

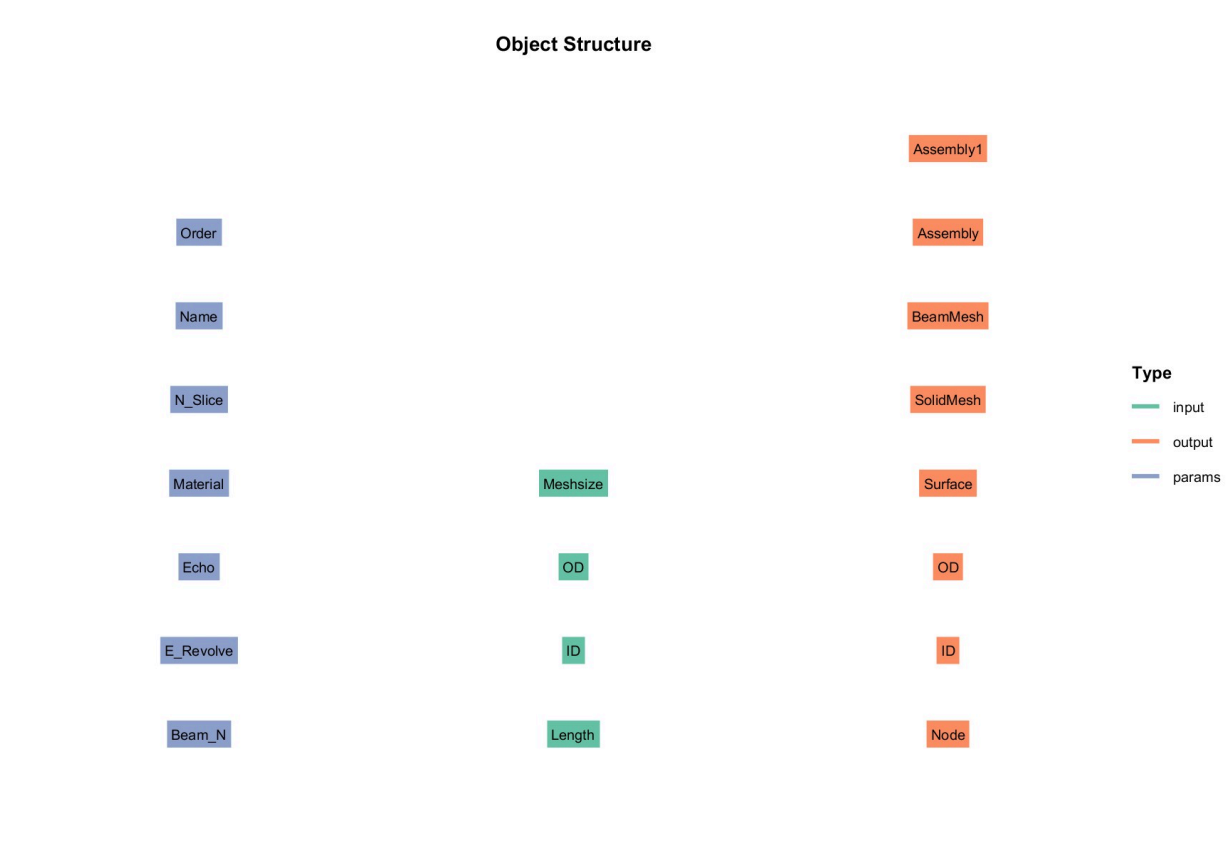
Commonshaft

Xie Yu

1 介绍

Commonshaft用来设计轴，依据输入的长度、外径和内径可生成轴的3D网格和梁网格。

2 类结构



输入 input:

- Meshsize : 单元尺寸
- OD : 轴外径
- ID : 轴内径
- Length : 轴长度

参数 params:

- Order : 单元阶数
- Name : 名称
- N_Slice: 梁单元轴向网格划分数量
- E_Revolve: 实体单元旋转方向网格划分数量
- Material : 轴材料

- Beam_N : 梁单元截面环向划分

输出 output :

- Assembly1 : 梁单元装配
- Assembly : 实体单元装配
- BeamMesh : 梁网格
- SolidMesh : 实体网格
- OD : 梁各个单元对应外径
- ID : 梁各个单元对应内径
- Node : 梁单元节点

