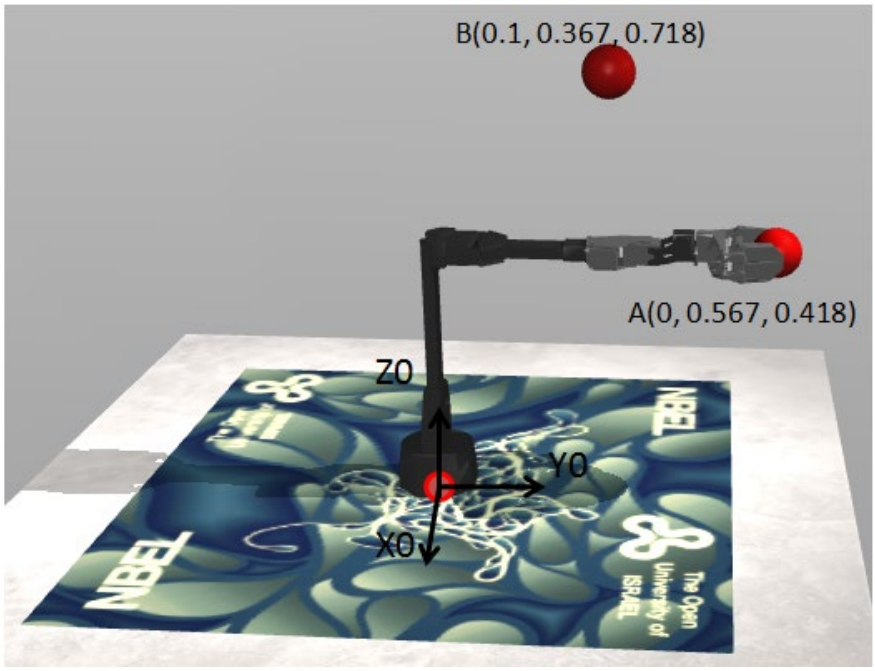
Algorithmic Robotics

Question 1:

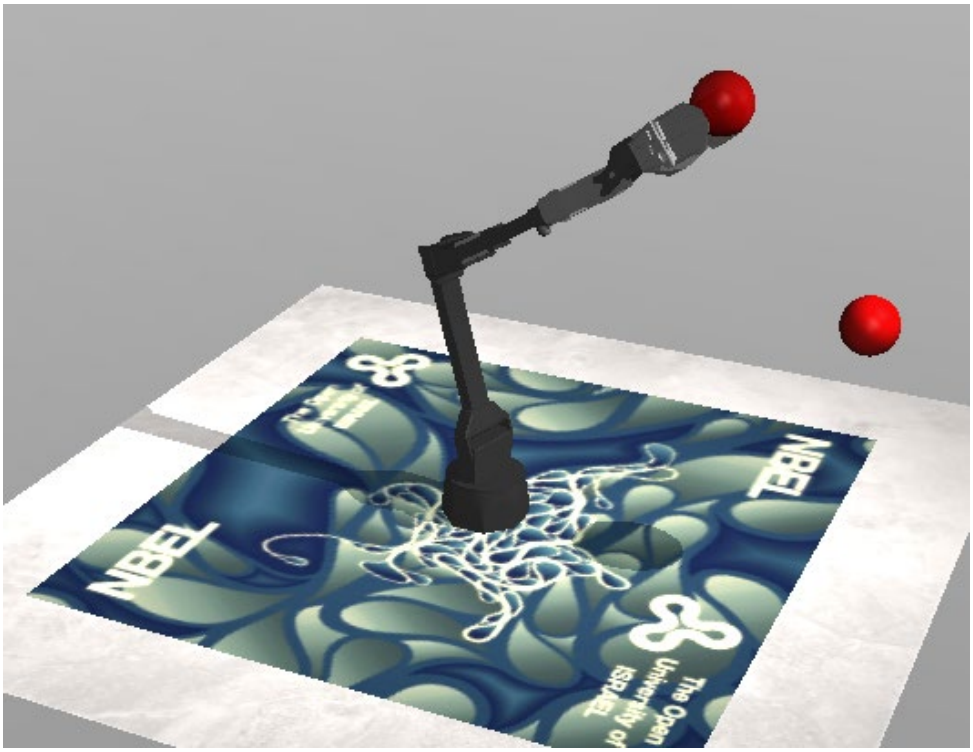
We will use inverse kinematics and the Jacobean to configurate the robot such that it makes a direct movement from current position $\mathrm{A}(0,0.567,0.418)$ to final position $\mathrm{B}(0.1, 0.367, 0.718)$:



