Aalto-yliopisto

ELEC-E8126 - Robotic manipulation

Exercise 6 Report

Student Name: - ABHIJIT. K. KAMATH

Student Number: - 802664

Date: - 05/04/2020

1) P matrix

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

The first diagonal element is 0 because the x co-ordinate is not controlled by the controller.

2) Mathematical equations used to compute position error

Error is calculated using the following code

```
const Eigen::Isometry3d desired_pose = Eigen::Translation3d(0.0,y,z)* starting_pose;
err = desired_pose.linear() * (desired_pose.inverse() * current_pose).translation();
```

The desired pose is formed using the translation of the starting pose by the y and z co-ordinate.

The co-ordinates are obtained by updating the co-ordinates as shown in the graph.

3) Plots of the desired and applied force

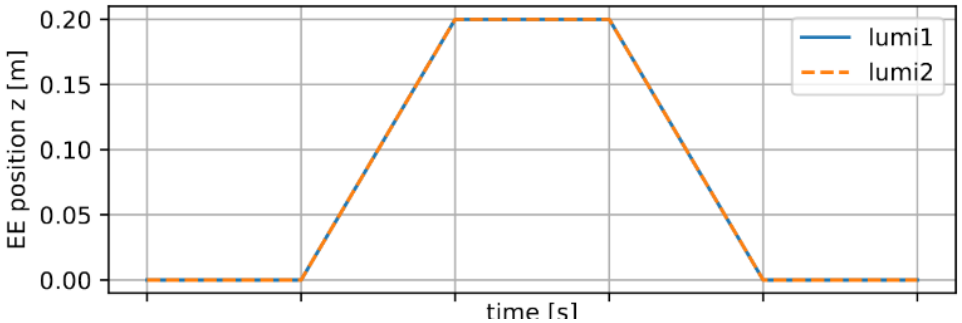


Figure 1:- Expected Graph in the z direction

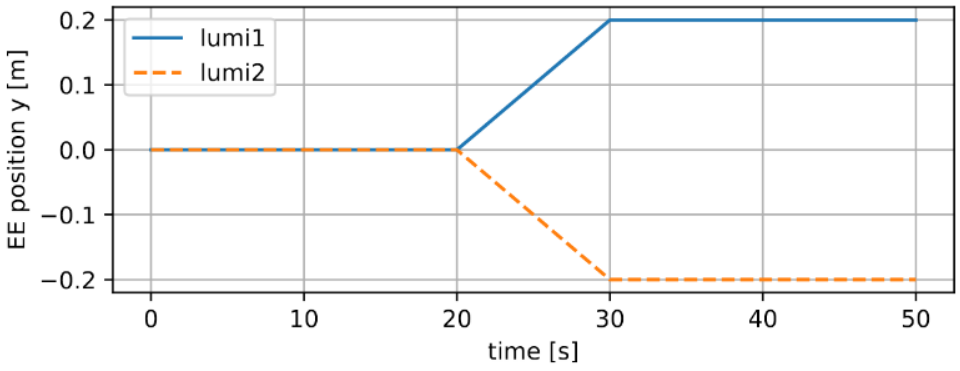
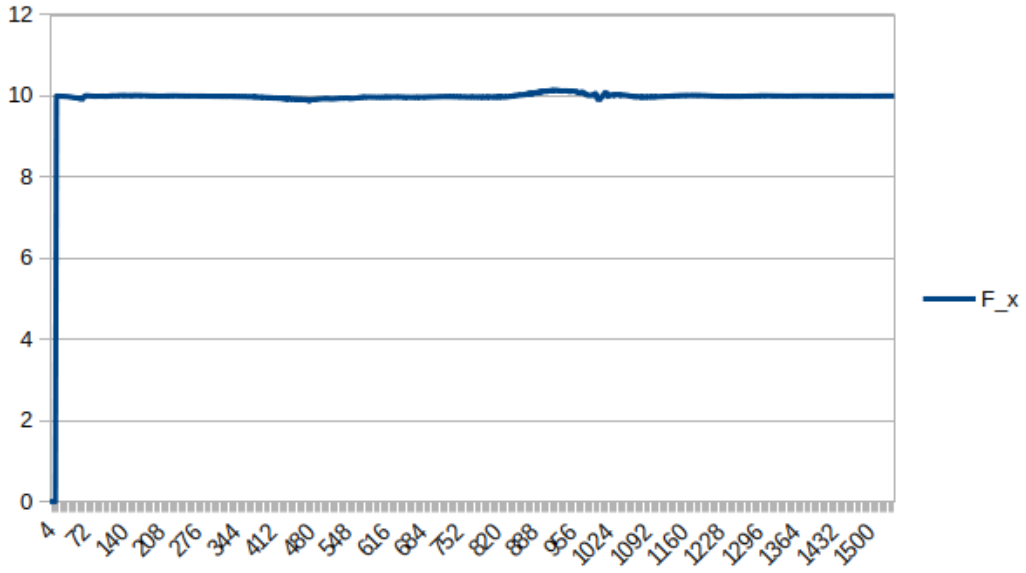
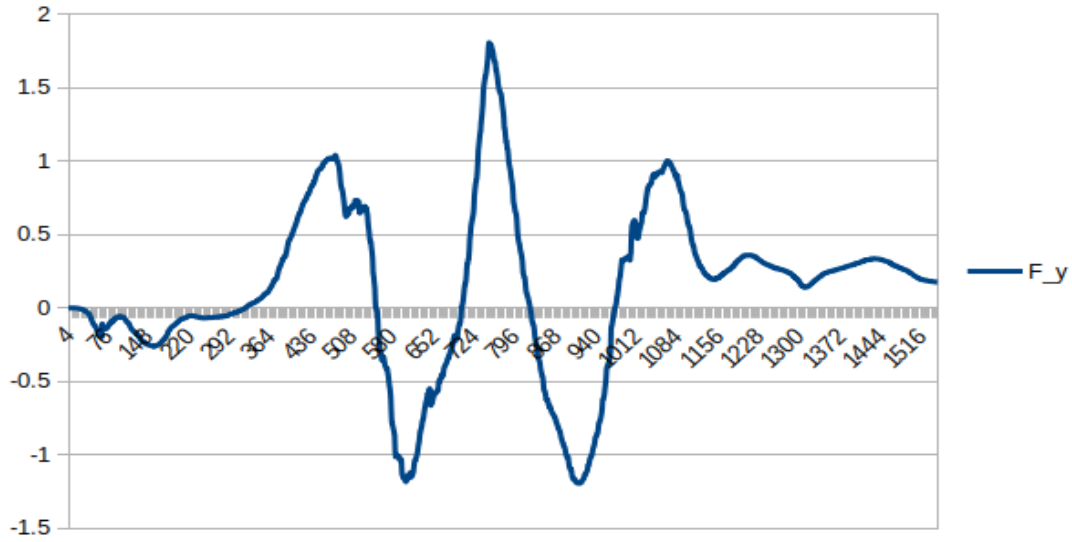
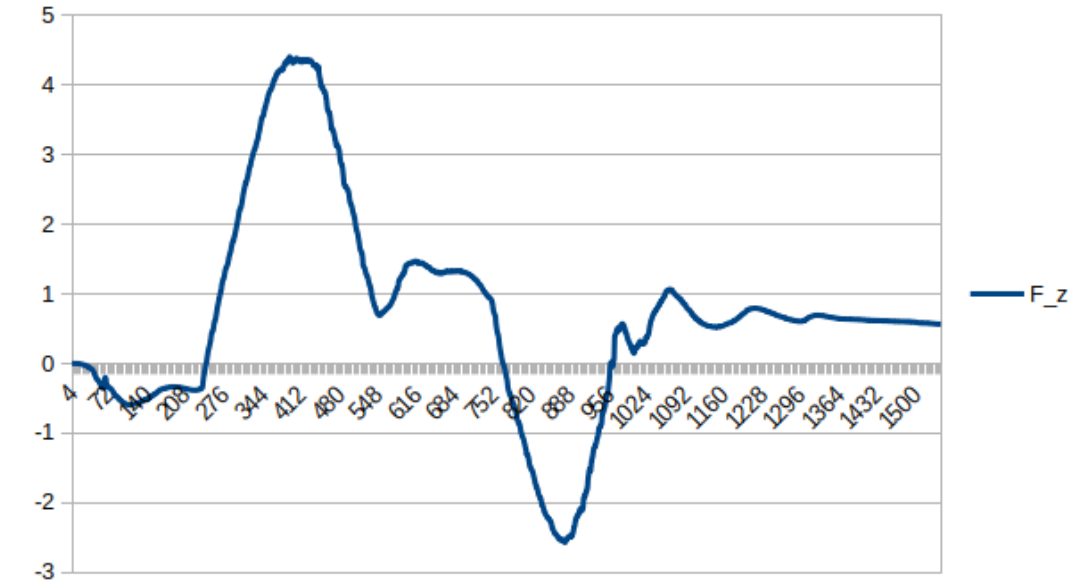


