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ECE470 Lab 1 Prelab

Question 1

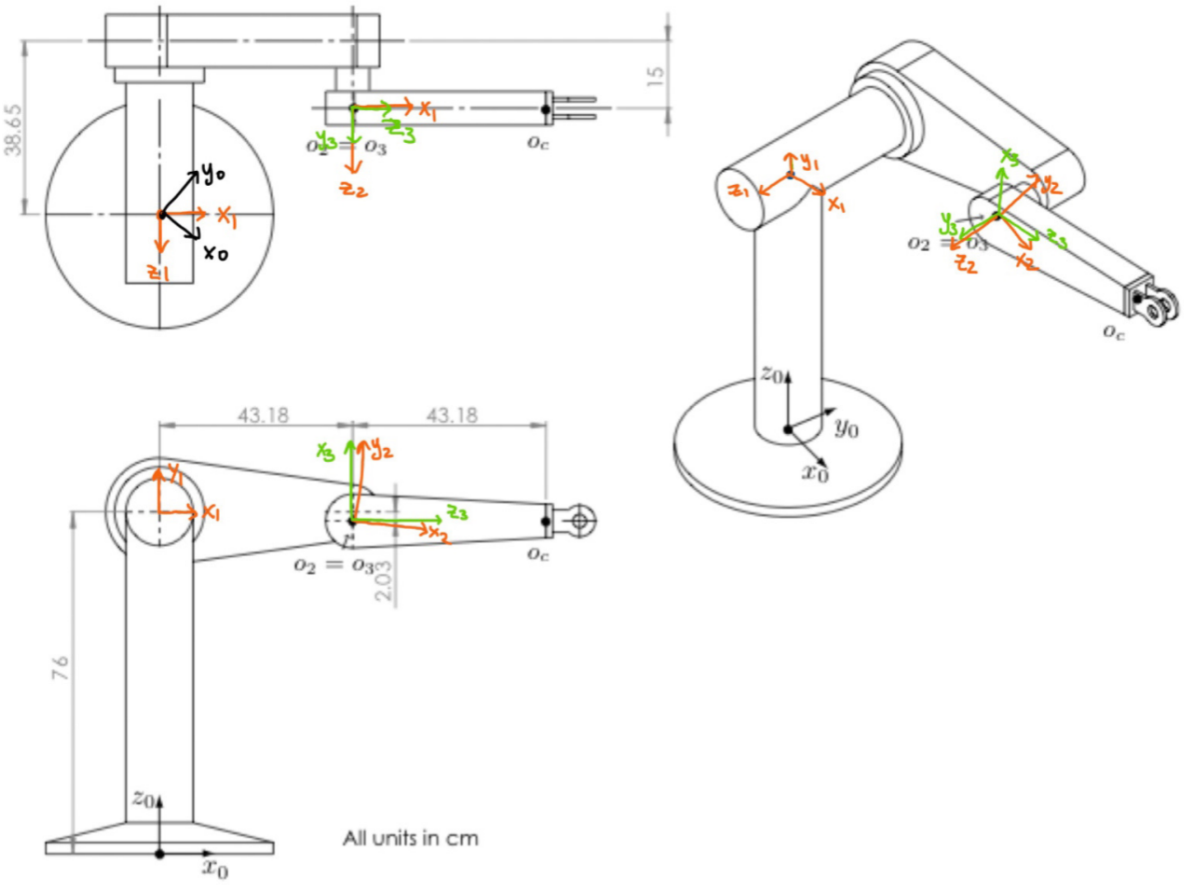

Figure 1: Schematics of the PUMA560 robot

Question 2

PUMA DH Table

Link	a	α	d	θ
1	0	π/2	76	θ_1^*
2	43.23	0	-23.65	θ_2^*
3	0	π/2	0	θ_3^*
4	0	- π/2	43.18	θ_4^*
5	0	π/2	0	θ_5^*
6	0	0	20	θ_6^*

* atan(y, x) format.

Question 3

$$\theta_1 = \text{atan}\left(y_c, x_c\right) - \text{atan}\left(-d_2, \sqrt{x_c^2 + y_c^2 - d_2^2}\right)$$

$$\theta_2 = \psi_2 - \psi_1 \quad ; \quad \psi_2 = \text{atan}\left(z_c - d_1, \sqrt{x_c^2 + y_c^2 - d_2^2}\right)$$

$$\psi_1 = \text{atan}\left(-d_4 \cos\theta_3^*, a_2 + d_4 \sin\theta_3^*\right)$$

$$\theta_3 = \text{atan}\left(\varphi, \sqrt{1 - \varphi^2}\right); \quad \varphi = \frac{r^2 + s^2 - a_2^2 - d_4^2}{2 a_2 d_4}$$

$$s = z_c - d_1$$

$$r = \sqrt{x_c^2 + y_c^2}\cos\gamma$$

$$\gamma = \sin^{-1}\left(\frac{-d_2}{\sqrt{x_c^2 + y_c^2}}\right)$$

$$R_6^3 = (R_3^0)^T R_6^0$$

$$\Rightarrow \theta_4 = \text{atan}\left(R_6^3(2,3), R_6^3(1,3)\right)$$

$$\theta_5 = \text{atan}\left(\sqrt{1 + R_6^3(3,3)^2}, R_6^3(3,3)\right)$$

$$\theta_6 = \text{atan}\left(R_6^3(3,2), -R_6^3(3,1)\right)$$