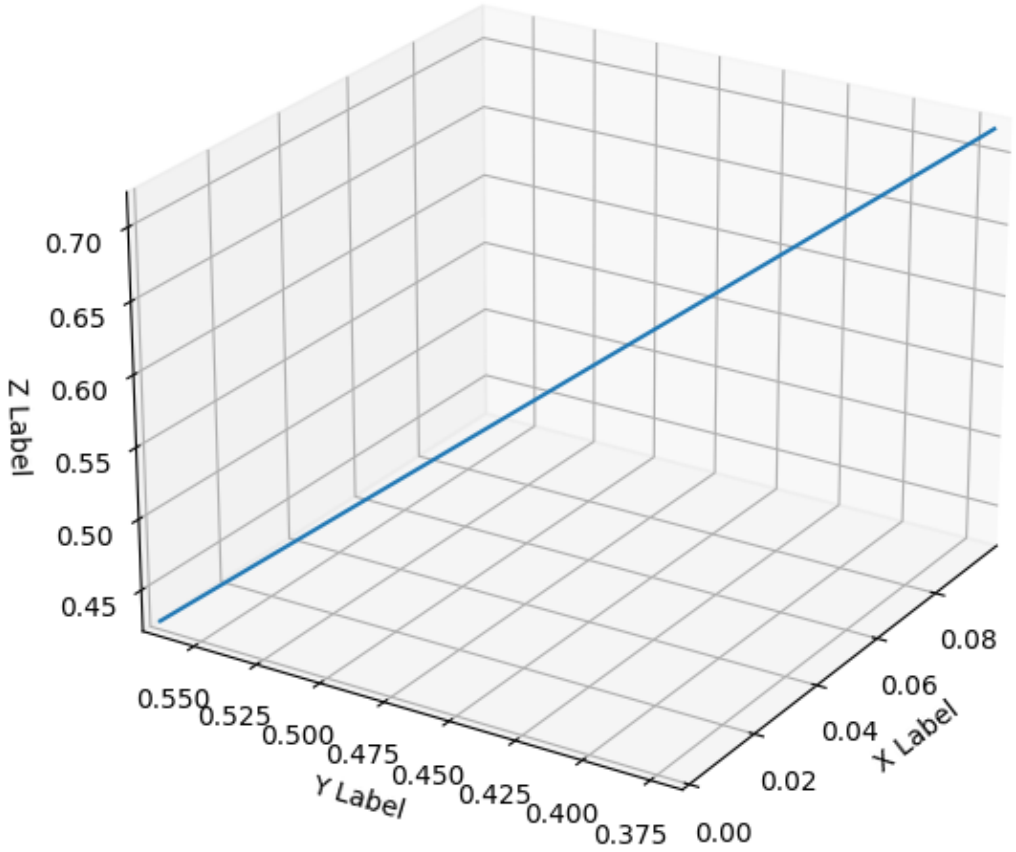
We split the path into $N = 10$ interval for making a straight movement.