3 案例

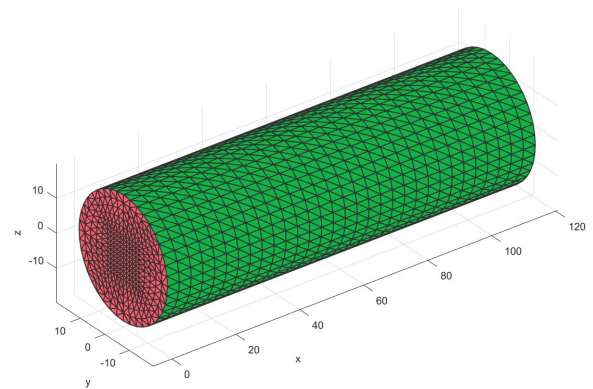
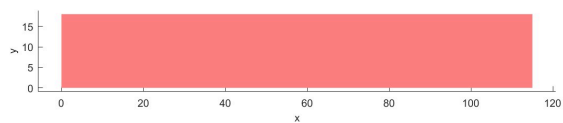
3.1 Shaft1 (Flag=1)

```

1  % Shaft 1
2  inputshaft1.Length = 115;
3  inputshaft1.ID = [0,0];
4  inputshaft1.OD = [36,36];
5  paramsshift1 = struct();
6  obj1 = shaft.Commonshaft(paramsshift1, inputshaft1);
7  obj1 = obj1.solve();
8  Plot2D(obj1);
9  Plot3D(obj1);

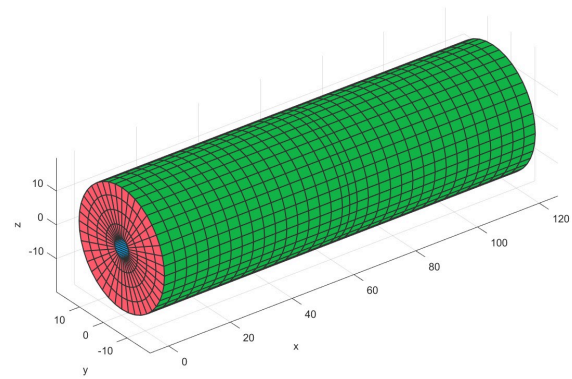
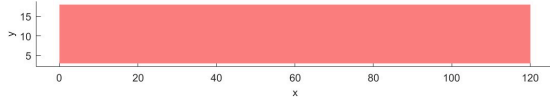
```

建立轴时定义好长度，内径和外径，即可生成轴网格：



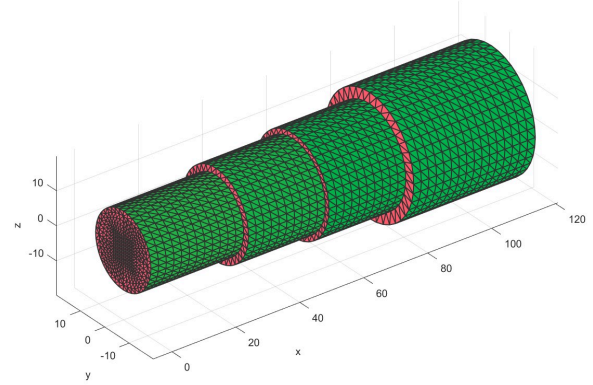
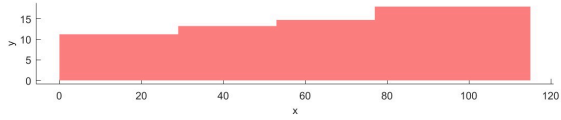
3.2 Shaft2 (Flag=2)

```
1 % Shaft 2
2 inputshaft1.Length = 120;
3 inputshaft1.ID = [6,6];
4 inputshaft1.OD = [36,36];
5 paramsshft1 = struct();
6 obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
7 obj1 = obj1.solve();
8 Plot2D(obj1);
9 Plot3D(obj1);
```



3.3 Shaft3 (Flag=3)

```
1 % Shaft 3
2 inputshaft1.Length = [29;53;77;115];
3 inputshaft1.ID = [[0,0];[0,0];[0,0];[0,0]];
4 inputshaft1.OD = [[22.5,22.5];[26.5,26.5];[29.5,29.5];[36,36]];
5 paramsshft1 = struct();
6 obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
7 obj1 = obj1.solve();
8 Plot2D(obj1);
9 Plot3D(obj1);
```

