

Milling and Welding Todo

Grup 11- Estudiants:

- Pol Casacuberta Gil
- Marta Granero i Martí

Link: <https://drive.matlab.com/sharing/b8a7f88a-dcb6-4c09-a328-ba6c7e737807>

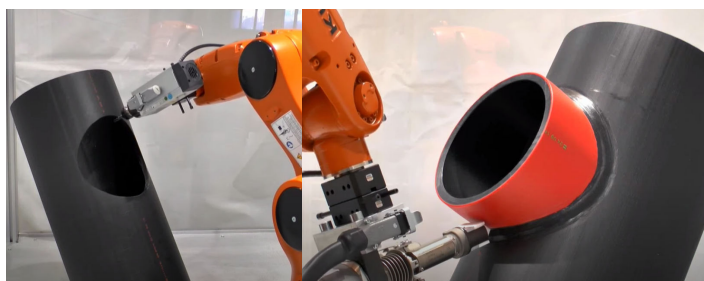
Table of Contents

Grup 11- Estudiants:	1
Sketching your ideas	1
Formalize the problem	1
Showing our workspace	2
Drawing cylinders	2
Initialization	3
Calculating the welding points	4
Calculating Puma 560 position and orientation	4
Plotting results	5
Some help for inspiration	6

See the video: <https://youtu.be/cVZWm9ORY30>

As you can see in the video a Robot Arm perform three task. Only two tasks are shown:

1. Make a hole in a cylinder by drilling it. Observe that the tool maintain the same orientation during the drilling task.
2. Insertion of a smaller cylinder not recorder here.
3. Welding the two cylinder. Observe that the tool always form a 45° with respect to red cylinder axis



Sketching your ideas

Conceptualize the problem. Add a sketch and make some small scripts

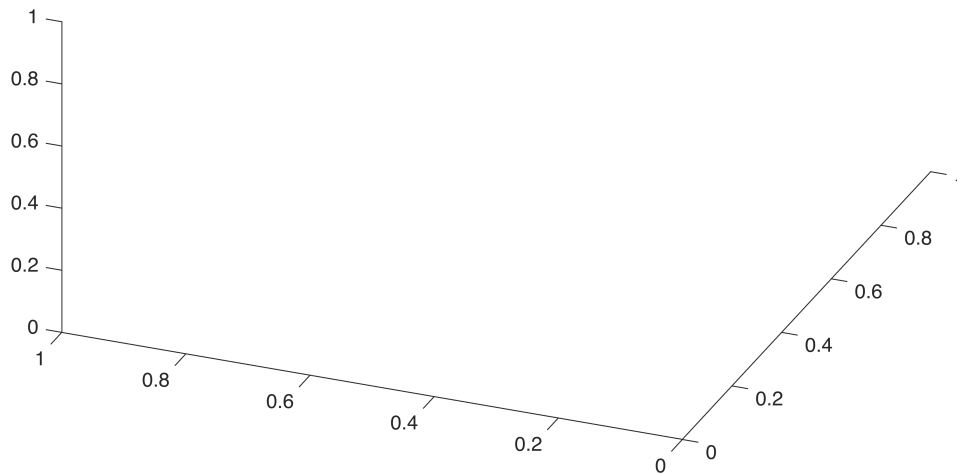
```
clear;  
close all;  
clf  
load('F_V_cylinder.mat');
```

Formalize the problem

Add sections and subsections to make the problem understandable among other engineers colleagues.

Showing our workspace

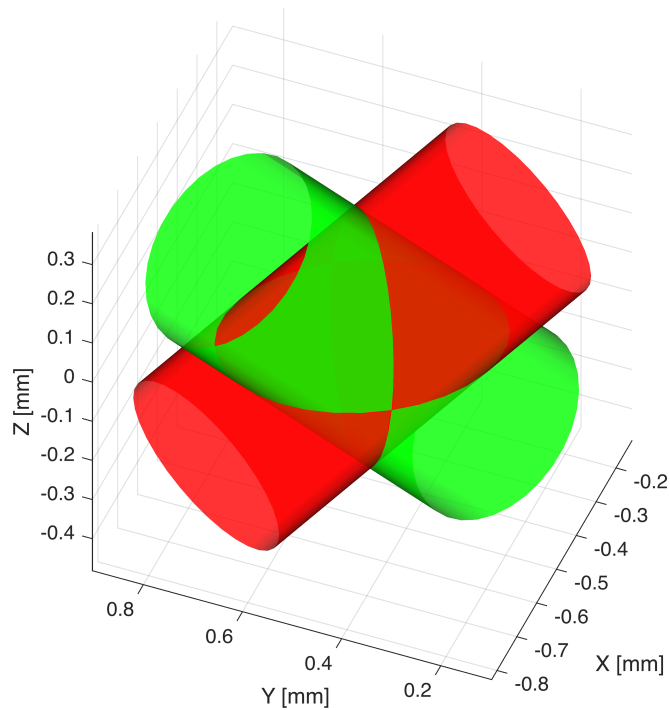
```
v = [-5 -2 5];  
[caz,cel] = view(v);
```



