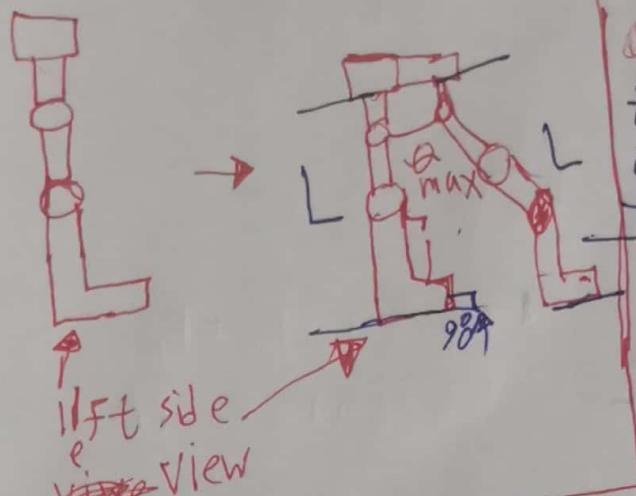
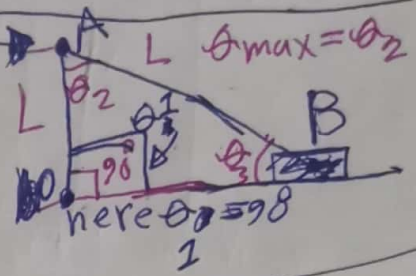
Angle Task

Find the max angle without lifting foot off the ground



assume; slider-crank Mechanism since that system or Mechanism act like slider-crank



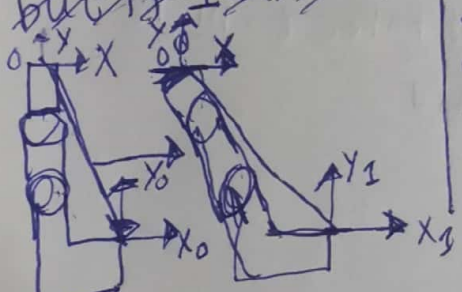
using tig function we know that $\theta_3 = \sin^{-1}\left(\frac{OA}{AB}\sin(\theta_1)\right)$

or simple use $\theta_1+\theta_2+\theta_3 = 180^\circ$, since $\theta_1 = 90^\circ$.

~~$\theta_2+\theta_2 = 90$~~ I use a lot of method and all of them give me wrong Answer that $\theta_2 = 90^\circ$, $\theta_3 = 0$

but I know all the Formulas I used are correct

~~but if I assume~~ the wrong come From Joint same start Point but diferent ehd Point The degrees of Freedom in the joints are responsible for this.



So I will assume that ~~$\theta_2 = \theta_3$~~ $\theta_2+\theta_3 = 90^\circ \rightarrow$ ~~$\theta_2 = 90^\circ \rightarrow \theta_2 = 45^\circ$~~

We will get $\theta_2 = \theta_3 = 45^\circ$. $\theta_{max} = \theta_2 = 45^\circ$

Motors location

assume:
we have 2 motors
1: 0.0001HP = 0.0746 watt
2: 0.1 HP = 74.6 watt

~~we know~~ good angular velocity

$P = \tau\omega$, let $\omega = 1$ rad/s

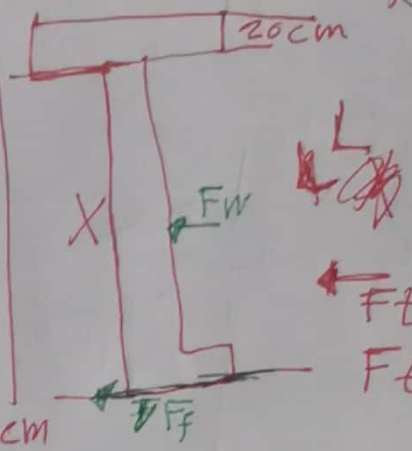
$\tau = \frac{P}{\omega}$, $\tau_1 = \frac{P_1}{\omega_1}$, $\tau_2 = \frac{P_2}{\omega_2}$

$\tau = F \times X \rightarrow F = \frac{\tau}{X}$

$\tau_1 = 0.746 N.cm$, $\tau_2 = 746 N.cm$

The leg

L = 64cm
x = 44cm

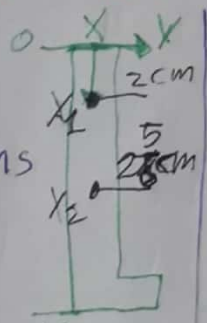


$F_{total} = F_w + F_f$
$F_{total} = 300N$

we needed little force to move the foot forward but before that we have to overcome the weight and friction

X_1: location of Motors 1, X_2: location of Motors 2

~~using Newton 2nd law~~ $\sum F = F_{total}$ ~~=~~ we need to get $\sum F > F_w$



$\sum F = F_1 + F_2 = \frac{\tau_1}{X_1} + \frac{\tau_2}{X_2}$

After a few calculations I got the following

$X_1 = 2cm$, $X_2 = 2\frac{5}{10}cm$

$\sum F = \frac{\tau_1}{X_1} + \frac{\tau_2}{X_2} = 302.13$

$\sum F_y = \sum F - F_{total}$

$\sum F_y = 302.13 - 300 = 2.13N$

little enough force to move foot forward