4 ROBOTS MÓVILES

4.1 Introducción: Preliminares y Conceptos.
4.2 Características de los Robots Móviles.
4.3 Estrategias de Control.
4.4 Seguimiento de Trayectorias.
4.5 Algoritmoms de Planificación.
4.6 Introducción a la Localización.
4.7 Control reactivo
4.8 Slam
4.9 Navegación Topológica

4.3 ESTRATEGIAS DE CONTROL DE ROBOTS MÓVILES

GENERALIDADES

Control Atractivo: Estrategia que hace que el robot converja hacia una configuración determinada.

Control Repulsivo: Estrategia que hace que el robot sea repelido de algunas configuraciones.

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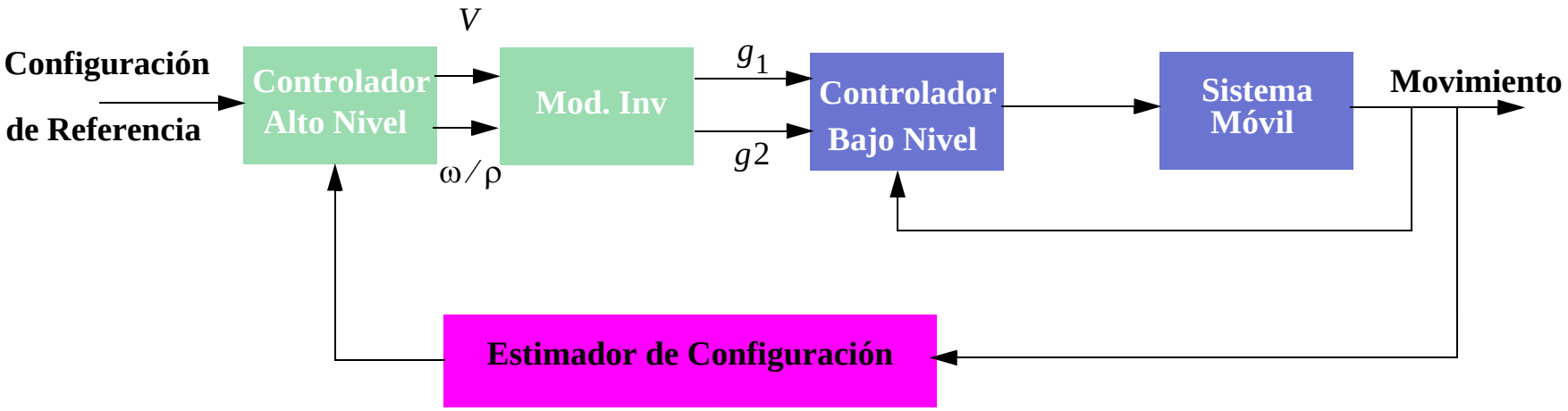
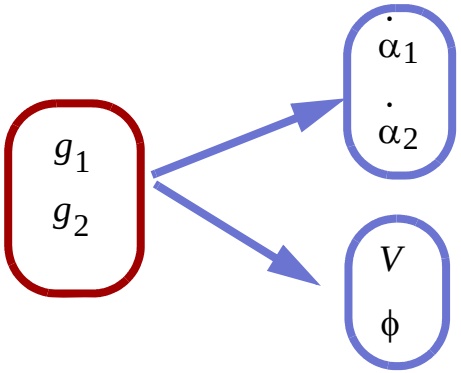
TEMA IV: ROBOTS MÓVILES

