LAB 2 : Inverse Kinematic

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For this lab, I could not apply the Pieper's solution for my robot. The last 3 joints have not one common intersection.
I chose to use the manipulator M-10iA, which was already ready in the file "*/Manipulator5_upute_rjesenje/LV1_manipulator5.py*".

Preparation : Computation of the Piper's solution.

The equation (4,15) gives us θ3 :

$$\mathbf{\theta 3} = arcsin((x^2 + y^2 + z^2 - d4^2 - a2^2) / (2*a2*d4))$$

We compute g1 by using $x^2 + y^2$:

$$g1^2 = x^2 + y^2$$

The equations (4,3) and (4,4) give us a system of equation to get **sin(θ2)** and **cos(θ2) :**

$$\mathbf{\theta 2} = arctan2(\sin(\theta 2), \cos(\theta 2))$$

And for θ1, we use (4,1) and (4,2) :

$$\mathbf{\theta 1} = arctan2(x/g1, y/g1)$$

Then we compute the matrix R63 =

c4*c5*c6 – s4*s6	- c4*c5*s6 – s4*c6	c4*s5
s4*c5*c6 + c4*s6	- s4*c5*s6 + c4*c6	s4*s5
-s5*c6	s5*s6	c5

We finnaly get the values of the real R63* computed for our own robot and we have :

$$\mathbf{\theta 5} = arcos(r33)$$

$$\mathbf{\theta 4} = arctan2(r23 / s5 , r13 / s5)$$

$$\mathbf{\theta 6} = arctan2(r32 / s5 , - r31 / s5)$$

**rij = R63[i][j]*

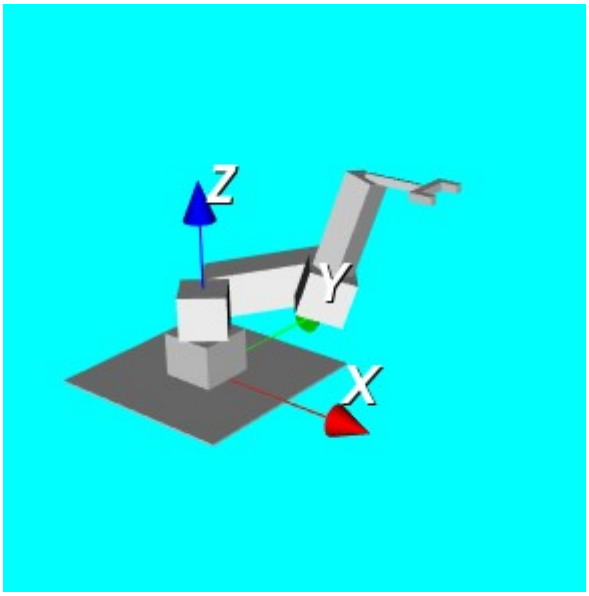
Exercice :

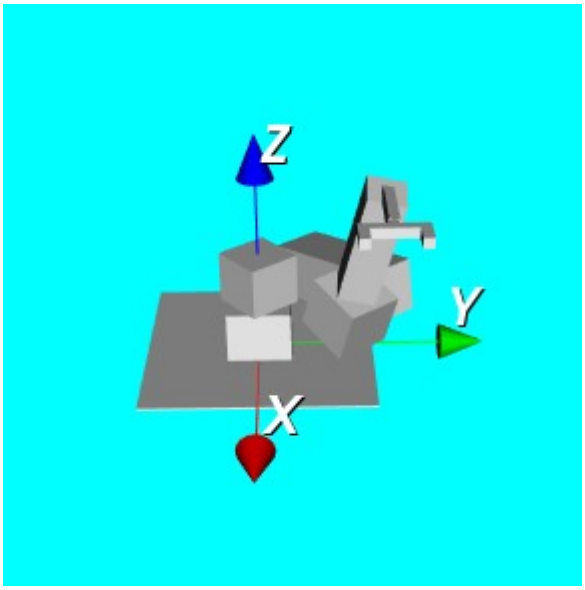
1. Function invik

I used the solution computed in **Prepartion** to return the vector **q** of joint variable.
However, in my preparation, I don't find all the solutions, but instead, I only give one possible.
Be aware that in some position wanted, we can miss to find the only solution because of that.

2. Positioning the tool

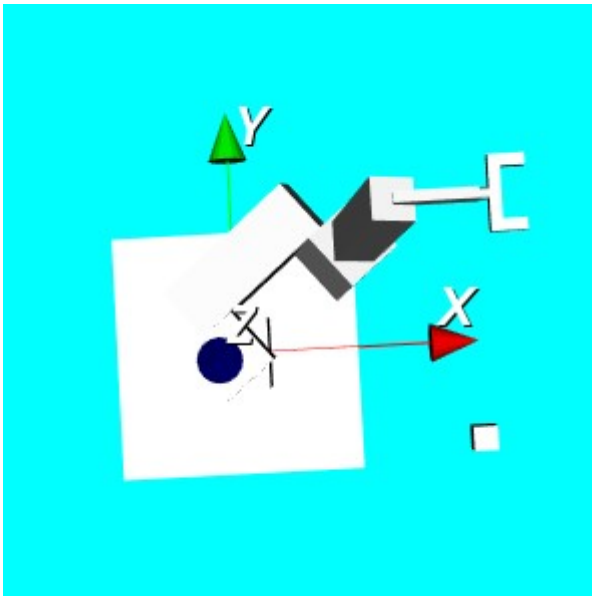
I positionned the tool at (x = 100cm, y = 50cm, z = 100cm) in the following picture :

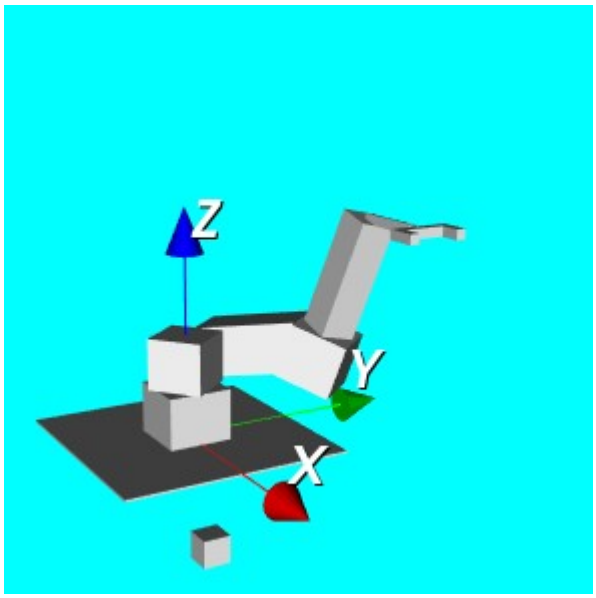




3. Cube A

With a cube A with dimensions 10cm*10cm*10cm.
On the surface, my robot can reach only an area described by a radius of 150cm.
I chose to divide the value of the position by 3. Then, we position the cube at (100, -40).





4. Grab the cube A

Then, we execute *invkin* to position the tool to grab the cube.