Transformation: Hints & Cues

Follow this order to stablish the ordered transformations

Table of Contents

Part of reference

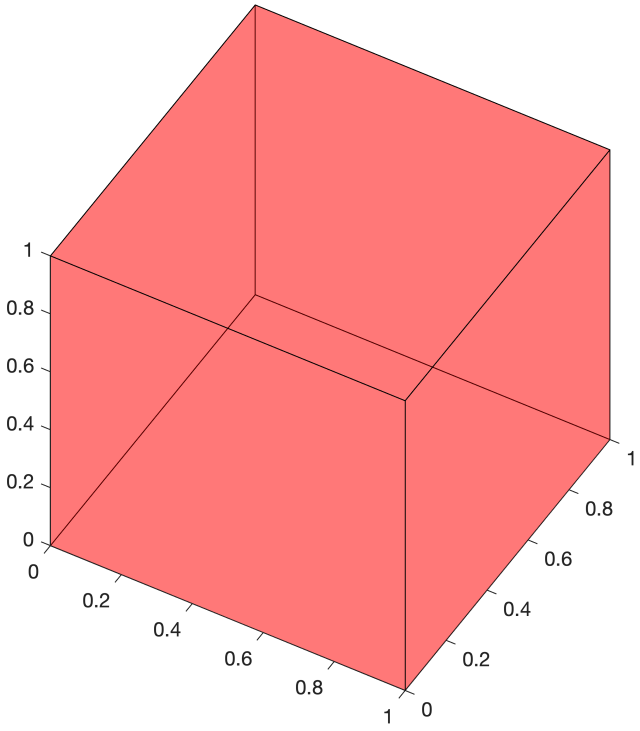
```
clear
close all
clf
v= [0 0 0;1 0 0;1 1 0;0 1 0;0 0 1;1 0 1;1 1 1;0 1 1]
```

```
v = 8×3
     0     0     0
     1     0     0
     1     1     0
     0     1     0
     0     0     1
     1     0     1
     1     1     1
     0     1     1
```

```
f = [1 2 6 5;2 3 7 6;3 4 8 7;4 1 5 8;1 2 3 4;5 6 7 8]
```

```
f = 6×4
     1     2     6     5
     2     3     7     6
     3     4     8     7
     4     1     5     8
     1     2     3     4
     5     6     7     8
```

```
patch('Vertices',v,'Faces',f,'FaceVertexCData',hsv(6),'FaceColor','r','FaceAlpha',0.3)
view(30,45)
axis equal
```



Part 1

At origen

Scaling vertices and visualize it

```
H=2
```

```
H = 2
```

```
W=0.9
```

```
W = 0.9000
```

```
D=0.08
```

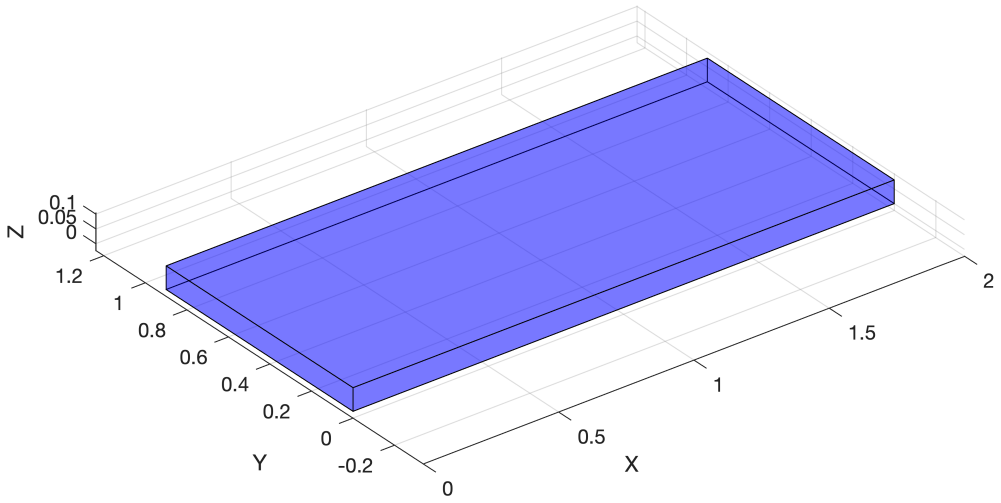
```
D = 0.0800
```

```
v_1=[H 0 0;0 W 0;0 0 D]*v'
```

```
v_1 = 3×8
         0    2.0000    2.0000         0         0    2.0000    2.0000         0
         0         0    0.9000    0.9000         0         0    0.9000    0.9000
         0         0         0         0    0.0800    0.0800    0.0800    0.0800
```

```
figure
patch('Vertices',v_1(1:3,:)','Faces',f,'FaceVertexCData',hsv(6),'FaceColor','b','FaceAl
grid on
xyzlabel
axis equal
```

```
view(3)
```



