

ANSYS Element Test

Xie Yu

1 介绍

本文档用于在Buffalo环境下，对ANSYS不同单元的验证。本文档大部分案例来自于王新敏老师的ANSYS结构分析单元与应用。

2 案例

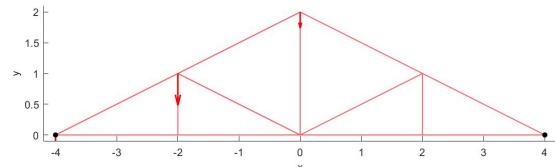
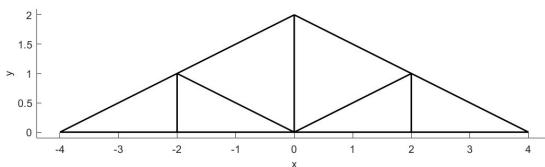
2.1 Link1 Static analysis of plane trusses (Flag=1)

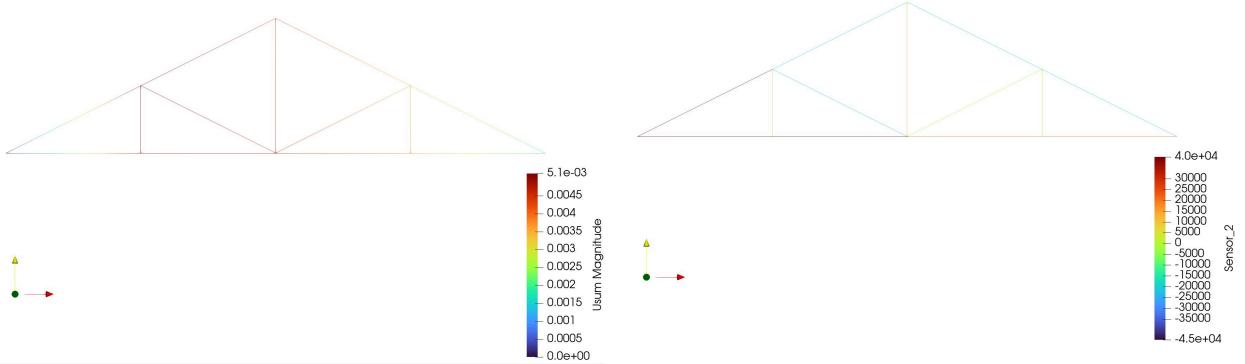
```
1 % Create geometry
2 a=Point2D('Point');
3 a=AddPoint(a,[-4;-2],[0;0]);
4 a=AddPoint(a,[-2;0],[0;0]);
5 a=AddPoint(a,[0;2],[0;0]);
6 a=AddPoint(a,[2;4],[0;0]);
7 a=AddPoint(a,[-4;-2],[0;1]);
8 a=AddPoint(a,[-2;-2],[0;1]);
9 a=AddPoint(a,[-2;0],[1;0]);
10 a=AddPoint(a,[0;2],[0;1]);
11 a=AddPoint(a,[2;2],[0;1]);
12 a=AddPoint(a,[2;4],[1;0]);
13 a=AddPoint(a,[-2;0],[1;2]);
14 a=AddPoint(a,[2;0],[1;2]);
15 a=AddPoint(a,[0;0],[2;0]);
16 b=Line2D('Plane Truss');
17 for i=1:13
18     b=AddLine(b,a,i);
19 end
20 Plot(b,'equal',1);
21 b=Meshoutput(b);
22 % Add assembly
23 Ass=Assembly('Plane_Truss1');
24 pos=[0,0,0,0,0,0];
25 Ass=AddPart(ass,b.Meshoutput,'position',pos);
26 % Load
27 Ass=AddLoad(ass,1,'No',1);
28 Ass=AddLoad(ass,1,'No',6);
29 Ass=AddLoad(ass,1,'No',8);
30 Load1=[0,-1e4,0,0,0,0];
31 Load2=[0,-2e4,0,0,0,0];
32 Ass=SetLoad(ass,1,Load1);
33 Ass=SetLoad(ass,2,Load2);
34 Ass=SetLoad(ass,3,Load1);
35 % Boundary
36 Ass=AddBoundary(ass,1,'No',1);
37 Ass=AddBoundary(ass,1,'No',5);
38 Bound1=[1,1,0,0,0,0];
39 Bound2=[0,1,0,0,0,0];
40 Ass=SetBoundaryType(ass,1,Bound1);
41 Ass=SetBoundaryType(ass,2,Bound2);
```

```

42 % Material
43 mat.Name='Wood';
44 mat.table=["EX",8500;"PRXY",0.2];
45 Ass=AddMaterial(ass,mat);
46 Ass=SetMaterial(ass,1,1);
47 % Element type
48 ET.name='1';
49 ET.opt=[];
50 ET.R=14400;
51 Ass=AddET(ass,ET);
52 Ass=SetET(ass,1,1);
53 Plot(ass,'View',[0,90],...
54         'boundary',1,...
55         'load',1,...
56         'load_scale',0.2);
57 % Static analysis
58 opt.ANTYPE=0;
59 Ass=AddSolu(ass,opt);
60 % Add sensor
61 Ass=AddSensor(ass,'U',1);
62 Ass=AddSensor(ass,'Etable','SMISC',...
63     'TableNum',1,...
64     'Part',1);
65 % Output to ANSYS
66 ANSYS_Output(ass);
67 if Cal
68     ANSYSSolve(ass);
69     PlotSensor(ass,1);
70     PlotSensor(ass,2);
71 end

```





2.2 Link1 Elasto-plastic analysis of plane trusses (Flag=2)

```

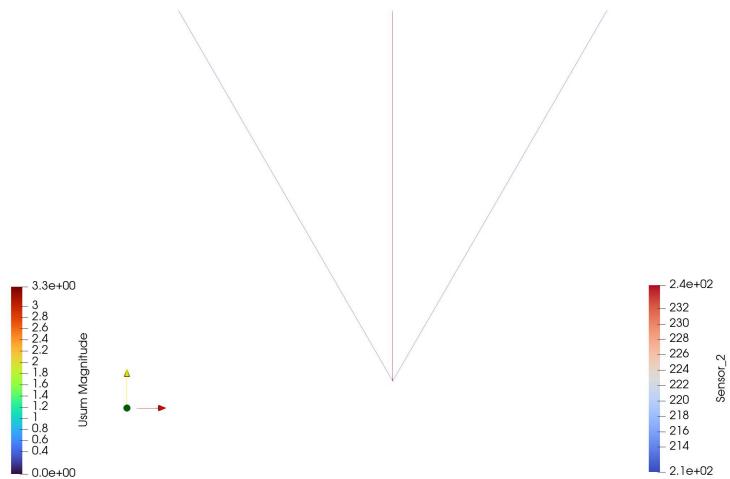
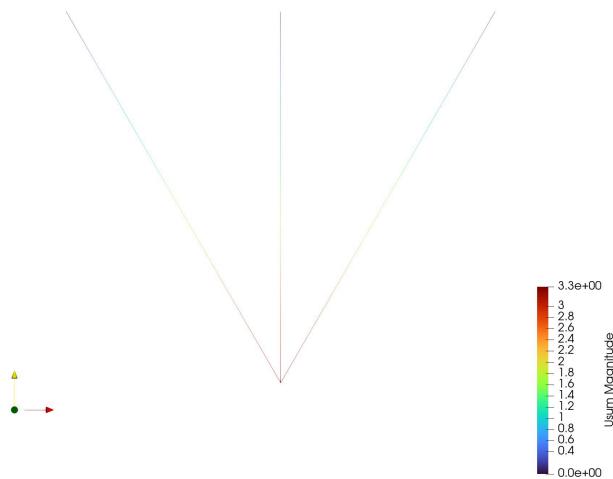
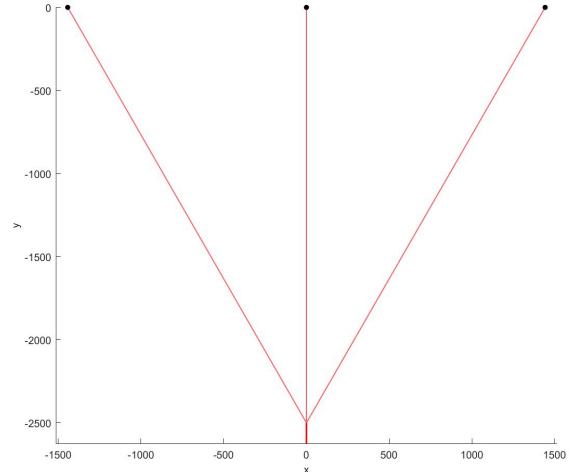
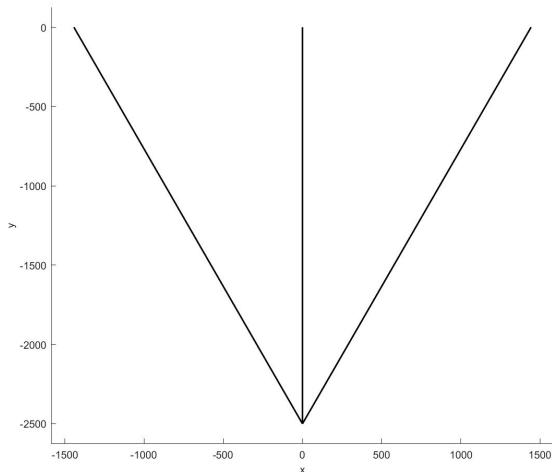
1 % Create geometry
2 a=Point2D('Point');
3 a=AddPoint(a,[-2500*tan(pi/6);0],[0;-2500]);
4 a=AddPoint(a,[0;0],[0;-2500]);
5 a=AddPoint(a,[2500*tan(pi/6);0],[0;-2500]);
6 b=Line2D('Plane Truss');
7 for i=1:3
8     b=AddLine(b,a,i);
9 end
10 Plot(b,'equal',1);
11 b=Meshoutput(b);
12 % Add assembly
13 Ass=Assembly('Plane_Truss2');
14 pos=[0,0,0,0,0,0];
15 Ass=AddPart(ass,b.Meshoutput,'position',pos);
16 % Load
17 Ass=AddLoad(ass,1,'No',2);
18 Load1=[0,-3e4,0,0,0,0];
19 Ass=SetLoad(ass,1,Load1);
20 % Boundary
21 Ass=AddBoundary(ass,1,'No',1);
22 Ass=AddBoundary(ass,1,'No',3);
23 Ass=AddBoundary(ass,1,'No',4);
24 Bound1=[1,1,0,0,0,0];
25 Ass=SetBoundaryType(ass,1,Bound1);
26 Ass=SetBoundaryType(ass,2,Bound1);
27 Ass=SetBoundaryType(ass,3,Bound1);
28 Plot(ass,'boundary',1,...
29      'load',1,...
30      'load_scale',0.2,'View',[0,90]);
31 % Material
32 mat.Name='Steel';
33 mat.table=[ "EX",210000;"PRXY",0.3];
34 mat.TBlab="BKIN";
35 mat.TBtable="235";% yield strength
36 Ass=AddMaterial(ass,mat);
37 Ass=SetMaterial(ass,1,1);
38 % Element type
39 ET.name='1';
40 ET.opt=[];