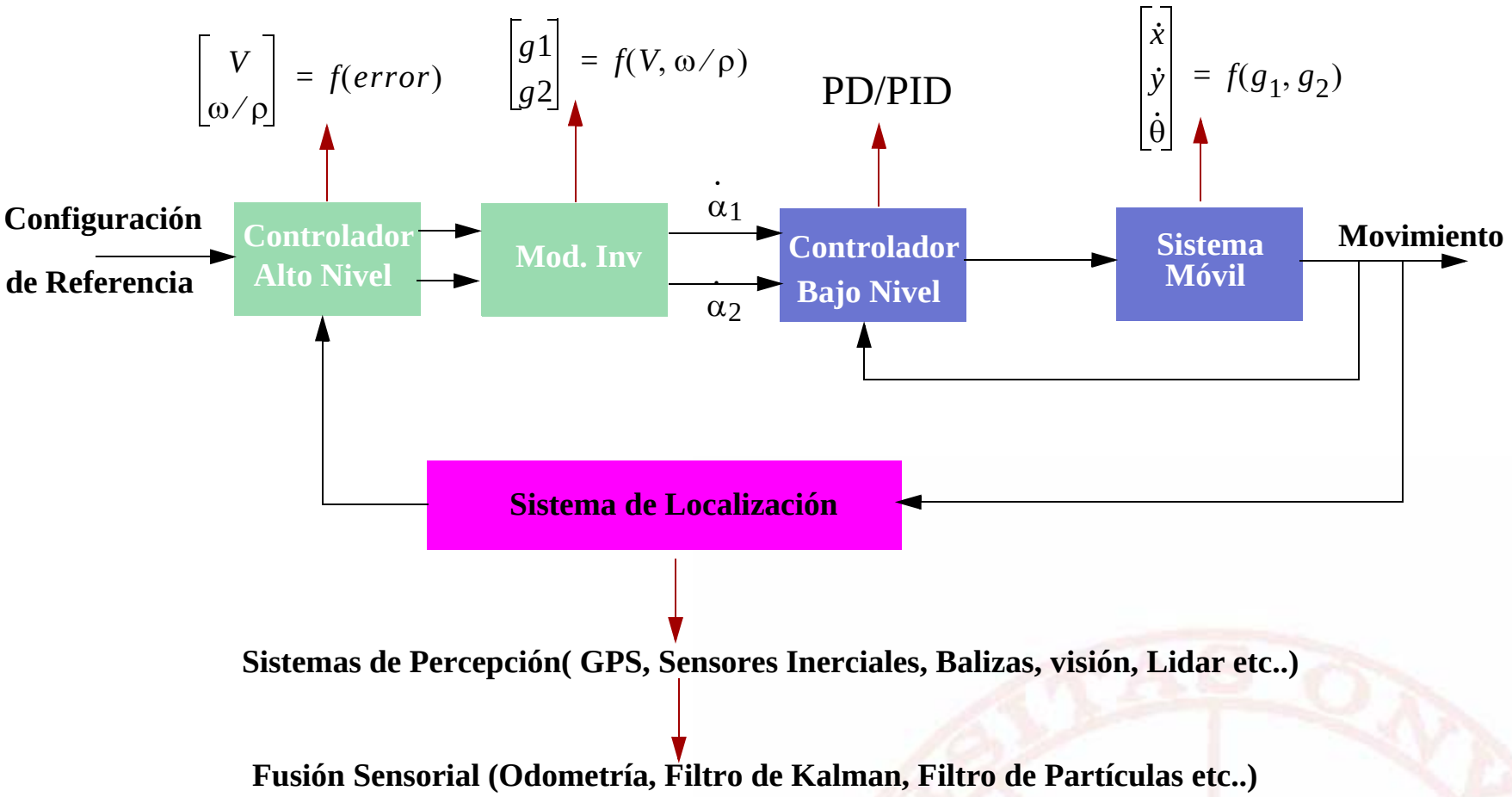
ESTRATEGIAS DE CONTROL

g_1, g_2 : Grados de libertad del vehículo

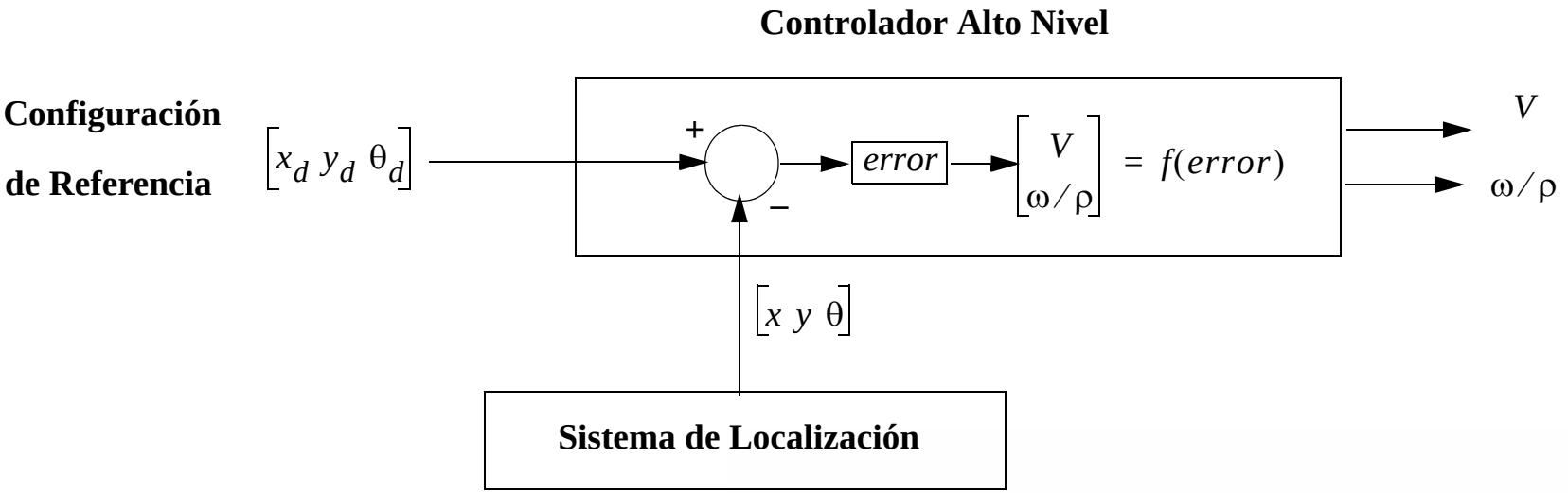


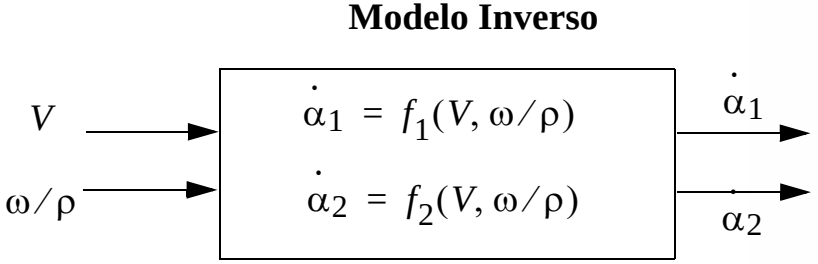


ESTRATEGIAS DE CONTROL