Figure 2:- Expected Graph in the y direction

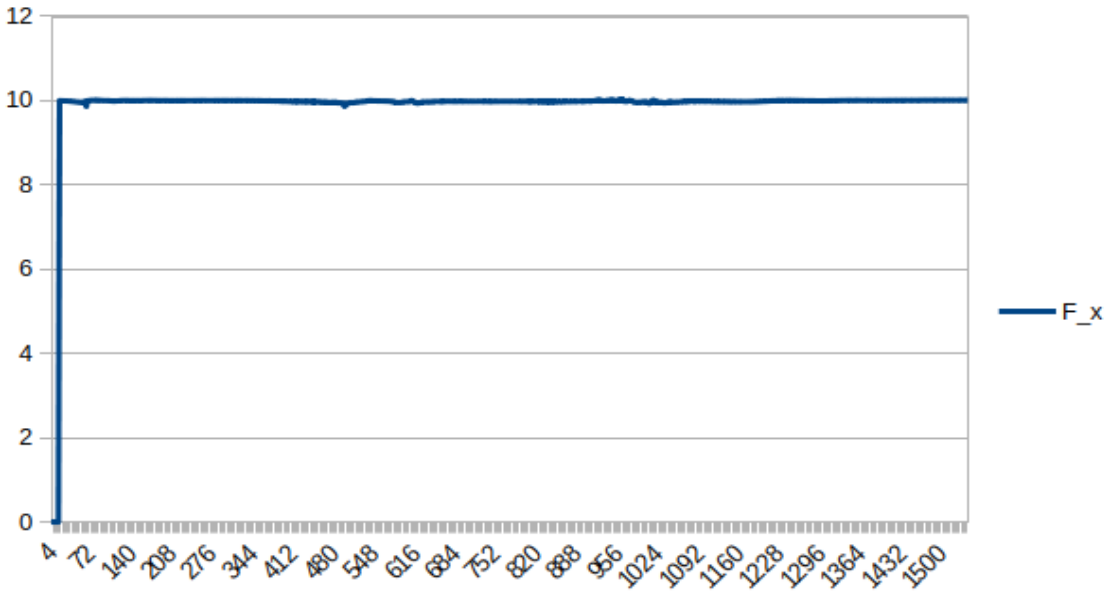
Robot 1 Plots

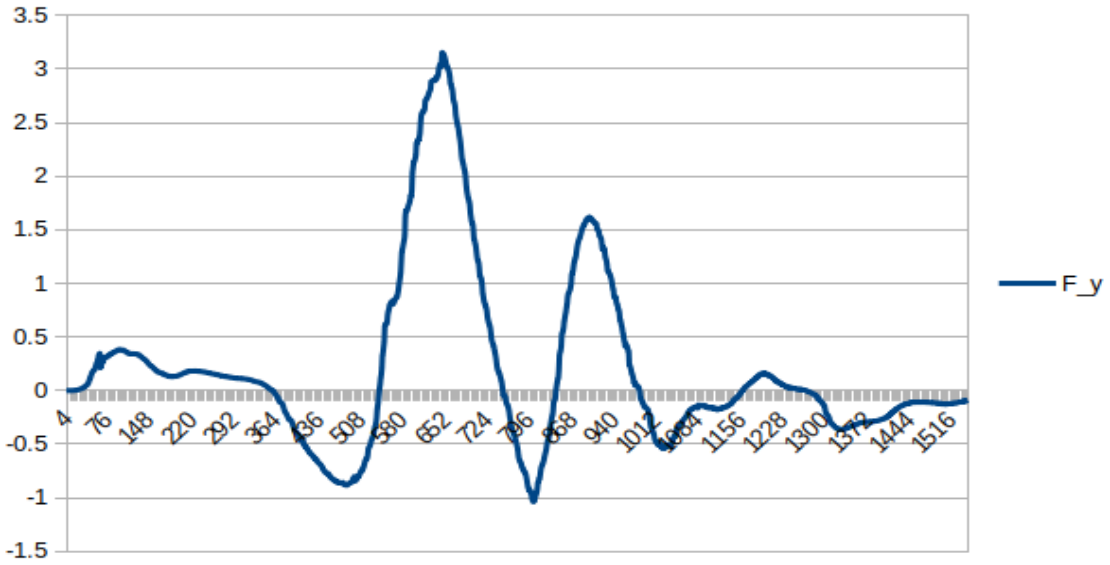


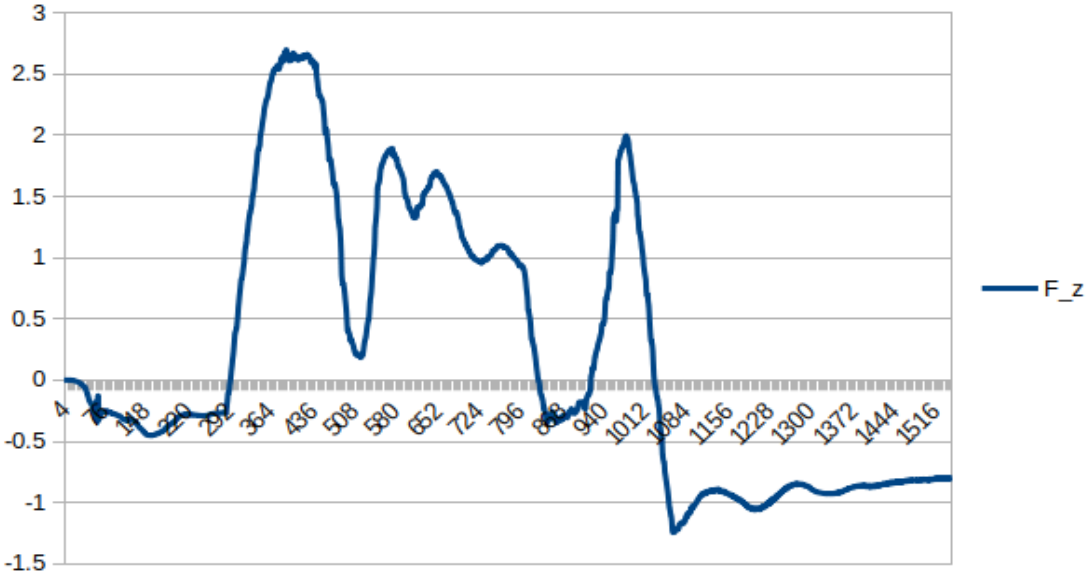




Robot 2 Plots

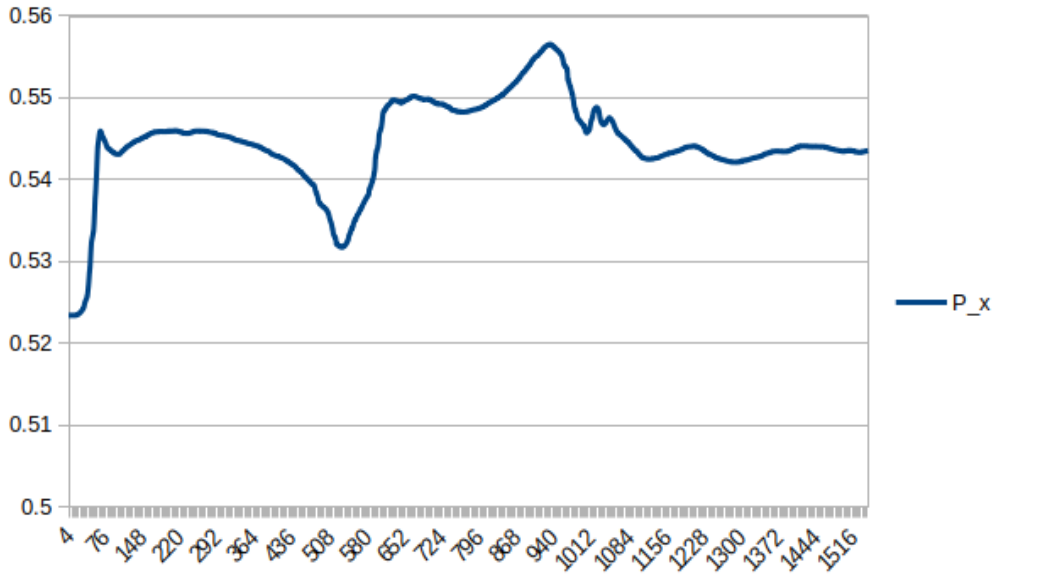


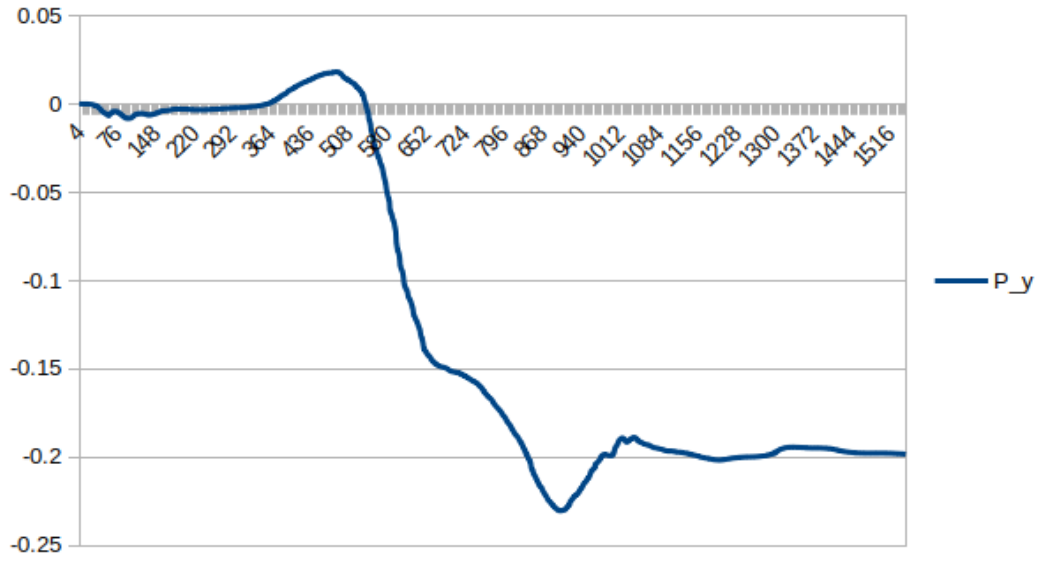


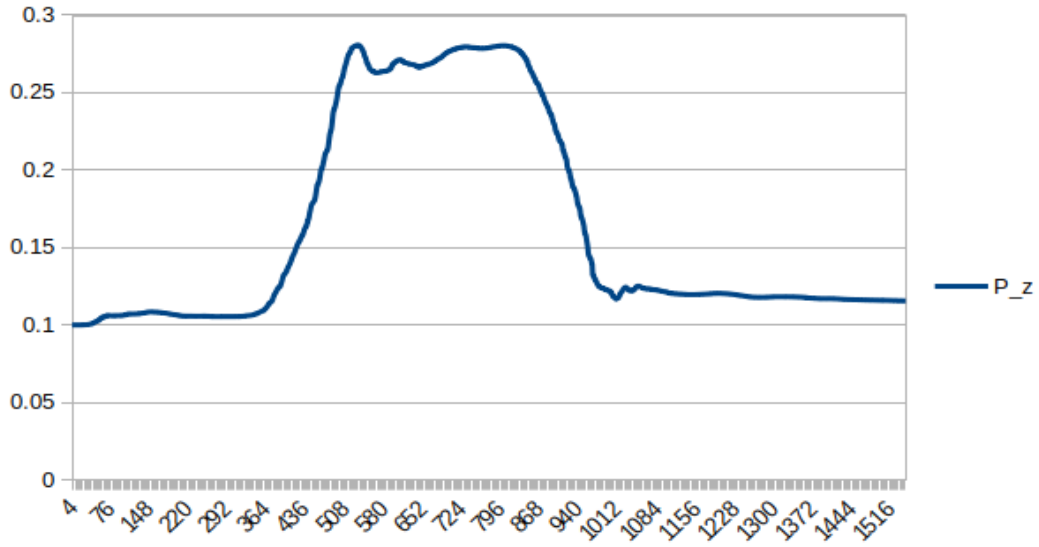


