

D-H

$$\begin{bmatrix} \theta_4 & d_4 \\ 0^\circ & 0 \end{bmatrix} \quad \begin{matrix} d_4 & d_4 \\ 0 & -90^\circ \end{matrix}$$

D-H

$$\begin{bmatrix} \theta_3 & d_3 \\ 0^\circ & d_3 \end{bmatrix}$$

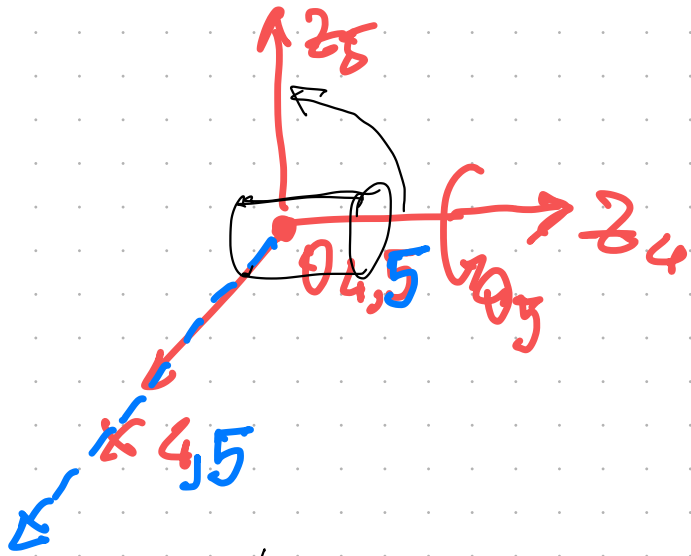
$$\begin{matrix} d_3 & d_3 \\ 0 & 0^\circ \end{matrix}$$

$$A_2^3$$

$$= \left[\begin{array}{ccc|c} 1 & & & 0 \\ & 1 & & 0 \\ & & 1 & d_3 \\ \hline 0 & 0 & 0 & 1 \end{array} \right]$$

$$A_3^4$$

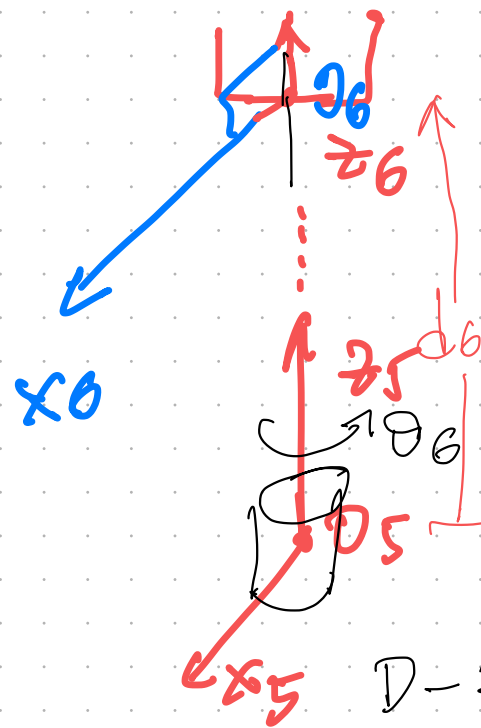
$$= \left[\begin{array}{ccc|c} c_4 & 0 & -s_4 & 0 \\ s_4 & 0 & c_4 & 0 \\ 0 & -1 & 0 & 0 \\ \hline & & & 1 \end{array} \right]$$



D-H

θ_5	d_5	a_5	α_5
0°	0	0	$+90^\circ$

$$A_4^5 = \left[\begin{array}{ccc|c} c_5 & 0 & s_5 & 0 \\ s_5 & 0 & -c_5 & 0 \\ \hline 0 & 1 & 0 & 0 \\ \hline & & & 1 \end{array} \right]$$