ESTRATEGIAS DE CONTROL





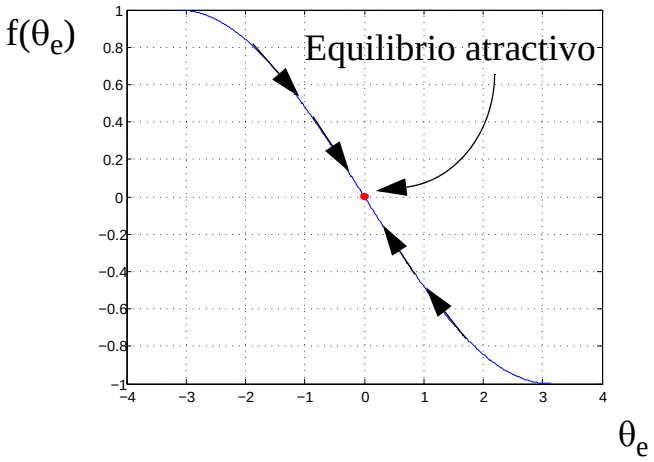
ESTRATEGIAS ATRACTIVAS

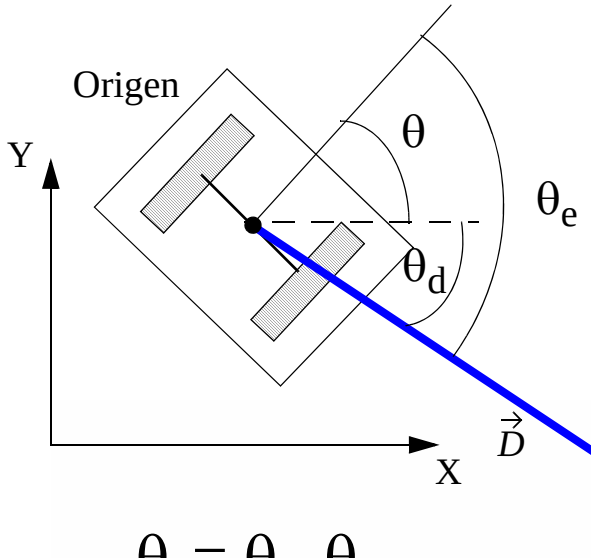
Diferencial Drive

$$v = k_v \cdot |D|$$

$$\omega = -f(\theta_e) \cdot \omega_{max}$$

$$\theta'_e = f(\theta_e) = -\sin(k_\theta \cdot \theta_e)$$





$$\dot{\alpha}_1 = \frac{V + \omega \cdot l}{r}$$

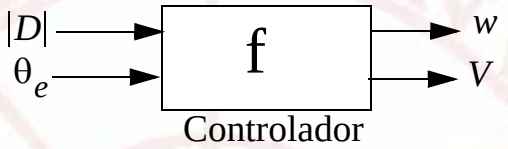
$$\dot{\alpha}_2 = \frac{V - \omega \cdot l}{r}$$

