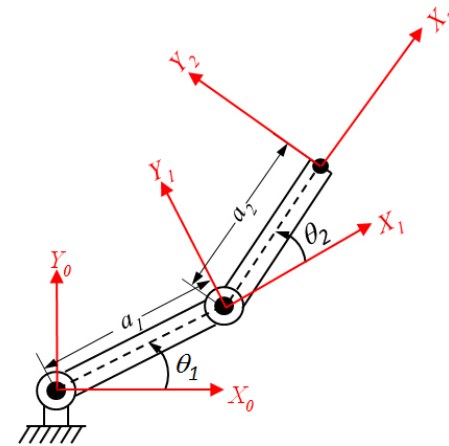


RTSX (Robotic Tools for Scilab/Xcos) Ver 1.00

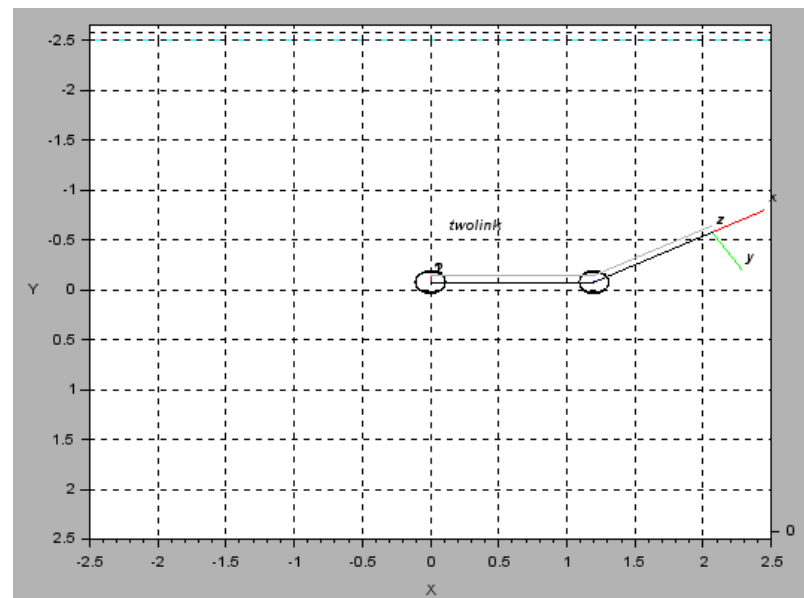
- Module manager - ATOMS / Robotics Toolbox 1.1.1
- <http://controlsystemslab.com/articles/>
- <http://www.mushindynamics.com/>
- <http://scilab.ninja/rtsx/>
- <http://scilab.ninja/download/RTSX1.0.zip>
- Telepítés:
- RTSX1.0.zip kicsomagolni a C:\Program Files\scilab-5.5.2\contrib\
• Change current directory
• C:\Program Files\scilab-5.5.2\contrib\Robotics_Toolbox
- `exec('C:\Program Files\scilab-5.5.2\contrib\Robotics_Toolbox\startup_rtsx.sce', -1)`

1. feladat

```
clear L;  
a1 = 1.2;  
a2 = 1;  
L1=Link([0 0 a1 0]);  
L2=Link([0 0 a2 0]); // theta d a alpha  
L=list(L1,L2);  
twolink=SerialLink(L);  
twolink.name='twolink';  
plot_robot(twolink, [0 -%pi/6]);
```

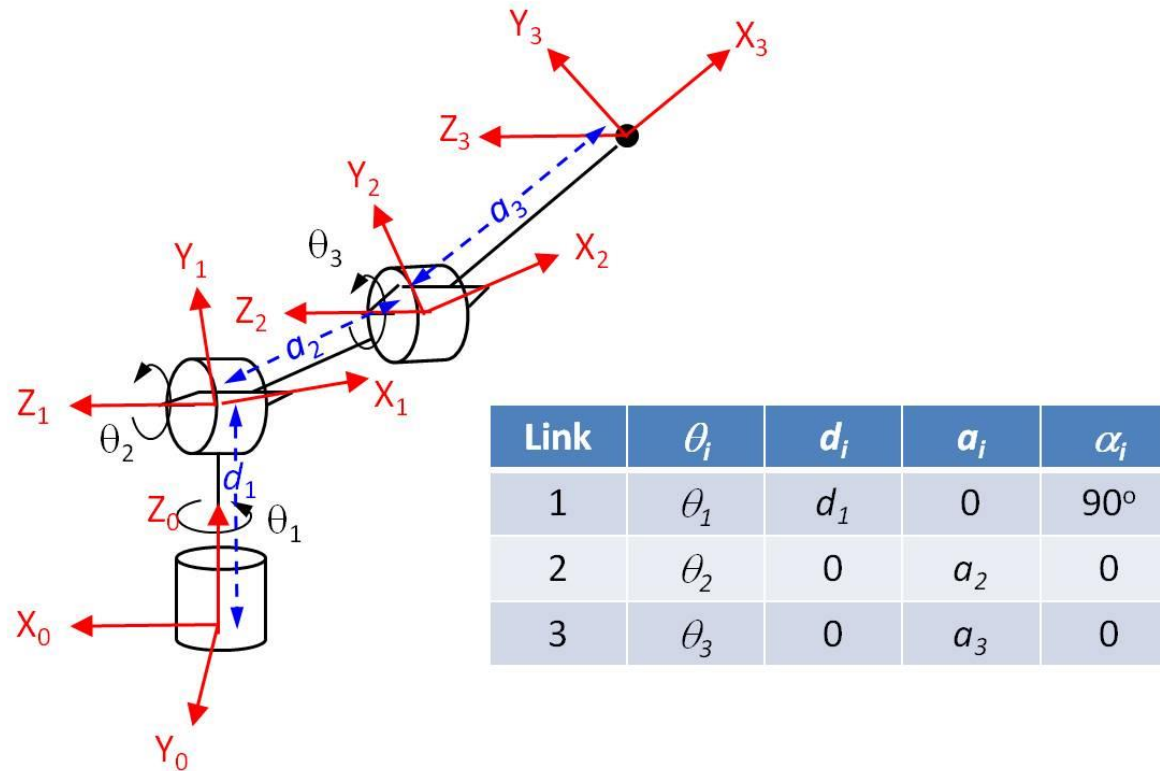


| link | θ_i | d_i | a_i | α_i |
|------|--------------|-------|-------|------------|
| 1 | θ_1^* | 0 | a_1 | 0 |
| 2 | θ_2^* | 0 | a_2 | 0 |



