ME572: Homework #3b

Due on Feb 3, 2012

Jedediah Frey

Problem 4

The simplified manipulator transform $[T_M]$ is shown in Enq. 1.

$$T_w = \begin{bmatrix} \cos(\theta_1+\theta_3) & 0 & sin(\theta_1+\theta_3) & 3\sin(\theta_1+\theta_3)+3\cos(\theta_1)+S_2\sin(\theta_1) \\ \sin(\theta_1+\theta_3) & 0 & -cos(\theta_1+\theta_3) & 3\sin(\theta_1)-3\cos(\theta_1+\theta_3)-S_2\cos(\theta_1) \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \tag{1}$$

A final transformation matrix in Eqn.2 is used to put the end of the robot into EECS (Eqn. 3). Where EECS is specified as 'n' normal of the hand and orthogonal to the fingers of the robot, 'o' sliding vector of the hand, 'a' is the approach vector of the hand. Substituting in $\theta_1 = 330^o$, $S_2 = 3$", and $\theta_3 = 80^o$ will get the solution, Eqn. 4.

$$T = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \tag{2}$$

$$T_{EECS} = \begin{bmatrix} n_x & o_x & a_x & p_x \\ n_y & o_y & a_y & p_y \\ n_z & o_z & a_z & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \tag{3}$$

$$= \begin{bmatrix} 0.00 & 0.64 & 0.77 & 3.40 \\ 0.00 & 0.77 & -0.64 & -6.03 \\ 1.00 & 0.00 & 0.00 & 0.00 \\ 0.00 & 0.00 & 0.00 & 1.00 \end{bmatrix} \tag{4}$$

Problem 5

Problem 6

Solution 1:

$$\theta_1 = 326.25^o \quad (5)$$

$$\theta_3 = 333.75^o \quad (6)$$

$$S_2 = 7.0154 \quad (7)$$