Destino

$$\theta_e = \theta_d - \theta$$

$$\downarrow$$

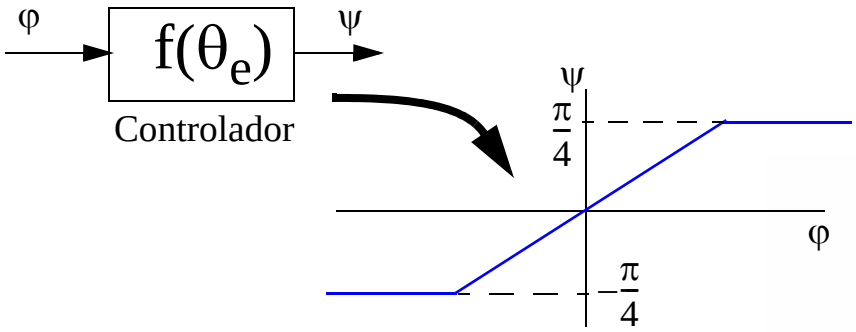
$$\theta'_e = -\theta'$$

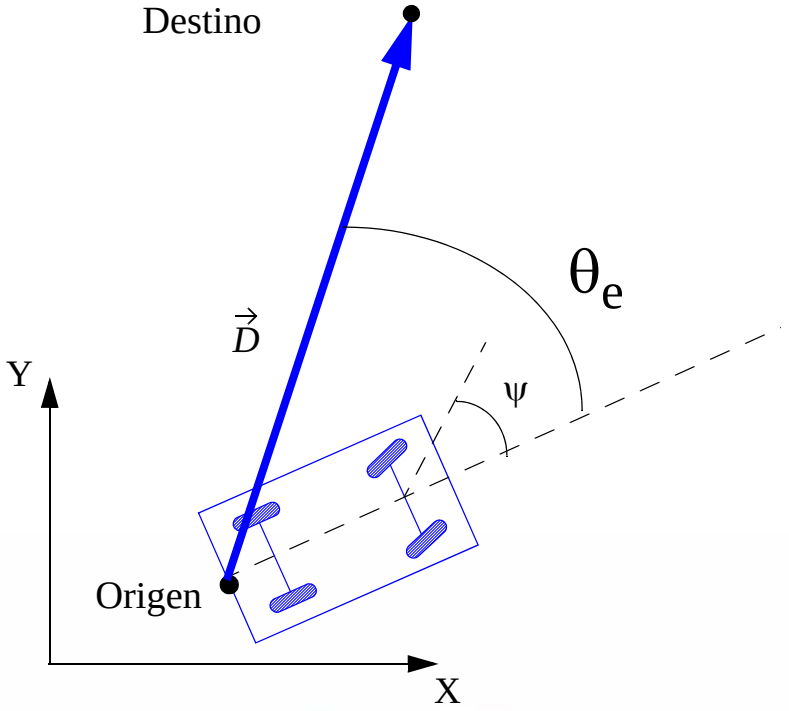


Triciclo y Ackerman

$$v = k_v \cdot |D|$$

$$\psi = f(\theta_e) \cdot \psi_{max}$$





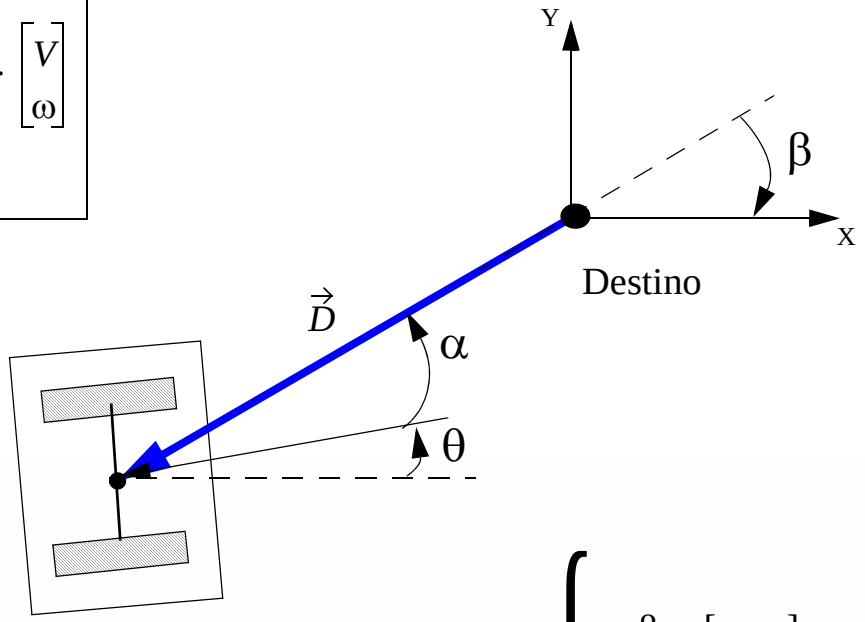
Convergencia Asintótica (Diferencial Drive)

$$\begin{bmatrix}\dot{x}\\ \dot{y}\\ \dot{\theta}\end{bmatrix} = \begin{bmatrix}\cos\theta & 0\\ \sin\theta & 0\\ 0 & 1\end{bmatrix}\cdot\begin{bmatrix}V\\ \omega\end{bmatrix} \rightarrow \begin{bmatrix}|\dot{D}|\\ \dot{\alpha}\\ \dot{\beta}\end{bmatrix} = \begin{bmatrix}\cos\alpha & 0\\ \frac{\sin\alpha}{|D|} & -1\\ \frac{-\sin\alpha}{|D|} & 0\end{bmatrix}\cdot\begin{bmatrix}V\\ \omega\end{bmatrix}$$

Para cumplir

la Condición de Brockett

$$\begin{bmatrix}|D|\\ \alpha\\ \beta\end{bmatrix} = \begin{bmatrix}\sqrt{x^2+y^2}\\ -\theta+\operatorname{atan2}(y,x)\\ -\theta-\alpha\end{bmatrix}$$