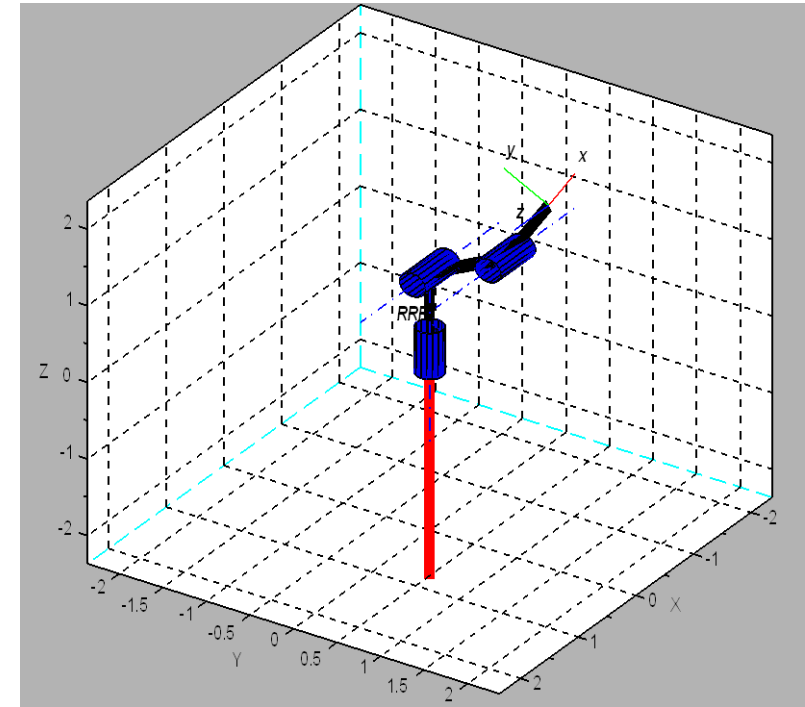
2. feladat

- RRR struktúra



2. feladat

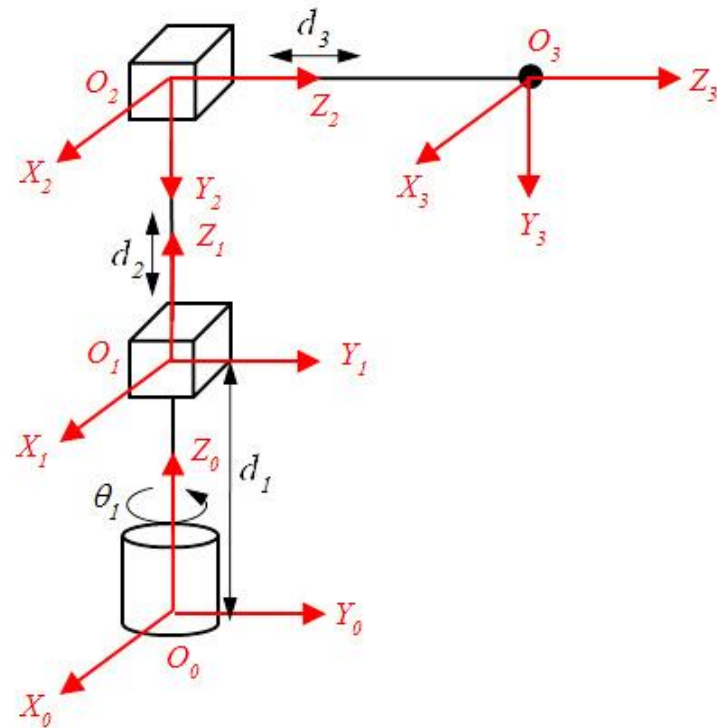
```
clear L;  
d1 = 1;  
a2 = 1;  
a3 = 1;  
L1= Link([0 d1 0 %pi/2]);  
L2=Link([0 0 a2 0]);  
L3=Link([0 0 a3 0]); // theta d a alpha  
L=list(L1,L2,L3);  
rrr_robot = SerialLink(L);  
//Robot_Info(rrr_robot);  
rrr_robot.name='RRR';  
plot_robot(rrr_robot,[%pi/2, %pi/6, %pi/6]);
```



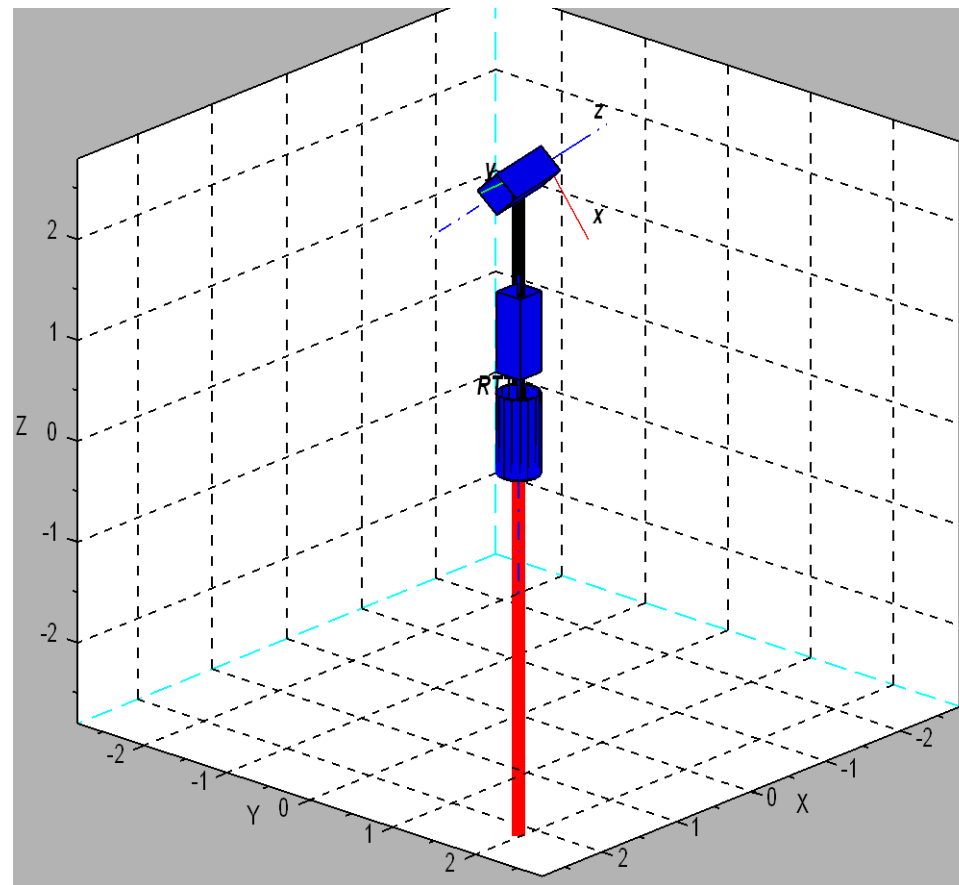
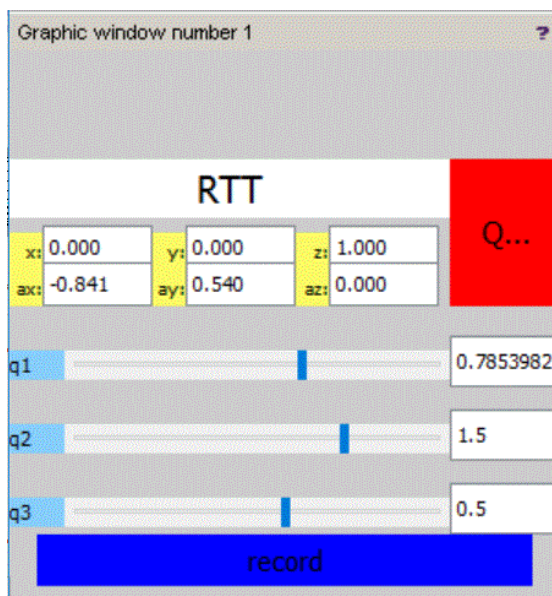
3. feladat