Part 2

At origen

Scaling vertices and visualize it

```
H=1.6 % x
```

```
H = 1.6000
```

```
W=0.6 % y
```

```
W = 0.6000
```

```
D=0.2 % z
```

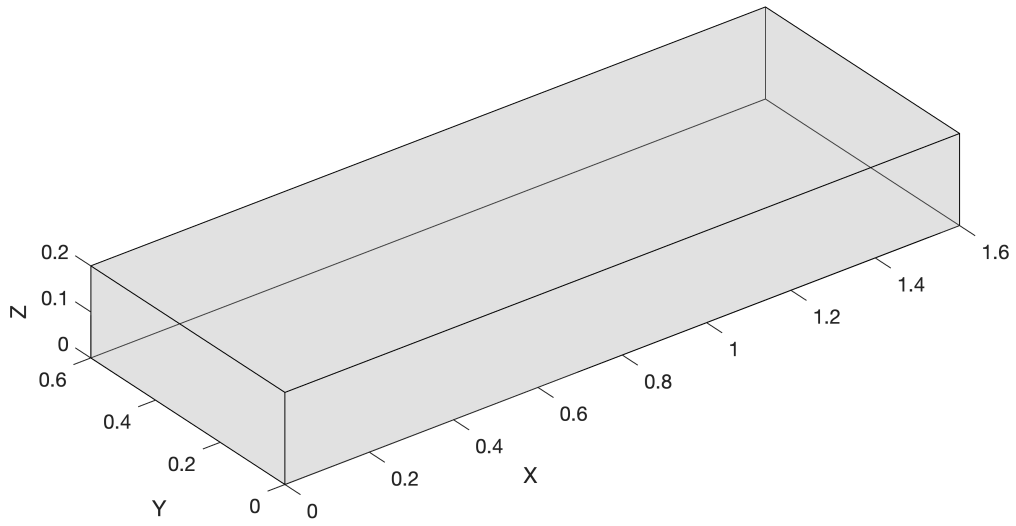
```
D = 0.2000
```

```
v_2=[H 0 0;0 W 0;0 0 D]*v'
```

```
v_2 = 3×8
         0    1.6000    1.6000         0         0    1.6000    1.6000         0
         0         0    0.6000    0.6000         0         0    0.6000    0.6000
         0         0         0         0    0.2000    0.2000    0.2000    0.2000
```

```
figure
patch('Vertices',v_2','Faces',f,'FaceVertexCData',hsv(6),'FaceColor',[0.8 0.8 0.8],'Fac
view(3)
```

```
xyzlabel
axis equal
```



Part 3

At origen

Scaling vertices and visualize it

```
H=0.15 % x
```

```
H = 0.1500
```

```
W=0.20 % y
```

```
W = 0.2000
```

```
D=0.17 % z
```