The script halted after 360 iterations with the next values which represent arm configuration:

θ_0	θ_1	θ_2	θ_3	θ_4
-15.2	18.1	14.2	0.2	5.4

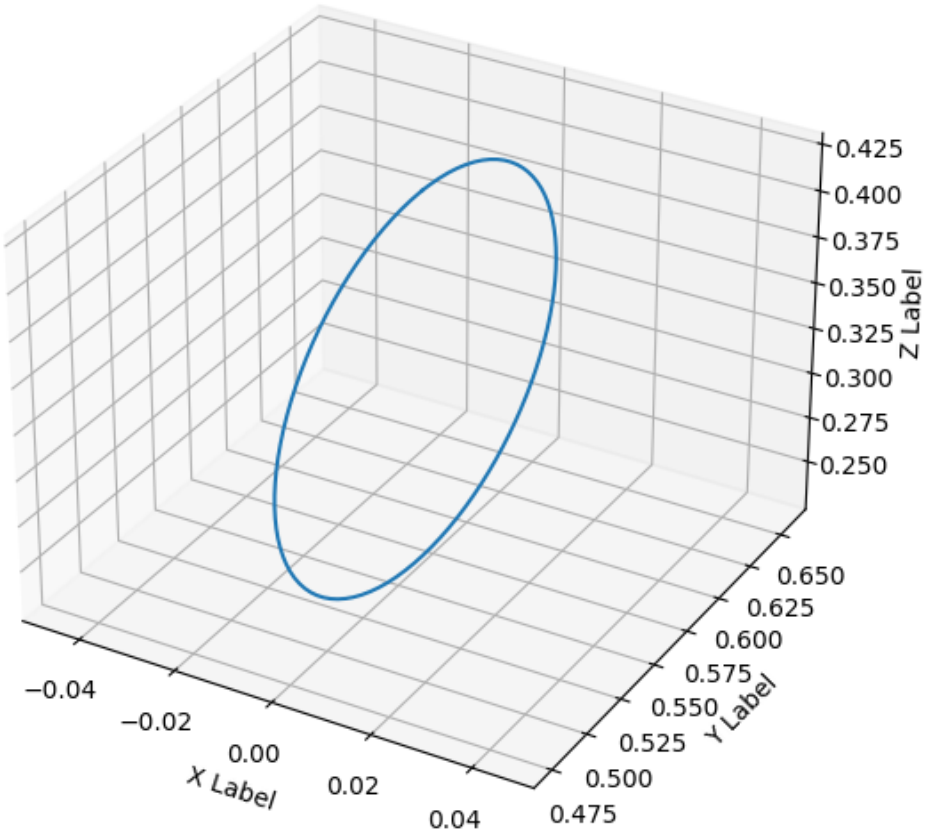


The position of the EE as function of iterations:



Circular motion

For this part we wrote a script that make a circle on the YZ axis with $r = 0.1[m]$ under the position of the EE (the center of the circle is $(0,0.456,0.418)$). for making a smooth movement and make it appear as a perfect circle we split it into $N = 100$ intervals



Question 2:

We used Newton-Raphson method as follow:

$q_i = q_{i-1} + J^{-1}|_{i-1} \cdot (EE_t - EE_i)$

q: The arm configuration of iteration i (vector of θ).

$J^{-1}|_{i-1}$:The transverse jacobian in the last iteration (q_{i-1} vector)