CONDICIONES

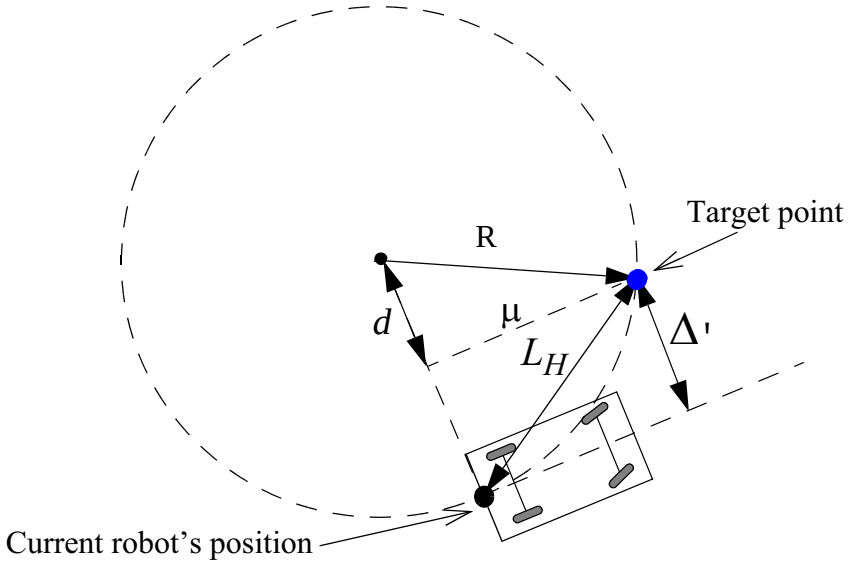
$\alpha, \beta \in [-\pi,\pi]$

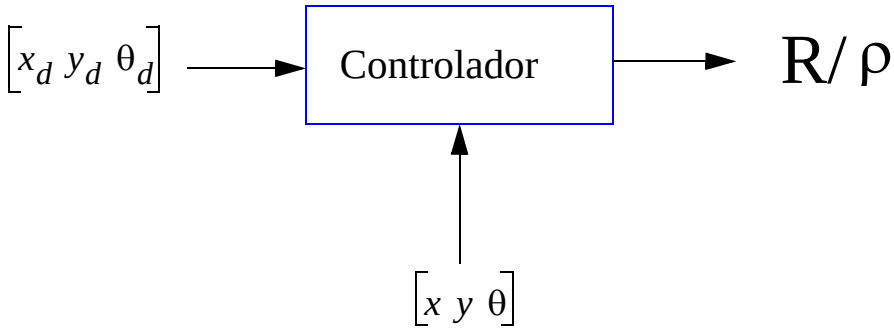
k_v, k_α, k_β

$$v = k_v\cdot|D| \quad \omega = k_\alpha\cdot\alpha + k_\beta\cdot\beta$$

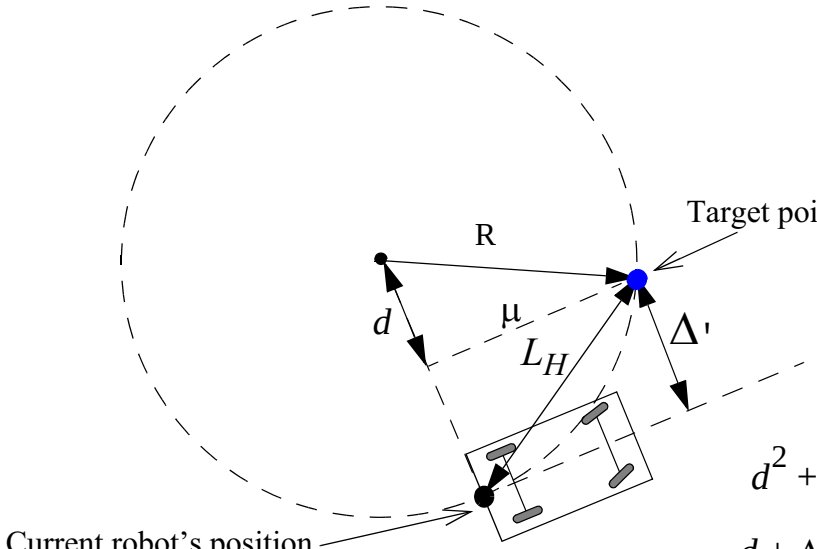
Garantizar Estabilidad

Método Geométrico



