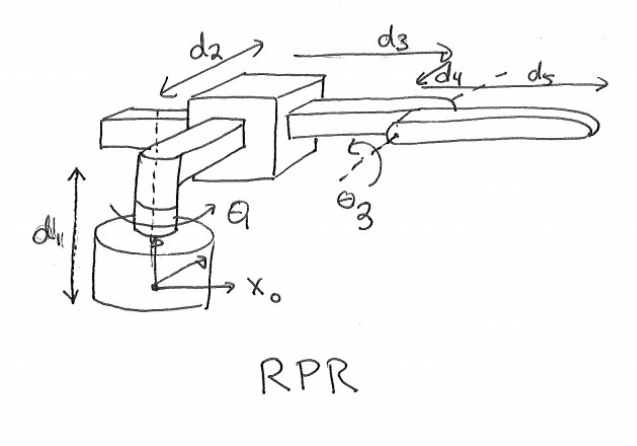
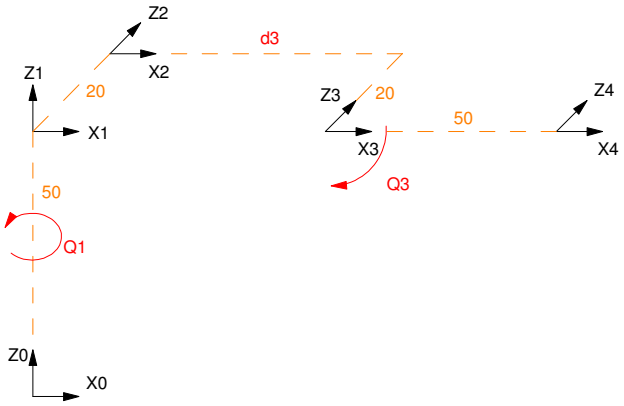
ECE 761 - Homework #5

Forward & Inverse Kinematics of an RPR Robot

RPR Robot (d2 + d4 = 0)





Forward Kinematics (RPR.m)

1a) Modify the program RRR.m to model a RPR robot from homework set #4, modified so that d2+d4=0.

Link i	;α_{i-1} The angle between the Zi-1 and Zi axis (twist)	;a_{i-1} The distance from Zi-1 to Zi measured along the Xi-1 axis	;d_i The distance from Xi-1 to Xi measured along the Zi axis	;θ_i The angle between Xi-1 and Xi measured about the Zi axis
1	0	0	50 cm	Q1
2	-90 deg	0	20 cm	0 deg
3	0 deg	d3	-20 cm	Q3
4 (tip)	0 deg	50	0	0

```
function [Tip] = RPR(W, TIP)
N = 4;
Q     = [W(1), 0, W(3)];
alpha = [0, -pi/2, 0, 0];
a     = [0,   0,  W(2), 50];
d     = [50,  20,  -20, 0];
```

1b) Determine the tip position for the angles of

- Q1 = 30 degrees, d3 = 40 cm, Q3 = 50 degrees
- Q1 = 80 degrees, d3 = 60 cm, Q3 = 80 degrees

2. Inverse Kinematics (InverseRPR.m)

Determine the equations for the inverse-kinematics for an RPR robot.

- Check these equations using the tip positions from problem #1

3. Simulation: (RPR_Simulation.m).

a) Draw a ball: The tip position is

```
t = [0:0.01:10]';
y = 5*t + 60;
r = sqrt(25^2 - (y-85).^2);
x = r.*cos(t*pi);
z = r.*sin(t*pi) + 50;
BALL = [x, y, z, x.^0]';
```

b) Plot the ending position of the robot drawing the ball

c) Plot the joint angles (Q1, d3, Q3) vs. time