D-H

θ_6	d_6	a_6	α_6
0°	d_6	0	0°

$$A_5^6 = \left[\begin{array}{ccc|c} c_6 & -s_6 & 0 & 0 \\ s_6 & c_6 & 0 & 0 \\ \hline 0 & 0 & 1 & d_6 \\ \hline 0 & 0 & 0 & 1 \end{array} \right]$$

$$\theta_6^{\min} < \theta_6 < \theta_6^{\max}$$

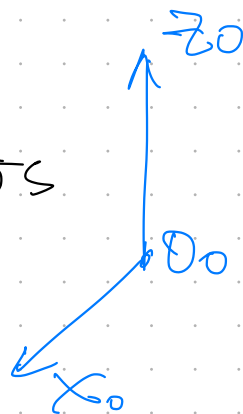
$$A_0^6 = A_0^1(\theta_1) A_1^2(\theta_2) A_2^3(\theta_3) A_3^4(\theta_4) A_4^5(\theta_5) A_5^6(\theta_6)$$

(2.55)

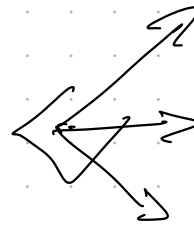
SYM @ MATLAB
Robotics Toolbox @ Corke

θ_1
 θ_2
 d_3
 θ_4
 θ_5
 θ_6
└───┘
Joint
variables

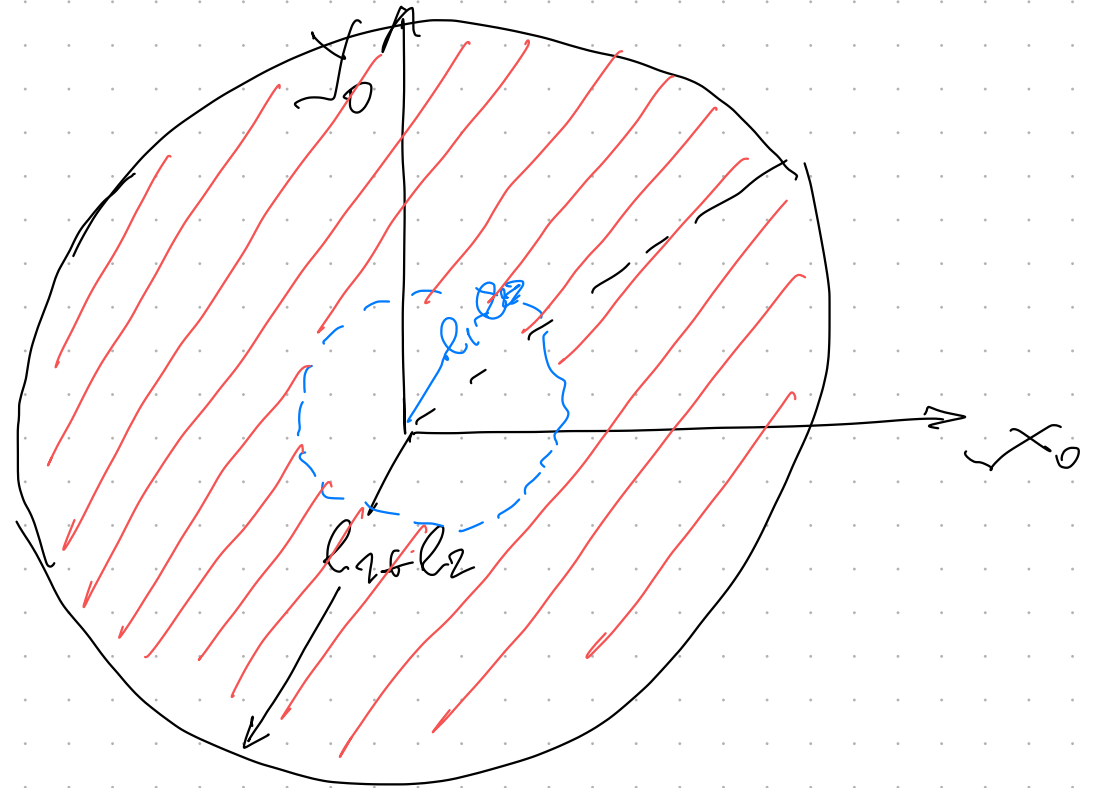
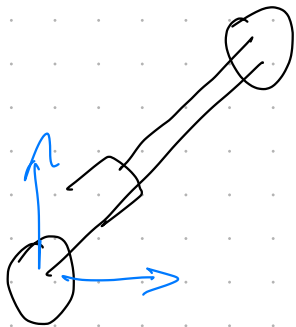
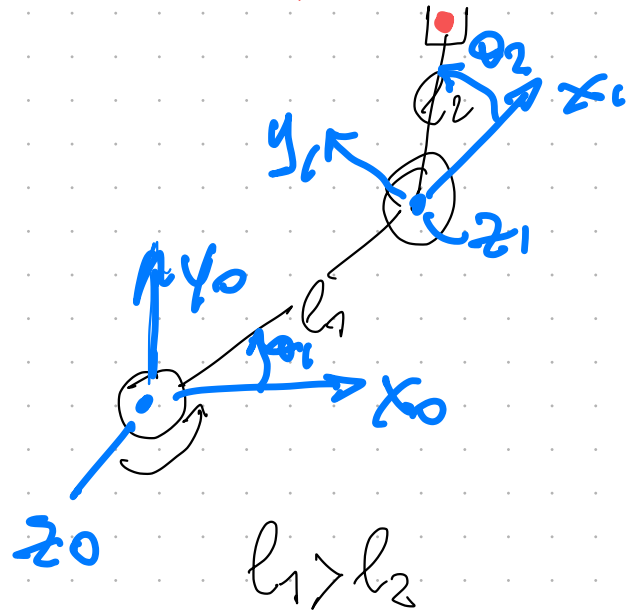
⇒ Direct
kinematics



