Exercise: IRB140's Working Space

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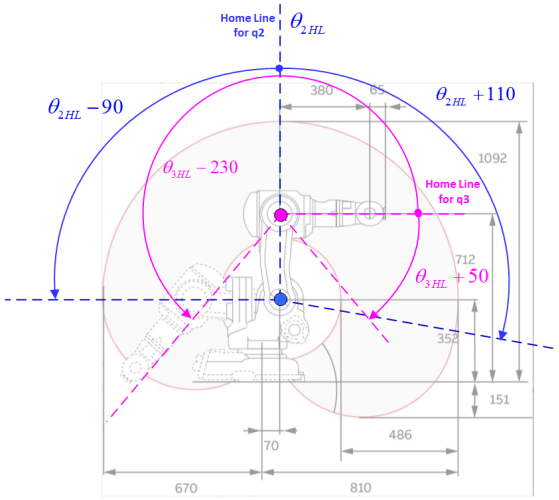
Plot the working area as shown in the figure

Link limits

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**)



$\max(\hat{X}) = 810 \rightarrow Link2 + Link3 + 70 = (712 - 352) + 380 + 70$

$\min(\hat{X}) = 670 \rightarrow Link2 + Link3 - 70 = (712 - 352) + 380 - 70$

$\max(\hat{Z}) = 1092 \rightarrow Link2 + Link3 + 352 = (712 - 352) + 380 + 352$

Invoque IRB140

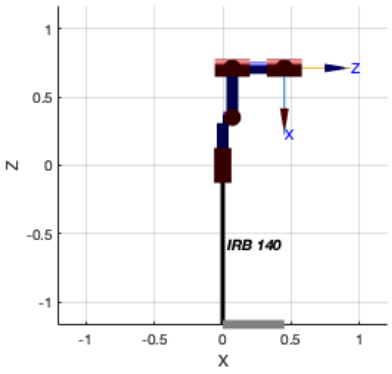
```
robot =

IRB 140 [ABB]:: 6 axis, RRRRRR, stdDH, fastRNE
+---+-----------+-----------+-----------+-----------+-----------+
| j |     theta |         d |         a |     alpha |    offset |
+---+-----------+-----------+-----------+-----------+-----------+
|  1|         q1|      0.352|       0.07|    -1.5708|          0|
|  2|         q2|          0|       0.36|          0|          0|
|  3|         q3|          0|          0|     1.5708|          0|
|  4|         q4|       0.38|          0|    -1.5708|          0|
|  5|         q5|          0|          0|     1.5708|          0|
|  6|         q6|          0|          0|          0|          0|
+---+-----------+-----------+-----------+-----------+-----------+
```

Plot the IRB at Home

You can play with teach for finding the same pose as in the figure.

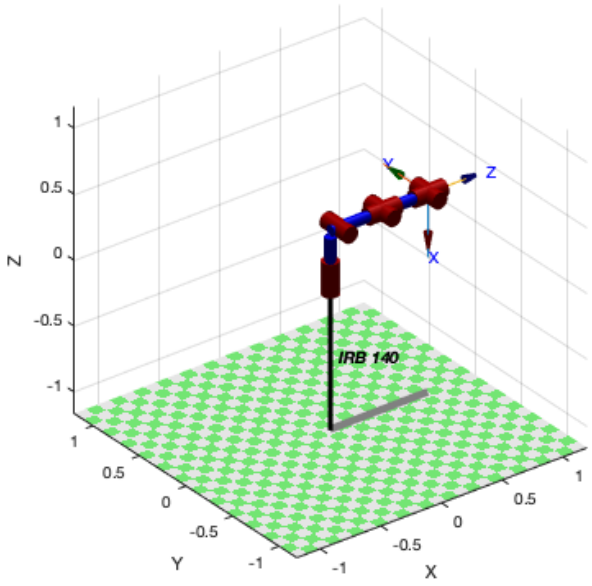
```
q_home = 1x6
         0   -1.5708    3.1416         0         0         0
```



Work space limits

q_max_X

```
q_max_x = 1x6
         0         0    1.5708         0         0         0
```

