Robot Morphology

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Link: --------

Location of RTB robot manipulator models:

.../MatlabDrive/RVC2/rvctools/robot/models

Table of Contents

6R Robot. Puma 560

Before start the exercise see the videos:

https://youtu.be/ArzP7rh4_9Q

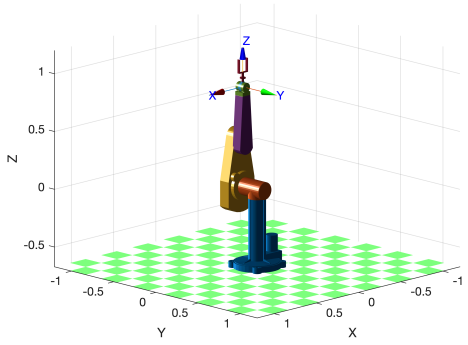
and

https://youtu.be/aHV5oY7viBM

Call the robot object and plot it

```
close all
clear
mdl_puma560 % Invoque the puma object
p560.plot3d(qr) % qz is the joint vector 1x6. Try qr, qn, any within the limits
```

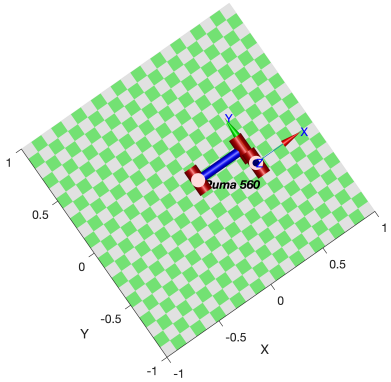
```
Loading STL models from ARTE Robotics Toolbox for Education  by Arturo Gil (http://arvc.umh.es/arte)......
```



Work with the wire model and change the point of view.

See: https://es.mathworks.com/help/matlab/creating_plots/setting-the-viewpoint-with-azimuth-and-elevation.html

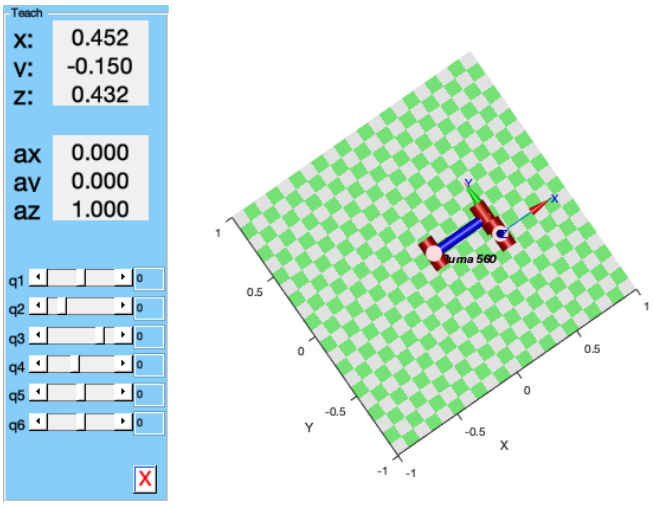
```
close all
p560.plot(qz)
view([-35 90])
```



Play with the teach

It is a kind of Joystick

```
p560.teach('approach')
```



Moving the Robot

```
clear all
close all
mdl_puma560
```

Declare a joint motion by adding rows

```
Q=zeros(100,6); % at the moment no motion
```

See the Joint 1 limits

```
q1_limits=p560.links(1, 1).qlim
```

```
q1_limits = 1×2
   -2.7925    2.7925
```

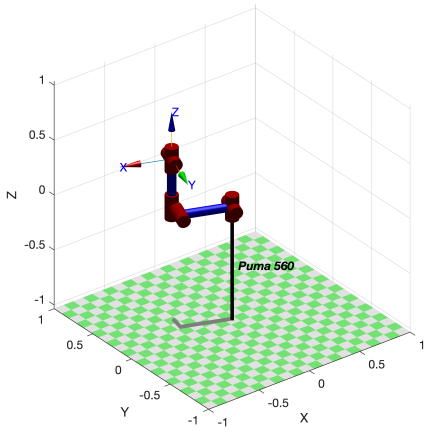
Build the joint's motion. Firts only Joint #1

```
q1=linspace(q1_limits(1),q1_limits(2),100)';
Q=[q1 Q(:,2:6)]
```

```
Q = 100×6
   -2.7925         0         0         0         0         0
   -2.7361         0         0         0         0         0
   -2.6797         0         0         0         0         0
   -2.6233         0         0         0         0         0
   -2.5669         0         0         0         0         0
   -2.5105         0         0         0         0         0
   -2.4540         0         0         0         0         0
   -2.3976         0         0         0         0         0
   -2.3412         0         0         0         0         0
   -2.2848         0         0         0         0         0
      ⋮
```

