106 Poursuite

$$\begin{cases} \dot{x}_1 = u_1 \cdot \cos(\theta_1) \\ \dot{y}_1 = u_1 \cdot \sin(\theta_1) \\ \dot{\theta}_1 = u_2 \end{cases} \quad \text{avec} \quad \begin{cases} \dot{x}_2 = v_1 \cos\theta_2 \\ \dot{y}_2 = v_1 \sin\theta_2 \\ \dot{\theta}_2 = v_2 \end{cases}$$

ROBOT 1 (Repère $\mathcal{R}_1$) — ROBOT 2. (Repère $\mathcal{R}_2$)

(1)

$$\begin{pmatrix} x \\ y \\ \theta \end{pmatrix} = \begin{pmatrix} \cos\theta_1 & \sin\theta_1 & 0 \\ -\sin\theta_1 & \cos\theta_1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} x_2 - x_1 \\ y_2 - y_1 \\ \theta_2 - \theta_1 \end{pmatrix}$$

$$\begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = R_{\theta_1} \cdot \begin{pmatrix} \dot{x}_2 - \dot{x}_1 \\ \dot{y}_2 - \dot{y}_1 \end{pmatrix} + \underbrace{\dot{\theta}_1}_{= u_2} \begin{pmatrix} -\sin\theta_1 & \cos\theta_1 \\ -\cos\theta_1 & -\sin\theta_1 \end{pmatrix} \begin{pmatrix} x_2 - x_1 \\ y_2 - y_1 \end{pmatrix}$$

on a $\begin{pmatrix} \dot{x}_2 \\ \dot{y}_2 \end{pmatrix} = v_1 \cdot \begin{pmatrix} \cos\theta_2 \\ \sin\theta_2 \end{pmatrix}$ et $\begin{pmatrix} \dot{x}_1 \\ \dot{y}_1 \end{pmatrix} = u_1 \cdot \begin{pmatrix} \cos\theta_1 \\ \sin\theta_1 \end{pmatrix}$

et $\begin{pmatrix} x_2 - x_1 \\ y_2 - y_1 \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix} \cdot R_{\theta_1}^T$

$$\begin{pmatrix} \dot{x}_2 - \dot{x}_1 \\ \dot{y}_2 - \dot{y}_1 \end{pmatrix} = \begin{pmatrix} v_1 \cos\theta_2 - u_1 \cos\theta_1 \\ v_1 \cdot \sin\theta_2 - u_1 \cdot \sin\theta_1 \end{pmatrix}$$

d'où $\begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = v_1 \begin{pmatrix} \cos(\theta_2 - \theta_1) \\ \sin(\theta_2 - \theta_1) \end{pmatrix} - u_1 \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix} + u_2 \cdot \begin{pmatrix} y \\ -\cancel{x} \end{pmatrix}$

$\dot{\theta} = \dot{\theta}_2 - \dot{\theta}_1 = v_2 - u_2$ on note $\theta = \theta_2 - \theta_1$

$$\Rightarrow \boxed{\begin{pmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{pmatrix} = \begin{pmatrix} -u_1 + v_1 \cdot \cos\theta + u_2 y \\ v_1 \cdot \sin\theta - u_2 x \\ v_2 - u_2 \end{pmatrix}}$$

② Méthode de linéarisation par bouclage :

$$\boxed{\begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = \underbrace{\begin{pmatrix} -1 & y \\ 0 & -1 \end{pmatrix}}_{A(x)} \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} + \underbrace{\begin{pmatrix} v_1 \cdot \cos\theta \\ v_1 \cdot \sin\theta \end{pmatrix}}_{b(x)}}$$

Non linéaire $\Rightarrow$ on pose $\boxed{u = A^{-1}(x) \cdot [\underbrace{v}_{\text{nouvelle entrée}} - b(x)]}$ $v = \begin{pmatrix} v_1 \\ v_2 \end{pmatrix}$

$$\Rightarrow \begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix} = \begin{pmatrix} v_1 \\ v_2 \end{pmatrix} = \begin{pmatrix} \overbrace{w_1 - x}^{e_x} \\ \underbrace{w_2 - y}_{e_y} \end{pmatrix} + \begin{pmatrix} \dot{w}_1 \\ \dot{w}_2 \end{pmatrix}$$

$$\Rightarrow \begin{cases} e_x + \dot{e}_x = 0 \\ e_y + \dot{e}_y = 0 \end{cases} \qquad P(s) = s + 1 \Rightarrow s = -1$$

$\hookrightarrow e^{-t}$

③ singularités $\Leftrightarrow$ "div/0" $\Rightarrow$ les cas où la loi de commande ne s'applique plus