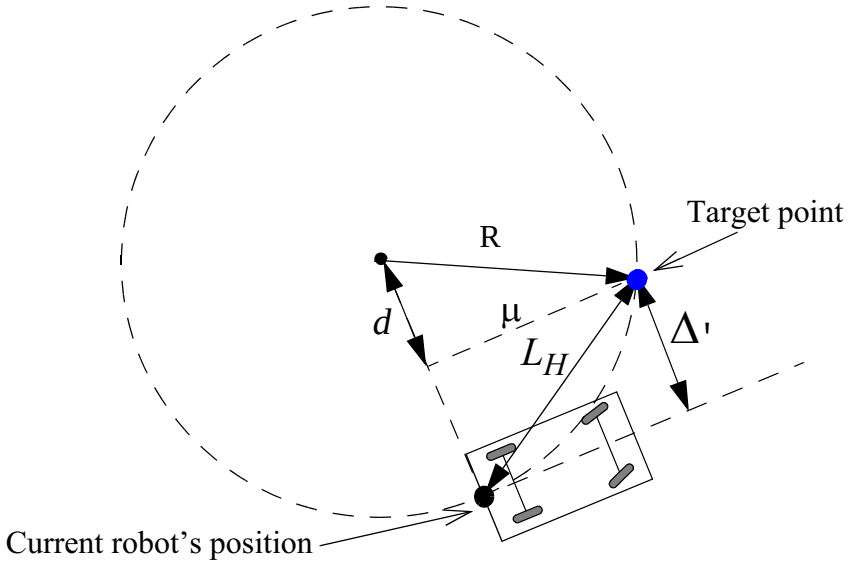


Método Geométrico

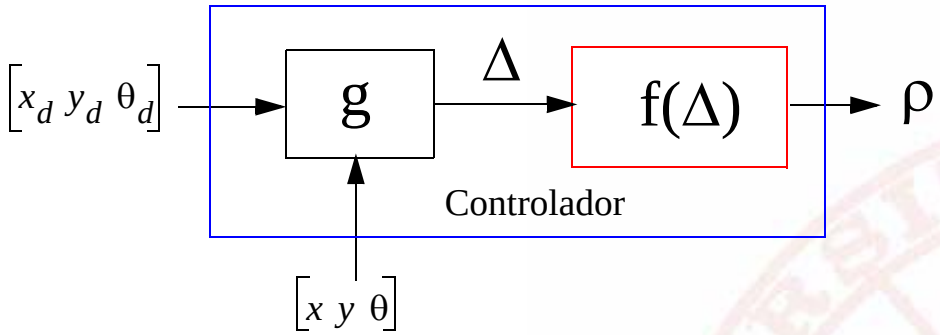


$$\left.\begin{aligned} d^2 + \mu^2 &= R^2 \\ d + \Delta &= R \\ \Delta^2 + \mu^2 &= L_H{}^2 \end{aligned}\right\} \longrightarrow \rho = \frac{1}{R} = f(\Delta) = \frac{2(\Delta)}{L_H{}^2}$$

