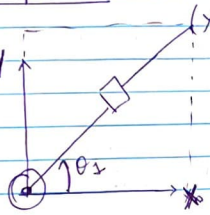
FENIL DESAI

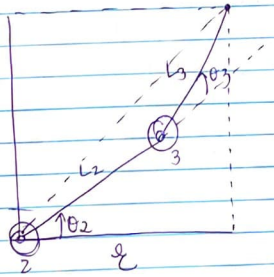
ROS PART OF ASSIGNMENT 4

→ In X-Y plane → (Top View)



$\theta_1 = \text{atan2}(Y, X)$

→ Side View



$S = Z - L_1$

$r = \sqrt{X^2 + Y^2}$

$\cos\theta_3 = \dfrac{r^2 + S^2 - L_2^2 - L_3^2}{2L_2L_3}$

let $D = \dfrac{X^2 + Y^2 + (Z - L_1)^2 - L_2^2 - L_3^2}{2L_2L_3}$

$$\theta_3 = \text{atan2}(D, \sqrt{1-D^2})$$

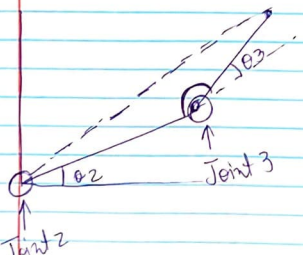
$$\theta_2 = \text{atan2}(r,s) - \text{atan2}(L_2 + L_3\cos\theta_3, L_3\sin\theta_3)$$

→ In my case, to make it consistent with the axis chosen for forward kinematics,

$\theta_3 = -\theta_3$ (obtained by geometric calculations)

$\theta_2 = -\theta_2$ (obtained by geometric calculations)

→ All the Inverse kinematic solutions presented are calculated in the elbow-down configurations as shown below



→ I am submitting "forward_kinematics" as a part of MW4.

— Its name is same as the last submission but it essentially does different jobs. It has a ~~subscriber~~ subscriber both for Forward kinematics as well as Inverse kinematics.

→ The calculations for forward kinematics & Inverse kinematics are done considering $L_1 = L_2 = L_3 = 1.0\,m$.

→ For executing the file do the following –

— Roscore
— rosrun forward_kinematics forward_kinematics

① Forward kinematics

– In new terminal publish the values of q_1, q_2 & q_3 using –

rostopic pub FK_topic forward_kinematics/joint_variables "q1: XX q2: XX q3: XX"

where XX is a joint variable in "degrees".

② Inverse kinematics

– In new terminal publish the pose of the robot using –

rostopic pub IK_topic geometry_msgs/Pose "position:
  x: XX
  y: XX
  z: XX

orientation:
x: 0.0
y: 0.0
z: 0.0
w: 0.0

} → any value of these variables won't matter. as it is a 3-DOF robot & currently we are interested in the position of the end-effector.

where xx is desired position of the end effector in meters.