- RTT struktúra

```
clear;  
d1 = 1;  
d2 = 2; // d1, d2, d3 are joint variables  
d3 = 1;  
L1=Link([0 d1 0 0]); // theta d a alpha  
L2=Link([1 d2 0 -%pi/2 1]); // '1' prismatic joint  
L3=Link([1 d3 0 0 1]);  
L=list(L1,L2,L3);  
rtt_robot=SerialLink(L);  
rtt_robot.name='RTT';  
plot_robot(rtt_robot,[%pi/4 1.5 0.5]);  
teach(rtt_robot)
```

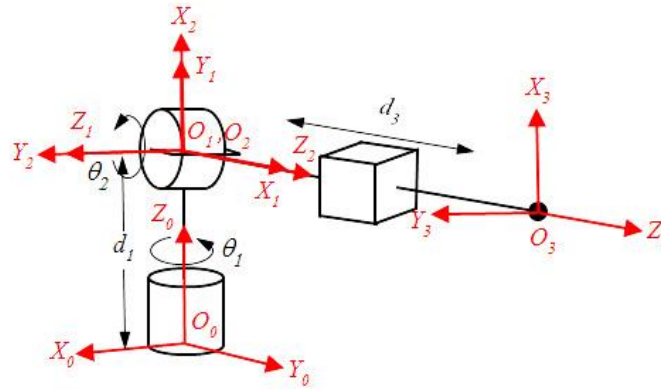


3. feladat

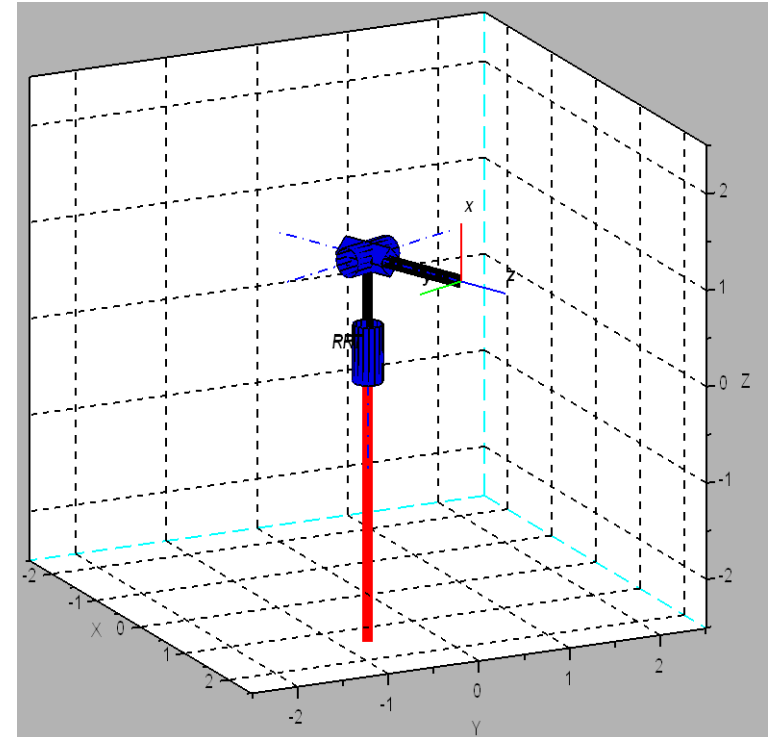


4. feladat

- RRT



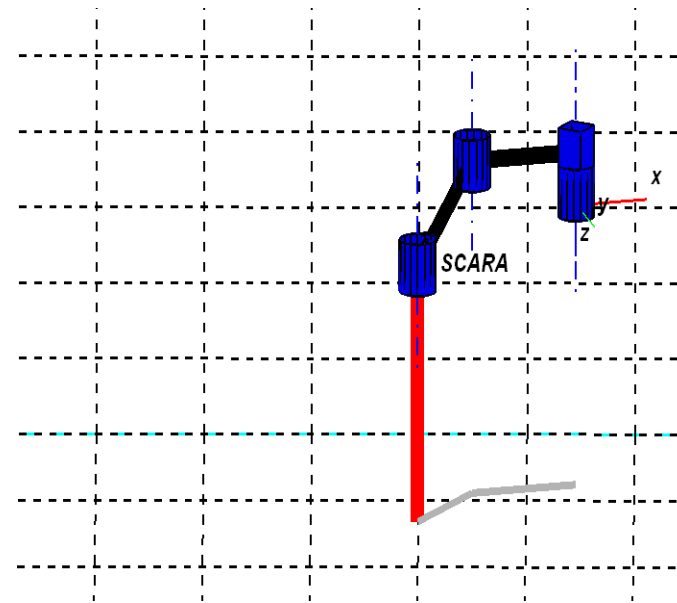
```
clear L;  
d1 = 1; // d1 and  
d3 = 2; // d3 is joint variable  
L1=Link([0 d1 0 %pi/2]);  
L2=Link([0 0 0 %pi/2]);  
L3=Link([0 d3 0 0 1]);  
L=list(L1,L2,L3);  
rrt_robot=SerialLink(L);  
rrt_robot.name='RRT';  
plot_robot(rrt_robot,[1 %pi/2 1.3]);  
teach(rrt_robot)
```



5. feladat

- SCARA

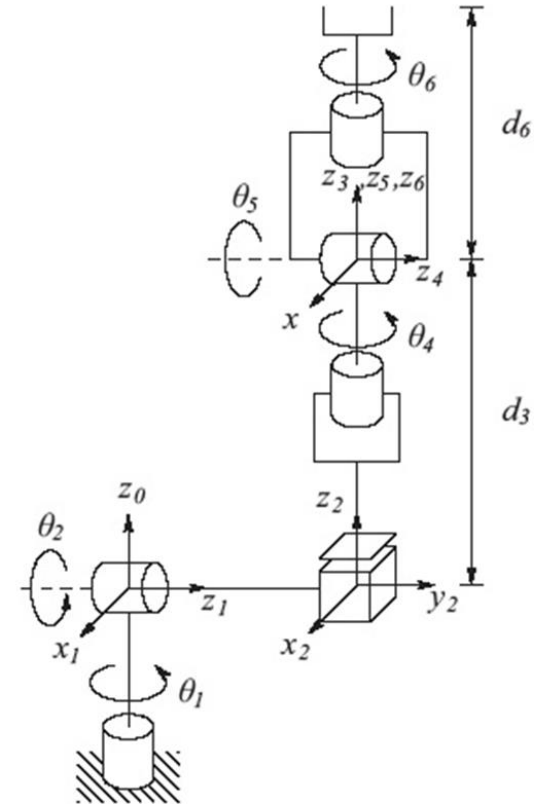
```
clear L;  
d1 = 1;  
a1 = 1;  
a2 = 1;  
d3 = 0.2; // joint variable  
d4 = 0.2;  
L1=Link([0 d1 a1 0]);  
L2=Link([0 0 a2 %pi]);  
L3=Link([0 d3 0 0 1]);  
L4=Link([0 d4 0 0]);  
L=list(L1,L2,L3,L4);  
scara_robot=SerialLink(L);  
scara_robot.name='SCARA';  
plot_robot(scara_robot,[%pi/3 -%pi/4 0.5 0]);  
teach(scara_robot)
```



