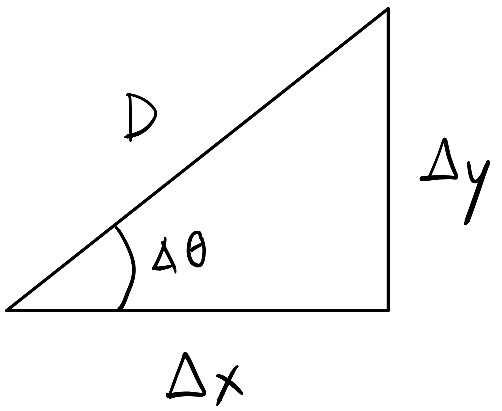
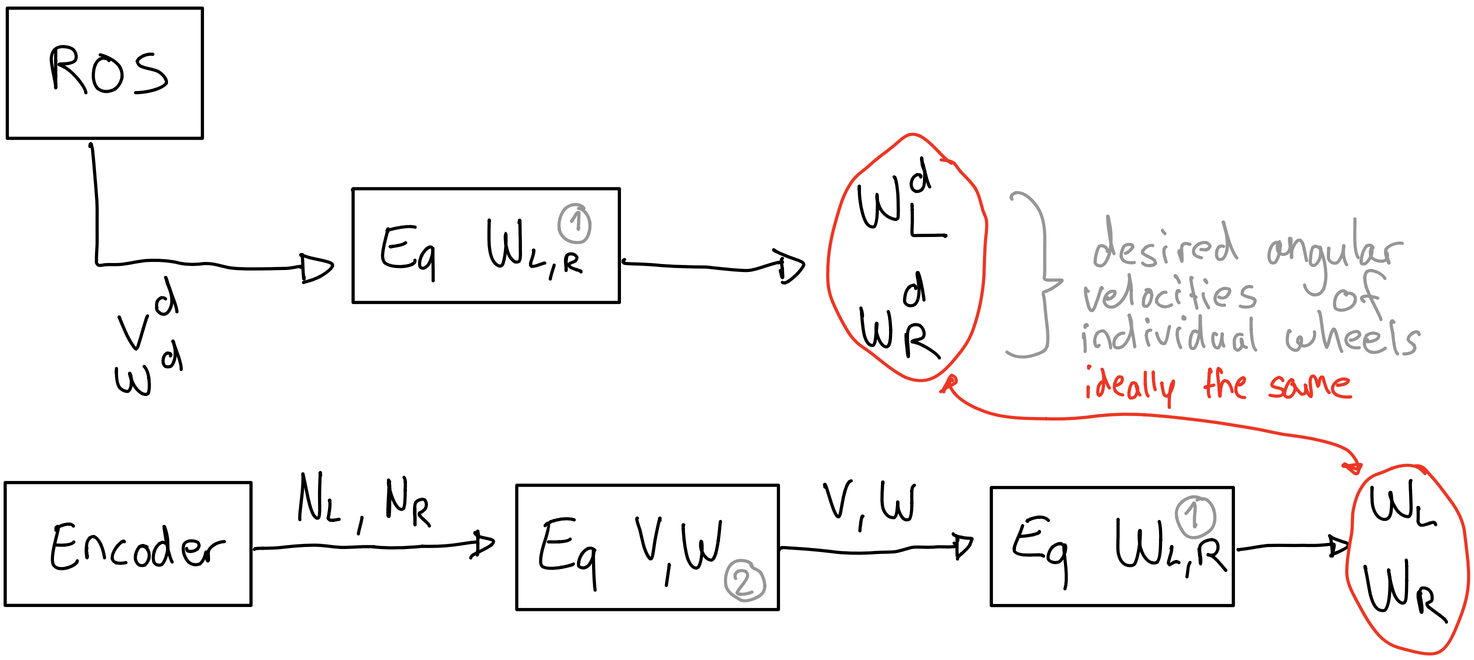


$$\Delta\theta = \frac{D_R - D_L}{b}$$ → differential kinematics

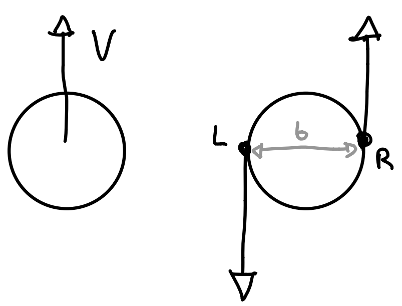
$$\Delta x = D \cdot \cos(\Delta\theta)$$
$$\Delta y = D \cdot \sin(\Delta\theta)$$