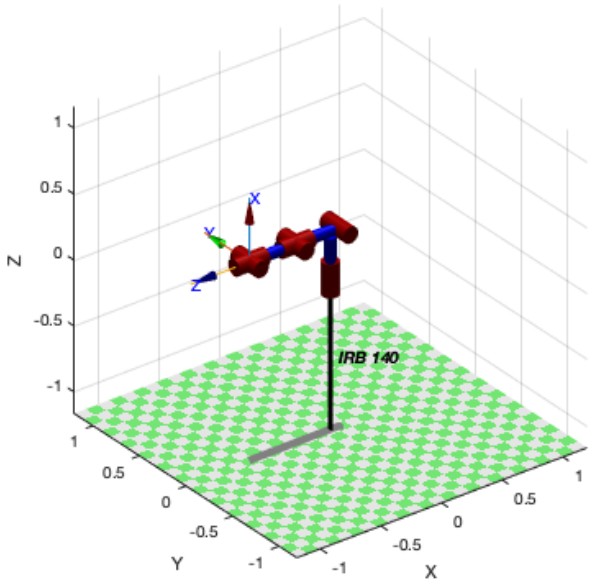



```
Pose_max_x =
         0         0         1      0.81
         0         1         0         0
        -1         0         0     0.352
         0         0         0         1

Position = 3x1
    0.8100
    0.0000
    0.3520
```

q_min_X

```
q_min_x = 1x6
         0   -3.1416    1.5708         0         0         0
```

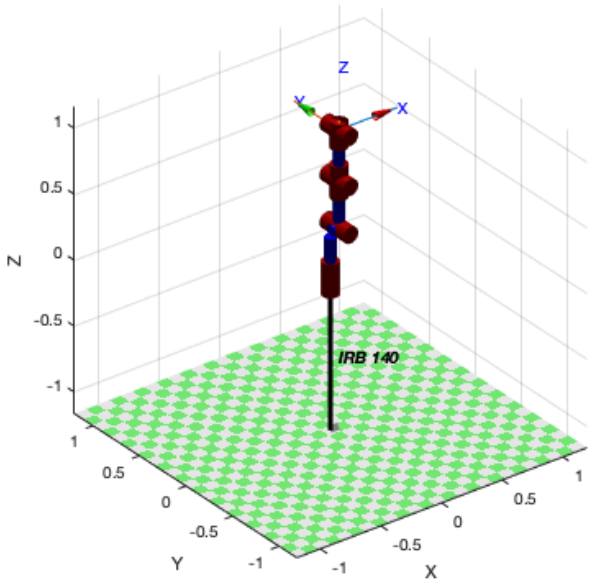



```
Pose_mim_x =
         0         0        -1     -0.67
         0         1         0         0
         1         0         0     0.352
         0         0         0         1


Position = 3x1
   -0.6700
    0.0000
    0.3520
```

q_max_Z

```
q_max_z = 1x6
         0   -1.5708    1.5708         0         0         0
```




```
Pose_max_z =
         1         0         0      0.07
         0         1         0         0
         0         0         1     1.092
         0         0         0         1


Position = 3x1
    0.0700
   -0.0000
    1.0920
```

Drawing the limits of the work space

Movement sequence: outer trajectory:

Start at {q2 = q2_home+110º & q3=q3_home+50º}

- Q1=Move only q3 from {q3_home+50º till q3_home-pi/2}. At the end q2 and q3 aligned
- Q2=Move only q2 from { q2_home+110º till q2_home-pi/2}
- Q3=Move only q3 from {q3_home-pi/2 till q3_home-230º}

Q1

```
q_start_pose_1 = 1x6
         0    0.3491    4.0143         0         0         0


q_end_pose_1 = 1x6
         0    0.3491    1.5708         0         0         0
```

Q1+Q2

```
q_start_pose_2 = 1x6
         0    0.3491    1.5708         0         0         0


q_end_pose_2 = 1x6
         0   -3.1416    1.5708         0         0         0
```

Q1+Q2+Q3

```
q_start_pose_3 = 1x6
         0   -3.1416    1.5708         0         0         0


q_end_pose_3 = 1x6
         0   -3.1416   -0.8727         0         0         0
```

Movement sequence inner trajectory:

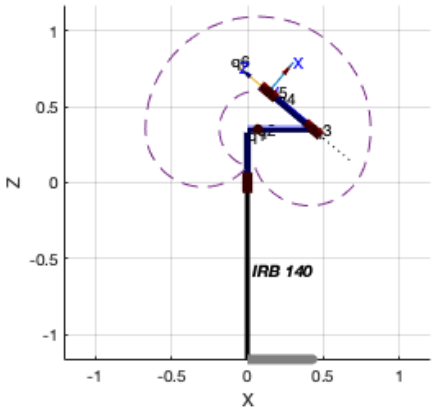
- Follow the same procedure

Q4

```
q_start_pose_4 = 1x6
         0   -3.1416   -0.8727         0         0         0


q_end_pose_4 = 1x6
         0         0   -0.8727         0         0         0


Animate: saving video --> irb140_WS.mp4 with profile 'MPEG-4'
```



Generate a video

Run:

irb140.plot(Q1_2_3_4,'trail','–','jaxes','zoom',2, 'view',[0 0],'movie','irb140_WS.mp4')