```

```

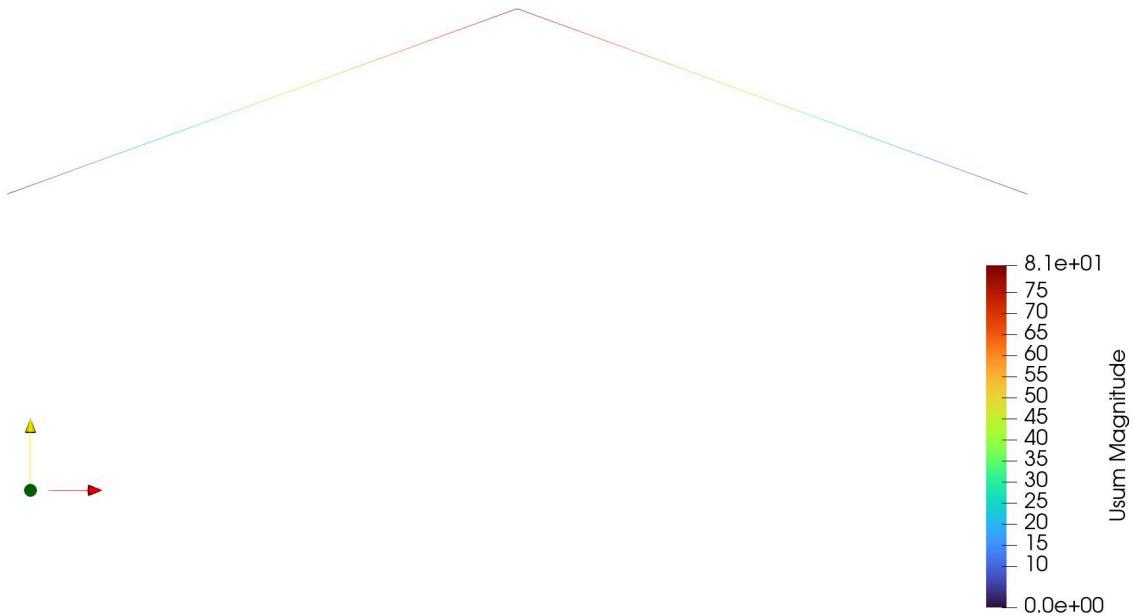
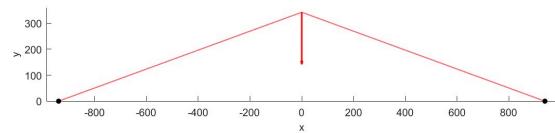
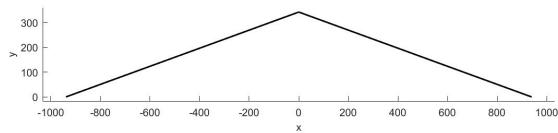
41 ET.R=50;
42 Ass=AddET(Ass,ET);
43 Ass=SetET(Ass,1,1);
44 % Static analysis
45 opt.ANTYPE=0;
46 Ass=AddSolu(Ass,opt);
47 % Add sensor
48 Ass=AddSensor(Ass,'U',1);
49 Ass=AddSensor(Ass,'Etable','LS',...
    'TableNum',1,...
    'Part',1);
50 % Output to ANSYS
51 ANSYS_Output(Ass);
52 if Cal
53     ANSYSSolve(Ass);
54     PlotSensor(Ass,1);
55     PlotSensor(Ass,2);
56 end

```



2.3 Link1 Two-force bar truss buckling analysis (Flag=3)

```
1 % Create geometry
2 a=Point2D('Point');
3 a=AddPoint(a,[-1000*cos(pi/9);0],[0;1000*sin(pi/9)]);
4 a=AddPoint(a,[0;1000*cos(pi/9)],[1000*sin(pi/9);0]);
5 b=Line2D('Two-force Truss');
6 for i=1:2
7 b=AddLine(b,a,i);
8 end
9 Plot(b,'equal',1);
10 b=Meshoutput(b);
11 % Add assembly
12 Ass=Assembly('Two-force_Truss');
13 pos=[0,0,0,0,0,0];
14 Ass=AddPart(ass,b.Meshoutput,'position',pos);
15 % Load
16 Ass=AddLoad(ass,1,'No',2);
17 Load1=[0,-2e5,0,0,0,0];
18 Ass=SetLoad(ass,1,Load1);
19 % Boundary
20 Ass=AddBoundary(ass,1,'No',1);
21 Ass=AddBoundary(ass,1,'No',3);
22 Bound1=[1,1,0,0,0,0];
23 Ass=SetBoundaryType(ass,1,Bound1);
24 Ass=SetBoundaryType(ass,2,Bound1);
25 Plot(ass,'boundary',1,...
26 'load',1,...
27 'load_scale',0.001,...
28 'View',[0,90]);
29 % Material
30 mat.Name='Steel';
31 mat.table=[ "EX",210000;"PRXY",0.3];
32 Ass=AddMaterial(ass,mat);
33 Ass=SetMaterial(ass,1,1);
34 % Element type
35 ET.name='1';
36 ET.opt=[];
37 ET.R=50;
38 Ass=AddET(ass,ET);
39 Ass=SetET(ass,1,1);
40 % Static analysis
41 opt.ANTYPE=0;
42 Ass=AddSolu(ass,opt);
43 % Add sensor
44 Ass=AddSensor(ass,'U',1);
45 % Output to ANSYS
46 ANSYS_Output(ass);
47 if Cal
48 ANSYSSolve(ass)
49 PlotSensor(ass,1)
50 end
```