6. feladat

- Stanford

```
L1 = Link([ 0 0.412 0 -%pi/2 0]);  
L2 = Link([0 0.154 0 %pi/2 0]);  
L3 = Link([-%pi/2 0 0 0 1 1]);  
L4 = Link([0 0 0 -%pi/2 0]);  
L5 = Link([0 0 0 %pi/2 0]);  
L6 = Link([0 0.263 0 0 0]);  
L=list(L1,L2,L3,L4,L5,L6);  
stanford= SerialLink(L);  
stanford.name='Stanford arm';  
plot_robot(stanford,[0 %pi/2 0.3 0 %pi/4 0]);  
teach(stanford)
```



7. feladat

- Puma p560

// th d a alpha

```
L1 = Link([ 0 0 0 %pi/2 0]);
```

```
L2 = Link([ 0 0 0.4318 0 0]);
```

```
L3 = Link([ 0 0.15005 0.0203 -%pi/2 0]);
```

```
L4 = Link([ 0 0.4318 0 %pi/2 0]);
```

```
L5 = Link([ 0 0 0 -%pi/2 0]);
```

```
L6 = Link([ 0 0 0 0 0]);
```

```
L=list(L1,L2,L3,L4,L5,L6);
```

```
p560 = SerialLink(L);
```

```
p560.name='Puma P560';
```

```
q_z = [0 0 0 0 0 0]; // zero angles, L shaped pose
```

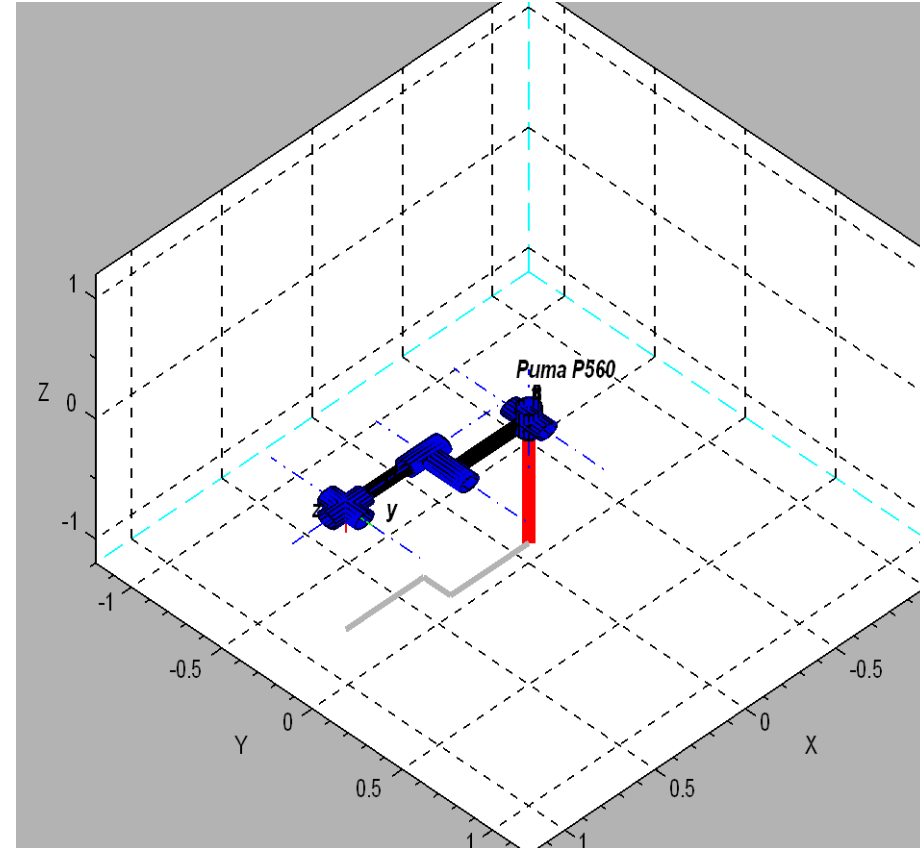
```
q_r = [0 %pi/2 -%pi/2 0 0 0]; // ready pose, arm up
```

```
q_s = [0 0 -%pi/2 0 0 0];
```

```
q_n=[0 %pi/4 %pi 0 %pi/4 0];
```

```
plot_robot(p560,q_s);
```

```
teach(p560)
```



