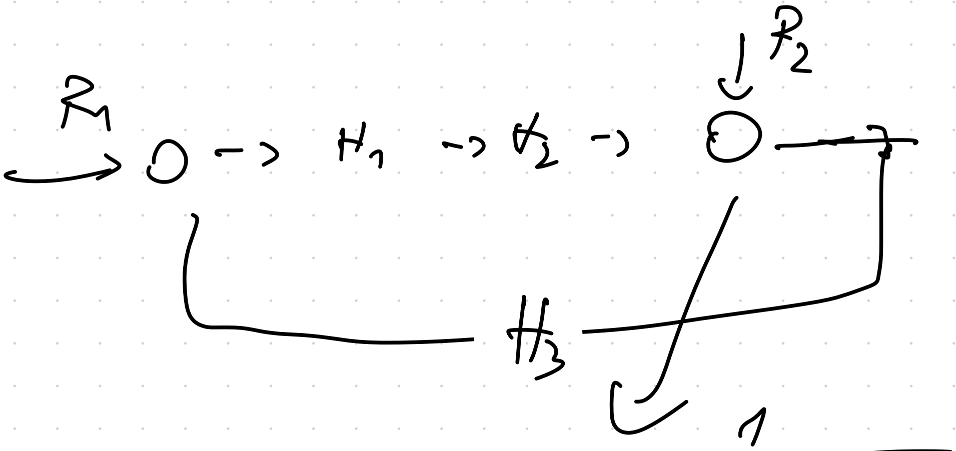
Eigenvalues

$$(-1)^n \det(A - \lambda I) = 0$$

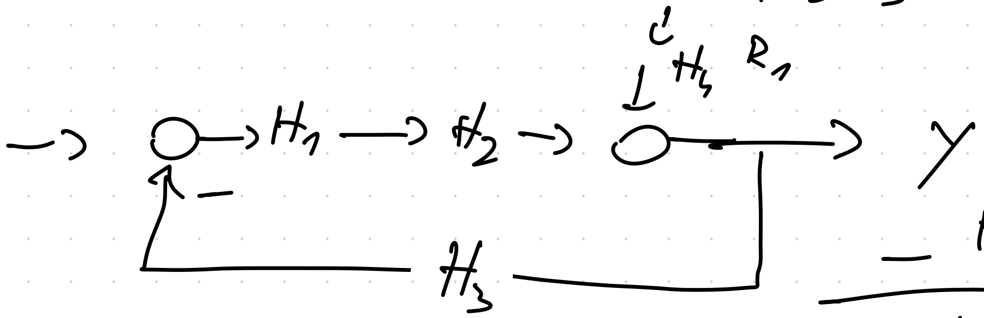
ec. caracteristică



$$Y(s) = \frac{H_1 H_2}{1 + H_1 H_2 H_3} R_1(s) + \frac{H_2}{1 + H_1 H_2 H_3} R_2(s)$$



$$\frac{1}{1 + H_1 H_2 H_3}$$



$$-\frac{H_2}{1 + H_1 H_2 H_3}$$

Matrici de transfer

$$Y = H \cdot R$$