6 DOFs robot

1. Model

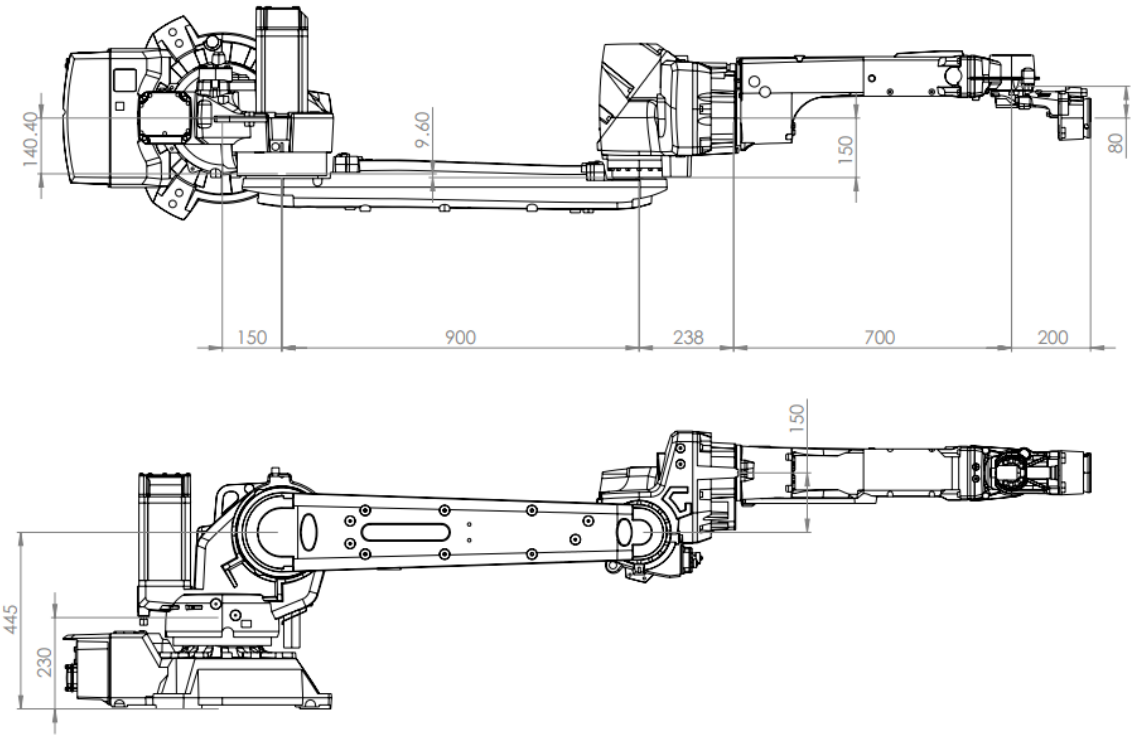

Figure 1: Robot Model

2. Basic DH

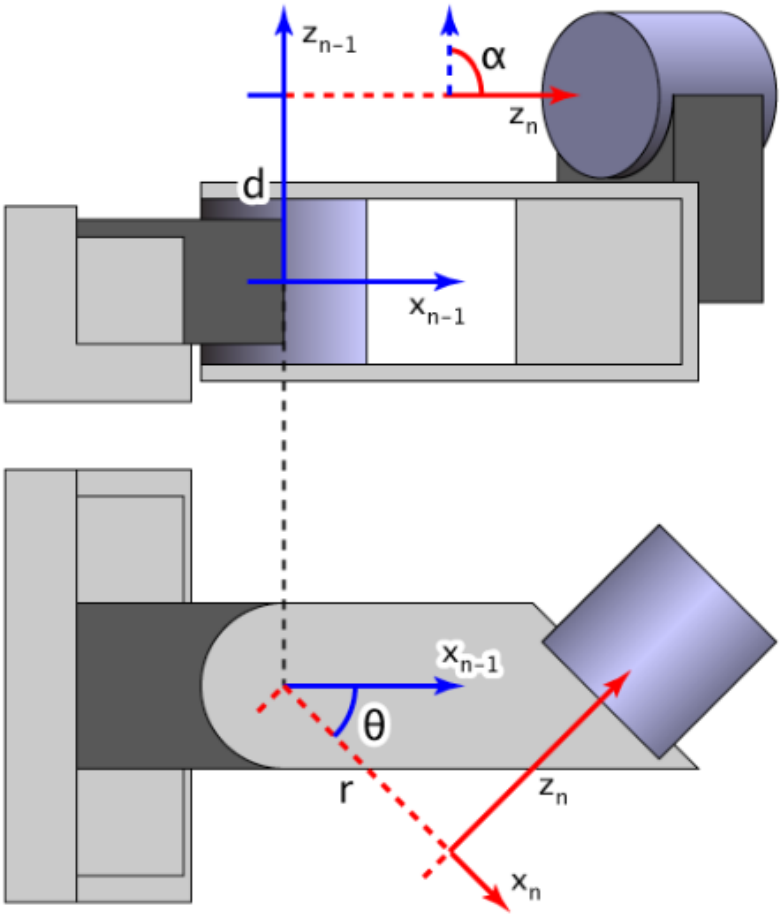

Figure 2: Visual of DH parameters

DH matrix:

$$
{}^{n-1}T_n = \left[\begin{array}{ccc|c} \cos\theta_n & -\sin\theta_n\cos\alpha_n & \sin\theta_n\sin\alpha_n & r_n\cos\theta_n \\ \sin\theta_n & \cos\theta_n\cos\alpha_n & -\cos\theta_n\sin\alpha_n & r_n\sin\theta_n \\ 0 & \sin\alpha_n & \cos\alpha_n & d_n \\ \hline 0 & 0 & 0 & 1 \end{array}\right] = \left[\begin{array}{ccc|c} & R & & T \\ \hline 0 & 0 & 0 & 1 \end{array}\right]
$$

3. DH parameters

	θ	α	d	r
1	θ_1	$-\frac{\pi}{2}$	445	150
2	θ_2	0	-150	900
3	$\left(\theta_3 - \frac{\pi}{2}\right)$	$-\frac{\pi}{2}$	150	150
4	θ_4	$\frac{\pi}{2}$	938	0
5	θ_5	$-\frac{\pi}{2}$	0	0
6	θ_6	0	199	0

Table 1: DH Parameters

4. DH Matrices

$$T_1^0 = \begin{bmatrix} \cos\theta_1 & 0 & -\sin\theta_1 & 150\cos\theta_1 \\ \sin\theta_1 & 0 & \cos\theta_1 & 150\sin\theta_1 \\ 0 & -1 & 0 & 445 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_2^1 = \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & 