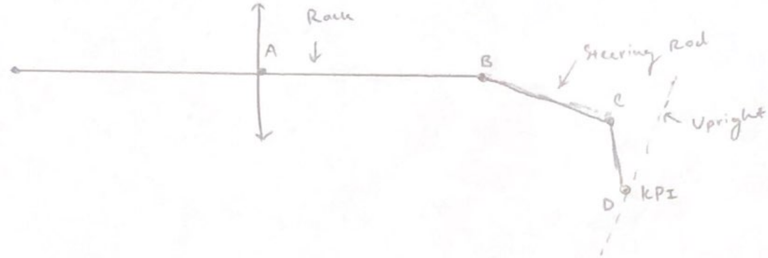
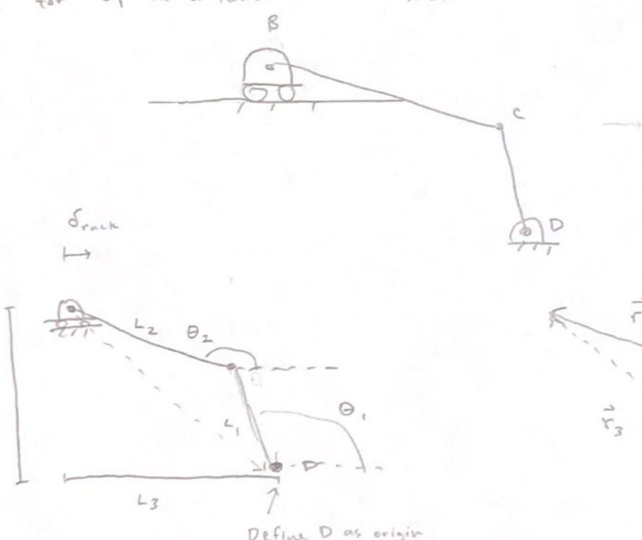
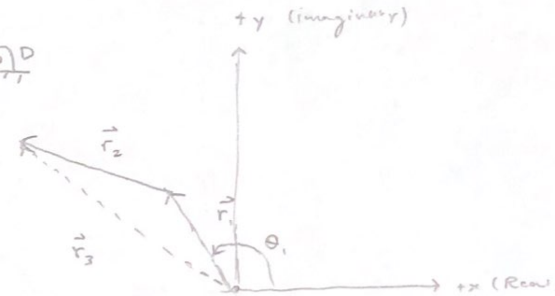
Steering Geometry Constraint Equations



Split @ Middle & Convert Into Equivalent Rocker/Slider

Want to solve for θ_1 as a function of δ_{rack}





Parameterizing Variable

Known: r_1, r_2, δ_{rack}, r_3

Unknown: θ_1, θ_2

Steered angle of tire

$$\|\vec{r_3}\| = \sqrt{L_3^2 + L_4^2}$$

Loop Closure:

$$\vec{r_1} + \vec{r_2} = \vec{r_3} \rightarrow r_1 e^{i\theta_1} + r_2 e^{i\theta_2} = r_3 e^{i\theta_3}$$

$$r_1 \left[\cos\theta_1 + i\sin\theta_1\right] + r_2\left[\cos\theta_2 + i\sin\theta_2\right] = \left[\underbrace{\left[-L_3 + \delta_{rack}\right]}_{\text{Real x-comp}} + \underbrace{iL_4}_{\text{Imaginary y-comp}}\right]$$

* $\vec{r_3}$ attached to slider, so $Im(\vec{r_3}) = L_4$

$$Re(\vec{r_3}) = -L_3 + \delta_{rack}$$

$$\|\vec{r_3}\| = \sqrt{L_4^2 + (-\delta_{rack} + L_3)^2}$$

$$\boxed{\begin{aligned} &1)\ r_1\cos\theta_1 + r_2\cos\theta_2 = \left[-L_3 + \delta_{rack}\right] \\ &2)\ r_1\sin\theta_2 + r_2\sin\theta_2 = L_4 \end{aligned}}$$

2 eq's, 2 unknown