4anis

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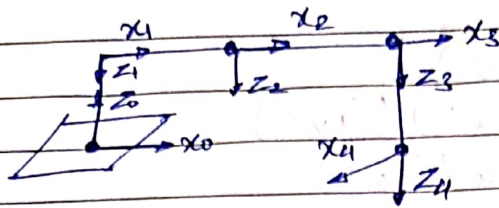


| i | $\alpha_{i-1}$ | $a_{i-1}$ | $d_i$ | $\theta_i$ |
|---|---|---|---|---|
| 1 | 180 | 0 | -877 | $\theta_1$ |
| 2 | 0 | 425 | 0 | $\theta_2$ |
| 3 | 0 | 375 | $d_3$ | 0 |
| 4 | 0 | 0 | 100 | $\theta_4$ |

$$^0_1T = \begin{bmatrix} C_1 & -S_1 & 0 & 0 \\ -S_1 & -C_1 & 0 & 0 \\ 0 & 0 & -1 & 877 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$^1_2T = \begin{bmatrix} C_2 & -S_2 & 0 & 425 \\ S_2 & C_2 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$^2_3T = \begin{bmatrix} 1 & 0 & 0 & 375 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$^3_4T = \begin{bmatrix} C_4 & -S_4 & 0 & 0 \\ S_4 & C_4 & 0 & 0 \\ 0 & 0 & 1 & 100 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$^{0}_{4}T = \begin{bmatrix} C_{124} & -S_{124} & 0 & 375C_2 + 425C_1 \\ -S_{124} & -C_{124} & 0 & -375S_{12} - 425S_1 \\ 0 & 0 & -1 & 777 - d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Assumming given matrix $\Rightarrow$

$$\begin{bmatrix} n_x & S_x & a_x & P_x \\ n_y & S_y & a_y & P_y \\ n_z & S_z & a_z & P_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

**Equations**

$\theta_{124} = atan2(-S_x, n_x)$

$d_3 = 777 - P_z$

$P_x = 375 cos(\theta_1 + \theta_2) + 425 cos\theta_1$

$P_y = -375 sin(\theta_1 + \theta_2) + 425 sin\theta_1$  $\Big\}$ standard form

$cos\theta_2 = \dfrac{P_x^2 + P_y^2 - 375^2 - 425^2}{2}$

$sin\theta_2 = \sqrt{1 - cos\theta_2^2}$

$\theta_2 = atan2(S\theta_2, C\theta_2)$

$\theta_1 = atan2(-\beta P_y - P_x \delta, P_x \beta - \delta P_y)$

here $\beta = 375 cos\theta_2 + 425$

$\delta = 375 sin\theta_2$

$\theta_{124} = atan2(-S_n, n_x)$

$\theta_4 = atan2(-S_n, n_x) - \theta_1 - \theta_2$

$d_3 = 777 - P_z$

$$Result = \begin{bmatrix} 0 & -1 & 0 & 800 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 777 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$Test = \begin{bmatrix} 180 & 0 & -877 & (0)\theta_1 \\ 0 & 425 & 0 & (0)\theta_2 \\ 0 & 375 & (0)d_3 & 0 \\ 0 & 0 & 100 & (90)\theta_4 \end{bmatrix}$$