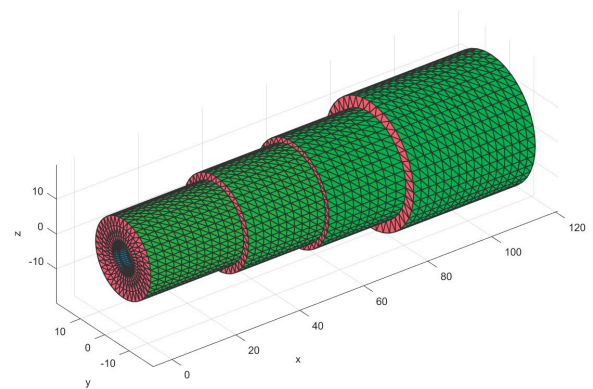
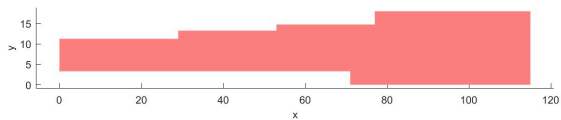


3.4 Shaft4 (Flag=4)

```

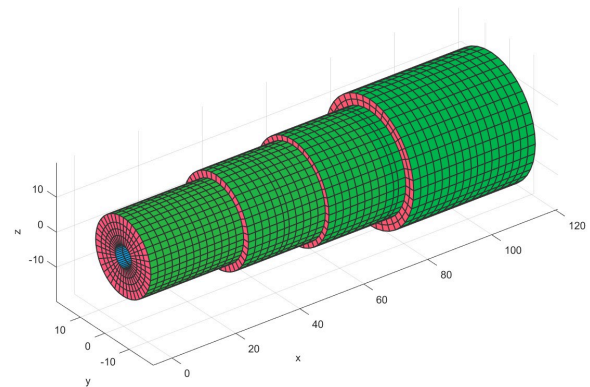
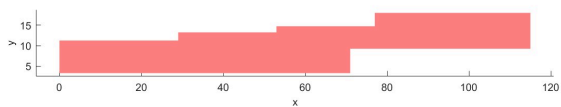
1 % Shaft 4
2 inputshaft1.Length = [29;53;71;77;115];
3 inputshaft1.ID = [[6.6,6.6];[6.6,6.6];[6.6,6.6];[0,0];[0,0]];
4 inputshaft1.OD = [[22.5,22.5];[26.5,26.5];[29.5,29.5];[29.5,29.5];[36,36]];
5 paramshaft1 = struct();
6 obj1 = shaft.Commonshaft(paramshaft1, inputshaft1);
7 obj1 = obj1.solve();
8 Plot2D(obj1);
9 Plot3D(obj1);

```



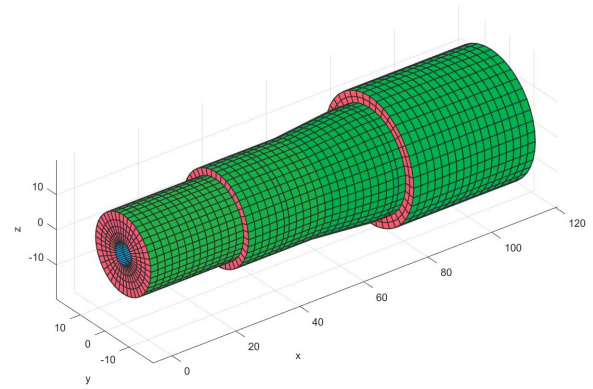
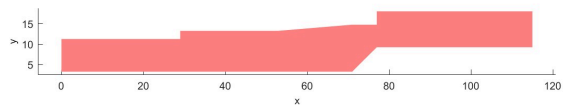
3.4.1 Shaft 5 (Flag=5)

```
1 % Shaft 5
2 inputshaft1.Length = [29;53;71;77;115];
3 inputshaft1.ID = [[6.6,6.6];[6.6,6.6];[6.6,6.6];[18.5,18.5];[18.5,18.5]];
4 inputshaft1.OD = [[22.5,22.5];[26.5,26.5];[29.5,29.5];[29.5,29.5];[36,36]];
5 paramsshft1 = struct();
6 obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
7 obj1 = obj1.solve();
8 Plot2D(obj1);
9 Plot3D(obj1);
```



