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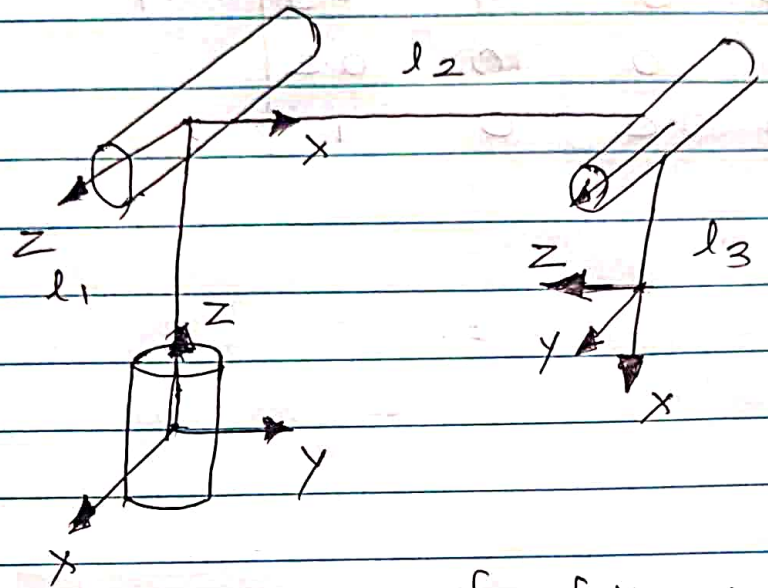
Course: RBE-501 ROBOT DYNAMICS.
ASSIGNMENT NO:- 2

Section 2.



The screw axes for following

$\therefore \quad S = \quad S_i = \{\omega_i \; v_i\}$

$S_1 = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}^T$

$S_1 = \begin{bmatrix} 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}^T$

$S_2 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0.4 & 0 \end{bmatrix}^T$

$S_3 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0.4 & -0.3 \end{bmatrix}^T$

Now lets calculate home configuration.

$$R = R_x(90)\, R_z(-90) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

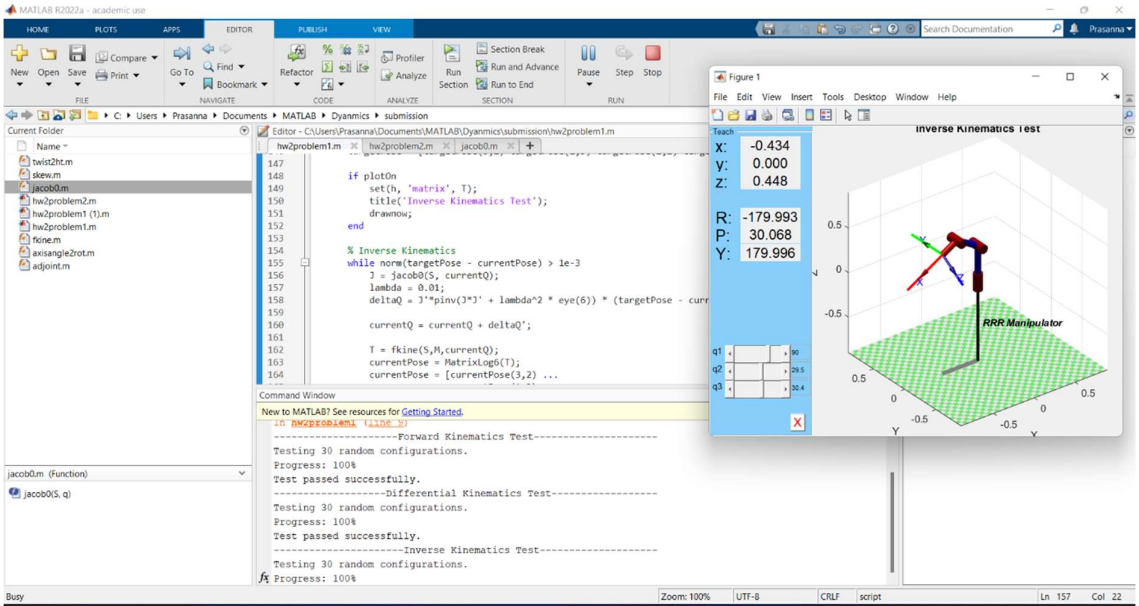
$$R = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & -1 \\ -1 & 0 & 0 \end{bmatrix}$$

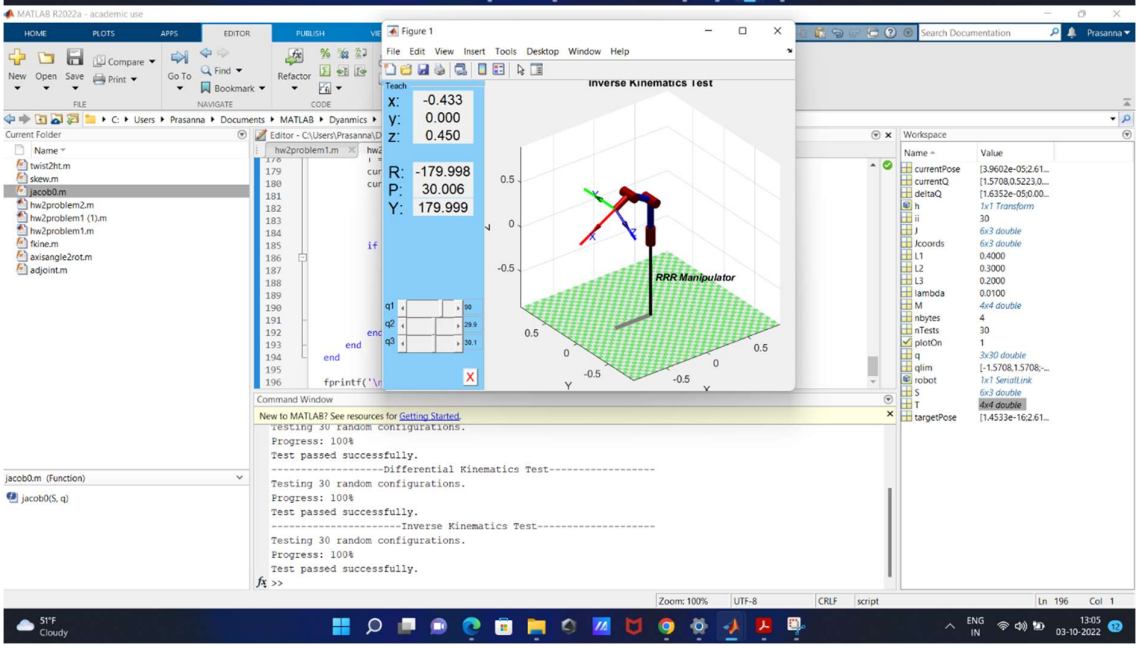
$$P = \begin{bmatrix} 0, & 0.3, & 0.2 \end{bmatrix}^T$$