2.4 Link8 Hexagonal Dome analysis (Flag=4)

```

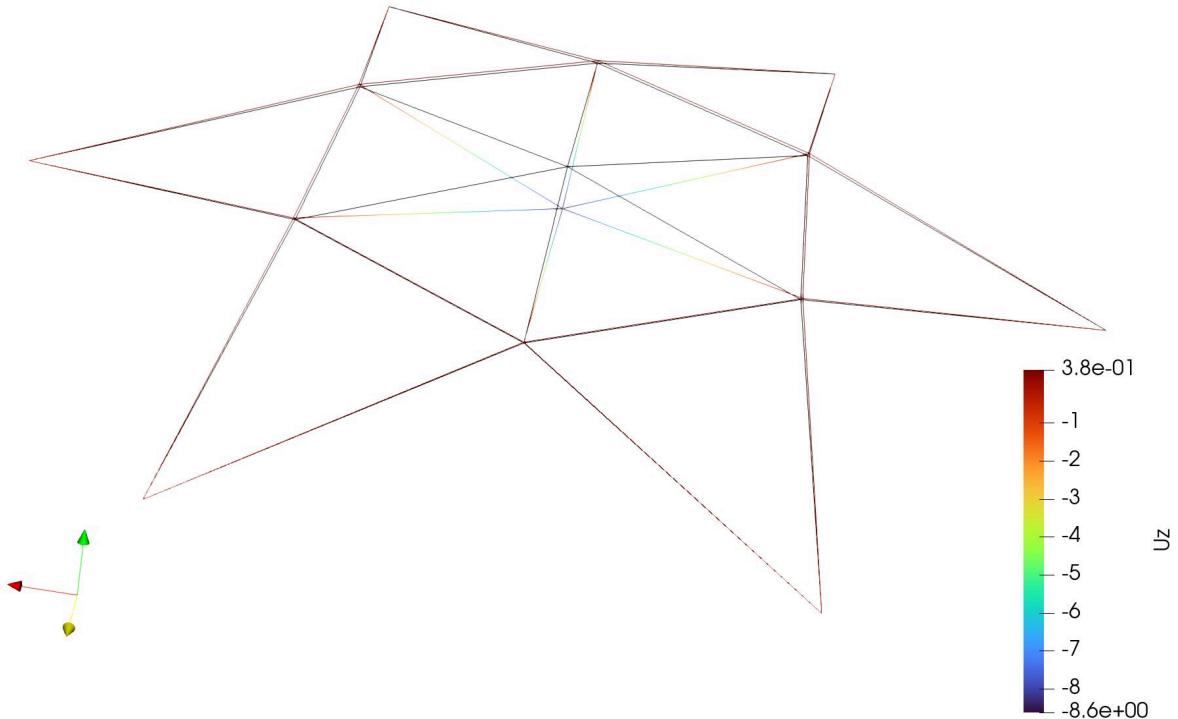
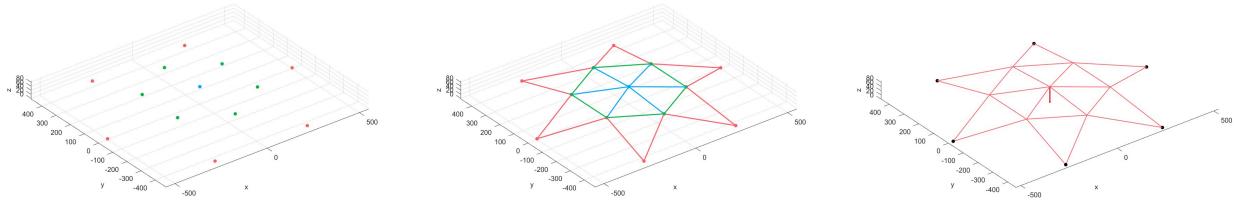
1 % Create points
2 theta1=linspace(60,360,6);
3 theta2=linspace(30,330,6);
4 a1=Point2D('Point1');
5 a2=Point2D('Point2');
6 a3=Point2D('Point3');
7 a1=AddPoint(a1,500*ones(6,1),theta1,'polar','deg');
8 a2=AddPoint(a2,250*ones(6,1),theta2,'polar','deg');
9 a3=AddPoint(a3,0,0);
10 % Create lines
11 l=Layer('frame');
12 pos2=[0,0,62.16,0,0,0];
13 pos3=[0,0,82.16,0,0,0];

```

```

14 l=AddElement(l,a1);
15 l=AddElement(l,a2, 'Transform',pos2);
16 l=AddElement(l,a3, 'Transform',pos3);
17 Plot(l);
18 l=ConnectPoints(l,1,2,[ (1:6)' ;(1:6)' ],[(1:6)' ;(2:6)' ;1]);
19 l=ConnectPoints(l,2,2,(1:6)',[(2:6)' ;1]);
20 l=ConnectPoints(l,2,3,(1:6)',ones(6,1));
21 Plot(l);
22 l=Meshoutput(l);
23 % Add assembly
24 Ass=Assembly('Hexagonal_Dome');
25 pos=[0,0,0,0,0,0];
26 Ass=AddPart(Ass,l.Meshoutput{1,1},...
27 'position',pos);
28 % Load
29 Ass=AddLoad(Ass,1,'No',13);
30 Load1=[0,0,-750,0,0,0];
31 Ass=SetLoad(Ass,1,Load1);
32 % Boundary
33 Ass=AddBoundary(Ass,1,'locz',0);
34 Bound1=[1,1,1,0,0,0];
35 Ass=SetBoundaryType(Ass,1,Bound1);
36 % Material
37 mat.table=[ "EX",3030;"PRXY",0.3];
38 Ass=AddMaterial(Ass,mat);
39 Ass=SetMaterial(Ass,1,1);
40 % Element type
41 ET.name='8';
42 ET.opt=[];
43 ET.R=317;
44 Ass=AddET(Ass,ET);
45 Ass=SetET(Ass,1,1);
46 Plot(Ass,'boundary',1,'load',1,'load_scale',0.1);
47 % Static analysis
48 opt.ANTYPE=0;
49 Ass=AddSolu(Ass,opt);
50 % Add sensor
51 Ass=AddSensor(Ass,'U',1);
52 % Output to ANSYS
53 ANSYS_Output(Ass);
54 if Cal
55 ANSYSSolve(Ass);
56 PlotSensor(Ass,1);
57 end

```



2.5 Link10 Force analysis of the cable in equilibrium state (Flag=5)

```

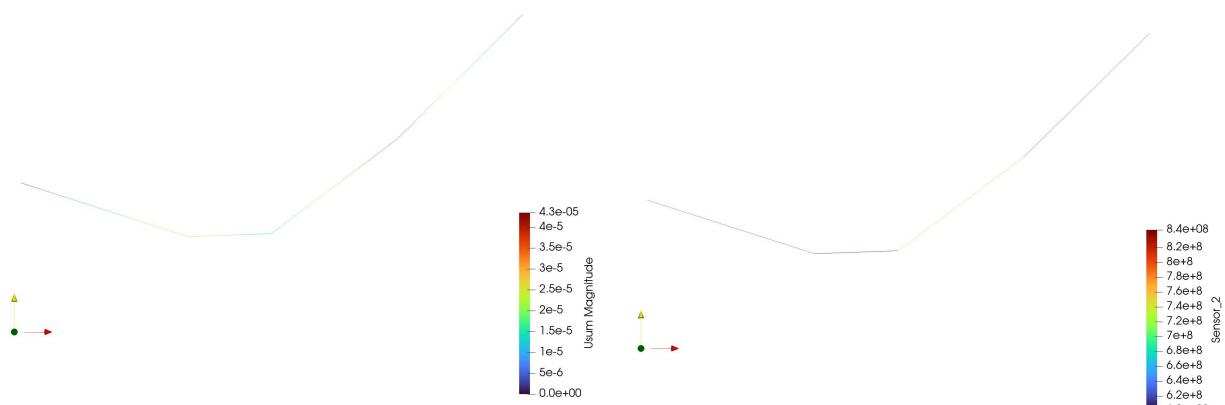
1 % Create points
2 x=[0 6 9 13.5 18];
3 y=[0 -1.9285 -1.8213 1.5537 6];
4 a=Point2D('Point');
5 a=AddPoint(a,x',y');
6 % Create lines
7 b=Line2D('Line');
8 b=AddCurve(b,a,1);
9 Plot(b,'equal',1,'grid',1)
10 b=Meshoutput(b);
11 % Add assembly
12 Ass=Assembly('Cable');
13 pos=[0,0,0,0,0,0];
14 Ass=AddPart(ass,b.Meshoutput,'position',pos);
15 % Load
16 Ass=AddLoad(ass,1,'No',2);
17 Ass=AddLoad(ass,1,'No',3);

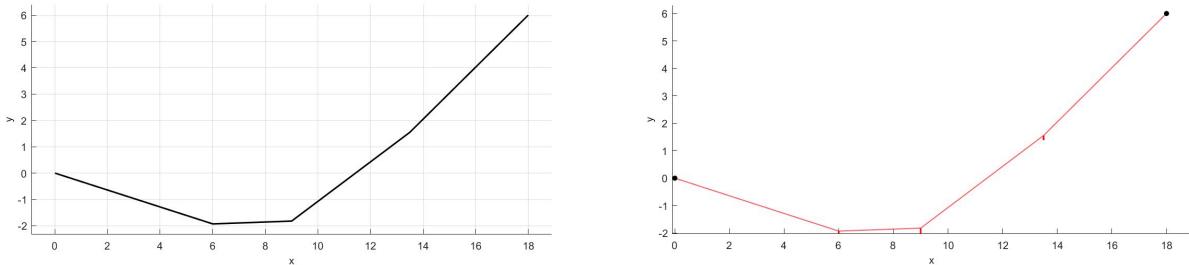
```

```

18 Ass=AddLoad(Ass,1,'No',4);
19 Load1=[0,-3e4,0,0,0,0];
20 Load2=[0,-6e4,0,0,0,0];
21 Load3=[0,-2e4,0,0,0,0];
22 Ass=SetLoad(Ass,1,Load1);
23 Ass=SetLoad(Ass,2,Load2);
24 Ass=SetLoad(Ass,3,Load3);
25 % Boundary
26 Ass=AddBoundary(Ass,1,'No',1);
27 Ass=AddBoundary(Ass,1,'No',5);
28 Bound1=[1,1,0,0,0];
29 Ass=SetBoundaryType(Ass,1,Bound1);
30 Ass=SetBoundaryType(Ass,2,Bound1);
31 % Material
32 mat.table=[ "EX",1.95e11*1e5; "PRXY",0.3];
33 Ass=AddMaterial(Ass,mat);
34 Ass=SetMaterial(Ass,1,1);
35 % Element type
36 ET.name='10';
37 ET.opt=[];
38 ET.R=[140e-6,1e6/(1.95e11*1e5)];
39 Ass=AddET(Ass,ET);
40 Ass=SetET(Ass,1,1);
41 % Static analysis
42 opt.ANTYPE=0;
43 opt.NLGEOM=1;% Nonlinear analysis
44 Ass=AddSolu(Ass,opt);
45 % Add sensor
46 Ass=AddSensor(Ass,'U',1);
47 Ass=AddSensor(Ass,'Etable','LS',...
48 'TableNum',1,...
49 'Part',1);
50 % Output to ANSYS
51 ANSYS_Output(Ass);
52 Plot(Ass,'boundary',1,...
53 'load',1,'load_scale',0.1,...
54 'view',[0,90]);
55 if Cal
56 ANSYSSolve(Ass);
57 PlotSensor(Ass,1);
58 PlotSensor(Ass,2);
59 end