Formulas

general relationship between linear and angular velocity:

$$V = W \cdot r$$



$V_R = W \cdot \frac{b}{2}$ where b = wheel distance and r = wheel radius

↳ total angular velocities of wheels: (1)

$$W_R = \frac{V + W \cdot \frac{b}{2}}{r}$$

$$W_L = \frac{V - W \cdot \frac{b}{2}}{r}$$

Linear and angular velocity of robot ②

$$v_{i+1} = \underbrace{\frac{2\pi r}{C} \cdot \frac{N_R + N_L}{2}}_{\text{total distance } D \text{ covered by robot}} \cdot \frac{1}{\Delta t}$$

total distance D covered by robot → over time → speed (linear velocity)

$$w_{i+1} = \underbrace{\frac{2\pi r}{C} \cdot \frac{N_R - N_L}{b}}_{\text{total rotation } \theta \text{ covered by robot}} \cdot \frac{1}{\Delta t}$$

④

total rotation θ covered by robot → over time → speed (angular velocity)

Rotation and position of robot ③

$$\theta_{i+1} = \tan^{-1}\left(\frac{\sin(\theta_i + w_{i+1} \cdot \Delta t)}{\cos(\theta_i + w_{i+1} \cdot \Delta t)}\right)$$

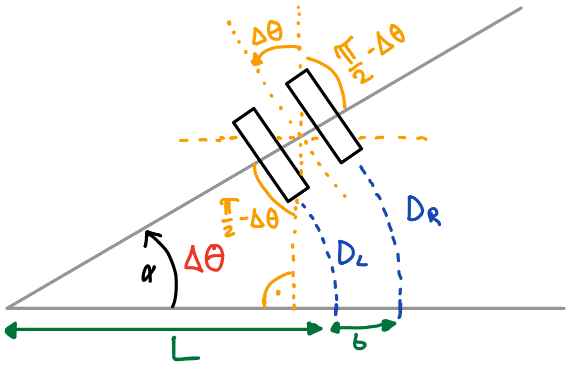
total displacement (hypothenuse) • share x-axis → x-component

$$x_{i+1} = x_i + \overbrace{v_{i+1} \cdot \Delta t}^{\text{total displacement}} \cdot \overbrace{\cos(\theta_{i+1})}^{\text{share x-axis}}$$

$$y_{i+1} = y_i + \underbrace{v_{i+1} \cdot \Delta t}_{\text{total displacement}} \cdot \underbrace{\sin(\theta_{i+1})}_{\text{share y-axis}}$$

total displacement (hypothenuse) • share y-axis → y-component

Derivations 4



$$\alpha = \pi - \frac{\pi}{2} - \left(\frac{\pi}{2} - \Delta\theta\right)$$

$$\alpha = \Delta\theta$$

$$D_L = L \cdot \Delta\theta \rightarrow L = \frac{D_L}{\Delta\theta}$$

$$D_R = (L+b) \cdot \Delta\theta \rightarrow \Delta\theta = \frac{D_R}{L+b}$$

↳ substitute L from equation 1 into equation 2:

$$\Delta\theta = \frac{D_R}{\frac{D_L}{\Delta\theta} + b} \quad \Big| \cdot \frac{D_L}{\Delta\theta} + b$$

$$\frac{D_L \cdot \cancel{\Delta\theta}}{\cancel{\Delta\theta}} + \Delta\theta \cdot b = D_R$$

$$D_L + \Delta\theta \cdot b = D_R \quad \Big| - D_L$$

$$\Delta\theta \cdot b = D_R - D_L \quad \Big| : b$$

$$\boxed{\Delta\theta = \frac{D_R - D_L}{b}}$$