3.5 Shaft 6(Flag=6)

```
1 % Shaft 6
2 inputshaft1.Length = [29;53;71;77;115];
3 inputshaft1.ID = [[6.6,6.6];[6.6,6.6];[6.6,6.6];[6.6,18.5];[18.5,18.5]];
4 inputshaft1.OD = [[22.5,22.5];[26.5,26.5];[26.5,29.5];[29.5,29.5];[36,36]];
5 paramsshft1 = struct();
6 obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
7 obj1 = obj1.solve();
8 Plot2D(obj1);
9 Plot3D(obj1);
```

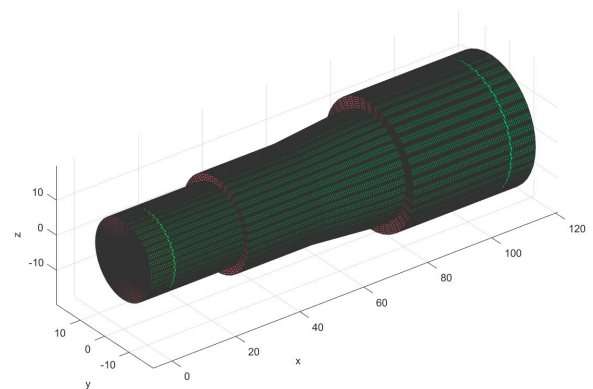
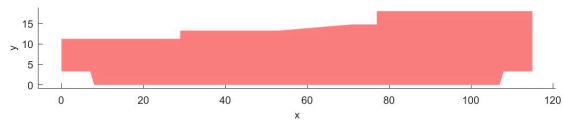


3.6 Shaft 7(Flag=7)

```

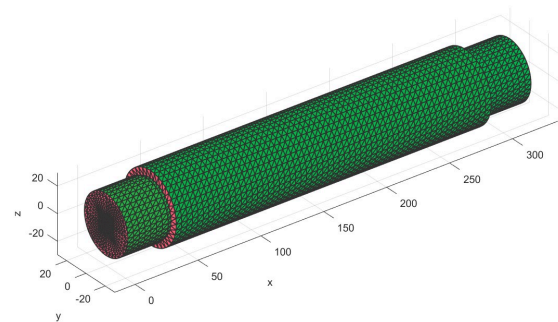
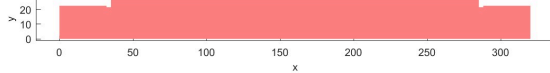
1  % Shaft 7
2  inputshaft1.Length = [7;8;29;53;71;77;107;108;115];
3  inputshaft1.ID = [[6.6,6.6];[6.6,0];[0,0];[0,0];[0,0];[0,0];[0,0];[0,6.6];[6.6,6.6]];
4  inputshaft1.OD = [[22.5,22.5];[22.5,22.5];[22.5,22.5];[26.5,26.5];[26.5,29.5];
5  [29.5,29.5];...
6  [36,36];[36,36];[36,36]];
7  inputshaft1.Meshsize=0.5;
8  paramshaft1 = struct();
9  obj1 = shaft.Commonshaft(paramshaft1, inputshaft1);
10 obj1 = obj1.solve();
11 Plot2D(obj1);
    Plot3D(obj1);

```



3.7 Shaft8(Flag=8)

```
1 % Shaft 8
2 inputshaft1.Length = [32;35;320-35;320-32;320];
3 inputshaft1.ID = [[0,0];[0,0];[0,0];[0,0];[0,0]];
4 inputshaft1.OD = [[45,45];[43,43];[54,54];[43,43];[45,45]];
5 paramsshft1.Order = 1;
6 obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
7 obj1 = obj1.solve();
8 Plot2D(obj1);
9 Plot3D(obj1);
```



