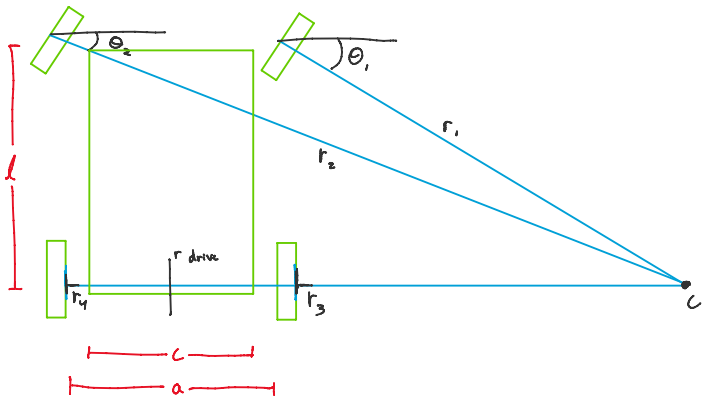
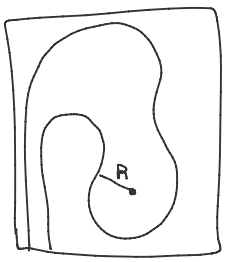
Motor Control Brainstorm

Thursday, October 16, 2020 9:12 PM



For track info, radius of turns R on track corresponds to r_{drive}.



FWL
FWR
BWL
BWR

inputs: ω, r_{drive}, $x_{displacement}$, $y_{displacement}$

Wheel radii

$$r_1 = \frac{l}{\sin(\theta_1)} - \left(\frac{a-c}{2}\right)$$

$$r_2 = \frac{l}{\sin(\theta_2)} + \left(\frac{a-c}{2}\right)$$

$$r_3 = \frac{l}{\tan(\theta_1)} - \left(\frac{a-c}{2}\right)$$

$$r_4 = \frac{l}{\tan(\theta_2)} + \left(\frac{a-c}{2}\right)$$

$$\Rightarrow \omega_1 = \frac{v_1}{r_1} \Rightarrow \alpha_1 = \frac{v_1^2}{r_1} \qquad \omega_2 = \frac{v_2}{r_2} \quad \alpha_2 = \frac{v_2^2}{r_2}$$

$$\omega_3 = \frac{v_3}{r_3} \quad \alpha_3 = \frac{v_3^2}{r_3} \qquad \omega_4 = \frac{v_4}{r_4} \quad \alpha_4 = \frac{v_4^2}{r_4}$$

$$r_{drive} = r_3 + \frac{a}{2} = r_4 - \frac{a}{2}$$

in terms of r_{drive}

$$r_3 = r_{drive} - \frac{a}{2} = \frac{l}{\tan(\theta_1)} - \left(\frac{a-c}{2}\right) \qquad r_4 = r_{drive} + \frac{a}{2} = \frac{l}{\tan(\theta_2)} + \frac{a-c}{2}$$

$$r_{drive} = \frac{l}{\tan(\theta_1)} + \frac{c}{2} \qquad r_{drive} = \frac{l}{\tan(\theta_2)} - \frac{c}{2}$$

$$r_{drive} - \frac{c}{2} = \frac{l}{\tan(\theta_1)} \qquad r_{drive} + \frac{c}{2} = \frac{l}{\tan(\theta_2)}$$

$$\tan(\theta_1) = \frac{2l}{2r_{drive} - c} \qquad \tan(\theta_2) = \frac{2l}{2r_{drive} + c}$$

$$\theta_1 = \tan^{-1}\left(\frac{2l}{2r_{drive} - c}\right) \qquad \theta_2 = \tan^{-1}\left(\frac{2l}{2r_{drive} + c}\right) \quad \text{Wheel Angle}$$

$\tau_n = I\alpha_n \Rightarrow$ all I's, ω's are same

$\tau_n = I\omega r_n \Rightarrow$

Demanded Torque

$$\tau_1 = I\omega^2 r_1$$

$$\tau_2 = I\omega^2 r_2$$

$$\tau_3 = I\omega^2 r_3$$

$$\tau_4 = I\omega^2 r_4$$