$$\therefore T = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0.3 \\ -1 & 0 & 0 & 0.2 \\ 0 & 0 & 0 & 1 \end{bmatrix} = M$$

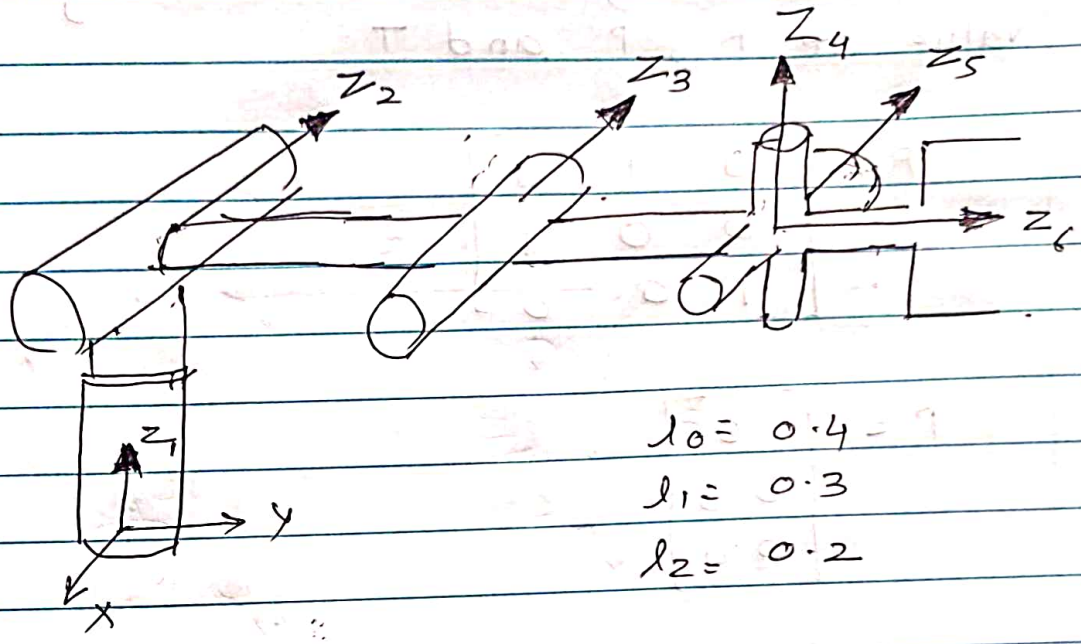
Section 2
steps

1. Initially we calculated all the values necessary for the Jacobian and inverse which are the home configuration and screw axes.
2. In the given problem we assign axes as shown and then calculate the axes S using the axisangle2rot function.
3. Then we calculate the twist using the twist2ht function.
4. We calculate adjoint function.
5. Later we calculate the forward kinematics using the S,M,q values.
6. Then we can calculate Jacobian using S,q that we got initially.
7. We use least square method for getting to the target position from the initial position where we can choose lamba/alpha of our choice





Section 3.



$l_0 = 0.4$

$l_1 = 0.3$

$l_2 = 0.2$

Now calculating Screw axes.

$S = \{w_i, v_i\}$.

$S_1 = [0 \quad 0 \quad 1 \quad 0 \quad 0 \quad 0]^T$

$S_2 = [-1 \quad 0 \quad 0 \quad -l_0 \quad 0 \quad 0]^T$

~~$S_3 = [0 \quad 0 \quad 1 \quad l_1+l_2 \quad 0 \quad 0]^T$~~

~~$S_4 = [-1 \quad 0 \quad 0 \quad 0 \quad 0 \quad l_1+l_2]^T$~~

S_3

$S_3 = [-1 \quad 0 \quad 0 \quad -l_0 \quad -l_1 \quad 0]$

$S_4 = [0 \quad 0 \quad 1 \quad (l_1+l_2) \quad 0 \quad 0]$

$S_5 = [-1 \quad 0 \quad 0 \quad 0 \quad 0 \quad (l_1+l_2)]$

$S_6 = [0 \quad 1 \quad 0 \quad l_0 \quad 0 \quad 0]$

For home configuration calculating the value of R, P and T.

$$R = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$$

$$P = \begin{bmatrix} 0 \\ 0.5 \\ 0.4 \end{bmatrix}$$

$$M = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0.5 \\ 1 & 0 & 0 & 0.4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Section 3

1. Here also we follow the same steps for getting to the solution as in section 2
2. We calculate all the value as shown and then input them to the function.
3. The inverse kinematics took around 3 hrs to reach to the final solution of 100% completion.