2nd HomeWork, Robotic 3992

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1)DH Parameters:

Sample code:

```
alpha = sym(-pi/2);
theta = theta1;
d=L1+L3;
a=0;
T1=[cos(theta), -sin(theta)*cos(alpha), sin(theta)*sin(alpha), a*cos(theta);
    sin(theta), cos(theta)*cos(alpha), -cos(theta)*sin(alpha), a*sin(theta);
    0         , sin(alpha)           , cos(alpha)            ,            d;
    0         , 0                    , 0                     ,            1];
```

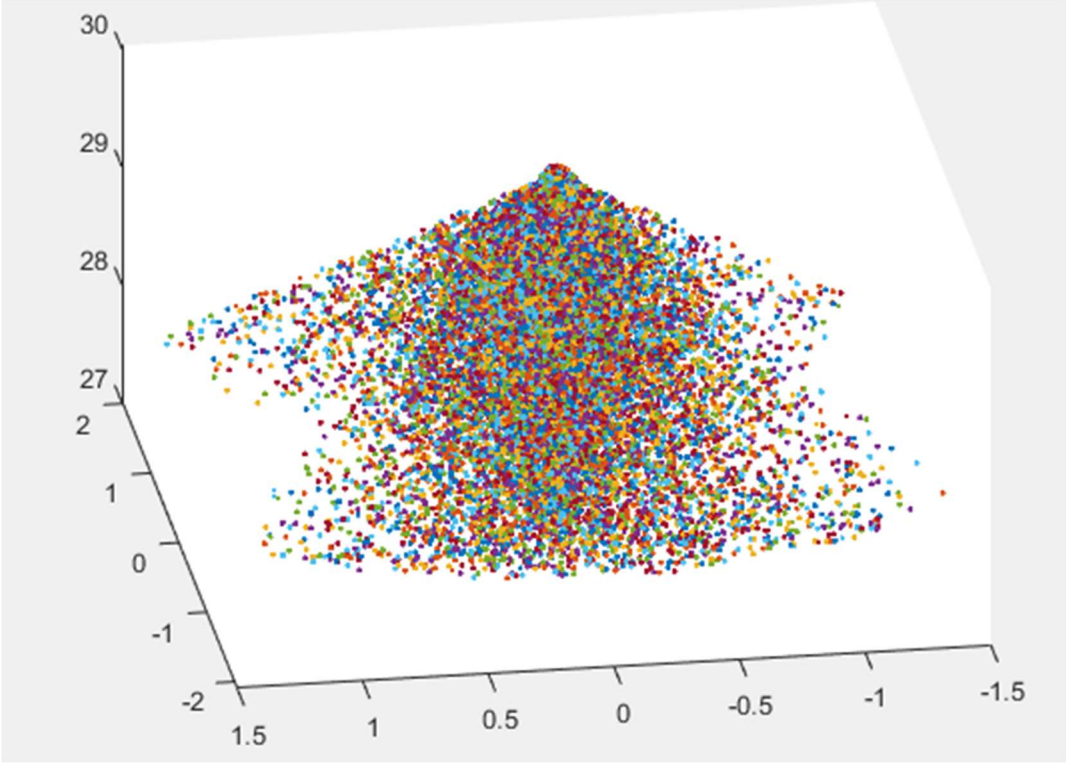
2) Successive Screw:

