Robotics Mini Project: Kinematic Analysis of a Robot Arm

Team Members:

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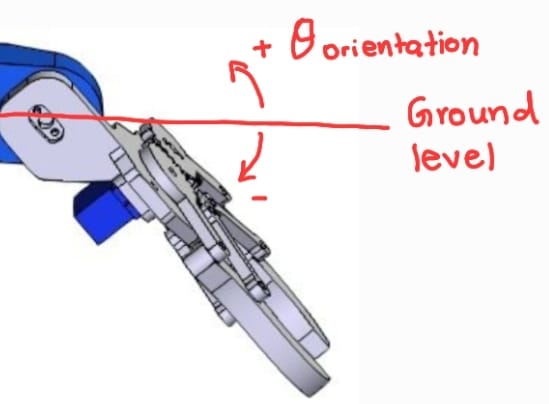
## **Frame Assignment and DH Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Link |  |  |  |  |
| 1 |  | 90⁰ |  |  |
| 2 |  | 0 | 0 |  |
| 3 |  | 0 | 0 |  |
| 4 |  | 0 | 0 |  |

## **Forward Kinematics**

* Symbols have the following meanings.
* Transformation Matrices

## **Inverse Kinematics**

Take the desired end position as .

Take the desired end effector orientation as and we get,

Using the geometric relationship, we can take,

Using the transformation matrix and desired position ,

or

and

Solving the above two equations we get,

When ,

When ,

Finally, we solve for , Knowing that is the addition of all

* The solutions are filtered to obtain only one solution by considering the range of the physical joints of the arm. (Each joint is limited to rotate only 180 degrees)
* The limits for the angles defined by our team are as follows. (Convention is the same as used in the frame assignment)

|  |  |  |
| --- | --- | --- |
| Angle | Minimum | Maximum |
|  | 0⁰ | 180⁰ |
|  | 0⁰ | 180⁰ |
|  | -135⁰ | 0⁰ |
|  | -90⁰ | 90⁰ |

## **Manipulator Jacobian**

## **Controlling the Arm**