$$ {}^2T_1 = \begin{bmatrix} \begin{bmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix} & \begin{bmatrix} 15 \\ 0 \\ 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 \end{bmatrix} & 1 \end{bmatrix} $$

$$ \underset{4\times4}{{}^2T_{origin}} = \underset{4\times4}{{}^2T_1} \cdot \underset{4\times4}{{}^1T_0} \cdot \underset{4\times4}{{}^0T_{origin}} $$

To go from ${}^2T_{origin}$ to ${}^{origin}T_2$
we simply ~~do~~
~~the~~

$$ {}^{origin}T_2 = {}^0T_{origin} \cdot {}^1T_0 \cdot {}^2T_1 $$

Add a row [0 0 0 1] to simplify multiplication to come.

$$
{}^{0}T_{origin} = \begin{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} & \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \\ [\,0 \quad 0 \quad 0 & 1\,] \end{bmatrix}
$$

- From 0 axes to 1 axes: rotation β about x_1
translate of 10 in x_1

$$
{}^{1}T_{0} = \left[rot(\hat{z}_1, 0)\, rot(\hat{y}, 0)\, rot(\hat{x}, \beta) \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix} \right]
$$

From the last part we can gather that
rotat$(x, y, z, 0) = I$ so ↓

Kevin Quizpi

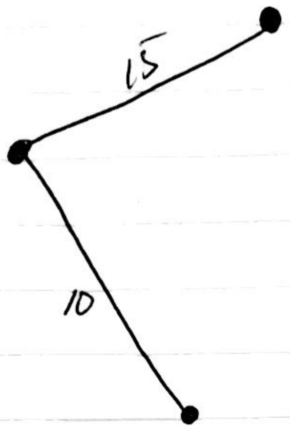
3x4 3x4 3x4

4x4

4x3 x 3x4

3x3 3x4 3x4

4x4 4x4 4x4



From origin to z_0 rotation θ about z

$$ {}^{0}T_{ur} = \left[rot(\hat{z}_0, \theta)\, rot(\hat{y}_0, 0)\, rot(\hat{x}_0, 0) \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right] $$

$$ Rot(z, \theta) = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} $$

$$ Rot(y, 0) = \begin{bmatrix} \cos 0 & 0 & \sin 0 \\ 0 & 1 & 0 \\ -\sin 0 & 0 & \cos 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} $$

$$ Rot(x, 0) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 0 & -\sin 0 \\ 0 & \sin 0 & \cos 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} $$