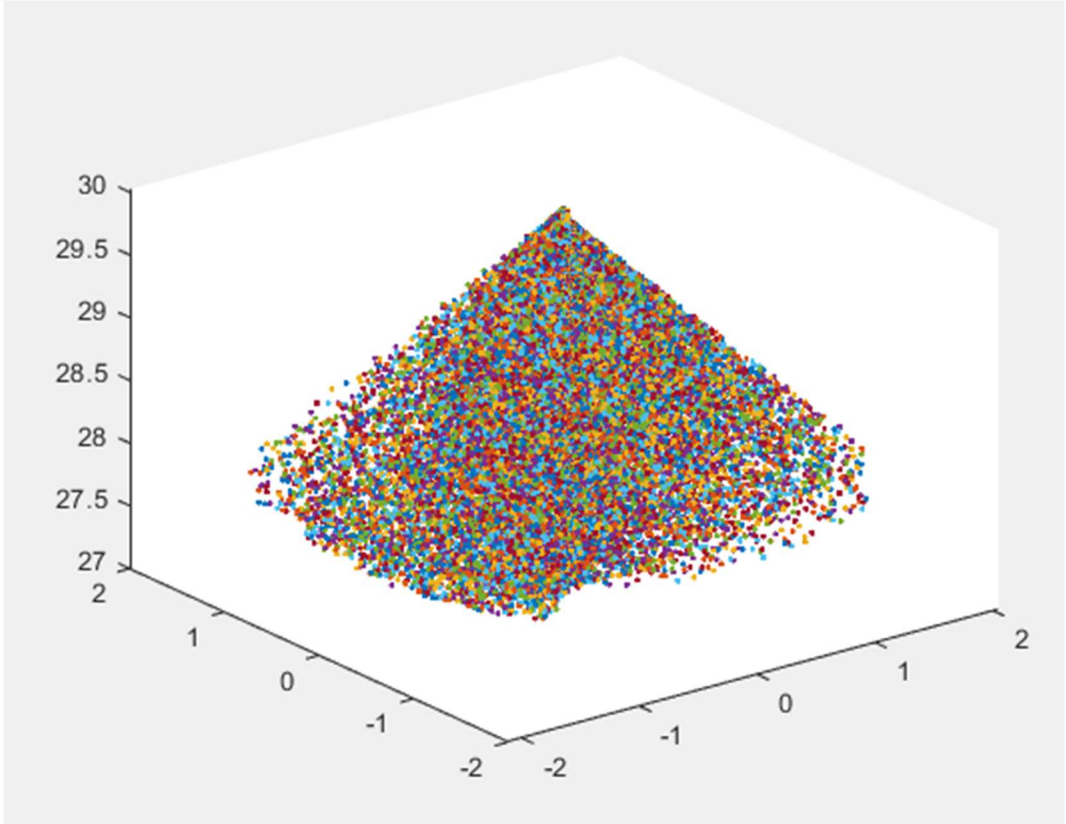
Sample code:

```
sx=0;
sy=0;
sz=1;
sox=0;
soy=0;
soz=0;
st=sin(theta1);
ct=cos(theta1);
vt=1-cos(theta1);
d=sox*sx+soy*sy+soz*sz;

px=d*sx-sox*(sx^2-1)*vt-soy*(sx*sy*vt-sz*st)-soz*(sx*sz*vt+sy*st);
py=d*sy-sox*(sy*sx*vt+sz*st)-soy*(sy^2-1)*vt-soz*(sy*sz*vt-sx*st);
pz=d*sz-sox*(sz*sx*vt-sy*st)-soy*(sz*sy*vt+sx*st)-soz*(sz^2-1)*vt;
A1=[sx^2*vt+ct, sx*sy*vt-sz*st, sx*sz*vt+sy*st, px;
   sy*sx*vt+sz*st, sy^2*vt+ct, sz*sy*vt-sx*st, py;
   sx*sz*vt-sy*st, sy*sz*vt+sx*st, sz^2*vt+ct,pz;
   0             , 0             , 0         , 1];
```

3)Workspace:

```
% Inserting D-H convention parameters
a1 = 0; alpha1 = -pi/2; d1 = 30;
a2 = 0; alpha2 = -pi/2; d2 = 0;
a3 =-0.045; alpha3 = pi/2; t3 = 0;

% Inserting joint limits for Arms
t1_min = -pi/4; t1_max = pi/4;
t2_min = -pi/4; t2_max = pi/4;
d3_min = 0; d3_max = 3;

% Monte Carlo method
% sampling size
N = 20000;
t1 = t1_min + (t1_max-t1_min)*rand(N,1);
t2 = t2_min + (t2_max-t2_min)*rand(N,1);
d3 = d3_min + (d3_max-d3_min)*rand(N,1);

for i = 1:N
A1 = TransMat(a1,alpha1,d1,t1(i));
A2 = TransMat(a2,alpha2,d2,t2(i));
A3 = TransMat(a3,alpha3,d3(i),t3);

T = A1*A2*A3;
X=T(1,4);
Y=T(2,4);
Z=T(3,4);
plot3(X,Y,Z,'.')
hold on;
end



function [ T ] = TransMat( a,b,c,d )

T = [ cos(d) -sin(d)*cos(b) sin(d)*sin(b) a*cos(d);
    sin(d) cos(d)*cos(b) -cos(d)*sin(b) a*sin(d);
0 sin(b) cos(b) c;
0 0 0 1];
end
```


30
29
28
27
2
1
0
-1
-2
1.5
1
0.5
0
-0.5
-1
-1.5


30
29.5
29
28.5
28
27.5
27
2
1
0
-1
-2
-2
-1
0
1
2