3.8 OutputSolidModel to ANSYS (Flag=9)

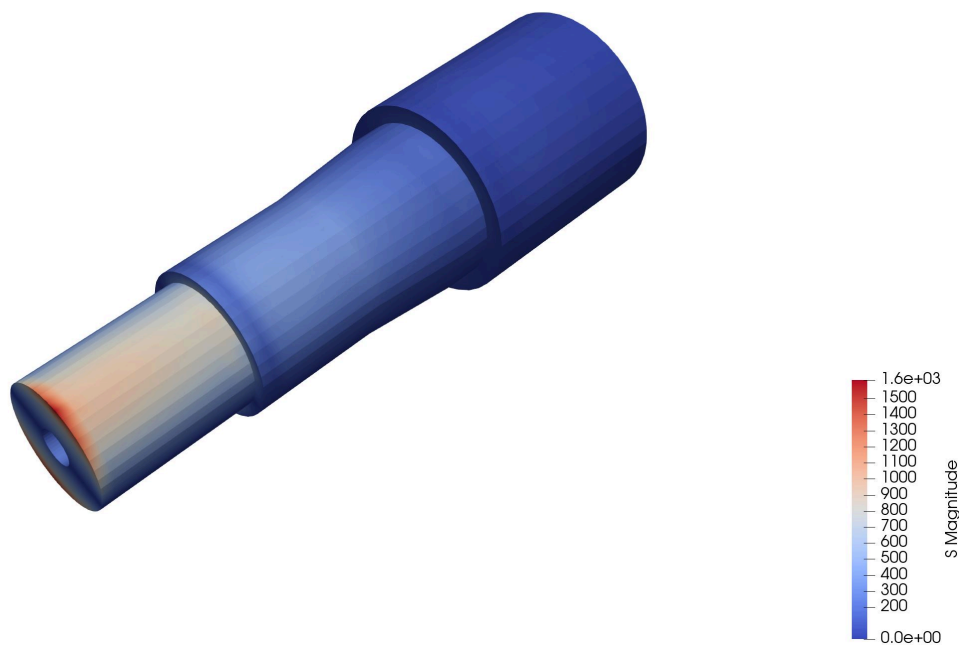
```
1 % Shaft 7
2 inputshaft1.Length = [7;8;29;53;71;77;107;108;115];
3 inputshaft1.ID = [[6.6,6.6];[6.6,0];[0,0];[0,0];[0,0];[0,0];[0,0];[0,6.6];[6.6,6.6]];
4 inputshaft1.OD = [[22.5,22.5];[22.5,22.5];[22.5,22.5];[26.5,26.5];[26.5,29.5];
5 [29.5,29.5];...
6 [36,36];[36,36];[36,36]];
7 paramsshft1.Order = 2;
8 obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
9 obj1 = obj1.solve();
10 Plot2D(obj1);
11 Plot3D(obj1);
12 %% Assembly
13 m=obj1.output.SolidMesh;
14 Ass=Assembly('Shaft_Assembly');
15 Ass=AddPart(Ass,m.Meshoutput);
16 % Boundary
17 Ass=AddBoundary(Ass,1,'No',302);
18 Bound1=[1,1,1,0,0,0];
19 Ass=SetBoundaryType(Ass,1,Bound1);
20 % Load
21 Ass=AddLoad(Ass,1,'No',305);
22 Load1=[0,-1e4,0,0,0,0];
23 Ass=SetLoad(Ass,1,Load1);
```

```

23 Plot(Ass,'boundary',1,'load',1);
24 % Material
25 mat.Name='Steel';
26 mat.table=["DENS",7.85e-9;"EX",210000;"NUXY",0.3];
27 Ass=AddMaterial(Ass,mat);
28 Ass=SetMaterial(Ass,1,1);
29 % Element type
30 if paramshaft1.Order==1
31 ET.name='185';
32 else
33 ET.name='186';
34 end
35 ET.opt=[];
36 ET.R=[];
37 Ass=AddET(Ass,ET);
38 Ass=SetET(Ass,1,1);
39 Ass=AddSensor(Ass,'Stress',1);
40 opt.ANTYPE=0;
41 Ass=AddSoln(Ass,opt);
42 %% Output to ANSYS
43 ANSYS_Output(Ass);
44 ANSYS_Solve(Ass)
45 PlotSensor(Ass,1)

```

建立轴模型，通过ANSYS分析计算，最终将结果导出到Paraview中显示：



3.9 OutputBeamModel to ANSYS (Flag=10)

```

1 % Shaft 7
2 inputshaft1.Length = [7;8;29;53;71;77;107;108;115];
3 inputshaft1.ID = [[6.6,6.6];[6.6,0];[0,0];[0,0];[0,0];[0,0];[0,0];[0,6.6];[6.6,6.6]];
4 inputshaft1.OD = [[22.5,22.5];[22.5,22.5];[22.5,22.5];[26.5,26.5];[26.5,29.5];
5 [29.5,29.5];...
6 [36,36];[36,36];[36,36]];
7 paramshaft1 = struct();
8 obj1 = shaft.Commonshaft(paramshaft1, inputshaft1);
9 obj1 = obj1.solve();