```





2.6 Link10 Rod structure with gaps (Flag=6)

```

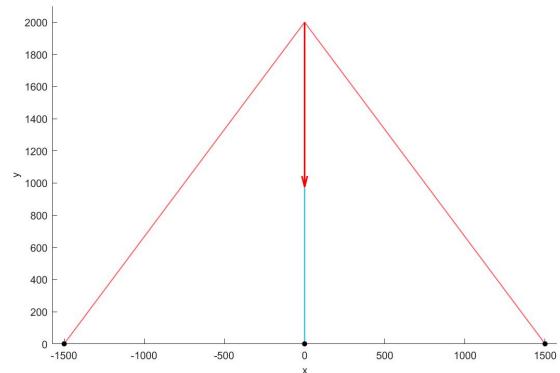
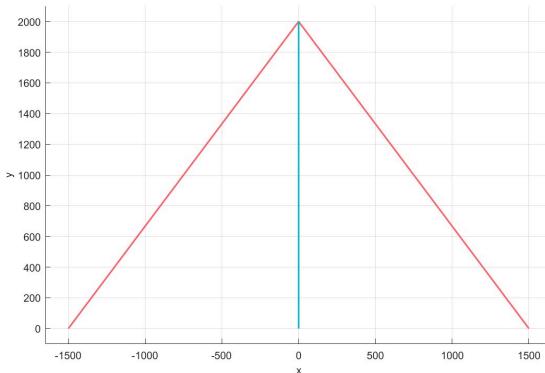
1 % Create points
2 a1=Point2D('Point1');
3 a1=AddPoint(a1,[-1500;0],[0;2000]);
4 a1=AddPoint(a1,[0;1500],[2000;0]);
5 a2=Point2D('Point2');
6 a2=AddPoint(a2,[0;0],[2000;0]);
7 % Create lines
8 b1=Line2D('Line1');
9 b1=AddLine(b1,a1,1);
10 b1=AddLine(b1,a1,2);
11 b2=Line2D('Line2');
12 b2=AddLine(b2,a2,1);
13 l=Layer('Layer');
14 l=addElement(l,b1);
15 l=addElement(l,b2);
16 Plot(l,'view',[0,90]);
17 l=Meshoutput(l);
18 % Add assembly
19 Ass=Assembly('Rod_structure_with_gaps');
20 pos=[0,0,0,0,0,0];
21 Ass=AddPart(ass,l.Meshoutput{1,1}, 'position', pos);
22 % Load
23 Ass=AddLoad(ass,1, 'No', 2);
24 Load1=[0,-20480,0,0,0,0];
25 Ass=SetLoad(ass,1,Load1);
26 % Boundary
27 Ass=AddBoundary(ass,1, 'No', 1);
28 Ass=AddBoundary(ass,1, 'No', 4);
29 Ass=AddBoundary(ass,1, 'No', 3);
30 Bound1=[1,1,1,0,0,0];
31 Ass=SetBoundaryType(ass,1,Bound1);
32 Ass=SetBoundaryType(ass,2,Bound1);
33 Ass=SetBoundaryType(ass,3,Bound1);
34 % Material
35 mat.table=[ "EX",1.2e5; "PRXY",0.3];

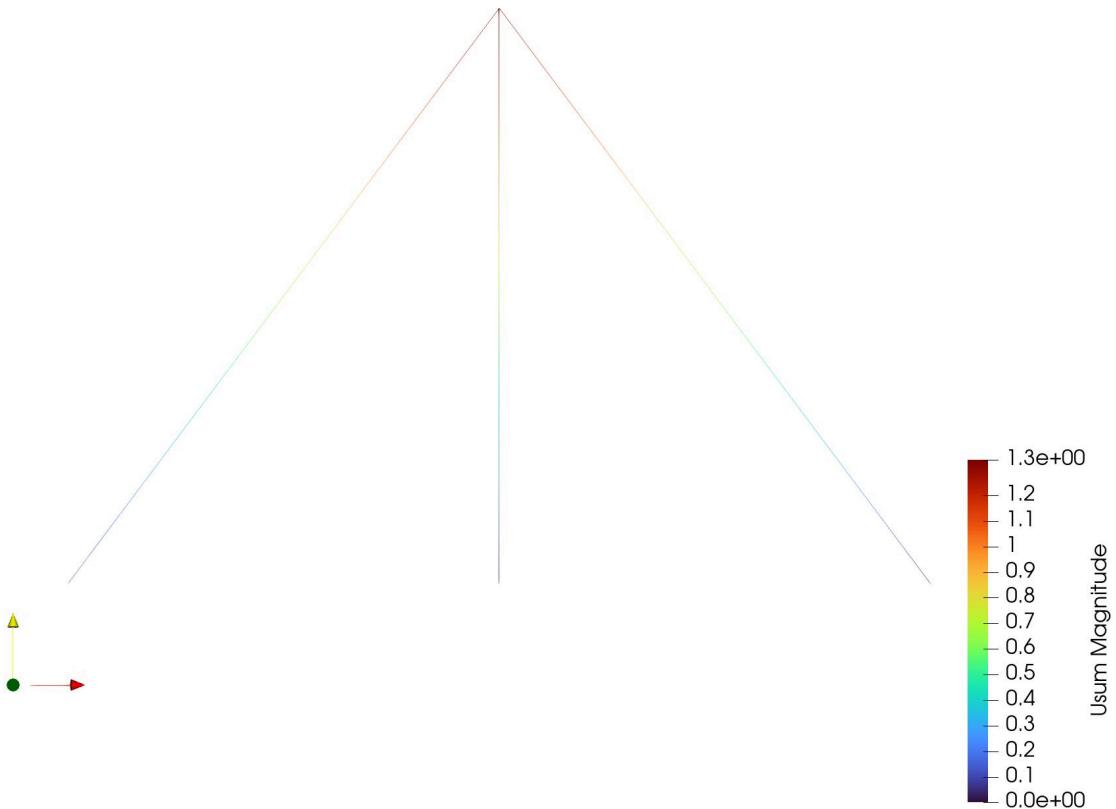
```

```

36 Ass=AddMaterial(Ass,mat);
37 Ass=SetMaterial(Ass,1,1);
38 % Divide part
39 Ass=DividePart(Ass,1,l.Matrix{1,1});
40 % Element type
41 ET1.name='8';
42 ET1.opt=[];
43 ET1.R=200;
44 ET2.name='10';
45 ET2.opt=[3,1];
46 ET2.R=[200,1/2000];
47 AddET(Ass,ET1);
48 AddET(Ass,ET2);
49 SetET(Ass,1,1);
50 SetET(Ass,2,2);
51 Plot(Ass,'boundary',1,...
52 'load',1,'load_scale',0.05,...
53 'view',[0,90]);
54 % Static analysis
55 opt.ANTYPE=0;
56 Ass=AddSolu(Ass,opt);
57 % Add sensor
58 Ass=AddSensor(Ass,'U',1);
59 % Output to ANSYS
60 ANSYS_Output(Ass);
61 if Cal
62 ANSYS_Solve(Ass);
63 PlotSensor(Ass,1);
64 end