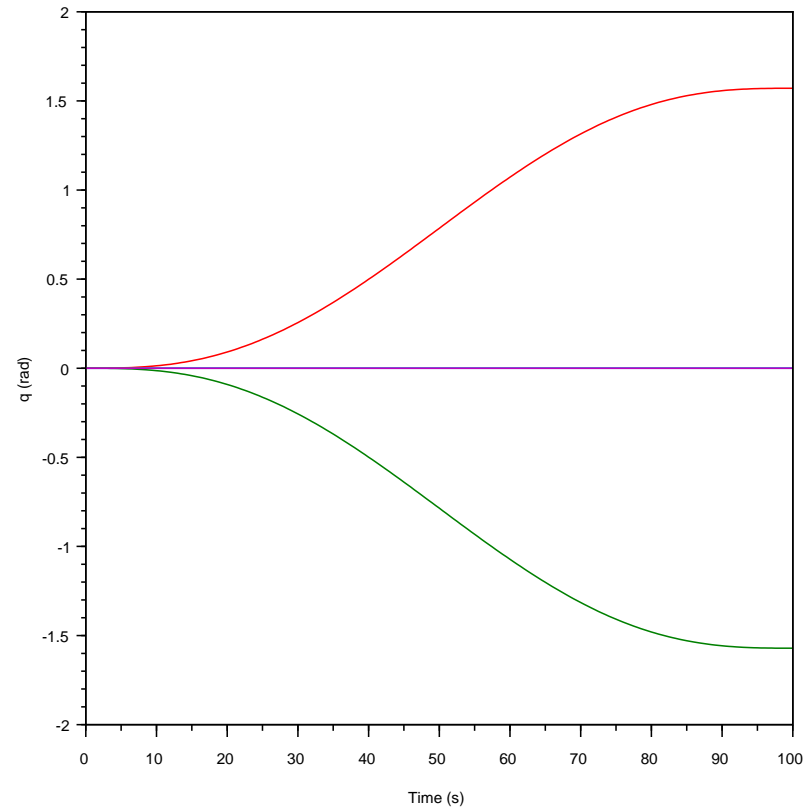
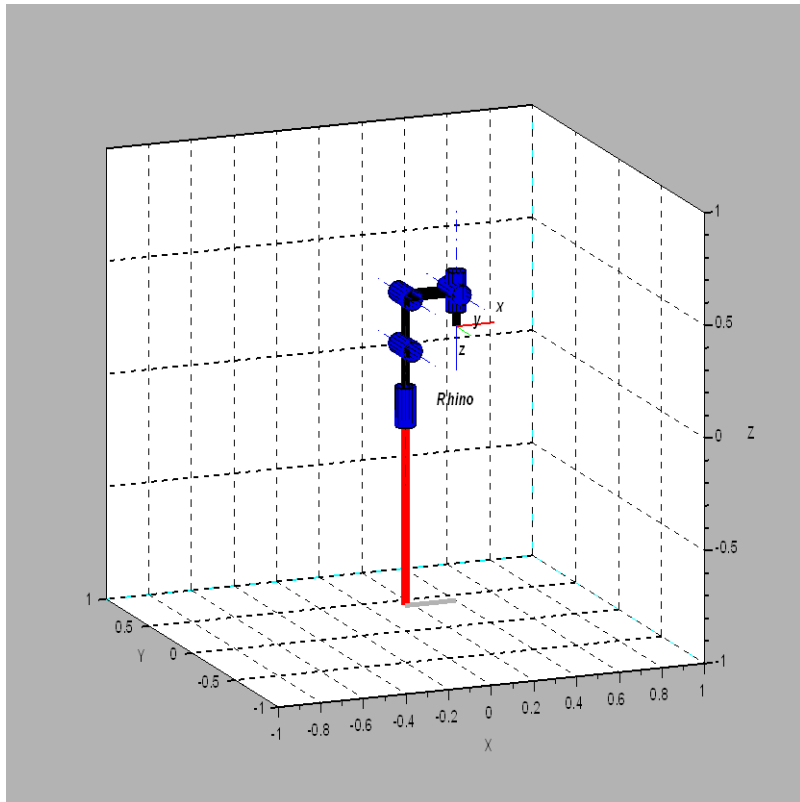
8. feladat

```
clear L;
a1 = 1.2;
a2 = 1;
L1=Link([0 0 a1 0]);
L2=Link([0 0 a2 0]);
L=list(L1,L2);
twolink=SerialLink(L);
twolink.name='twolink';

// a 2-link manipulator
// generate simple setpoints
// both joints move full circle
t = [0:0.01:1]';
// "time" data
qs = [%pi*t %pi/2*t];
for q=qs'
plot_robot(twolink,q');
end
```

9. feladat

- Rhino

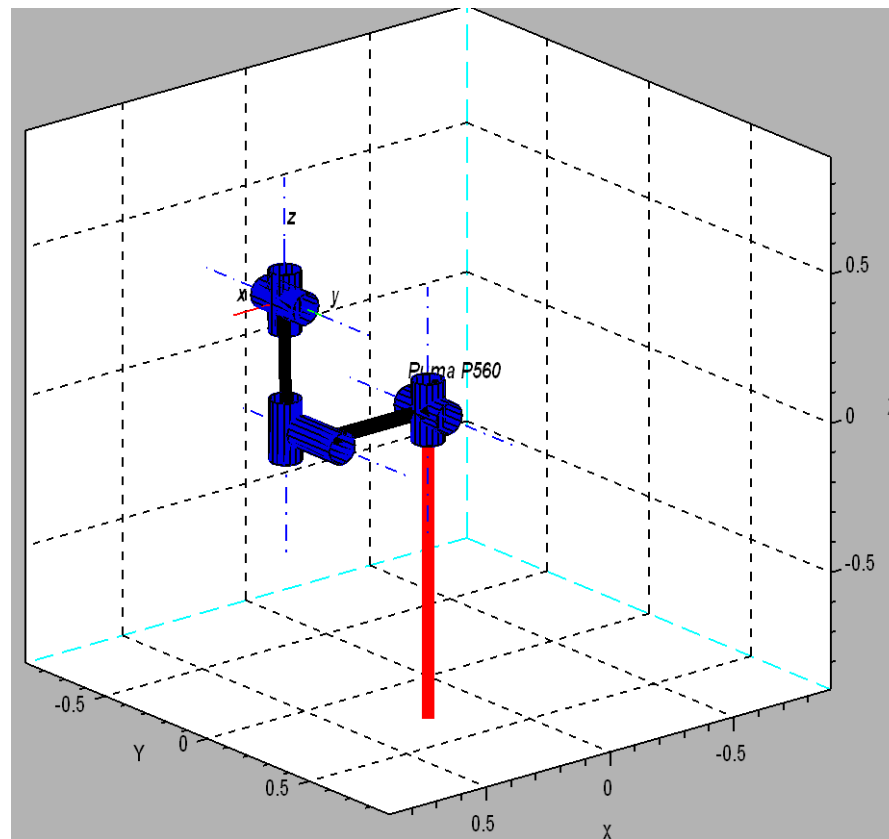


9. feladat

```
clear all
// th d a alpha
L1 = Link([0 0.26035 0 -%pi/2]);
L2 = Link([-%pi/2 0 0.2286 0]);
L3 = Link[%pi/2 0 0.2286 0];
L4 = Link([0 0 0.009525 -%pi/2]);
L5 = Link([0 0.15875 0 0]);
L=list(L1,L2,L3,L4,L5);
Rhino = SerialLink(L, 'Rhino');
Rhino.name='Rhino';
q0 = [0 0 0 0 0];
qinit = [0 -%pi/2 %pi/2 0 0];
t = [0:0.5:100];
q = jtraj(q0, qinit, t);
plot(t,q)
xlabel('Time (s)')
ylabel('q (rad)')
for qq=q'
plot_robot(Rhino,qq')
end
```