```

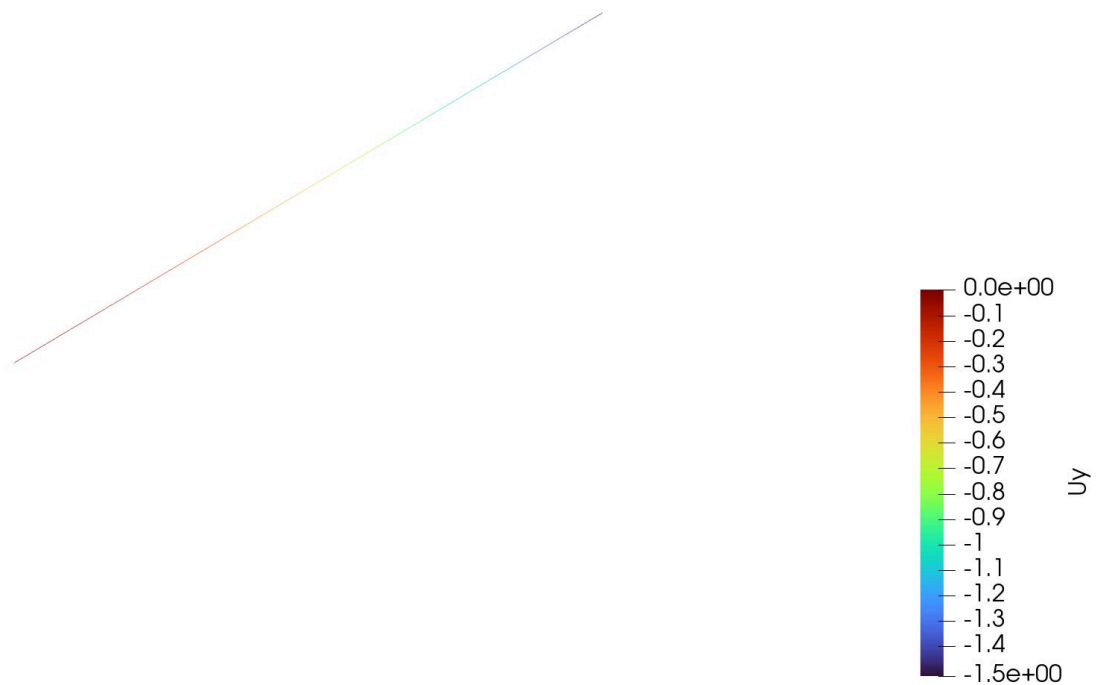


```

9 %% Add assembly
10 Ass=Assembly('Common_shaft_BeamModel');
11 Ass=AddPart(Ass,obj1.output.BeamMesh.Meshoutput);
12 % Boundary
13 Ass=AddBoundary(Ass,1,'No',1);
14 Bound1=[1,1,1,1,1,1];
15 Ass=SetBoundaryType(Ass,1,Bound1);
16 % Material
17 mat.table=["EX",2.1e5;"PRXY",0.3];
18 Ass=AddMaterial(Ass,mat);
19 Ass=SetMaterial(Ass,1,1);
20 % Add load
21 Ass=AddLoad(Ass,1,'No',101);
22 Load1=[0,-1e4,0,0,0,0];
23 Ass=SetLoad(Ass,1,Load1);
24 % Element type
25 ET.name='188';
26 ET.opt=[];
27 ET.R=[];
28 Ass=AddET(Ass,ET);
29 Ass=SetET(Ass,1,1);
30 Ass=BeamK(Ass,1);
31 % Section
32 Section=obj1.output.BeamMesh.Section;
33 Ass=DividePart(Ass,1,mat2cell((1:size(Section,1))',ones(1,size(Section,1))));
34 for i=1:size(Section,1)
35 Ass=AddSection(Ass,Section{i,1});
36 Ass=SetSection(Ass,i,i);
37 end
38 Plot(Ass,'boundary',1,'load',1,'load_scale',0.1);
39 %% Output to ANSYS
40 Ass=AddSensor(Ass,'U',1);
41 opt.ANTYPE=0;
42 Ass=AddSoln(Ass,opt);
43 %% Output to ANSYS
44 ANSYS_Output(Ass);
45 ANSYS_Solve(Ass)
46 PlotSensor(Ass,1)

