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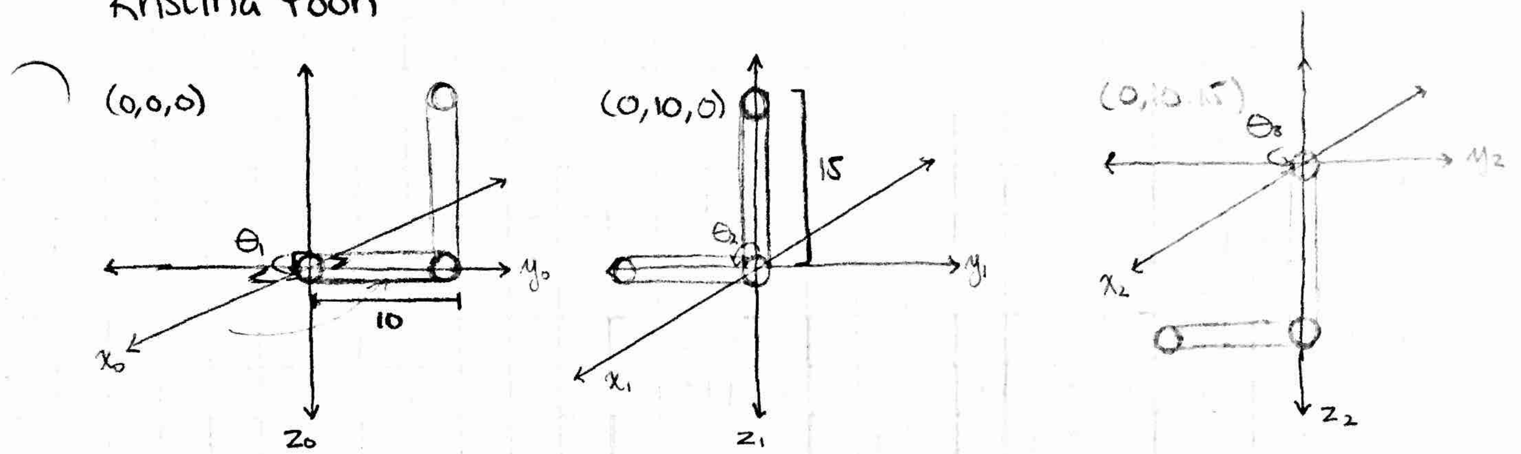

θ_1 = Rotates about z_0 by θ_0
$\theta_1 = 90°$

θ_2 = Rotate about x_1 by α_1
$\theta_2 = 90°$

θ_3 = Rotate about z_2 by θ_2
$\theta_3 = 0°$

$[{}^0R_1\ {}^0t_1]$

$$Rot(\tilde{z},\theta_1) = \begin{bmatrix} \cos(\theta_1) & -\sin(\theta_1) & 0 \\ \sin(\theta_1) & \cos(\theta_1) & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
$\theta_1 = 90°$

$$Rot(\tilde{y},\beta_1) = \begin{bmatrix} \cos(0) & 0 & \sin(0) \\ 0 & 1 & 0 \\ -\sin(0) & 0 & \cos(0) \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
$\beta_1 = 0$

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

$Rot(\tilde{z},\theta_1)\,Rot(\tilde{y},\beta_1) =$
$$\begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$Rot(\tilde{z},\theta_1)\,Rot(\tilde{y},\beta)\,Rot(\tilde{x},\alpha) =$
$$\begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$[{}^0R_1\ {}^0t_1] = \left[\begin{array}{ccc|c} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 10 \\ 0 & 0 & 1 & 0 \end{array}\right]$$

$$[{}^2R_1\ {}^2t_1] = \left[\begin{array}{ccc|c} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 15 \end{array}\right]$$

$[{}^1R_2\ {}^1t_2]$

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

$$Rot(\tilde{y},\beta_2) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
$\beta_2 = 0$

$$Rot(\tilde{x},\alpha_1) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\alpha) & -\sin(\alpha) \\ 0 & \sin(\alpha) & \cos(\alpha) \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$
$\alpha_1 = 90$

$$Rot(\tilde{z},\theta)\,Rot(\tilde{y},\beta_2) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$Rot(\tilde{z},\theta)\,Rot(\tilde{y},\beta_2)\,Rot(\tilde{x},\alpha_1) =$
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$^1R_2 = {}^2R_1^{-1} = ({}^2R_1)^T$$
$$^0R_1\,{}^1R_2 = {}^0R_2$$

$$^2R_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix} \rightarrow ({}^2R_1)^T = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{bmatrix} = {}^1R_2$$

$$^0R_2 = {}^0R_1\,{}^1R_2 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & -1 \\ 1 & 0 & 0 \\ 0 & -1 & 0 \end{bmatrix}$$

$$^1R_0 = {}^0R_1^{-1} = ({}^0R_1)^T$$
$$^0R_1 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow ({}^0R_1)^T = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} = {}^1R_0$$

$$^2R_0 = {}^2R_1\,{}^1R_0 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & -1 \\ -1 & 0 & 0 \end{bmatrix}$$

$$^0T_2 = \left[\begin{array}{ccc|c} 0 & 0 & -1 & 0 \\ 1 & 0 & 0 & 10 \\ 0 & -1 & 0 & 15 \end{array}\right] \qquad {}^2T_0 = \left[\begin{array}{ccc|c} 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & -10 \\ -1 & 0 & 0 & -15 \end{array}\right]$$

$$^0R_2 = {}^0R_1\,{}^1R_2 = \begin{bmatrix} \cos(\theta_1) & -\sin(\theta_1) & 0 \\ \sin(\theta_1) & \cos(\theta_1) & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\theta_2) & \sin(\theta_2) \\ 0 & -\sin(\theta_2) & \cos(\theta_2) \end{bmatrix}$$

$$^0T_2 = \left[\begin{array}{ccc|c} \cos(\theta_1) & -\sin(\theta_1)\cos(\theta_2) & -\sin(\theta_1)\sin(\theta_2) & 0 \\ \sin(\theta_1) & \cos(\theta_1)\cos(\theta_2) & \cos(\theta_1)\sin(\theta_2) & 10 \\ 0 & -\sin(\theta_2) & \cos(\theta_2) & 15 \end{array}\right]$$

$$^2R_0 = {}^2R_1\,{}^1R_0 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\theta_2) & -\sin(\theta_2) \\ 0 & \sin(\theta_2) & \cos(\theta_2) \end{bmatrix} \cdot \begin{bmatrix} \cos(\theta_1) & \sin(\theta_1) & 0 \\ -\sin(\theta) & \cos(\theta_1) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$^2T_0 = \left[\begin{array}{ccc|c} \cos(\theta_1) & \sin(\theta_1) & 0 & 0 \\ -\sin(\theta_1)\cos(\theta_2) & \cos(\theta_1)\cos(\theta_2) & -\sin(\theta_2) & -10 \\ -\sin(\theta)\sin(\theta_2) & \cos(\theta_1)\sin(\theta_2) & \cos(\theta_2) & -15 \end{array}\right]$$