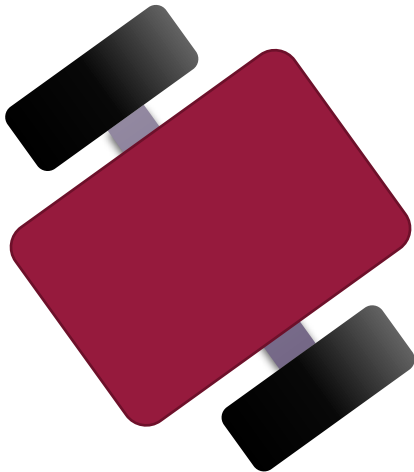# C 2.1 Dubins car model

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Dubins car

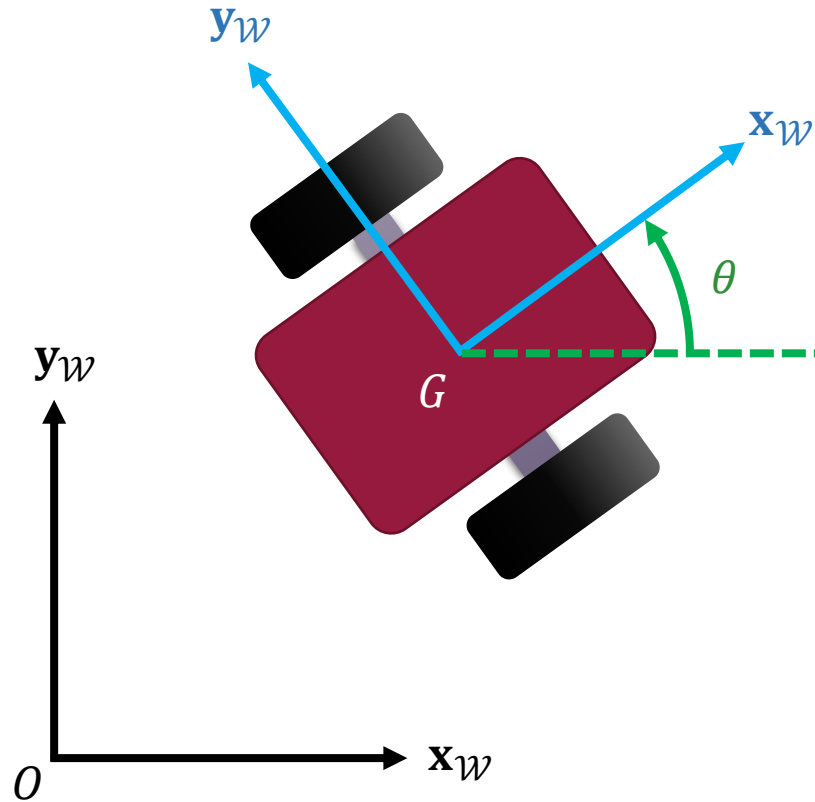## Dubins car system

A simple system

- 2 independently actuated wheels
- 3 degrees of freedom: 2D translation + 1D rotation

underactuated

Dubins car

Dubins car system

$$\mathbf{y}_{\mathcal{W}}$$

$$\mathbf{x}_{\mathcal{W}}$$

$$\theta$$

$$G$$

$$\mathbf{y}_{\mathcal{W}}$$

$$O$$

$$\mathbf{x}_{\mathcal{W}}$$

State

Position $\qquad p = \overrightarrow{OG} = \begin{pmatrix} x \\ y \end{pmatrix}$

Orientation $\qquad \theta$

Inputs

Forward velocity $\qquad v$

Angular velocity $\qquad \omega$

Kinematic model

$$\begin{cases} \dot{x} = v c_\theta \\ \dot{y} = v s_\theta \\ \dot{\theta} = \omega \end{cases}$$

Dubins car

Integrator model
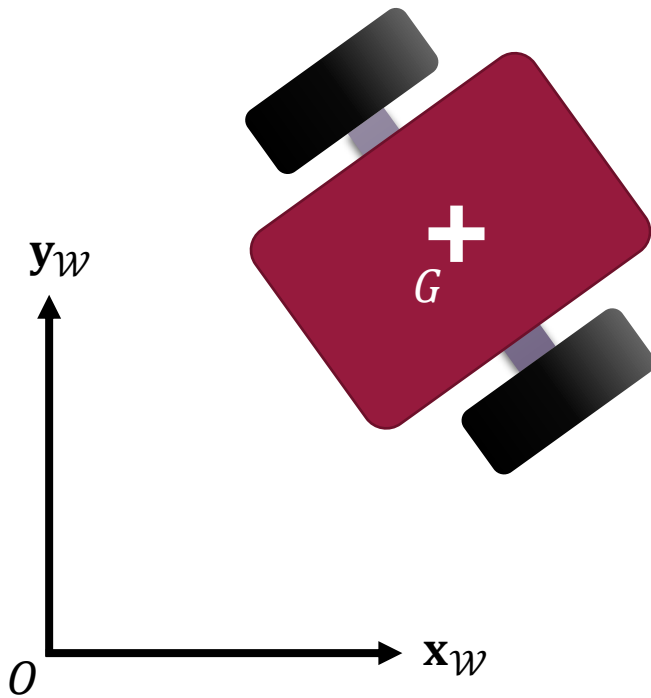
State

Position $\qquad p = \overrightarrow{OG} = \begin{pmatrix} x \\ y \end{pmatrix}$

Inputs

2D velocity $\qquad \dot{p} = \begin{pmatrix} \dot{x} \\ \dot{y} \end{pmatrix}$

Example

$$\theta_{\mathrm{ref}} = \arctan_2(\dot{y}_{\mathrm{ref}}, \dot{x}_{\mathrm{ref}}) \qquad \omega = k(\theta_{\mathrm{ref}} - \theta)$$