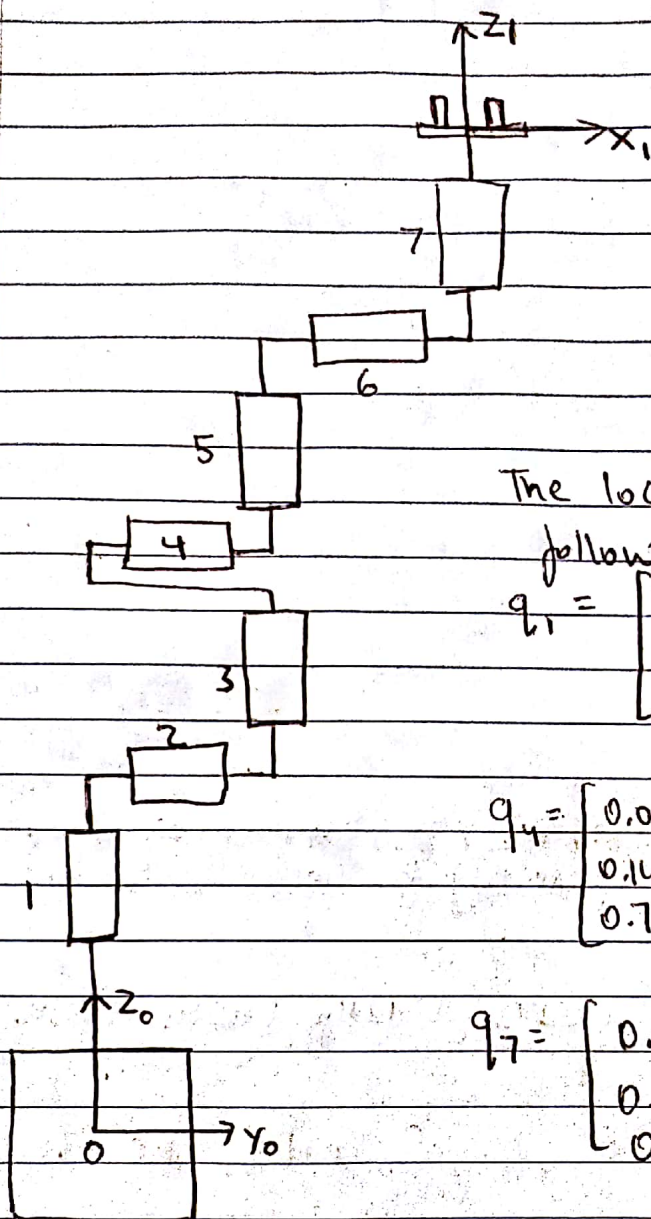


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Vjain10  
ECE 470  
PROJECT



Using the data found through V-REP, the initial pose of the robot is

$$M = \begin{bmatrix} 0 & -1 & 0 & 0.0735 \\ 1 & 0 & 0 & 0.1604 \\ 0 & 0 & 1 & 1.2914 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

The locations of the joints are as follows:

$$q_1 = \begin{bmatrix} 0.00012 \\ 0.00012 \\ 0.0865 \end{bmatrix}$$

$$q_2 = \begin{bmatrix} 0.0811 \\ 0.0611 \\ 0.3170 \end{bmatrix}$$

$$q_3 = \begin{bmatrix} 0.0811 \\ 0.1926 \\ 0.4415 \end{bmatrix}$$

$$q_4 = \begin{bmatrix} 0.0811 \\ 0.1451 \\ 0.7170 \end{bmatrix}$$

$$q_5 = \begin{bmatrix} 0.0811 \\ 0.0241 \\ 0.8301 \end{bmatrix}$$

$$q_6 = \begin{bmatrix} 0.0811 \\ 0.0646 \\ 0.1170 \end{bmatrix}$$

$$q_7 = \begin{bmatrix} 0.0811 \\ 0.01604 \\ 0.11910 \end{bmatrix}$$

The joint axes are:

$$a_1 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$a_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$a_3 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$a_4 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$a_5 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$a_6 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$a_7 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Since we can see that all joints are revolute, we can compute the screw axis with the following equation

$$S_n = \begin{bmatrix} a_n \\ -[a_n] * q_n \end{bmatrix}$$

where  $n=1, 2, 3, 4, 5, 6, 7$

Using the computed  $S_1, S_2, S_3, S_4, S_5, S_6, S_7$ , we can compute the final pose of the robot with the following equation

$$T_1^0 = e^{[S_1]\theta_1} e^{[S_2]\theta_2} e^{[S_3]\theta_3} e^{[S_4]\theta_4} e^{[S_5]\theta_5} e^{[S_6]\theta_6} e^{[S_7]\theta_7} M$$

Where  $\theta_1, \theta_2, \theta_3, \theta_4, \theta_5, \theta_6$  and  $\theta_7$  are inputs from the user.