10. feladat

- Összetett mozgásterv



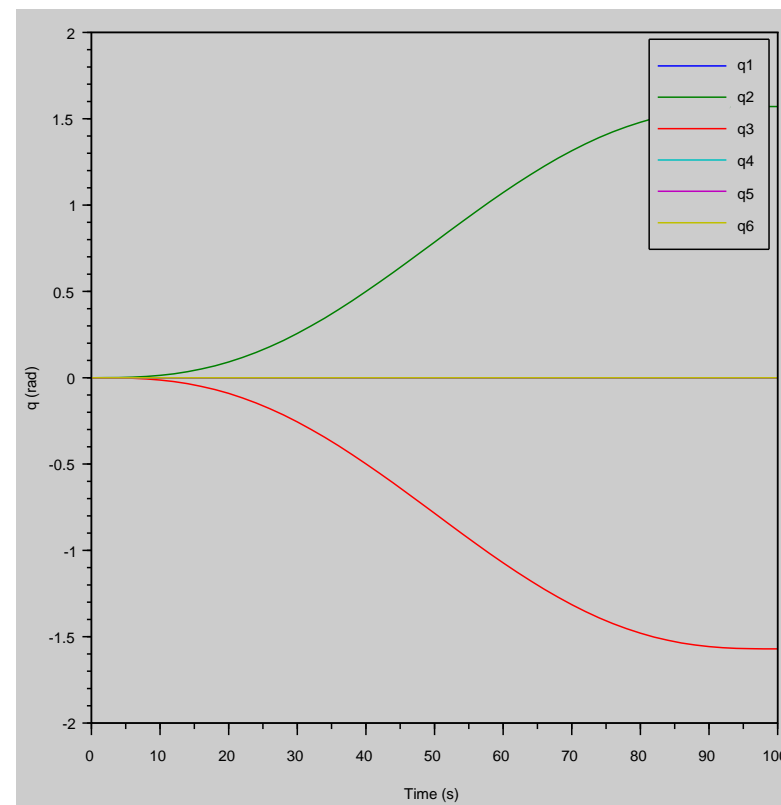
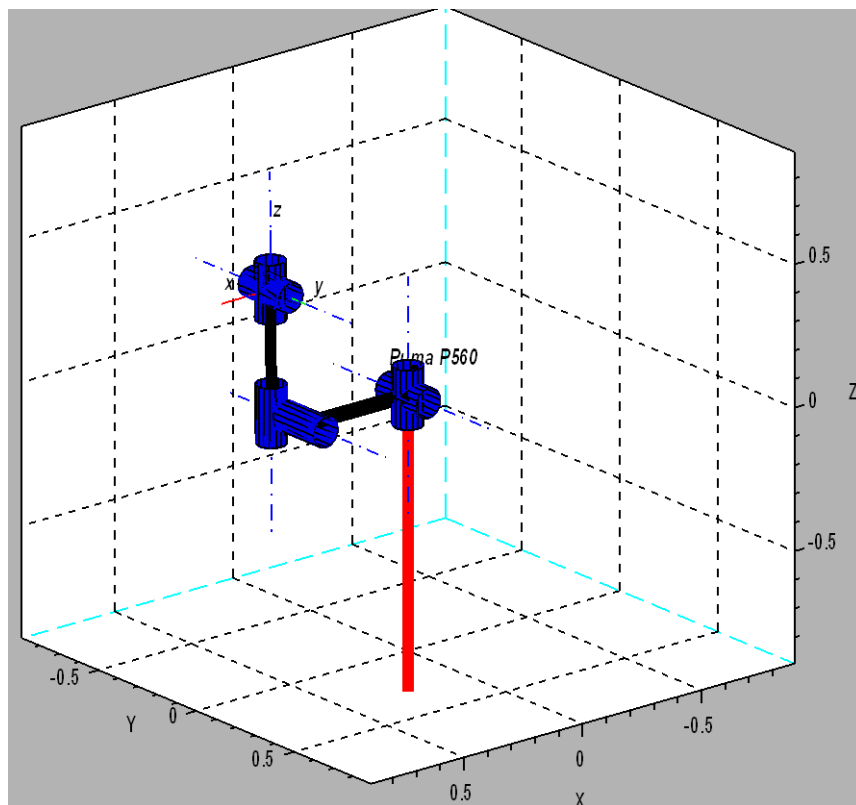
10. feladat

```
clear L; // th d a alpha
L1 = Link([ 0 0 0 %pi/2 0]);
L2 = Link([ 0 0 0.4318 0 0]);
L3 = Link([ 0 0.15005 0.0203 -%pi/2 0]);
L4 = Link([ 0 0.4318 0 %pi/2 0]);
L5 = Link([ 0 0 0 -%pi/2 0]);
L6 = Link([ 0 0 0 0 0]);
L=list(L1,L2,L3,L4,L5,L6);
p560 = SerialLink(L);
p560.name='Puma P560';
q_z = [0 0 0 0 0 0]; // zero angles, L shaped pose
q_r = [0 %pi/2 -%pi/2 0 0 0]; // ready pose, arm up
q_s = [0 0 -%pi/2 0 0 0];
q_n=[0 %pi/4 %pi 0 %pi/4 0]; //plotrobot(p560,q_r)
t = [0:2:100];
while(1)
q = jtraj(q_z, q_n, t);
for qq=q'
plot_robot(p560,qq')
```

```
end
q = jtraj(q_n, q_r, t);
for qq=q'
plot_robot(p560,qq')
end
q = jtraj(q_r, q_s, t);
for qq=q'
plot_robot(p560,qq')
end
q = jtraj(q_s, q_z, t);
for qq=q'
plot_robot(p560,qq')
end
end
```

11. feladat

- q plot



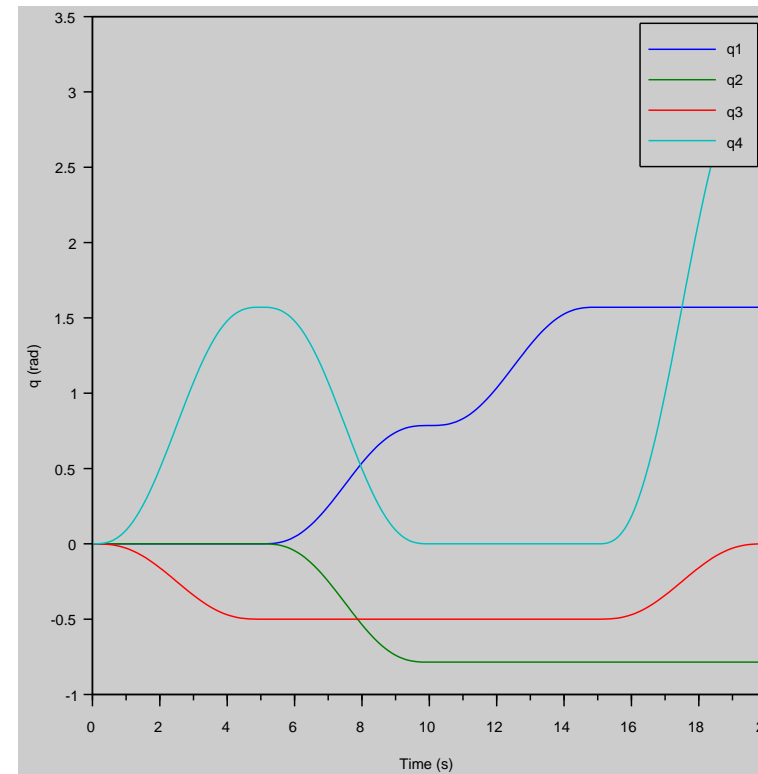
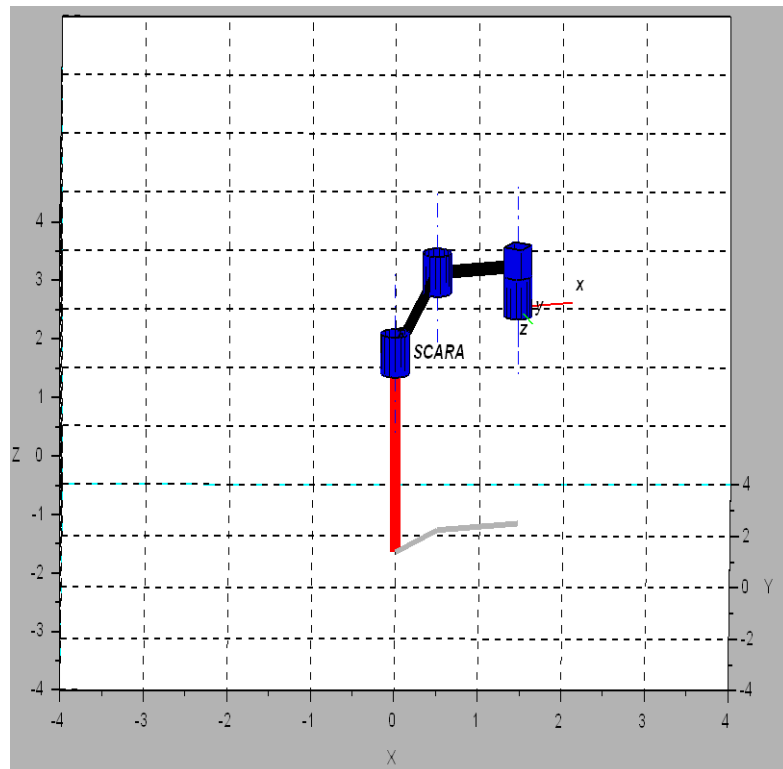
11. feladat

```
clear L; // th d a alpha
L1 = Link([ 0 0 0 %pi/2 0]);
L2 = Link([ 0 0 0.4318 0 0]);
L3 = Link([ 0 0.15005 0.0203 -%pi/2 0]);
L4 = Link([ 0 0.4318 0 %pi/2 0]);
L5 = Link([ 0 0 0 -%pi/2 0]);
L6 = Link([ 0 0 0 0 0]);
L=list(L1,L2,L3,L4,L5,L6);
p560 = SerialLink(L);
p560.name='Puma P560';
q_z = [0 0 0 0 0 0]; // zero angles, L shaped
pose
q_r = [0 %pi/2 -%pi/2 0 0 0]; // ready pose,
arm up
q_s = [0 0 -%pi/2 0 0 0];
```

```
q_n=[0 %pi/4 %pi 0 %pi/4 0];
//plotrobot(p560,q_r)
t = [0:2:100];
q = jtraj(q_z, q_r, t); // Plot
figure(1);
plot(t,q);
xlabel('Time (s)');
ylabel('q (rad)');
legend({'q1','q2','q3','q4','q5','q6'},'FontSize',
8,'FontWeight','bold')
for qq=q'
plot_robot(p560,qq')
end
```

