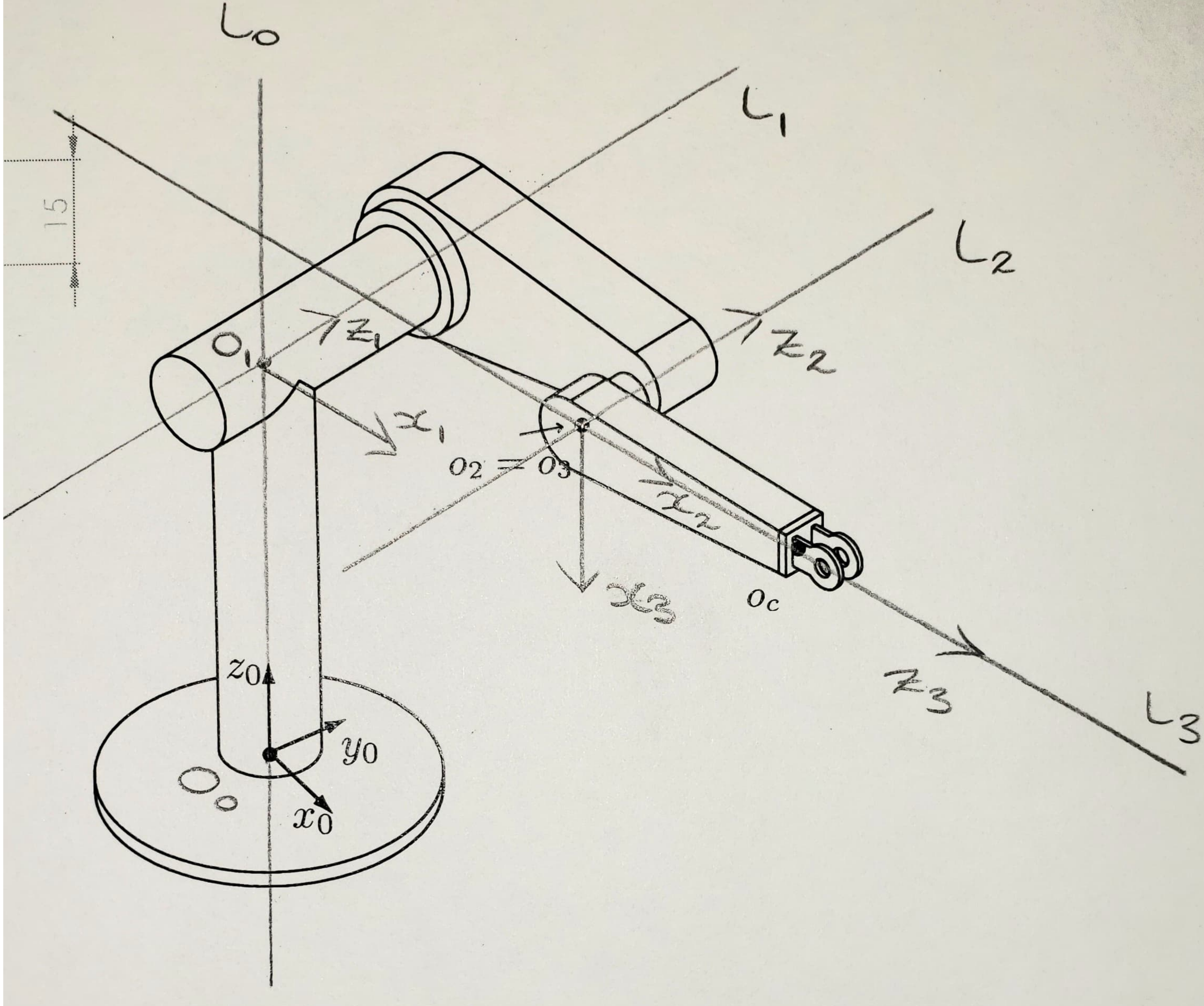
6x4 DH Table

Link	a_i (cm)	α_i (radians)	d_i (cm)	θ (radians)
1	0	$-\pi/2$	76	θ_1
2	43.18	0	23.65	θ_2
3	0	$\pi/2$	0	θ_3
4	0	$-\pi/2$	43.18	θ_4
5	0	$\pi/2$	0	θ_5
6	0	0	20	θ_6



L0
L1
L2
L3
15
O1
z1
x1
z2
o2 = o3
x2
x3
oc
z3
z0
y0
x0
O0

Compute $o_d^0 - R_d\begin{bmatrix}0\\0\\d_6\end{bmatrix}$, and denote the resulting vector $\begin{bmatrix}x_c\\y_c\\z_c\end{bmatrix}$

$$\theta_1 : \mathrm{atan2}(y_c, x_c) - \mathrm{atan2}(d_2, x^2+y^2-d_2^2)$$

$$\theta_2 : \mathrm{atan2}\left(z_c - d_1, \sqrt{x_c^2+y_c^2-d_2^2}\right) - \left(\frac{\pi - \Phi}{2}\right)$$

$$\theta_3 : \mathrm{atan2}(\text{sinphi}, \text{cosphi})$$

$$\text{sinphi} : \frac{-\left(\left(-\sqrt{a_2^2+2.03^2}\right) - d_4^2 + (z_c - d_1)^2 + y_c^2 + x_c^2 - d_2^2\right)}{-2 * \sqrt{a_2^2+2.03^2} * d_4}$$

$$\text{cosphi} : \sqrt{1 - \text{sinphi}^2}$$

$$\Phi = \frac{3\pi}{2} - \mathrm{atan2}(\text{sinphi}, \text{cosphi})$$

Then, compute $R_3^0(\theta_1, \theta_2, \theta_3)$ and compute $R_6^3(\theta_4, \theta_5, \theta_6) = (R_3^0)^T R_d$

Use the Euler angle formula, denote C

$$\theta_4 = \phi = \mathrm{atan2}(C_{23}, C_{13}) \text{ or } \mathrm{atan2}(-C_{23}, -C_{13})$$

$$\theta_5 = \theta = \mathrm{atan2}\left(\sqrt{1-C_{33}^2}, C_{33}\right) \text{ or } \mathrm{atan2}\left(-\sqrt{1-C_{33}^2}, C_{33}\right)$$

$$\theta_6 = \psi = \mathrm{atan2}(C_{32}, -C_{31}) \text{ or } \mathrm{atan2}(-C_{32}, C_{31})$$