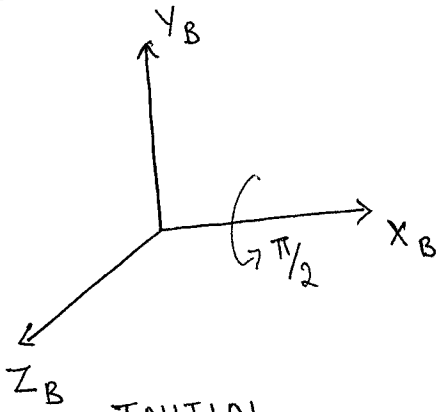
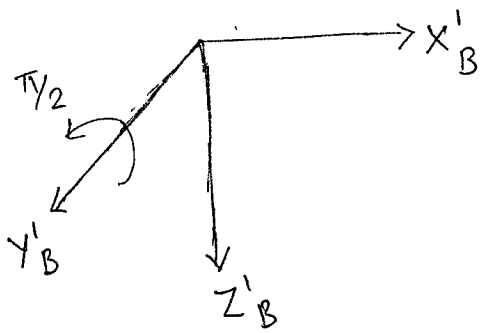
HW Q1:

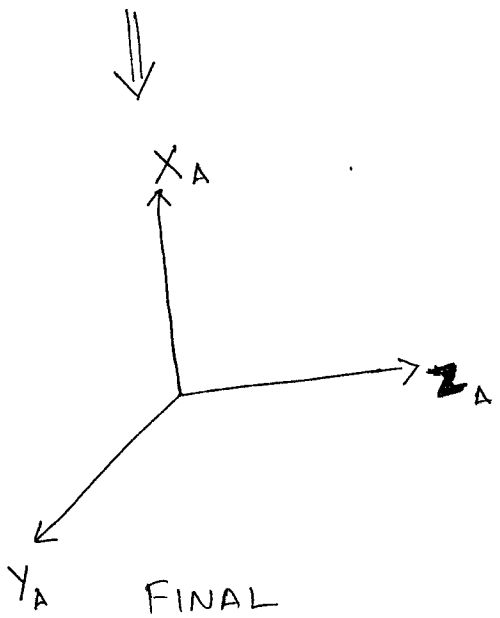


INITIAL



$$R = \text{rotx}(pi/2) \times \text{roty}(pi/2)$$

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



FINAL

HW Q2:

$$ {}^{0_0}T_{0_1} = \begin{pmatrix} {}^{0_0}R_{0_1} & {}^{0_0}d_{0_1} \\ 0_{1\times 3} & 1 \end{pmatrix} $$

$$ {}^{0_0}R_{0_1} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad {}^{0_0}d_{0_1} = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix} $$

$$ {}^{0_0}T_{0_1} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix} $$

$$ {}^{0_0}T_{0_2} = \begin{pmatrix} {}^{0_0}R_{0_2} & {}^{0_0}d_{0_2} \\ 0_{1\times 3} & 1 \end{pmatrix} $$

$$ {}^{0_0}R_{0_2} = {}^{0_0}R_{0_1} \times {}^{0_1}R_{0_2} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} $$

$$ {}^{0_0}R_{0_2} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} $$

$$ {}^{0}d_{O_2} = {}^{0}d_{O_1} + {}^{1}d_{O_2} = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix} + \begin{pmatrix} -0.5 \\ 0.5 \\ 0 \end{pmatrix} = \begin{pmatrix} -0.5 \\ 1.5 \\ 1 \end{pmatrix} $$

$$ {}^{0}T_{O_2} = \begin{pmatrix} 1 & 0 & 0 & -0.5 \\ 0 & 1 & 0 & 1.5 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix} $$

$$ {}^{0}T_{O_3} = \begin{pmatrix} {}^{0}R_{O_3} & {}^{0}d_{O_3} \\ 0_{1\times 3} & 1 \end{pmatrix} $$

$$ {}^{0}R_{O_3} = {}^{0}R_{O_1} \times {}^{1}R_{O_2} \times {}^{2}R_{O_3} = {}^{0}R_{O_2} \times {}^{2}R_{O_3} $$

$$ {}^{0}R_{O_3} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix} = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix} $$

$$ {}^{0}d_{O_3} = {}^{0}d_{O_1} + {}^{1}d_{O_2} + {}^{2}d_{O_3} = {}^{0}d_{O_2} + {}^{2}d_{O_3} $$

$$ {}^{0}d_{O_3} = \begin{bmatrix} -0.5 \\ 1.5 \\ 1 \end{bmatrix} + \begin{pmatrix} 0 \\ 0 \\ 2 \end{pmatrix} = \begin{pmatrix} -0.5 \\ 1.5 \\ 3 \end{pmatrix} $$

$$ {}^{0}T_{O_3} = \begin{pmatrix} 0 & 1 & 0 & -0.5 \\ 1 & 0 & 0 & 1.5 \\ 0 & 0 & -1 & 3 \\ 0 & 0 & 0 & 1 \end{pmatrix} $$

$$ {}^{O_3}T_{O_2} = {}^{O_2}T_{O_3}^{-1} = \begin{pmatrix} {}^{O_2}R_{O_3}^{T} & -{}^{O_2}R_{O_3}^{T}\,{}^{O_2}d_{O_3} \\ 0_{1\times 3} & 1 \end{pmatrix} $$

$$ {}^{O_2}R_{O_3}^{T}\,{}^{O_2}d_{O_3} = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix} \begin{pmatrix} 0 \\ 0 \\ 2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ -2 \end{pmatrix} $$

$$ {}^{O_3}T_{O_2} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 2 \\ 0 & 0 & 0 & 1 \end{pmatrix} $$