Plotting

```
p560.plot(Q)
```



Play with the plot options

Moving two joints. See above

```
q2_limits=p560.links(1, 2).qlim
```

```
q2_limits = 1×2
   -0.7854    3.9270
```

```
q2=linspace(q2_limits(1),q2_limits(2),100)';
Q12=[q1 q2 Q(:,3:6)];
```

Options: Add a trail to see the trajectory, display the join axis, make biger or smaller the robot

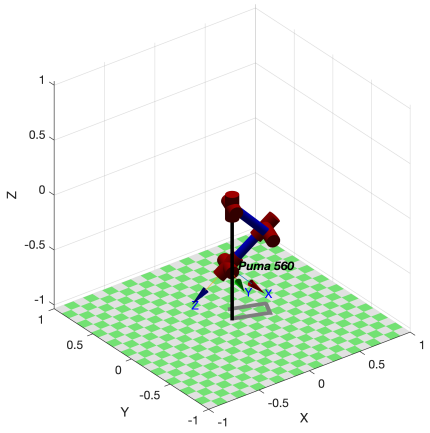
Visit the RTB manual.pdf at:

https://atenea.upc.edu/pluginfile.php/3871049/mod_resource/content/3/robot.pdf

or

https://petercorke.com/toolboxes/robotics-toolbox/

```
p560.plot(Q12,'trail','--','jaxes','zoom',2) %% Play outside the mlx file to see it: co
```



Play with other options to get familiar with. You must! becouse all along the course it will be necesary

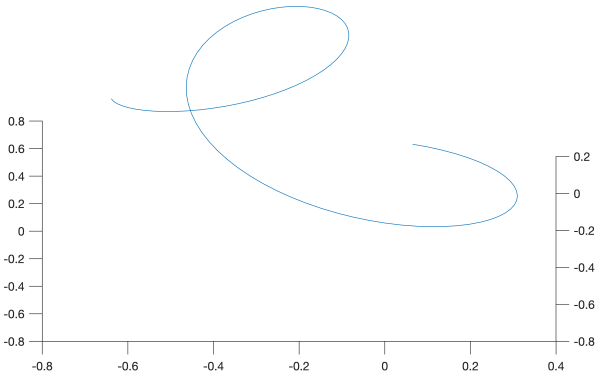
Recovering End efector position

Use function 'fkine' for recovering the finger tips of the robot

```
T=p560.fkine(Q12); % Forward Kinematic to be explained. Given Theta's (q's) obtain the
ft=[T.t] % to gert only the position
```

```
ft = 3×100
   -0.6386   -0.6335   -0.6251   -0.6135   -0.5990   -0.5817   -0.5618   -0.5397 ···
   -0.0728   -0.1086   -0.1436   -0.1772   -0.2092   -0.2393   -0.2672   -0.2928
   -0.0144    0.0154    0.0451    0.0747    0.1042    0.1334    0.1623    0.1909
```

```
figure
plot3(ft(1,:),ft(2,:), ft(3,:))
view(0,40)
```



Working area

```
clear all
close all
```

```
mdl_puma560
q2_limits=p560.links(1, 2).qlim
```

```
q2_limits = 1×2
   -0.7854    3.9270
```

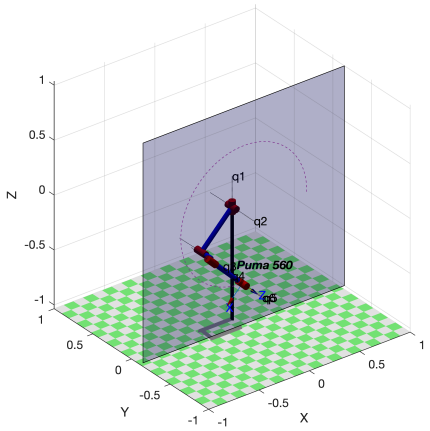
```
q2=linspace(q2_limits(1),q2_limits(2),100)';
Q= [zeros(100,1) linspace(q2_limits(1),q2_limits(2),100)' zeros(100,4) ]
```

```
Q = 100×6
         0   -0.7854         0         0         0         0
         0   -0.7378         0         0         0         0
         0   -0.6902         0         0         0         0
         0   -0.6426         0         0         0         0
         0   -0.5950         0         0         0         0
         0   -0.5474         0         0         0         0
         0   -0.4998         0         0         0         0
         0   -0.4522         0         0         0         0
         0   -0.4046         0         0         0         0
         0   -0.3570         0         0         0         0
    ⋮
```

```
p560.plot(Q,'trail','--','jaxes','zoom',2)
T=p560.fkine(Q);
ft=[T.t]
```

```
ft = 3×100
    0.6250    0.6250    0.6235    0.6207    0.6164    0.6108    0.6037    0.5953 ···
   -0.1501   -0.1501   -0.1501   -0.1501   -0.1501   -0.1500   -0.1500   -0.1500
   -0.0144    0.0154    0.0451    0.0747    0.1042    0.1334    0.1623    0.1909
```