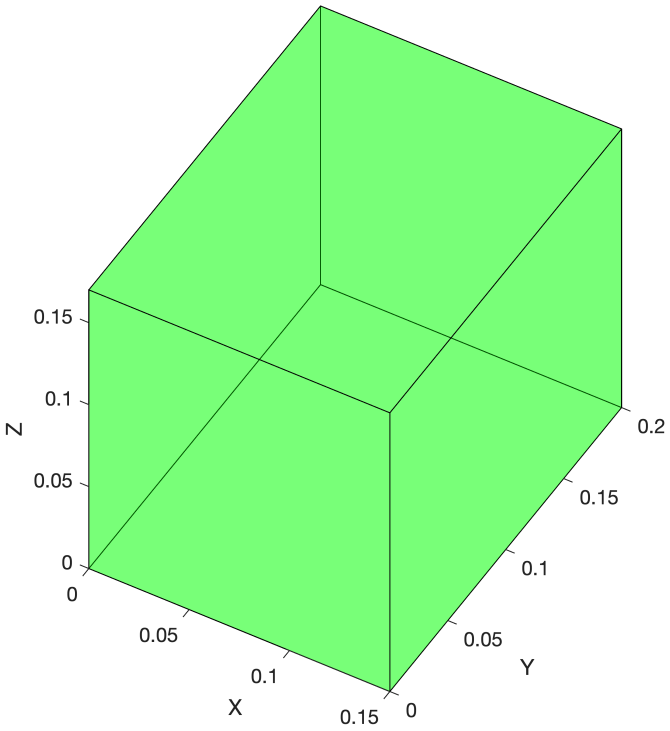
```
D = 0.1700
```

```
v_3=[H 0 0;0 W 0;0 0 D]*v'
```

```
v_3 = 3×8
         0    0.1500    0.1500         0         0    0.1500    0.1500         0
         0         0    0.2000    0.2000         0         0    0.2000    0.2000
         0         0         0         0    0.1700    0.1700    0.1700    0.1700
```

```
figure
patch('Vertices',v_3','Faces',f,'FaceVertexCData',hsv(6),'FaceColor','g','FaceAlpha',0.
```

```
view(30,45)
xyzlabel
axis equal
```



Point

With respect to Referece Frame {I}

```
[X,Y,Z] = sphere;
```

Plot a 16mm sphere centered at the origin.

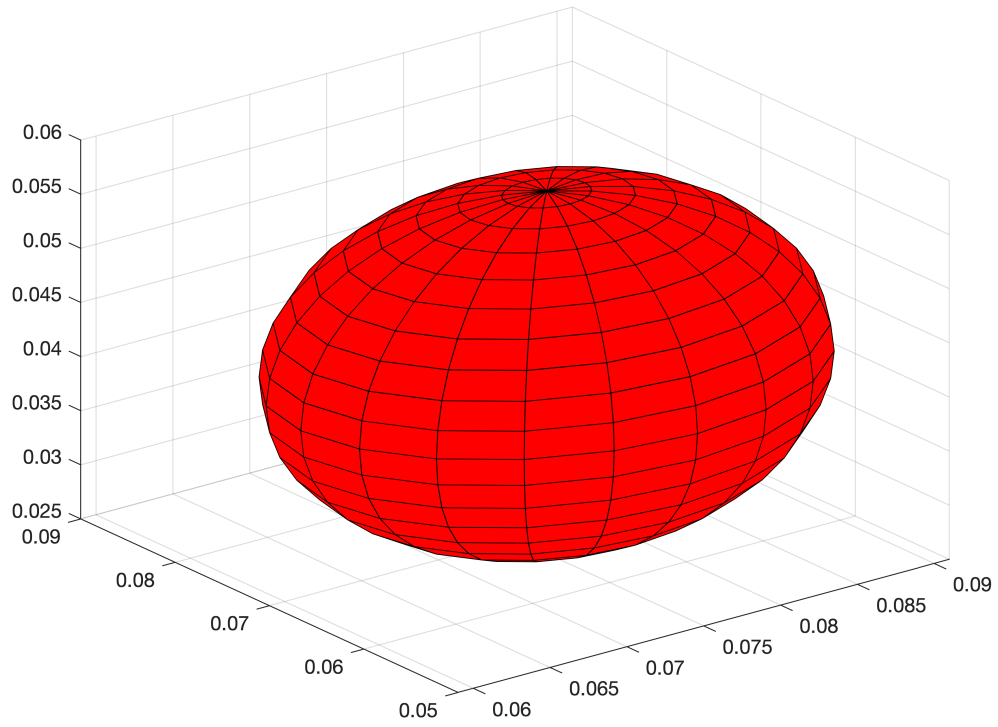
```
r=0.016 % 16 mm
```

```
r = 0.0160
```

```
xyz_p=[H/2 W/3 D/4 1]'
```

```
xyz_p = 4×1
    0.0750
    0.0667
    0.0425
    1.0000
```

```
figure
surf(X*r+xyz_p(1),Y*r+xyz_p(2),Z*r+xyz_p(3),'FaceColor',[1 0 0])
```



Transformations.