0 & 900\cos\theta_2 \\ \sin\theta_2 & \cos\theta_2 & 0 & 900\sin\theta_2 \\ 0 & 0 & 1 & \text{-150} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_3^2 = \begin{bmatrix} \cos\left(\theta_3 - \frac{\pi}{2}\right) & 0 & -\sin\left(\theta_3 - \frac{\pi}{2}\right) & 150\cos\left(\theta_3 - \frac{\pi}{2}\right) \\ \sin\left(\theta_3 - \frac{\pi}{2}\right) & 0 & \cos\left(\theta_3 - \frac{\pi}{2}\right) & 150\sin\left(\theta_3 - \frac{\pi}{2}\right) \\ 0 & -1 & 0 & 150 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_4^3 = \begin{bmatrix} \cos\theta_4 & 0 & \sin\theta_4 & 0 \\ \sin\theta_4 & 0 & -\cos\theta_4 & 0 \\ 0 & 1 & 0 & 938 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_5^4 = \begin{bmatrix} \cos\theta_5 & 0 & -\sin\theta_5 & 0 \\ \sin\theta_5 & 0 & \cos\theta_5 & 0 \\ 0 & -1 & 0 & 938 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_6^5 = \begin{bmatrix} \cos\theta_6 & -\sin\theta_6 & 0 & 0 \\ \sin\theta_6 & \cos\theta_6 & 0 & 0 \\ 0 & 0 & 1 & 938 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T = T_1^0 * T_2^1 * T_3^2 * T_4^3 * T_5^4 * T_6^5$$