HW2 - D

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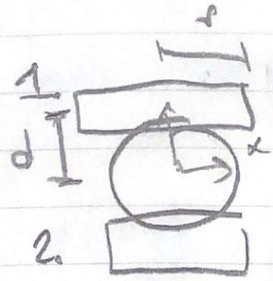
$$\Delta\theta = H(0)\, V_b$$

$$V_b = F\Delta\theta = r\begin{bmatrix} -\frac{1}{2d} & \frac{1}{2d} \\ \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \end{bmatrix}\begin{bmatrix} \Delta\theta_L \\ \Delta\theta_R \end{bmatrix}$$



$$u = \begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix} = \overbrace{\begin{bmatrix} x & x & x \\ x & x & x \\ \theta & x & y \end{bmatrix}}^{2\times 3}\overbrace{\begin{bmatrix} \omega_b \\ v_{bx} \\ v_{by} \end{bmatrix}}^{3\times 1}$$

$$\begin{matrix} -1 & 1 & 0 \\ 1 & 1 & 0 \end{matrix}$$

- Can't move ~~only~~ in Y
- Can move in X
- Wheel 1 turns back, Wheel 2 turns forward To spin in place

$$\frac{1}{r}\begin{bmatrix} -d & 1 & 0 \\ d & 1 & 0 \end{bmatrix} = H(0)$$

$$\begin{bmatrix} \text{Wheel 1} \\ \text{Wheel 2} \end{bmatrix} = H(0) \cdot \begin{bmatrix} \omega_b \\ v_{bx} \\ v_{by} \end{bmatrix} \leftarrow \text{Twist}$$

↑ rates

Part D.1.3 IK

Part 0.1.1 give twist → return phis / timestep

2. given ϕ_1', ϕ_2' and current q, update

return q' → ultimate output?

✓ 3. given twist, find $\dot{\phi}_1, \dot{\phi}_2$

return

1. returns ϕ_1' ϕ_2', given $\dot{\phi}_1$ $\dot{\phi}_2$ and ϕ_1, ϕ_2

T_{bb} (old_pos_vec) add ↘

↗ $T_{bb'}$ → new position vector → theta

twist, oldconfig ↘ new Q

↑

forward-kinematics wheel velocities

q, old_angles, new_angles

Use angles to get

Wheel vel to twist

$$L_{dot} = (-d \cdot \dot{\theta} + \dot{x}) / r$$
$$R_{dot} = (d \cdot \dot{\theta} + \dot{x}) / r$$

$R_{dot} \cdot r + \dot{x} = d\dot{\theta}$ → $R_{dot} \cdot \frac{r}{I} + \dot{x} = \dot{\theta}$

$$\dot{R} = d\dot{\theta} + \dot{x}$$

$$\dot{L} = -d\dot{\theta} + \dot{x}$$

$$\dot{L} = -d\left(\dot{R}\cdot\frac{r}{d} + \dot{x}\right) + \dot{x}$$

$$\begin{bmatrix} \dot{L} \\ \dot{R} \end{bmatrix} = \begin{bmatrix} -d & 1 & 0 \\ d & 1 & 0 \end{bmatrix} \begin{bmatrix} \dot{\theta} \\ \dot{x} \\ \dot{y} \end{bmatrix}$$

$$r(\dot{R}-\dot{L}) = 2d\dot{\theta} \rightarrow \dot{\theta} = \frac{r}{2d}(\dot{R}-\dot{L})$$

$$\checkmark\ r(\dot{R}+\dot{L}) = 2\dot{x} \qquad \dot{x} = \frac{r}{2}(\dot{R}+\dot{L})$$

Diff_Drive object tracks the states
updates them as simulation runs