```

将轴网格导出到Paraview中显示：

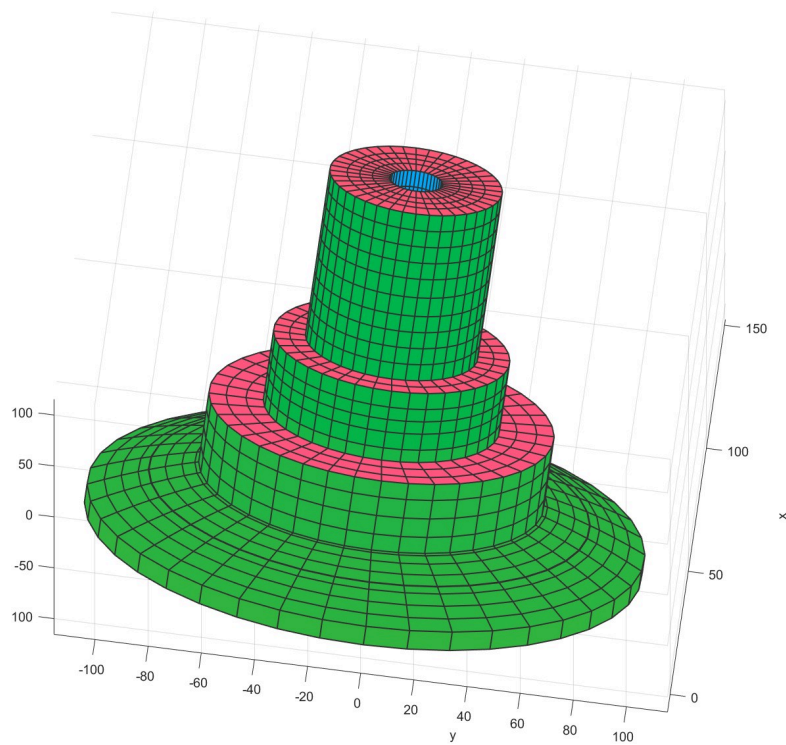
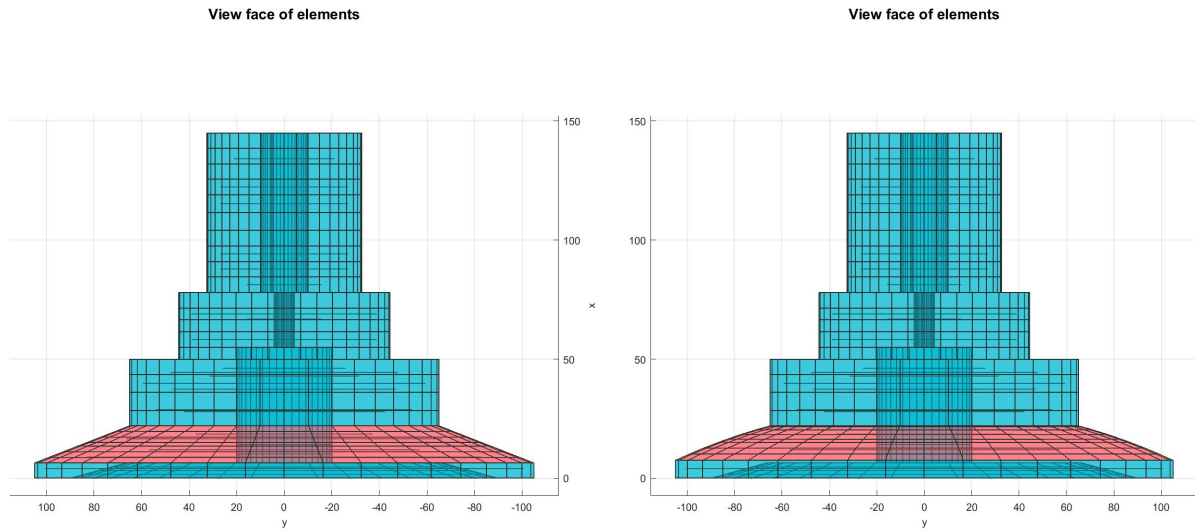


