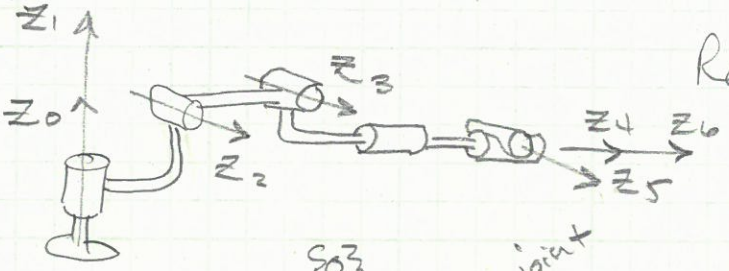
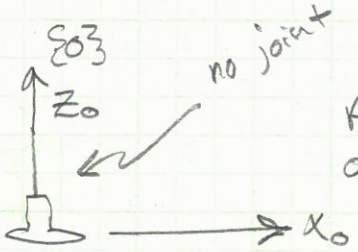
Kuka KR270 Example



Robot Arm

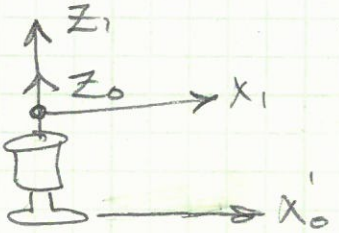


Base link $\{0\}$

this is the non-moving frame

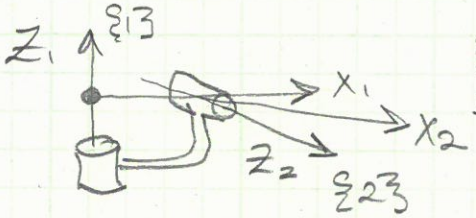
Assume this is a useful direction, so point x this way.

Link 1



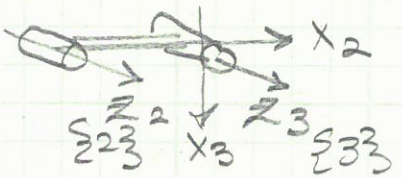
Now link 1 moves because of the first revolute joint

Link 2



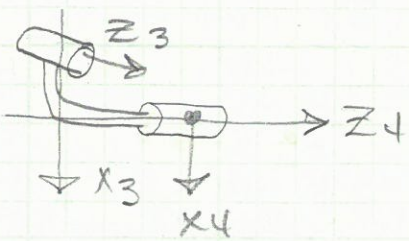
Notice how x_1 intersects z_2. x_2 will also intersect z_3

Link 3



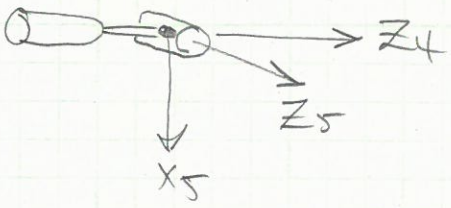
Again, x_3 will intersect z_4 axis.

Link 4



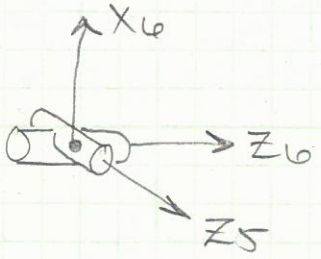
Now here is a choice. Since the z_4 and z_5 frames are co-linear, you can choose where to point x_4. It is generally wise to take x_4 perpendicular to z_3-z_4 plane. Therefore you could also choose to draw x_4 going up instead of down

Link 5



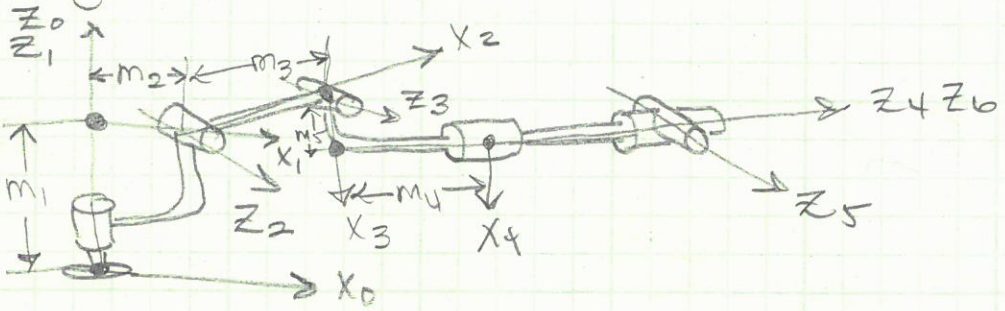
Now, Z_4 intersects Z_5, so at that point you put X_5.

Link 6



Again, X_6 is where Z_5 and Z_6 intersect

All together



a_{i-1} : link length from Z_{i-1} to Z_i along X_i

α_{i-1} : angle from Z_{i-1} to Z_i about X_i

d_i : distance from X_{i-1} to X_i along Z_i

θ_i : angle from X_{i-1} to X_i about Z_i

Link i	a_{i-1}	α_{i-1}	d_i	θ_i
$i=1 \rightarrow 1$	0	0	m_1	θ_1
$i=2 \rightarrow 2$	m_2	90	0	θ_2
3	m_3	0	0	θ_3
4	m_5	-90	m_4	θ_4
5	0	90	0	θ_5
6	0	-90	m_6	θ_6

Link 1: $i=1$
$a_{i-1} = 0$, Z_0 and Z_1 co-linear, no distance
$\alpha_{i-1} = 0$, Z_0 and Z_1 co-linear, no rotation
$d_i = m_1$, X_0 and X_1 are separated by distance m_1 along Z_1 axis
$\theta_i = \theta_1$, Since Z_1 is on a revolute joint, X_0 and X_1 can be pointing in different directions as joint 1 moves

Link 2: $i=2$
$a_{i-1} = m_2$, Z_1 and Z_2 seperated by m_2
$\alpha_{i-1} = 90$, Z_2 is rotated 90 degrees relative to Z_1
$d_i = 0$, X_1 and X_2 lie in same plane
$\theta_i = \theta_2$, revolute joint

Link 3: $i=3$
$a_{i-1} = m_3$, Z_2 and Z_3 are off set by distance m_3
$\alpha_{i-1} = 0$, Z_2 and Z_3 are parallel
$d_i = 0$, X_2 and X_3 intersect, distance = 0
$\theta_i = \theta_3$, revolute joint

Link 4: $i=4$
$a_{i-1} = m_5$, distance between Z_3 and Z_4 is m_5
$\alpha_{i-1} = -90$, the rotation from Z_3 to Z_4 about X_4 is -90 deg. Now if
$d_i = m_4$, distance between X_3 and X_4 along Z_4
$\theta_i = \theta_4$, revolute joint

* the rest follow this same pattern