EE_t: The target of the EE

EE_i :EE current position

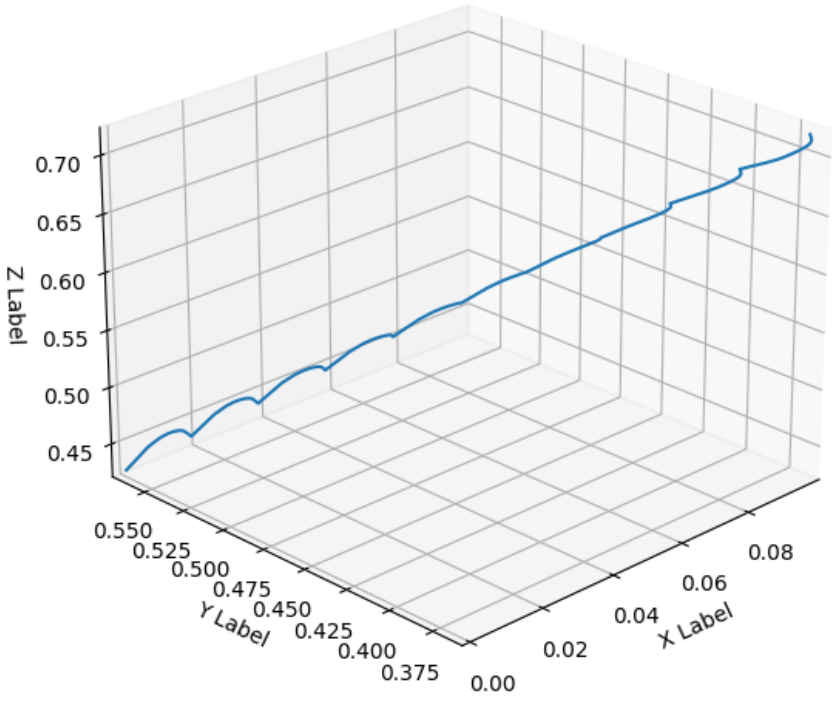
We split the path into $N = 10$ interval for making a straight movement.

The script halted after 473 iterations with the next values which represent arm configuration:

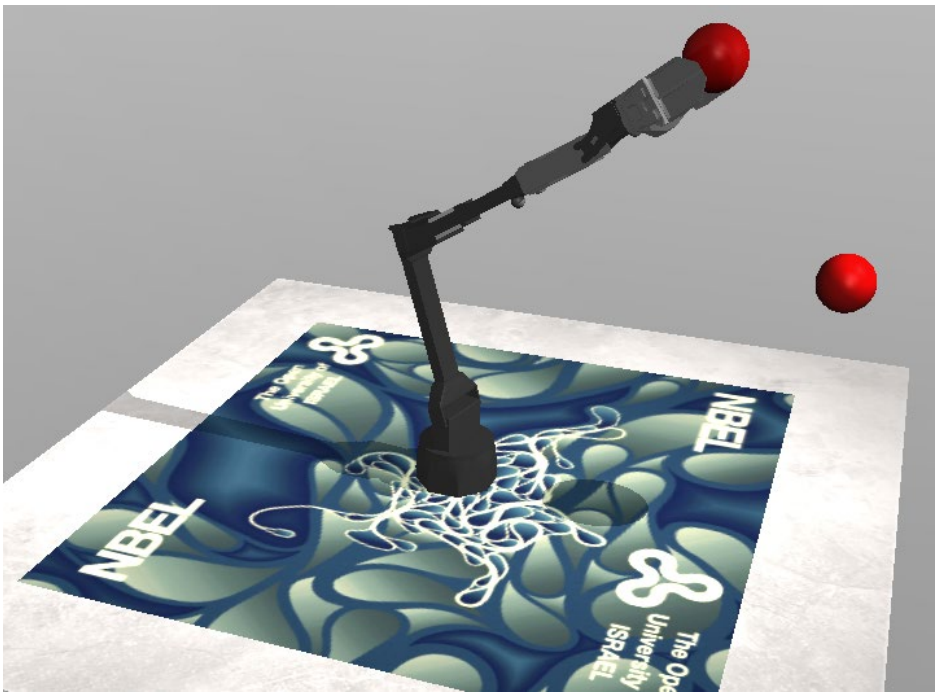
θ_0	θ_1	θ_2	θ_3	θ_4
-15.2	18.3	14.0	0.2	5.4

We got almost the same configuration as in part 1

The position of the EE as function of iterations:



In this part we can see that the EE run less in a straight line. We can split it into 30 intervals and get more linear movement.



The position of the EE as function of iterations ($N = 30$):