12. feladat

- SCARA



12. feladat

```
clear L;
d1 = 1;
a1 = 1;
a2 = 1;
d3 = 0.5; // joint variable
d4 = 0;
L1=Link([0 d1 a1 0]);
L2=Link([0 0 a2 %pi]);
L3=Link([0 d3 0 0 1]);
L4=Link([0 d4 0 0]);
L=list(L1,L2,L3,L4);
scara_robot=SerialLink(L);
scara_robot.name='SCARA';
// plotrobot(scara_robot,[pi/3 -pi/4 0.5 0]);
//definition of time series
tab = [0:0.1:5]; t= [tab 5+tab 10+tab 15+tab];
//Generating coordinates
aq = itraj([0 0 0 0] ,[0 0 -0.5 %pi/2], tab);
bq = itraj([0 0 -0.5 %pi/2],[%pi/4 -%pi/4 -0.5 0], tab);
```

```
cq = itraj([%pi/4 -%pi/4 -0.5 0],[%pi/2 -%pi/4 -0.5 0],
tab);
dq = itraj([%pi/2 -%pi/4 -0.5 0],[%pi/2 -%pi/4 0 %pi],
tab);
// generating one movement series from the four
movements
q = [aq; bq; cq; dq];
// Plot
figure(1);
plot(t,q);
xlabel('Time (s)');
ylabel('q (rad)');
legend({'q1','q2','q3','q4'},'FontSize',8,'FontWeight','bold')
for qq=q'
plot_robot(scara_robot,qq')
end
```

13. feladat

```
clear;
d1 = 1;
a2 = 1;
a3 = 1;
L1=Link([0 d1 0 %pi/2]);
L2=Link([0 0 a2 0]);
L3=Link([0 0 a3 0]);
L=list(L1,L2,L3);
RRR_robot=SerialLink(L);
q0 = [0 -%pi/2 0];
T=fkine(RRR_robot,q0)
// From a robot model and a vector of joint variable values, compute homogeneous
transformation matrices from tool frame to base.
disp(T)
```

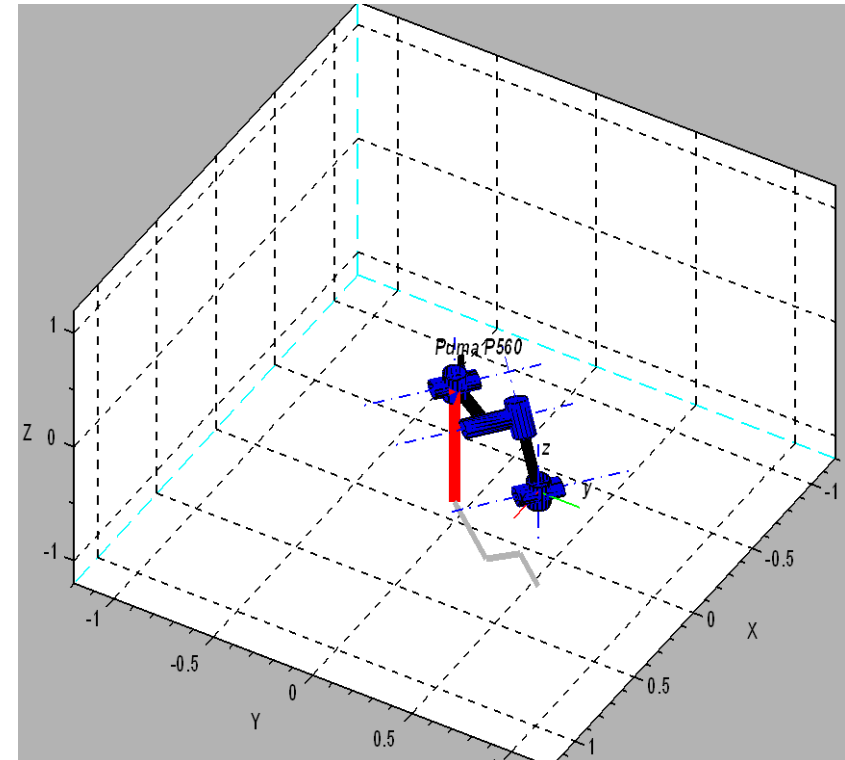
```
-->T
T =

    0.    1.    0.    0.
    0.    0.   -1.    0.
   -1.    0.    0.   -1.
    0.    0.    0.    1.

-->
```