4) Plots of the followed paths

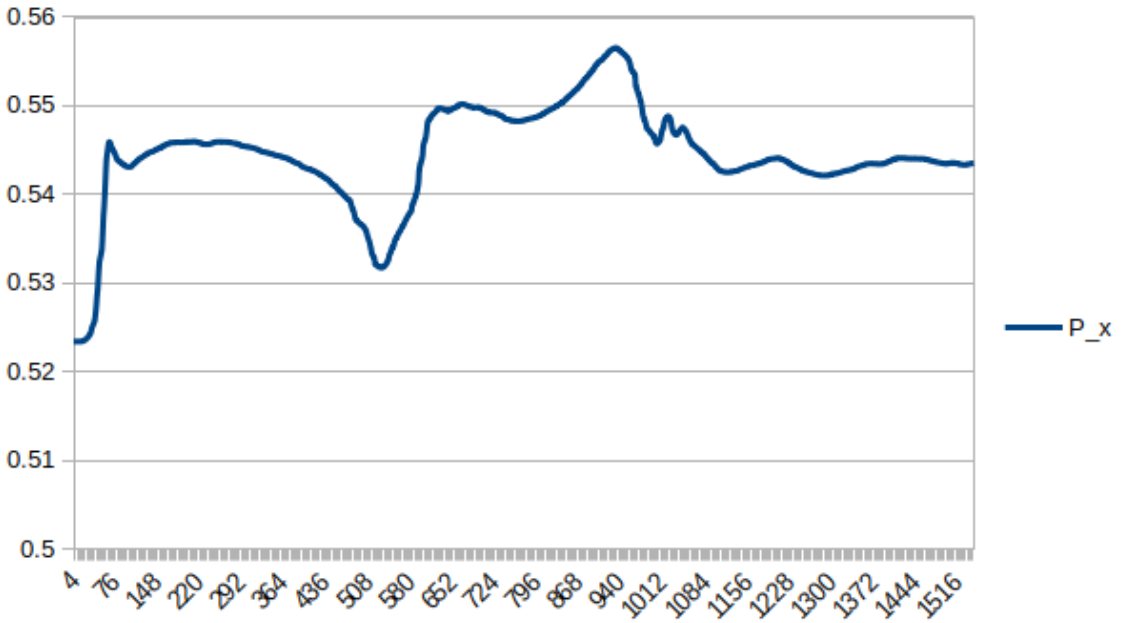
Robot 1

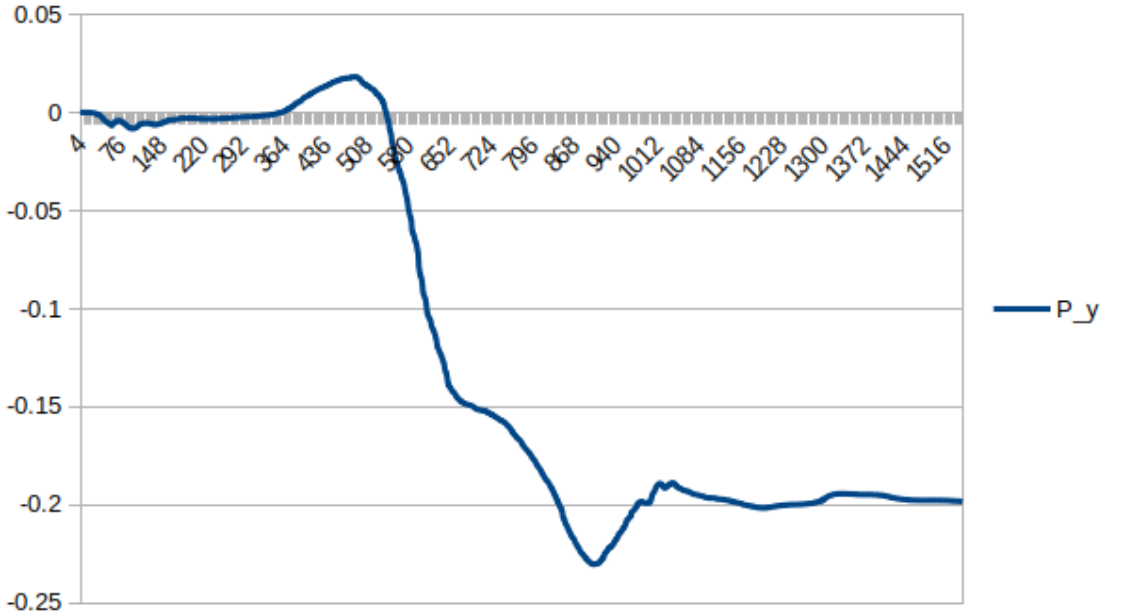


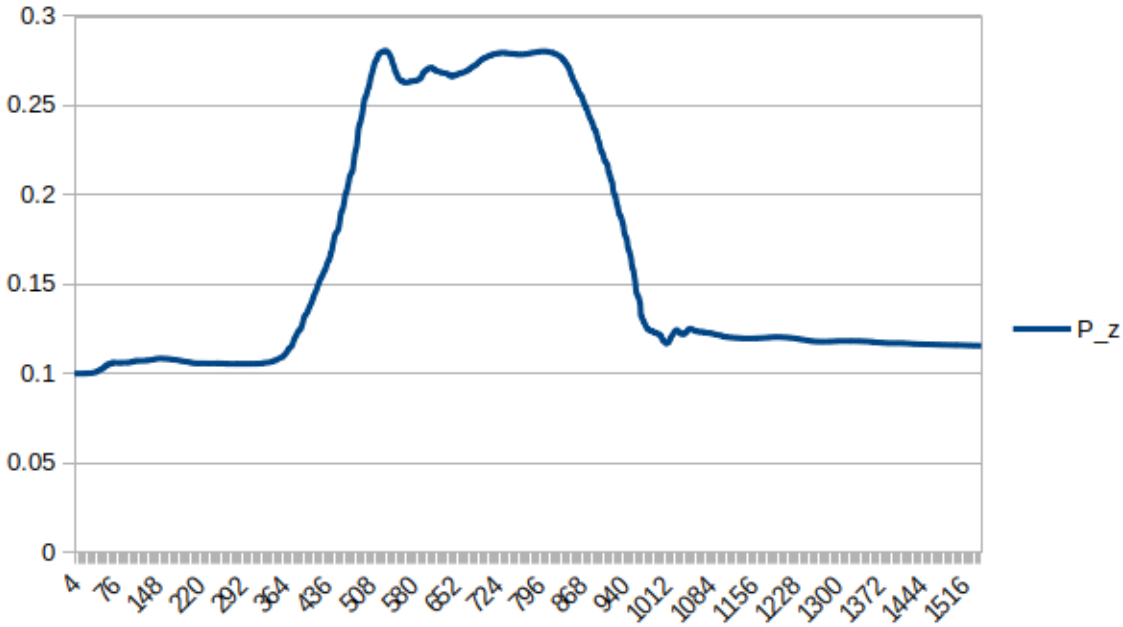




Robot 2


0.56
0.55
0.54
0.53
0.52
0.51
0.5
4 76 148 220 292 364 436 508 580 652 724 796 868 940 1012 1084 1156 1228 1300 1372 1444 1516
P_x


0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
4 76 148 220 292 364 436 508 580 652 724 796 868 940 1012 1084 1156 1228 1300 1372 1444 1516
P_y


0.3
0.25
0.2
0.15
0.1
0.05
0
4 76 148 220 292 364 436 508 580 652 724 796 868 940 1012 1084 1156 1228 1300 1372 1444 1516
P_z

Is the contact force equal to the desired force?

Yes the contact force is equal to the desired force as shown in the Force in x direction graph.

– Does the followed trajectory correspond to the desired one?

As seen in the graphs the trajectory is more or less following the expected trajectory but has a few spikes.

– Are all Cartesian degrees of freedom followed equally accurately? If not, explain why.

Well even though we control the x co-ordinate with force and y and z co-ordinates with the controller we see that x co-ordinates are also changing. Hence not all Cartesian degrees of freedom are followed equally.

Estimate of time spent: - 18 hours