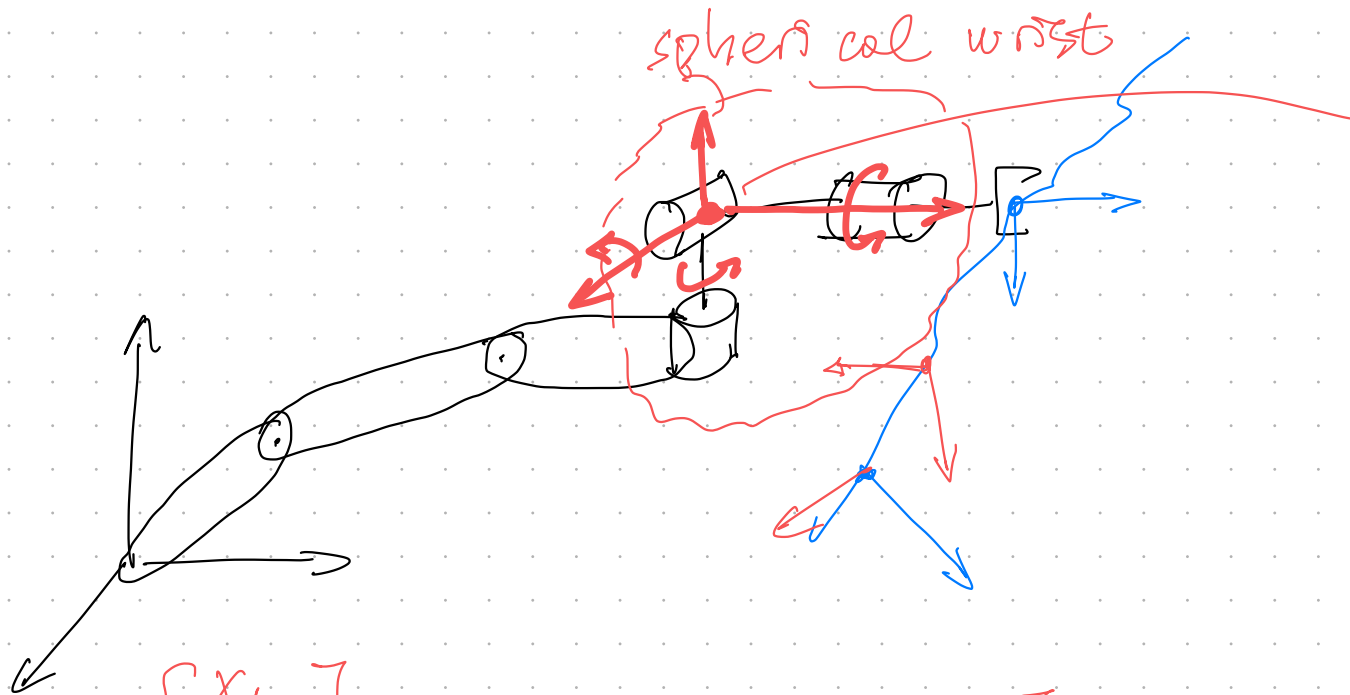
@ Joint coordinate
space



Workspace of robot



INVERSE KINEMATICS



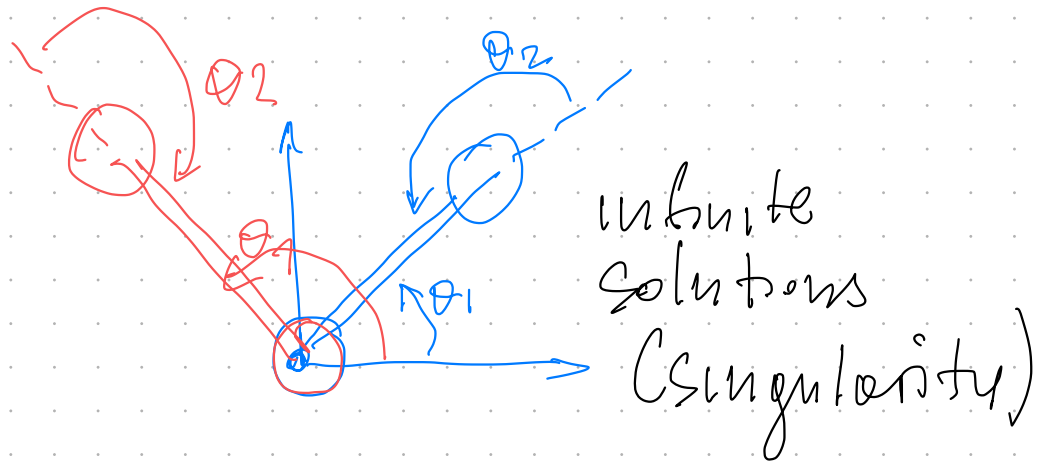
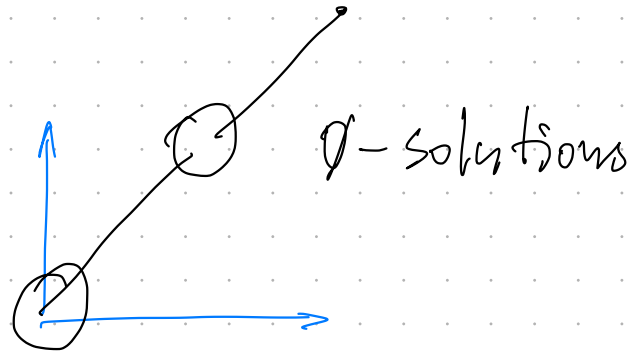
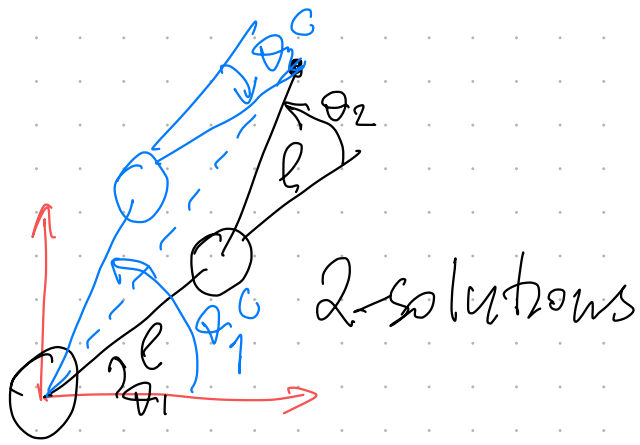
Coordinate of $\theta_3, \theta_4, \theta_5$ which coincide do not depend on $\theta_4, \theta_5, \theta_6$

$$\begin{bmatrix} x_b \\ y_b \\ z_b \\ Roll \\ Pitch \\ Yaw \end{bmatrix}$$

$$\Rightarrow \begin{matrix} 6 \\ 0 \end{matrix}$$

Joint variables $q_i =$

$$\begin{cases} \theta_i & \text{rotational angle} \\ d_i & \text{translational joint} \end{cases}$$



Inverse Kinematics