14. feladat

```
clear L; // szegmensek definiálása az értékek theta d a alpha
L1 = Link([ 0 0 0 %pi/2 0]);
L2 = Link([ 0 0 0.4318 0 0]);
L3 = Link([ 0 0.15005 0.0203 -%pi/2 0]);
L4 = Link([ 0 0.4318 0 %pi/2 0]);
L5 = Link([ 0 0 0 -%pi/2 0]);
L6 = Link([ 0 0 0 0 0]);
L=list(L1,L2,L3,L4,L5,L6); //Robot definiálása
p560 = SerialLink(L);
p560.name='Puma P560';
t = [0:.5:100]; // idővektor
T1 = transl(0.3, -0.6, 0.4) // kezdő pont(X,Y,Z)
T2 = transl(0.3, 0.6, -0.2) // végpont (X,Y,Z)
T = ctraj(T1, T2, length(t)); // pálya kiszámítása
q = ikine6s(p560, T); // Inverz kinematika
for p=q' //animálás
plot_robot(p560,p');
end
```



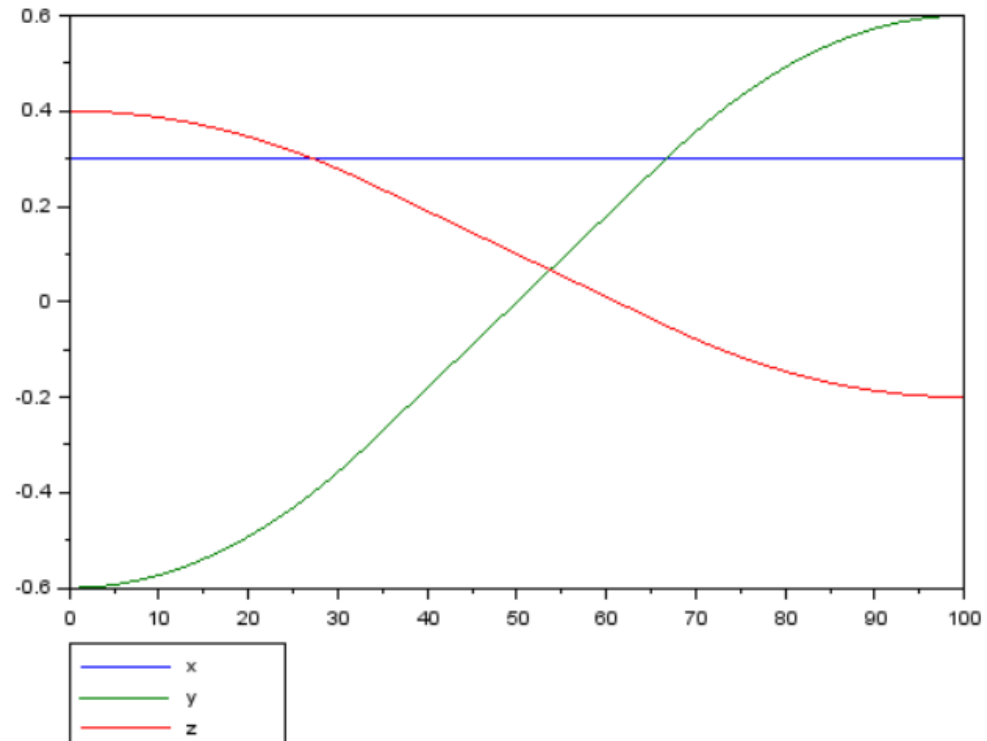
14. feladat

```
x=[];  
y=[];  
z=[];  
for i=1:size(t,2)  
    x(i)=T(:,i)(1,4);  
    y(i)=T(:,i)(2,4);  
    z(i)=T(:,i)(3,4);  
end
```

```
end
```

```
plot(t',[x y z])
```

```
legend({'x','y','z'},'FontSize',8,'FontWeight','bold','pos',"lower_caption")
```



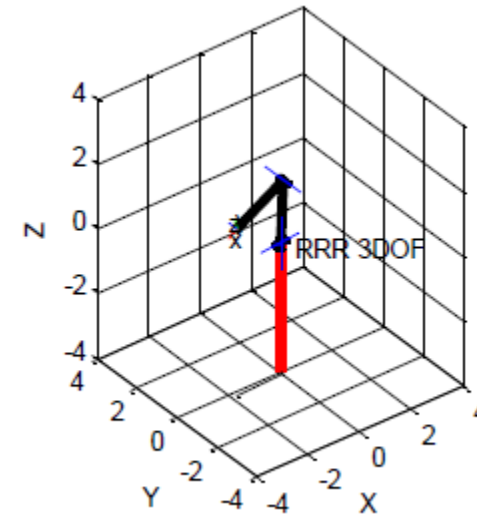
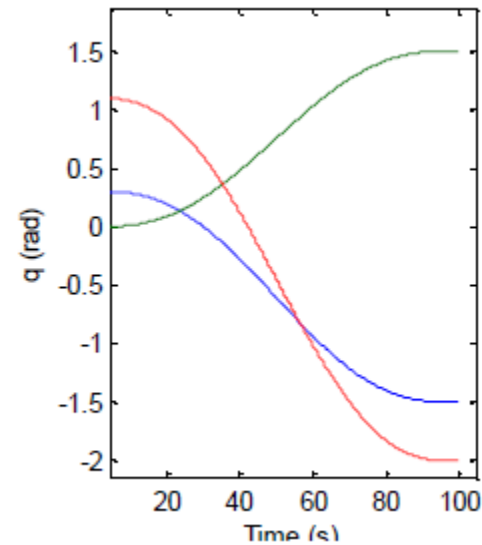
15. feladat

- V alak (megpróbálni T-t)

```
clear L;
L1 = Link([ 0 0 0 %pi/2 0]);
L2 = Link([ 0 0 0.4318 0 0]);
L3 = Link([ 0 0.15005 0.0203 -%pi/2 0]);
L4 = Link([ 0 0.4318 0 %pi/2 0]);
L5 = Link([ 0 0 0 -%pi/2 0]);
L6 = Link([ 0 0 0 0 0]);
L=list(L1,L2,L3,L4,L5,L6);
rob=SerialLink(L);
rob.name='Puma P560';
t = [0:0.5:100];
T1 = transl(0.6, 0.3, 0.3)
T2 = transl(0.3, 0, 0.3)
T3 = transl(0.6, -0.3, 0.3)
Ta = ctraj(T1, T2, length(t));
Tb = ctraj(T2, T3, length(t));
q1 = ikine6s(rob, Ta);
q2 = ikine6s(rob, Tb);
q=[q1;q2];
for p=q
plot_robot(rob,p');
end
```

16. feladat

- RRR
- (kék, zöld, piros)
- $L1 = \text{Link}([\ \%pi/2\ 0\ 0\ 0\ 0]);$
- $L2 = \text{Link}([\ -\%pi/2\ 2\ 0\ 0\ 0]);$
- $L3 = \text{Link}([\ 0\ 2\ 0\ 0\ 0]);$



16. feladat

```
clear L;  
L1 = Link([ %pi/2 0 0 0 0]);  
L2 = Link([ -%pi/2 2 0 0 0]);  
L3 = Link([ 0 2 0 0 0]);  
L=list(L1,L2,L3);  
rob=SerialLink(L);  
rob.name='RRR';  
qz=[0.3 0 1.1];  
qt=[-1.5 1.5 -2];  
q=jtraj(qz, qt, t);  
plot(t,q)  
xlabel('Time (s)')  
ylabel('q (rad)')  
for p=q'  
plot_robot(rob,p');  
end
```