```





2.7 Link180 Rod structure with initial stress (Flag=7)

```

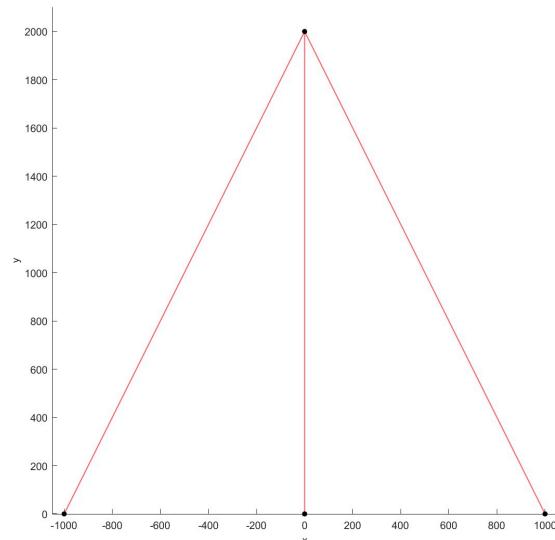
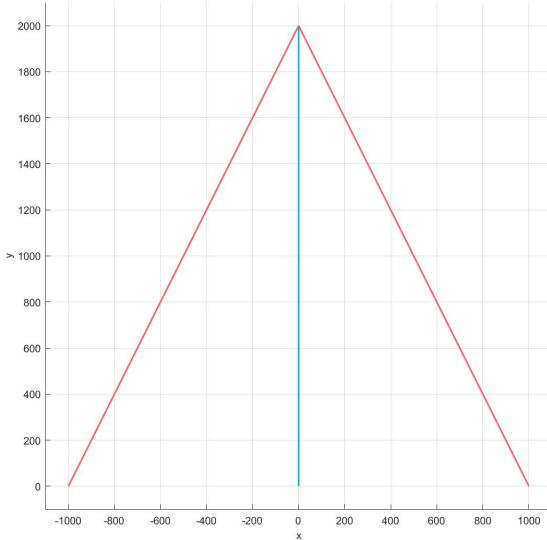
1 % Create points
2 a1=Point2D('Point1');
3 a1=AddPoint(a1,[-1000;0],[0;2000]);
4 a1=AddPoint(a1,[0;1000],[2000;0]);
5 a2=Point2D('Point2');
6 a2=AddPoint(a2,[0;0],[2000;0]);
7 % Create lines
8 b1=Line2D('Line1');
9 b1=AddLine(b1,a1,1);
10 b1=AddLine(b1,a1,2);
11 b2=Line2D('Line2');
12 b2=AddLine(b2,a2,1);
13 l=Layer('Layer');
14 l=addElement(l,b1);
15 l=addElement(l,b2);
16 Plot(l,'view',[0,90]);
17 l=Meshoutput(l);
18 % Add assembly
19 Ass=Assembly('Rod_structure_with_initial_stress');
20 pos=[0,0,0,0,0,0];
21 Ass=AddPart(ass,l.Meshoutput{1,1}, 'position', pos);
22 % Boundary
23 Ass=AddBoundary(ass,1, 'No', 1);
24 Ass=AddBoundary(ass,1, 'No', 4);
25 Ass=AddBoundary(ass,1, 'No', 3);
26 Ass=AddBoundary(ass,1, 'No', 2);
27 Bound1=[1,1,1,0,0,0];
28 Bound2=[0,0,1,0,0,0];
29 Ass=SetBoundaryType(ass,1,Bound1);

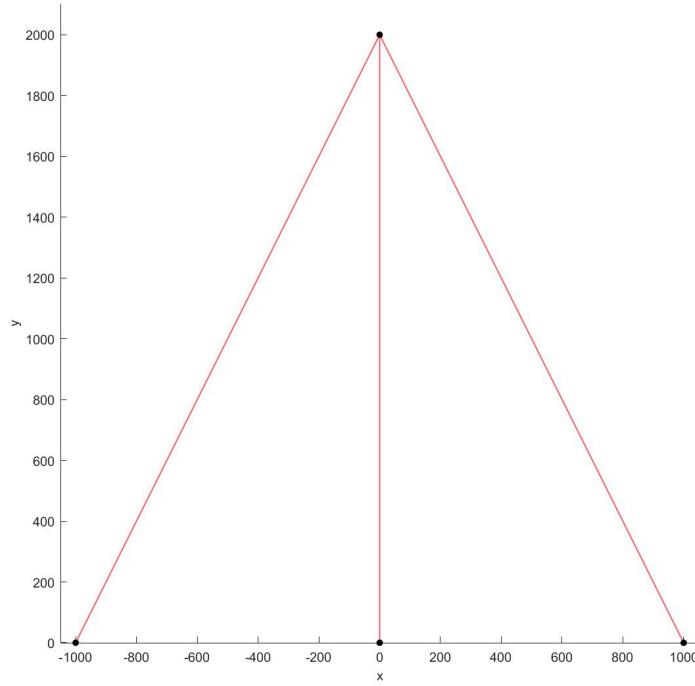
```

```

30 Ass=SetBoundaryType(Ass,2,Bound1);
31 Ass=SetBoundaryType(Ass,3,Bound1);
32 Ass=SetBoundaryType(Ass,4,Bound2);
33 % Material
34 mat.table=[ "EX",1.2e5;"PRXY",0.3];
35 Ass=AddMaterial(Ass,mat);
36 Ass=SetMaterial(Ass,1,1);
37 % Element type
38 ET1.name='180';
39 ET1.opt=[];
40 ET1.R=10;
41 Ass=AddET(Ass,ET1);
42 Ass=SetET(Ass,1,1);
43 Plot(Ass,'boundary',1,...
44 'load',1,'load_scale',0.05,...
45 'view',[0,90]);
46 % Intial Stress
47 Ass=AddIStress(Ass,1,100,'element',2);
48 % Static analysis
49 opt.ANTYPE=0;
50 Ass=AddSolu(Ass,opt);
51 % Add sensor
52 Ass=AddSensor(Ass,'U',1);
53 % Output to ANSYS
54 ANSYS_Output(Ass);
55 if Cal
56 ANSYSSolve(Ass);
57 PlotSensor(Ass,1);
58 end

```





2.8 Beam3 Static analysis of multi-span beams (Flag=8)

```

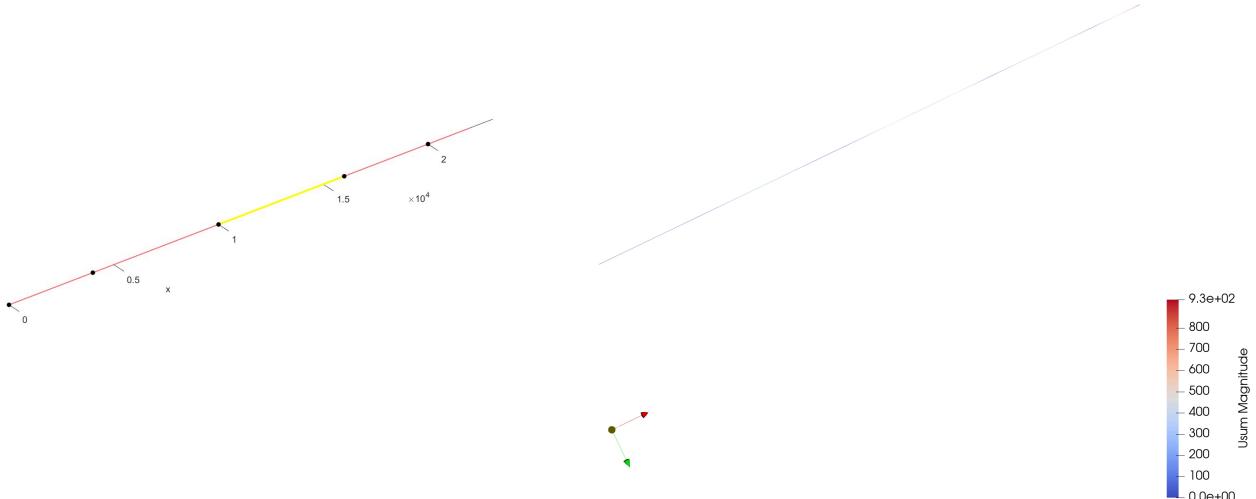
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:500:22000)',zeros(45,1));
4 % Creat lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 b=Meshoutput(b);
8 % Add assembly
9 Ass=Assembly('Multi-span_beams');
10 pos=[0,0,0,0,0,0];
11 Ass=AddPart(ass,b.Meshoutput,'position',pos);
12 % Boundary
13 Ass=AddBoundary(ass,1,'No',1);
14 Ass=AddBoundary(ass,1,'No',9);
15 Ass=AddBoundary(ass,1,'No',21);
16 Ass=AddBoundary(ass,1,'No',33);
17 Ass=AddBoundary(ass,1,'No',41);
18 Bound1=[1,1,0,0,0,0];
19 Bound2=[0,1,0,0,0,0];
20 Ass=SetBoundaryType(ass,1,Bound1);
21 Ass=SetBoundaryType(ass,2,Bound2);
22 Ass=SetBoundaryType(ass,3,Bound2);
23 Ass=SetBoundaryType(ass,4,Bound2);
24 Ass=SetBoundaryType(ass,5,Bound2);
25 % Material
26 mat.table=["EX",2.1e5;"PRXY",0.3];
27 Ass=AddMaterial(ass,mat);
28 Ass=SetMaterial(ass,1,1);
29 % Element type

```

```

30 ET1.name='3';
31 ET1.opt=[];
32 ET1.R=[4000,1e6,20];
33 Ass=AddET(Ass,ET1);
34 Ass=SetET(Ass,1,1);
35 % Add load
36 Ass=AddLoad(Ass,1,'No',13);
37 Ass=AddLoad(Ass,1,'No',17);
38 Ass=AddLoad(Ass,1,'No',45);
39 Load1=[0,-3e4,0,0,0,0];
40 Load2=[0,-2e4,0,0,0,0];
41 Ass=SetLoad(Ass,1,Load1);
42 Ass=SetLoad(Ass,2,Load1);
43 Ass=SetLoad(Ass,3,Load2);
44 % Add SF
45 Ass=AddSF(Ass,1,(21:32)');
46 value=[1,20,20];
47 Ass=SetSF(Ass,1,value);
48 Plot(Ass,'boundary',1,'load',1,'load_scale',1);
49 % Static analysis
50 opt.ANTYPE=0;
51 Ass=AddSolu(Ass,opt);
52 % Add sensor
53 Ass=AddSensor(Ass,'U',1);
54 % Output to ANSYS
55 ANSYS_Output(Ass);
56 if Cal
57 PlotSensor(Ass,1);
58 end