Drawing cylinders

In this section we calculate the coordinates of the two cylinders and we plot them.

```
%scale of cylinders  
Cy_scale = 0.20;  
  
%position of both cylinders  
CY_pose = eye(4)*transl([-0.3 0.3 -0.35])*troty(-pi/6)*trotx(-pi/6);  
CY_pose2 = CY_pose * transl(0,0,0.4) * trotx(-pi/2) * troty(-pi/4) * transl(0,0, -0.4)  
  
%scale of both cylinders  
V_cy_drill = CY_pose*[Cy_scale.*V_cy'; ones(1,length(V_cy))];  
V_cy_drill2 = CY_pose2*[Cy_scale.*V_cy'; ones(1,length(V_cy))];  
  
%plotting of both cylinders  
FVsPlot(F_cy,V_cy_drill(1:3,:)',[0 1 0])  
FVsPlot(F_cy,V_cy_drill2(1:3,:)',[1 0 0])
```



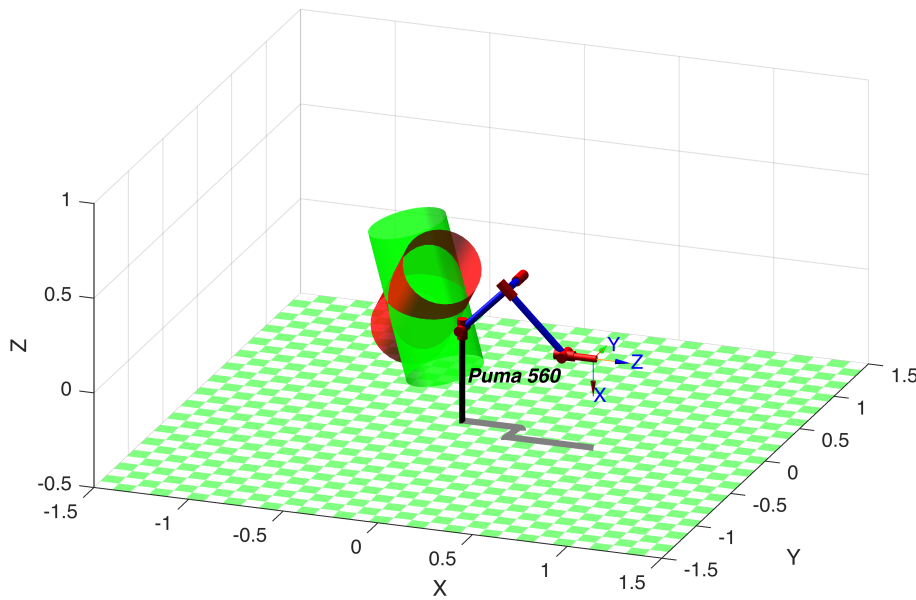
Initialization

In this section we initialize some constants and we plot our workspace

```
radius = 0.20;
mdl_puma560;

p560.base = transl(-0.1, 0, 0);
p560.tool = transl(0,0,0.15);

p560.plot(qn,'zoom',2.5,'workspace', [-1.5 1.5 -1.5 1.5 -0.5 1],'view',[20 20] );
hold on
```



Calculating the welding points

```
t = 0:pi/16:2*pi;
cp0 = [radius*cos(t)-0.1; radius*sin(t); abs(radius*cos(t)); ones(1,length(t))]
```

```
cp0 = 4x33
    0.1000    0.0962    0.0848    0.0663    0.0414    0.0111   -0.0235   -0.0610 ...
         0    0.0390    0.0765    0.1111    0.1414    0.1663    0.1848    0.1962
    0.2000    0.1962    0.1848    0.1663    0.1414    0.1111    0.0765    0.0390
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

Calculating Puma 560 position and orientation

Center of the welding points(*Drill hole center 'D_h_c'*):

