1 Espaces d'états

$$U(s) \xrightarrow{p \text{ signaux}} G(s) \xrightarrow{r \text{ signaux}} Y(s)$$

$$u(t) \xrightarrow{u} \begin{array}{c} x = Ax + Bu \\ y = Cx + Du \end{array} \qquad y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_r \end{bmatrix}$$

$$u = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_r \end{bmatrix} \xrightarrow{p} \qquad y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_r \end{bmatrix}$$

$$u = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_r \end{bmatrix} \xrightarrow{p} \qquad y = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_r \end{bmatrix}$$

1.1
$$A, B, C, D \longrightarrow G$$

$$G(s) = C(sI - A)^{-1}B + D$$

 $G(z) = C_n(zI - A_n)^{-1}B_n + D_n$

1.1.1 Gain haute fréquence

$$\lim_{s\to\infty}G(s)=D$$

1.1.2 Gain basse fréquence

$$G(0) = -CA^{-1}B + D$$

1.2
$$G(s) \longrightarrow A, B, C, D$$

1.3
$$G(z) \longrightarrow A, B, C, D$$

1.4 Mise en cascade

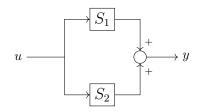
$$u \longrightarrow S_1 \longrightarrow S_1 \longrightarrow y$$

$$S_{tot} = S_2(s) \cdot S_1(s) \qquad \text{ordre important}$$

$$A_{tot} = \begin{bmatrix} A_1 & 0 \\ B_2C_1 & A_2 \end{bmatrix} \qquad B_{tot} = \begin{bmatrix} B_1 \\ B_2D_1 \end{bmatrix}$$

 $C_{tot} = \begin{bmatrix} D_2 C_1 & C_2 \end{bmatrix} \qquad D_{tot} = D_2 D_1$

1.5 Mise en parallèle



$$S_{tot}(s) = S_1(s) + S_2(s)$$

$$A_{tot} = \begin{bmatrix} A_1 & 0\\ 0 & A_2 \end{bmatrix} \qquad B_{tot} = \begin{bmatrix} B_1\\ B_2 \end{bmatrix}$$

$$C_{tot} = \begin{bmatrix} C_1 & C_2 \end{bmatrix} \qquad D_{tot} = D_1 + D_2$$

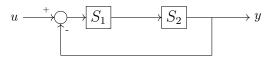
1.5.1 Mise en contre-réaction 1

$$u \xrightarrow{+} S_{1} \longrightarrow y$$

$$A_{tot} = \begin{bmatrix} A_{1} - B_{1}D_{2}(I - D_{1}D_{2})^{-1}C_{1} & -B_{1}(C_{2} - D_{2}D_{1}C_{2}) \\ B_{2}(I - D_{1}D_{2})^{-1}C_{1} & A_{2} - B_{2}(I - D_{1}D_{2})^{-1}D_{1}C_{2} \end{bmatrix} \qquad B_{tot} = \begin{bmatrix} B_{1} - B_{1}D_{2}ND_{1} \\ B_{2}ND_{1} \end{bmatrix}$$

$$C_{tot} = \begin{bmatrix} (I - D_{1}D_{2})^{-1}C_{1} & -(I - D_{1}D_{2})^{-1}D_{1}C_{2} \end{bmatrix} \qquad D_{tot} = (I - D_{1}D_{2})^{-1}D_{1}$$

1.5.2 Mise en contre-réaction 2



$$S_{tot}(s) = (I + S_1(s)S_2(s))^{-1} S_1(s)$$

$$A_{tot} = \begin{bmatrix} A_1 & 0 \\ B_2C_1 & A_2 \end{bmatrix} \qquad B_{tot} = \begin{bmatrix} B_1 \\ B_2D_1 \end{bmatrix}$$

$$C_{tot} = \begin{bmatrix} D_2C_1 & C_2 \end{bmatrix} \qquad D_{tot} = D_1D_2$$