```



2.9 Beam3 Semicircular Hingeless Arch (Flag=9)

```

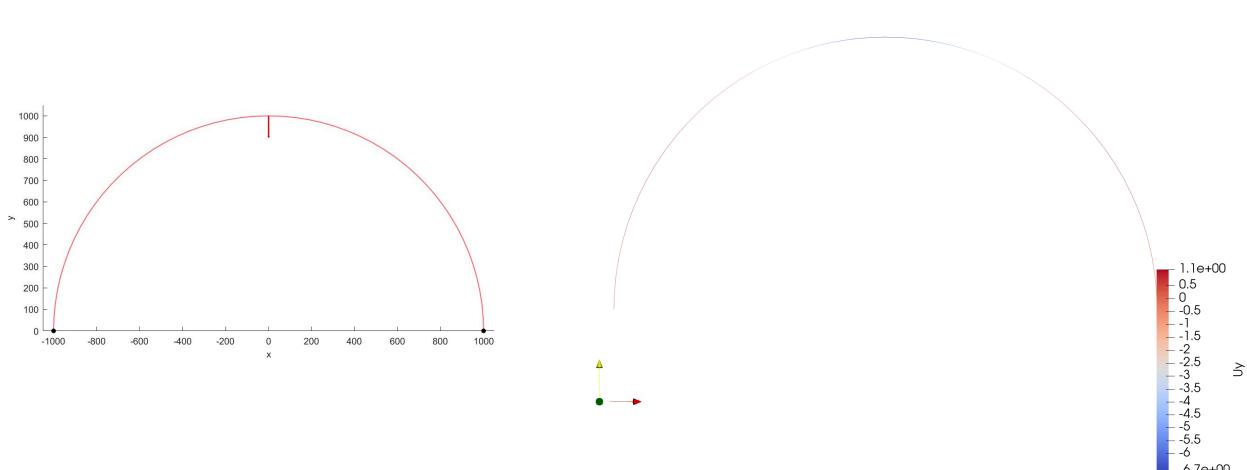
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,0,0);
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCircle(b,1000,a,1,'ang',180,'seg',50);
7 Plot(b);

```

```

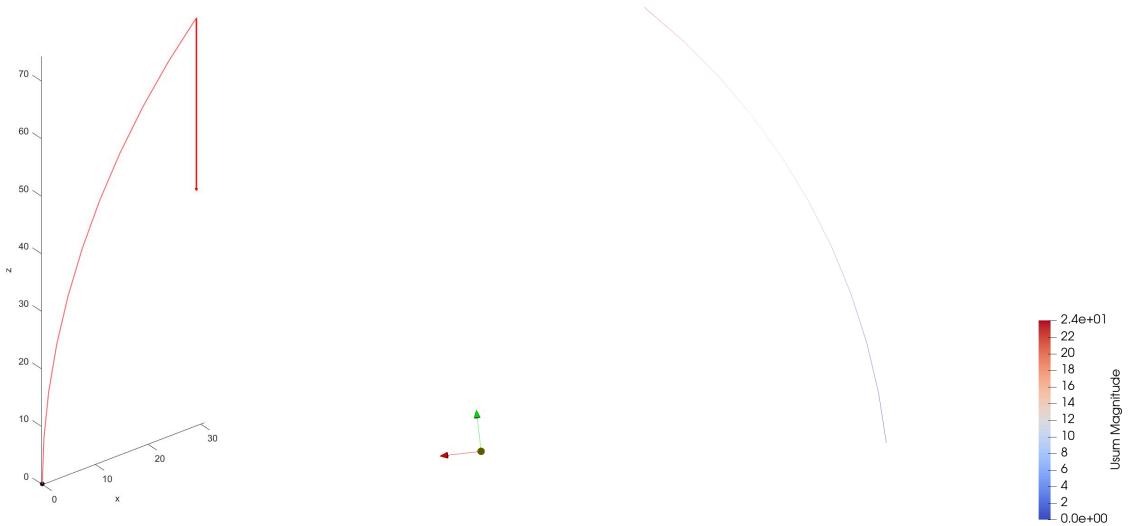
8 b=Meshoutput(b);
9 % Add assembly
10 Ass=Assembly('Semicircular_Hingeless_Arch');
11 pos=[0,0,0,0,0,0];
12 Ass=AddPart(ass,b.Meshoutput,'position',pos);
13 % Boundary
14 Ass=AddBoundary(ass,1,'No',1);
15 Ass=AddBoundary(ass,1,'No',50+1);
16 Bound1=[1,1,1,1,1,1];
17 Ass=SetBoundaryType(ass,1,Bound1);
18 Ass=SetBoundaryType(ass,2,Bound1);
19 % Material
20 mat.table=[ "EX",2.1e5; "PRXY",0.3];
21 Ass=AddMaterial(ass,mat);
22 Ass=SetMaterial(ass,1,1);
23 % Element type
24 ET1.name='3';
25 ET1.opt=[];
26 ET1.R=[100,10^4/12,10,1.2];
27 Ass=AddET(ass,ET1);
28 Ass=SetET(ass,1,1);
29 % Add load
30 Ass=AddLoad(ass,1,'No',26);
31 Load1=[0,-100,0,0,0,0];
32 Ass=SetLoad(ass,1,Load1);
33 Plot(ass,'boundary',1,...
34 'load',1,'load_scale',1,...
35 'view',[0,90]);
36 % Static analysis
37 opt.ANTYPE=0;
38 Ass=AddSolu(ass,opt);
39 % Add sensor
40 Ass=AddSensor(ass,'U',1);
41 % Output to ANSYS
42 ANSYS_Output(ass);
43 if Cal
44 ANSYSSolve(ass);
45 PlotSensor(ass,1);
46 end

```



2.10 Beam4 45° curve beam (Flag=10)

```
1 % Create points
2 a=Point2D('Point1');
3 AddPoint(a,100,0);
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCircle(b,100,a,1,'sang',180,'ang',-45,'seg',10);
7 Plot(b);
8 b=Meshoutput(b);
9 % Add assembly
10 Ass=Assembly('Curve_Beam');
11 pos=[0,0,0,-90,0,0];
12 Ass=AddPart(ass,b.Meshoutput,'position',pos);
13 % Boundary
14 Ass=AddBoundary(ass,1,'No',1);
15 Bound1=[1,1,1,1,1,1];
16 Ass=SetBoundaryType(ass,1,Bound1);
17 % Material
18 mat.table=[ "EX",1.1e7; "GXY",1.5e6];
19 Ass=AddMaterial(ass,mat);
20 Ass=SetMaterial(ass,1,1);
21 % Element type
22 ET1.name='4';
23 ET1.opt=[];
24 ET1.R=[1,1/12,1/12,1,1];
25 Ass=AddET(ass,ET1);
26 Ass=SetET(ass,1,1);
27 % Load
28 Ass=AddLoad(ass,1,'No',11);
29 Load1=[0,0,-300,0,0,0];
30 Ass=SetLoad(ass,1,Load1);
31 Plot(ass,'boundary',1,'load',1,'load_scale',0.1);
32 % Static analysis
33 opt.ANTYPE=0;
34 Ass=AddSolu(ass,opt);
35 % Add sensor
36 Ass=AddSensor(ass,'U',1);
37 % Output to ANSYS
38 ANSYS_Output(ass);
39 if Cal
40 ANSYSSolve(ass);
41 PlotSensor(ass,1);
42 end
```