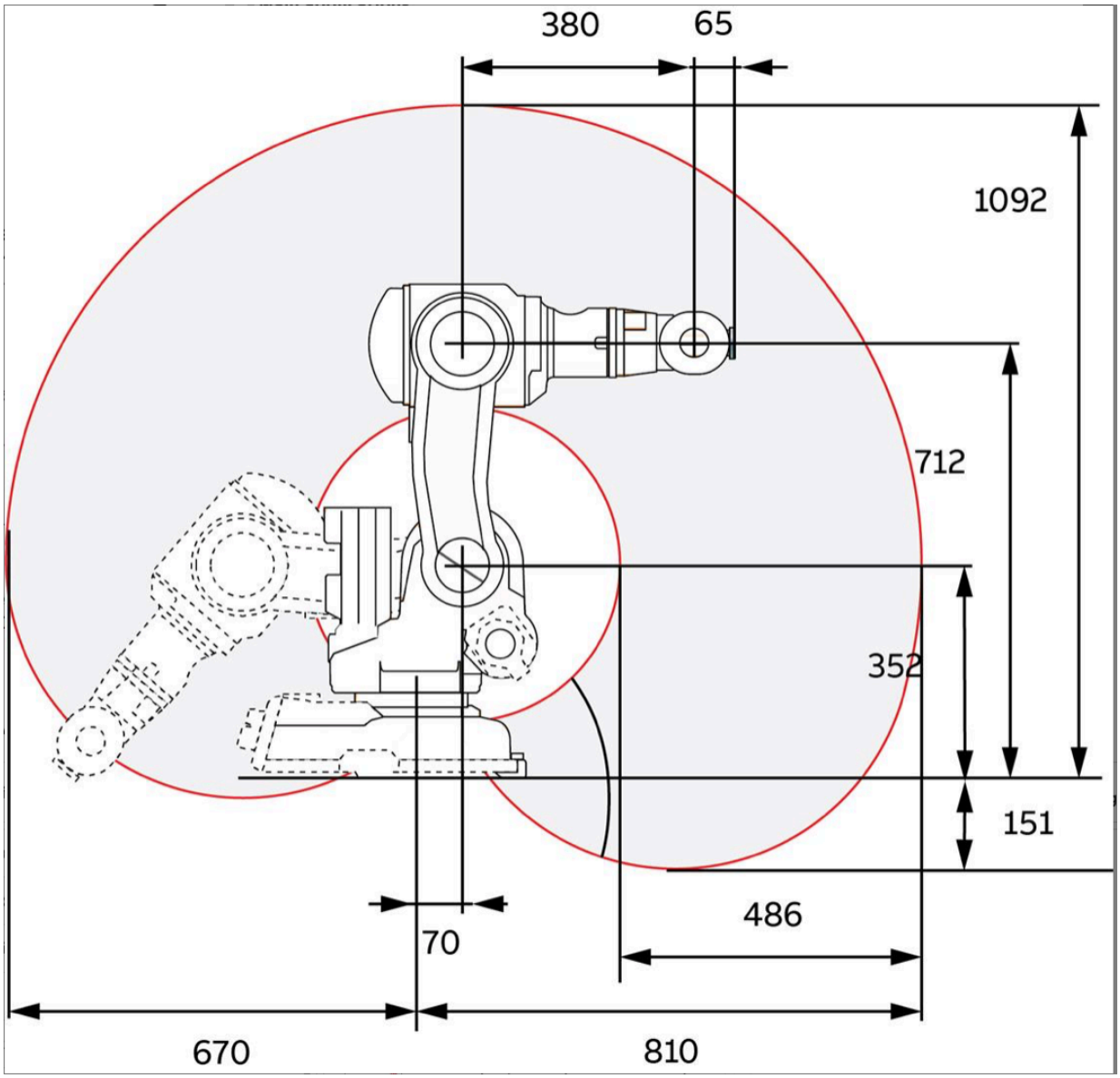
```
hold on
v = [-1 -0.1501 -1 ; 1 -0.1501 -1 ; 1 -0.1501 1; -1 -0.1501 1];
f = [1 2 3 4];
patch('Faces',f,'Vertices',v,'FaceColor','blue','FaceAlpha',.3)
```



IRB140 exercise

Make the same exercise for the irb140 manipulator and plot the working area as shown in the figure

Type of motion	Range of movement
Axis 1: Rotation motion	+180° to - 80°
Axis 2: Arm motion	+110° to -90°
Axis 3: Arm motion	+50° to -230°
Axis 4: Wrist motion	+200° to +200° Default +165 revolutions to -165 revolutions Max**)
Axis 5: Bend motion	+120° to -120°
Axis 6: Turn motion	+400° to -400° Default +163 revolutions to -163 revolutions Max**)



Invoque IRB140

```
clear
close all
mdl_irb140
```

Plot the IRB

```
irb140.plot(qz)
```