T_1_0. Desired pose

```
T_1_0=transl(-0.3,-0.5,0)*trotz(pi/3)
```

```
T_1_0 = 4×4
    0.5000   -0.8660         0   -0.3000
    0.8660    0.5000         0   -0.5000
         0         0    1.0000         0
         0         0         0    1.0000
```

T_2_1

```
T_2_1=transl(0.4,0.15,0.1)
```

```
T_2_1 = 4×4
    1.0000         0         0    0.4000
         0    1.0000         0    0.1500
         0         0    1.0000    0.1000
         0         0         0    1.0000
```

```
T_2_0=T_1_0*T_2_1
```

```
T_2_0 = 4×4
    0.5000   -0.8660         0   -0.2299
    0.8660    0.5000         0   -0.0786
         0         0    1.0000    0.1000
         0         0         0    1.0000
```

T_3_2

Auxiliar Reference Frame, i.e transformation

```
T_3_2=transl(1.75,0.2,0)
```

```
T_3_2 = 4×4
    1.0000         0         0    1.7500
         0    1.0000         0    0.2000
         0         0    1.0000         0
         0         0         0    1.0000
```

```
T_3_0=T_2_0*T_3_2
```

```
T_3_0 = 4×4
    0.5000   -0.8660         0    0.4719
    0.8660    0.5000         0    1.5370
         0         0    1.0000    0.1000
         0         0         0    1.0000
```

T_I_3

```
T_I_3=trotz(-pi/2)*trotx(-pi/2)*transl(-W, -H,0)
```

```
T_I_3 = 4×4
         0         0    1.0000         0
   -1.0000         0         0    0.2000
         0   -1.0000         0    0.1500
         0         0         0    1.0000
```

```
T_I_0=T_3_0*T_I_3
```

```
T_I_0 = 4×4
    0.8660         0    0.5000    0.2987
   -0.5000         0    0.8660    1.6370
         0   -1.0000         0    0.2500
         0         0         0    1.0000
```

Operating vertices

```
v_1(4,:)=1
```

```
v_1 = 4×8
         0    2.0000    2.0000         0         0    2.0000    2.0000         0
         0         0    0.9000    0.9000         0         0    0.9000    0.9000
         0         0         0         0    0.0800    0.0800    0.0800    0.0800
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
v_1_0=T_1_0*v_1
```

```
v_1_0 = 4×8
   -0.3000    0.7000   -0.0794   -1.0794   -0.3000    0.7000   -0.0794   -1.0794
   -0.5000    1.2321    1.6821   -0.0500   -0.5000    1.2321    1.6821   -0.0500
         0         0         0         0    0.0800    0.0800    0.0800    0.0800
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
v_2(4,:)=1
```

```
v_2 = 4×8
```

```
         0    1.6000    1.6000         0         0    1.6000    1.6000         0
         0         0    0.6000    0.6000         0         0    0.6000    0.6000
         0         0         0         0    0.2000    0.2000    0.2000    0.2000
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
v_2_p=T_2_0*v_2
```

```
v_2_p = 4×8
   -0.2299    0.5701    0.0505   -0.7495   -0.2299    0.5701    0.0505   -0.7495
   -0.0786    1.3071    1.6071    0.2214   -0.0786    1.3071    1.6071    0.2214
    0.1000    0.1000    0.1000    0.1000    0.3000    0.3000    0.3000    0.3000
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
v_3(4,:)=1
```

```
v_3 = 4×8
         0    0.1500    0.1500         0         0    0.1500    0.1500         0
         0         0    0.2000    0.2000         0         0    0.2000    0.2000
         0         0         0         0    0.1700    0.1700    0.1700    0.1700
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
v_3_p=T_3_0*v_3
```

```
v_3_p = 4×8
    0.4719    0.5469    0.3737    0.2987    0.4719    0.5469    0.3737    0.2987
    1.5370    1.6669    1.7669    1.6370    1.5370    1.6669    1.7669    1.6370
    0.1000    0.1000    0.1000    0.1000    0.2700    0.2700    0.2700    0.2700
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
Point_U=T_I_0*xyz_p
```