3.10 Deform Face (Flag=11)

```
1 inputShaft1.Length = [6.4;22;50;55;78;145];
2 inputShaft1.ID = [[180,133];[40,40];[40,40];[40,40];[8.5,8.5];[20,20]];
3 inputShaft1.OD = [[210,210];[210,130];[130,130];[89,89];[89,89];[65,65]];
4 paramsShaft1 = struct();
5 obj1 = shaft.Commonshaft(paramsShaft1, inputShaft1);
6 obj1 = obj1.solve();
7 Plot3D(obj1, 'faceno', 102);
8 f=@(r)sqrt(250^2-r.^2)+22-sqrt(250^2-65^2);
9 obj1=DeformFace(obj1,102,f);
10 Plot3D(obj1);
```

支持小幅度的网格节点偏移。

注意：当网格节点偏移时，网格会发生变形，可能引起网格读取错误



3.11 3.13 Plot faceno (Flag=12)

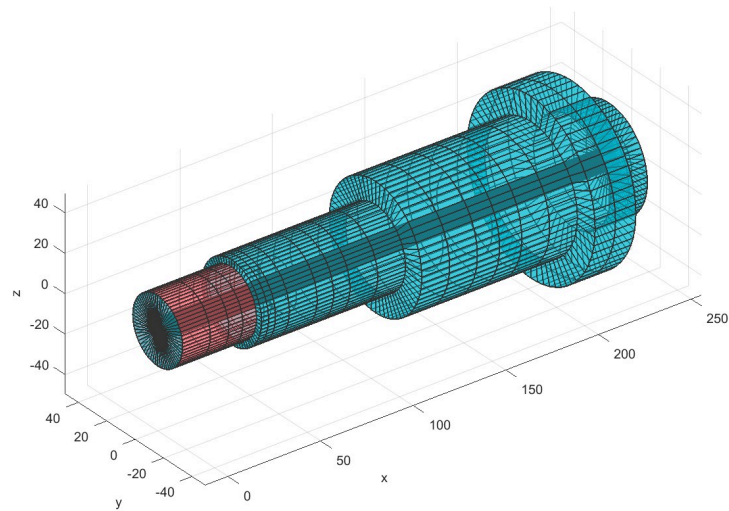
```

1 Shaft2_Height=243.7;
2 Shaft2_Step_Height=20;
3 inputShaft2.Length = [40;117.7;201.7;Shaft2_Height-Shaft2_Step_Height;Shaft2_Height];
4 inputShaft2.OD = [[35,35];[42,42];[65,65];[90,90];[54,54]];
5 inputShaft2.ID = [[10,10];[10,10];[10,10];[10,10];[10,10]];
6 inputShaft2.Meshsize=15;
7 paramsShaft2.E_Revolve = 60;
8 obj1 = shaft.Commonshaft(paramsShaft2, inputShaft2);
9 obj1 = obj1.solve();
10 Plot3D(obj1,'faceno',101);

```

显示面编号:

View face of elements

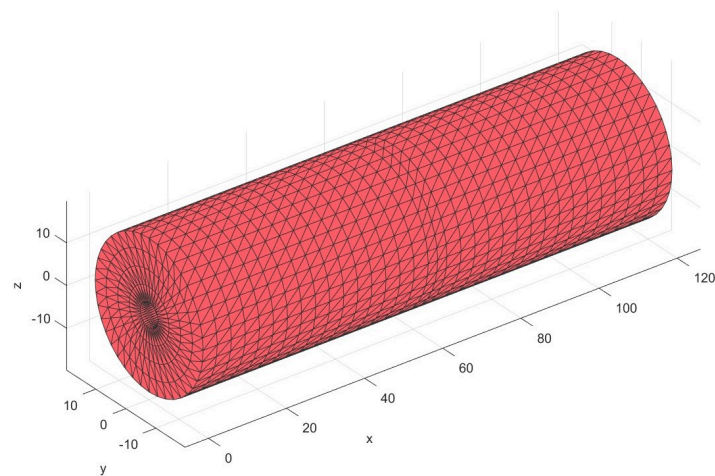


3.12 3.14 Output STL (Flag=13)

```

1  % Shaft 2
2  inputshaft1.Length = 120;
3  inputshaft1.ID = [6,6];
4  inputshaft1.OD = [36,36];
5  paramsshft1 = struct();
6  obj1 = shaft.Commonshaft(paramsshft1, inputshaft1);
7  obj1 = obj1.solve();
8  Plot2D(obj1);
9  Plot3D(obj1);
10 OutputSTL(obj1)
11 % Load stl file
12 L=Layer('test');
13 Name=strcat(obj1.params.Name, '.stl');
14 L=STLRead(L, Name);
15 Plot(L);
16 end

```



4 参考文献