```
D_h_c = CY_pose*transl(0,0,0.5)*trotx(-pi/2)*troty(-pi/4);
%Calculating the pos and orientation of each different welding poses:
n = 33 %numbers of welding points
```

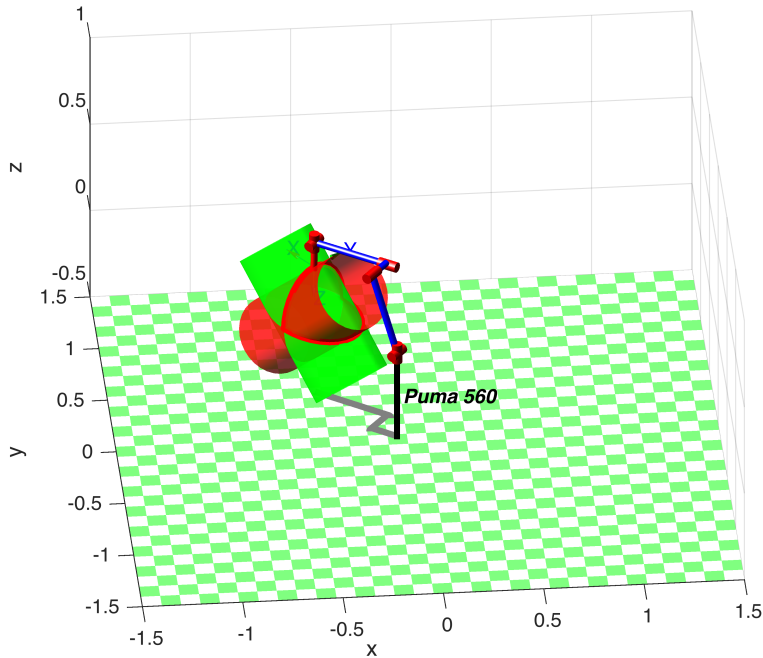
```
n = 33
```

```
for i=1:n
    Weld_Pose(:, :, i) = D_h_c*trotx(pi)*troty(pi/2)*transl(cp0(1,i),cp0(2,i),cp0(3,i))*
end
```

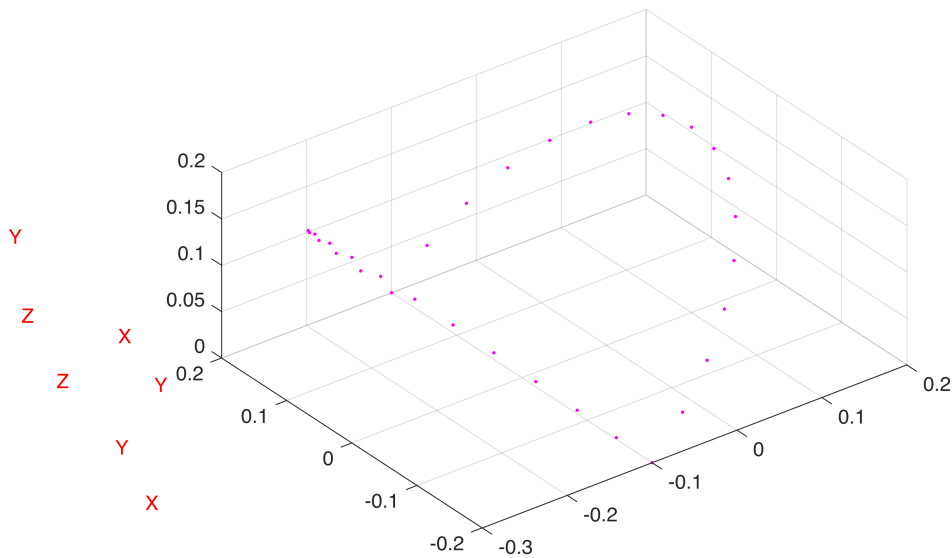
```
weld = transl(Weld_Pose)';
```

Plotting results

```
plot3(weld(1,:), weld(2,:), weld(3,:), 'r', 'LineWidth', 3);  
xyzlabel;  
Q= p560.ikine6s(Weld_Pose, 'run');  
p560.plot(Q, 'view', [20 20], 'zoom', 1.5, 'workspace', [-1.5 1.5 -1.5 1.5 -0.5 1], 'trail
```



```
%Draw points  
figure  
scatter3(cp0(1,:), cp0(2,:), cp0(3,:), '.', 'm', 'LineWidth', 2);  
hold on  
for i = 1:5:n  
    trplot(Weld_Pose(:, :, i), 'length', radius/2, 'arrow', 'width', 0.5, 'color', 'r')  
end
```



```
function T_b_a=FVsPlot(F,V,color)
patch('Faces',F,'Vertices',V,'FaceColor',color, ...
      'FaceAlpha',0.8,...
      'EdgeColor',      'none',      ...
      'FaceLighting',   'gouraud',   ...
      'AmbientStrength', 0.15);

% Add a camera light, and tone down the specular highlighting
camlight('headlight');
material('dull');

grid on
xlabel 'X [mm]'
ylabel 'Y [mm]'
zlabel 'Z [mm]'
axis equal
end
```

Some help for inspiration

Visit in that order the folder: Hints_Cues

1_Puma_doing_task_example.mlx

2_Puma_doing_task.mp4

3_Drilling_Solution.mlx

4_Puma_doing_drilling_task.avi

5_Puma_doing_welding_task.avi

6_Hint_cue_for welding task.fig