calculate forward and inverse kinematics of a robot with 3rd DOF

Forward kinematics

Question:

Given:

- **Link lengths: L1, L2, L3**
- **Joint angles: θ1, θ2, θ3**

Unknown:

- **The position of the end effector in Cartesian coordinates (x, y, z).**

Answer:

x = L1 cos(theta_1) + L2 cos(theta_1 + theta_2) + L3 cos(theta_1 + theta_2 + theta_3)

y = L1 sin(theta_1) + L2 sin(theta_1 + theta_2) + L3 sin(theta_1 + theta_2 + theta_3)

z = 0

Inverse kinematics

Question:

Given:

- **The position of the end effector in Cartesian coordinates: (x,y,z)**
- **Link lengths: L1, L2, L3**

Unknown:

- **The joint angles: θ1, θ2, θ3**

Answer:

thata1= arctan(y/x)

theta2=arccos((r^2-L1^2-L2^2)/(2L1L2))

theta3=ϕ-theta2

where r = sqrt{x^2 + y^2}) and ϕ= arctan(y/x) - arctan ((L2sin(theta2))/ L1+L2 cos(theta2))