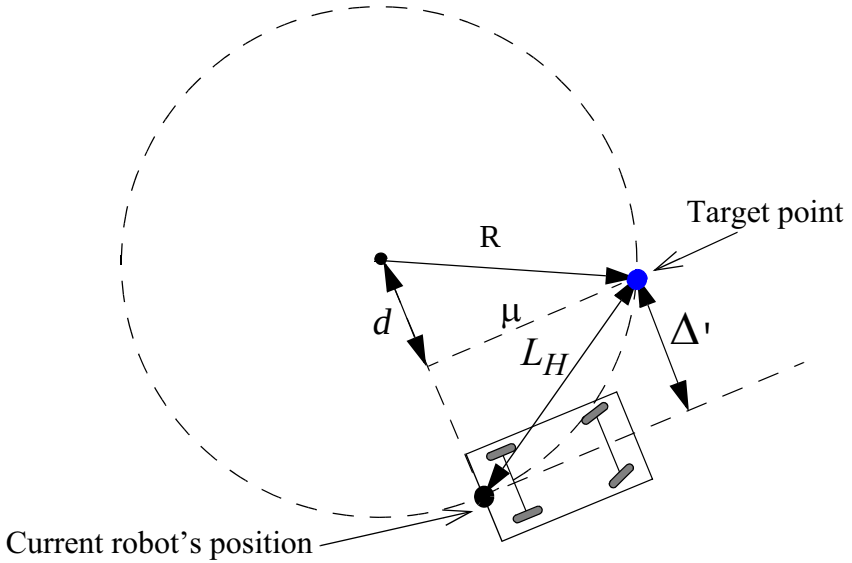
Método Geométrico



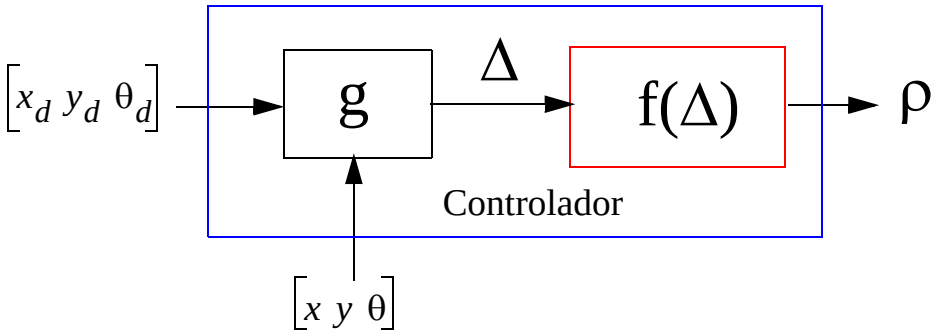
$$\rho = \frac{1}{R} = f(\Delta) = \frac{2(\Delta)}{L_H^2}$$



Método Geométrico



$$\rho = \frac{1}{R} = f(\Delta) = \frac{2(\Delta)}{L_H^2}$$

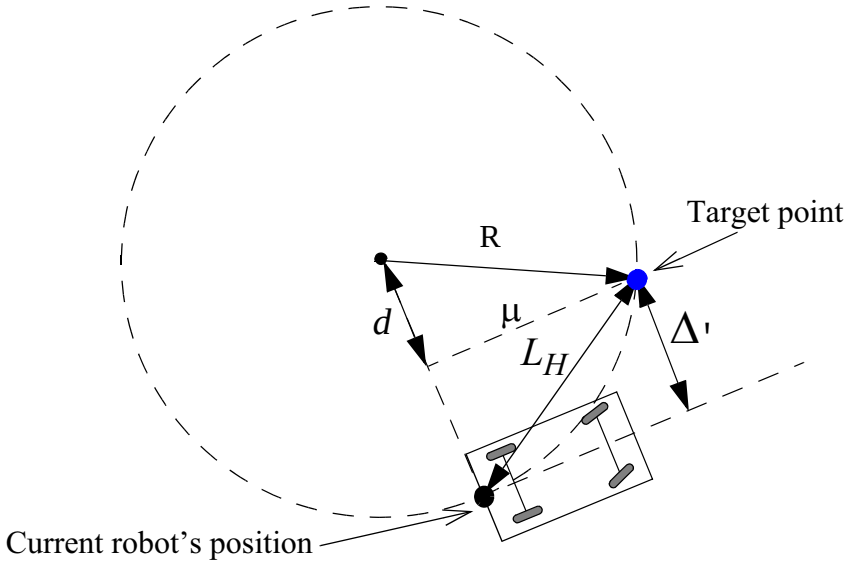


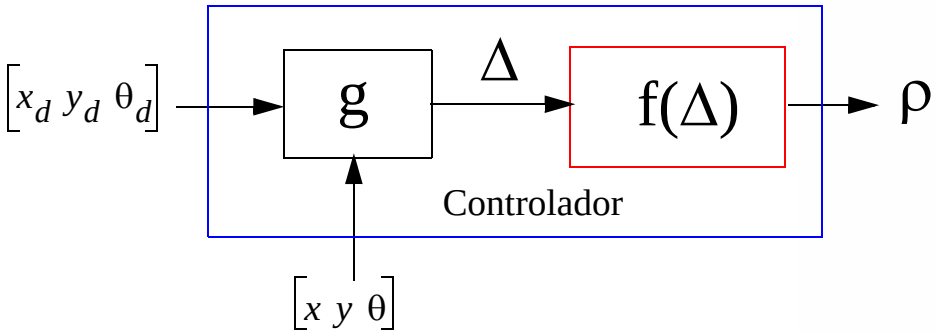
Para un Car-like robot

$$v = h(error).$$

$$\phi = \operatorname{atan}\left(\frac{l}{r}\right) = \operatorname{atan}(l \cdot \rho)$$

Método Geométrico





Para un Car-like robot

1. $\Delta = g([x\ y\ \theta], [x_d\ y_d])$
2. $\rho = f(\Delta)$
3. $v = h(error)$.
4. $\phi = \text{atan}(l \cdot \rho)$