2.11 Beam23 Plastic analysis of single-story frame (Flag=11)

```

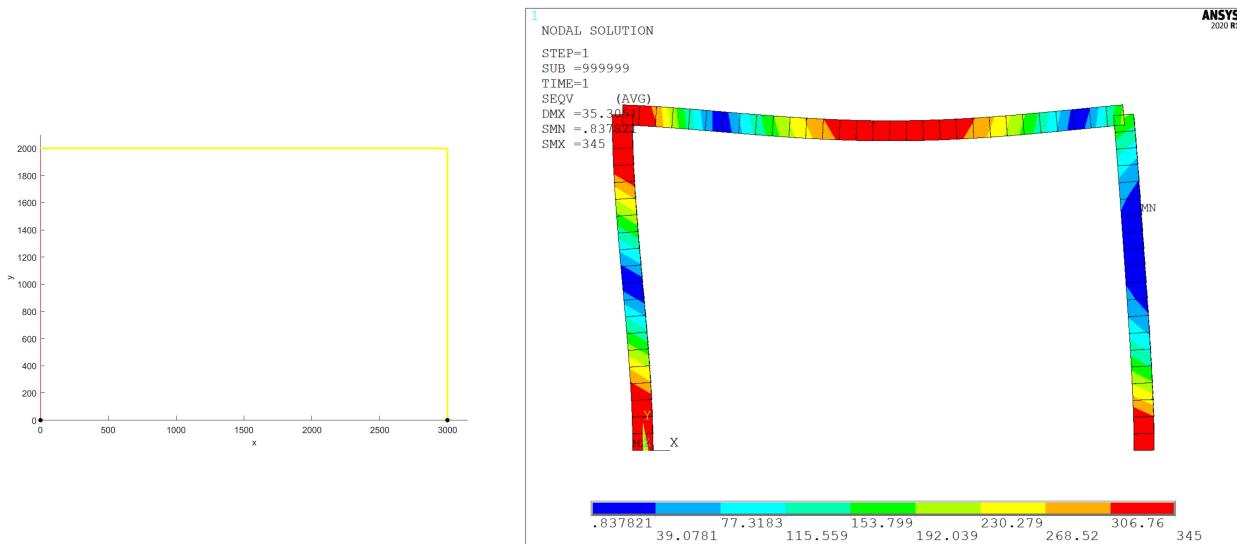
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,zeros(21,1),(0:100:2000)');
4 a=AddPoint(a,(0:100:3000)',2000*ones(31,1));
5 a=AddPoint(a,3000*ones(21,1),(2000:-100:0)');
6 % Create lines
7 b=Line2D('Line1');
8 b=AddCurve(b,a,1);
9 b=AddCurve(b,a,2);
10 b=AddCurve(b,a,3);
11 Plot(b);
12 b=Meshoutput(b);
13 % Add assembly
14 Ass=Assembly('Single_story_Beam');
15 pos=[0,0,0,0,0,0];
16 Ass=AddPart(ass,b.Meshoutput,'position',pos);
17 % Boundary
18 Ass=AddBoundary(ass,1,'No',1);
19 Ass=AddBoundary(ass,1,'No',71);
20 Bound1=[1,1,1,1,1,1];
21 Ass=SetBoundaryType(ass,1,Bound1);
22 Ass=SetBoundaryType(ass,2,Bound1);
23 % Material
24 mat.table=[ "EX",2.1e5; "PRXY",0.3];
25 mat.TBlab="BISO";
26 mat.TBtable=[345,0];
27 Ass=AddMaterial(ass,mat);
28 Ass=SetMaterial(ass,1,1);
29 % Element type
30 ET1.name='23';
31 ET1.opt=[];
32 ET1.R=[6000,50*120^3/12,120];
33 Ass=AddET(ass,ET1);
34 Ass=SetET(ass,1,1);
35 % Add SF

```

```

36 Ass=AddSF(Ass,1,(21:70)');
37 value1=[1,80];
38 Ass=SetSF(Ass,1,value1);
39 Plot(Ass,'boundary',1,...
40 'load',1,...
41 'load_scale',1,...
42 'view',[0,90]);
43 % Static analysis
44 opt.ANTYPE=0;
45 Ass=AddSolu(Ass,opt);
46 % Add sensor
47 Ass=AddSensor(Ass,'U',1);
48 % Output to ANSYS
49 ANSYS_Output(Ass);
50 if Cal
51 ANSYSSolve(Ass);
52 PlotSensor(Ass,1);
53 end

```



2.12 Beam24 Cross-section cantilever beam (Flag=12)

```

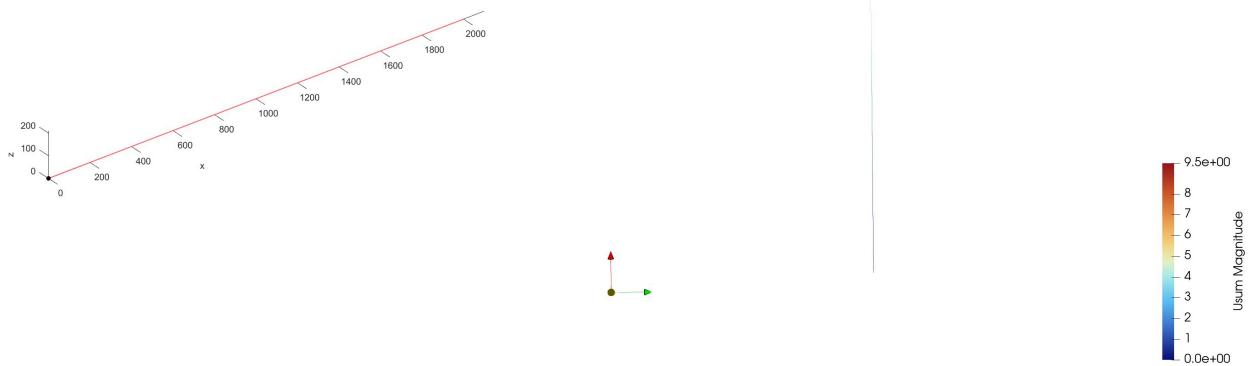
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:200:2000)',zeros(11,1));
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 b=Meshoutput(b);
8 % Add assembly
9 Ass=Assembly('Cross-section_cantilever_beam');
10 pos=[0,0,0,0,0,0];
11 Ass=AddPart(Ass,b.Meshoutput,'position',pos);
12 % 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 % Element type
21 ET1.name='24';
22 ET1.opt=[1,1;3,1;6,1];
23 ET1.R=[0,0,0,0,112,20,-60,112,16,0,112,0,0,200,20,0,112,0,140,112,16];
24 Ass=BeamK(Asse,1);
25 Ass=AddET(Asse,ET1);
26 Ass=SetET(Asse,1,1);
27 % Add load
28 Ass=AddLoad(Asse,1,'No',11);
29 Load1=[0,-1e4,0,0,0,0];
30 Ass=SetLoad(Asse,1,Load1);
31 Plot(Asse,'boundary',1,'load',1,'load_scale',1);
32 % Static analysis
33 opt.ANTYPE=0;
34 Ass=AddSolu(Asse,opt);
35 % Add sensor
36 Ass=AddSensor(Asse,'U',1);
37 % Output to ANSYS
38 ANSYS_Output(Asse);
39 if Cal
40 ANSYSSolve(Asse);
41 PlotSensor(Asse,1);
42 end

```



2.13 Beam24 biaxially symmetrical I-beam rigid frame (Flag=13)

```

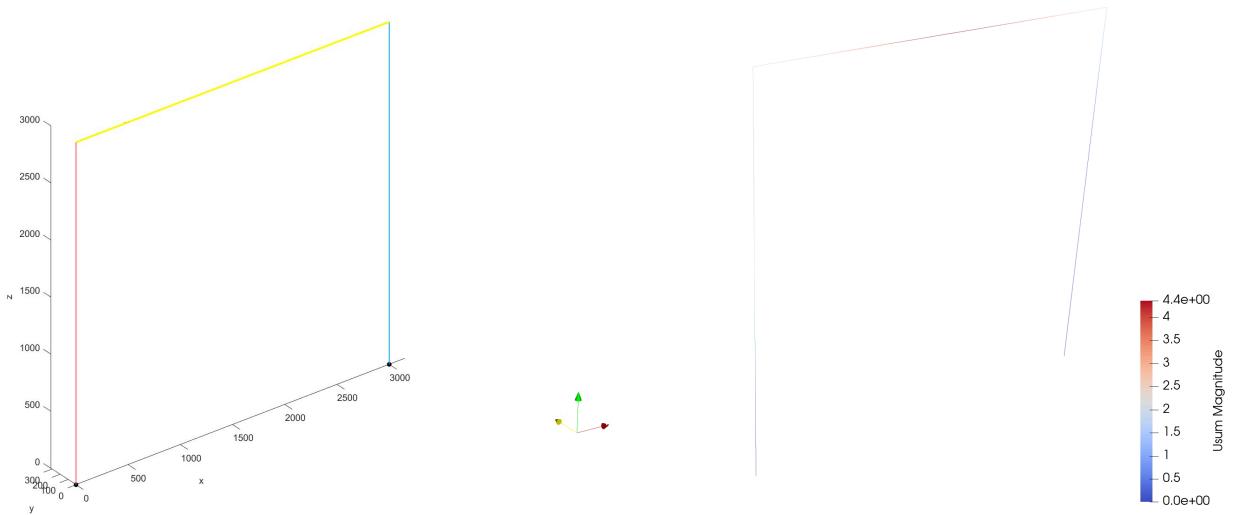
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,zeros(11,1),(0:300:3000)');
4 a=AddPoint(a,(0:300:3000)',3000*ones(11,1));
5 a=AddPoint(a,3000*ones(11,1),(0:300:3000)');
6 % Creat lines
7 b1=Line2D('Line1');
8 b1=AddCurve(b1,a,1);
9 b1=AddCurve(b1,a,2);
10 b1=AddCurve(b1,a,3);
11 b1=Meshoutput(b1);
12 % Add assembly
13 Ass=Assembly('biaxially_symmetrical_frame');