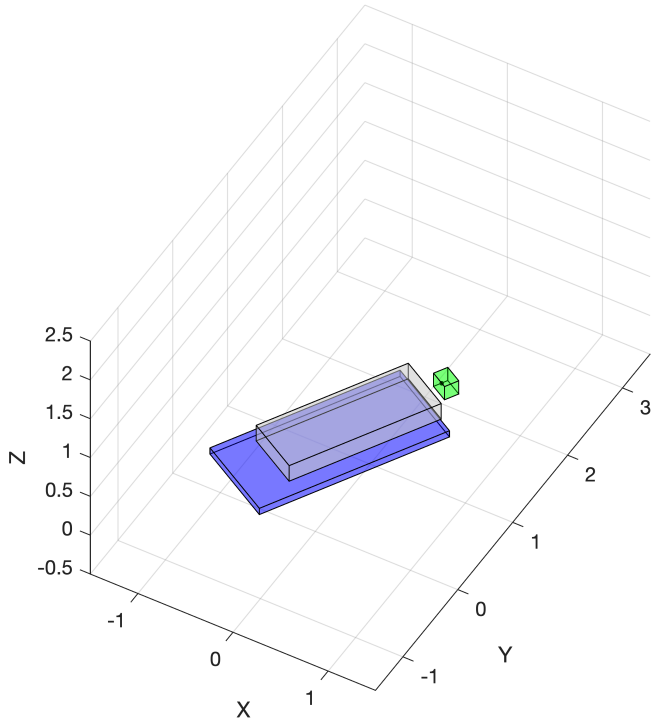
```
Point_U = 4×1
    0.3849
    1.6363
    0.1833
    1.0000
```

Plotting parts

```
figure
hold on
patch('Vertices',v_1_0(1:3,:)','Faces',f,'FaceVertexCData',hsv(6),'FaceColor','b','Face
patch('Vertices',v_2_p(1:3,:)','Faces',f,'FaceVertexCData',hsv(6),'FaceColor',[0.8 0.8
patch('Vertices',v_3_p(1:3,:)','Faces',f,'FaceVertexCData',hsv(6),'FaceColor','g','Face
view(30,45)
grid on
xyzlabel
axis equal
axis([-1.5 1.5 -1.5 3.5 -0.5 2.5])
```

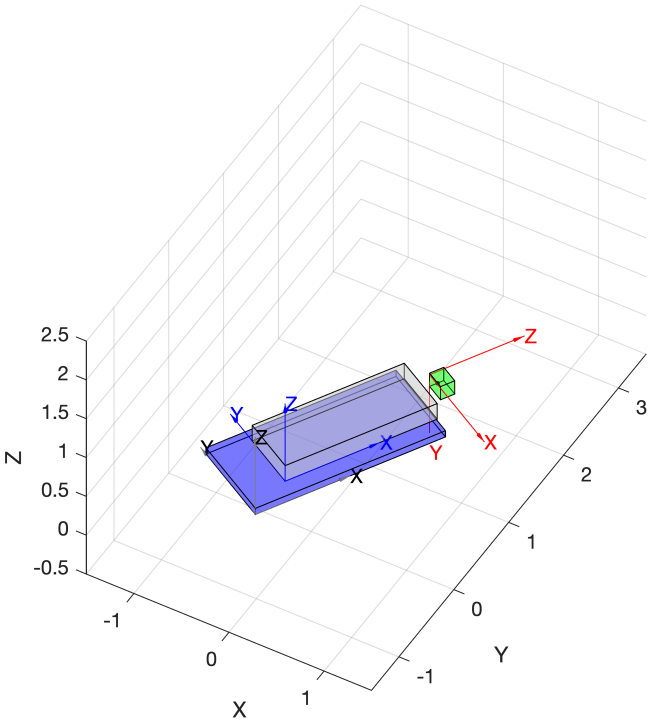
Plotting point wrt {U}

```
surf(X*r+Point_U(1),Y*r+Point_U(2),Z*r+Point_U(3),'FaceColor',[1 0 0])
```



Reference frames

```
trplot(T_1_0,'framelabel','T' ,'color', 'black','arrow','width',0.4)
trplot(T_2_0,'framelabel','B' ,'color', 'b','arrow','width',0.4)
trplot(T_I_0,'framelabel','I' ,'color', 'r','arrow','width',0.4)
```


2.5
2
1.5
1
0.5
0
-0.5
Z
-1
0
1
X
-1
0
1
2
3
Y
Z
X
Y
Y
Z
X
Z
X