```

```

14 pos=[0,0,0,-90,0,0];
15 Ass=AddPart(ass,b1.Meshoutput,'position',pos);
16 % Boundary
17 Ass=AddBoundary(ass,1,'No',1);
18 Ass=AddBoundary(ass,1,'No',22);
19 Bound1=[1,1,1,1,1,1];
20 Ass=SetBoundaryType(ass,1,Bound1);
21 Ass=SetBoundaryType(ass,2,Bound1);
22 % Material
23 mat.table=[ "EX",2.1e5; "PRXY",0.3];
24 Ass=AddMaterial(ass,mat);
25 Ass=SetMaterial(ass,1,1);
26 % Add load
27 Ass=AddLoad(ass,1,'No',11);
28 Load1=[50000,0,0,0,0,0];
29 Ass=SetLoad(ass,1,Load1);
30 % Element type
31 ET1.name='24';
32 ET1.opt=[];
33 ET1.R=[ -92,142,0,92,142,20,92,-142,20,-92,-142,20,-92,142,20];
34 ET2.name='24';
35 ET2.opt=[];
36 ET2.R=[ -140,-100,0,-140,100,20,-140,0,0,140,0,16,140,100,0,140,-100,20];
37 Ass=BeamK(ass,1);
38 Ass=AddET(ass,ET1);
39 Ass=AddET(ass,ET2);
40 % Divide part
41 Matrix{1,1}=(1:10)';
42 Matrix{2,1}=(11:20)';
43 Matrix{3,1}=(21:30)';
44 Ass=DividePart(ass,1,Matrix);
45 Ass=SetET(ass,1,2);
46 Ass=SetET(ass,2,1);
47 Ass=SetET(ass,3,2);
48 % Add SF
49 Ass=AddSF(ass,2,(1:10)');
50 value1=[1,300];
51 Ass=SetSF(ass,1,value1);
52 Plot(ass,'boundary',1,...
53 'load',1,'load_scale',0.01,...
54 'zlim',[0,3000]);
55 % Static analysis
56 opt.ANTYPE=0;
57 Ass=AddSolu(ass,opt);
58 % Add sensor
59 Ass=AddSensor(ass,'U',1);
60 % Output to ANSYS
61 ANSYS_Output(ass);
62 if Cal
63 ANSYSSolve(ass);
64 PlotSensor(ass,1);
65 end

```



2.14 Beam44 Stress analysis of simply supported beam with Z-shaped section (Flag=14)

```

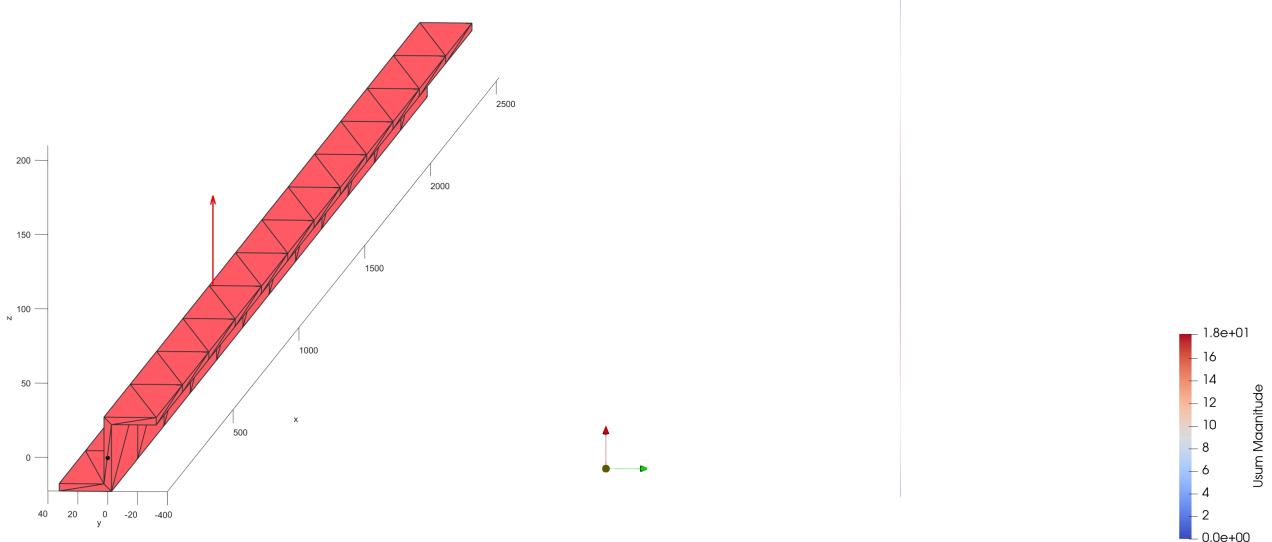
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:200:2400)',zeros(13,1));
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 b=Meshoutput(b);
8 % Add assembly
9 Ass=Assembly('Z-shaped_section_beam');
10 pos=[0,0,0,0,0,0];
11 Ass=AddPart(Ass,b.Meshoutput,'position',pos);
12 % Boundary
13 Ass=AddBoundary(Ass,1,'No',1);
14 Ass=AddBoundary(Ass,1,'No',13);
15 Bound1=[1,1,1,1,0,0];
16 Bound2=[0,1,1,1,0,0];
17 Ass=SetBoundaryType(Ass,1,Bound1);
18 Ass=SetBoundaryType(Ass,2,Bound2);
19 % Material
20 mat.table=[ "EX",2.06e5;"PRXY",0.3];
21 Ass=AddMaterial(Ass,mat);
22 Ass=SetMaterial(Ass,1,1);
23 % Element type
24 ET1.name='44';
25 ET1.opt=[];
26 ET1.R=[];
27 Ass=BeamK(Ass,1);
28 Ass=AddET(Ass,ET1);
29 Ass=SetET(Ass,1,1);
30 % Section
31 Sec.type="beam";
32 Sec.subtype="Z";
33 Sec.data=[35,35,50,5,5,5];
34 Ass=AddSection(Ass,Sec);
35 Ass=SetSection(Ass,1,1);

```

```

36 % Add load
37 Ass=AddLoad(Ass,1,'No',5);
38 Load1=[0,0,880,0,0,0];
39 Ass=SetLoad(Ass,1,Load1);
40 Plot(Ass,'boundary',1,'load',1,'load_scale',0.1,'BeamGeom',1,'ylim',[-40,40]);
41 % Static analysis
42 opt.ANTYPE=0;
43 Ass=AddSolu(Ass,opt);
44 % Add sensor
45 Ass=AddSensor(Ass,'U',1);
46 % Output to ANSYS
47 ANSYS_Output(Ass);
48 if Cal
49 ANSYSSolve(Ass);
50 PlotSensor(Ass,1);
51 end

```



2.15 Beam54 Three-span continuous beam with variable section (Flag=15)

```

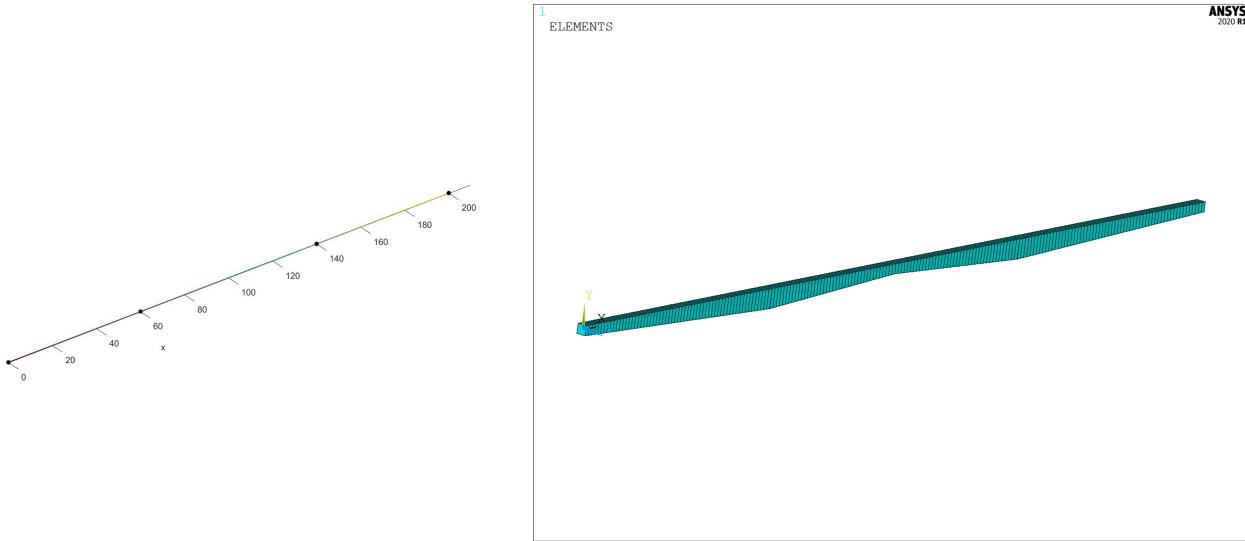
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:1:200)',zeros(201,1));
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 Plot(b);
8 b=Meshoutput(b);
9 % Add assembly
10 Ass=Assembly('Variable_section_beam');
11 pos=[0,0,0,0,0,0];
12 Ass=AddPart(Ass,b.Meshoutput,'position',pos);
13 % Boundary
14 Ass=AddBoundary(Ass,1,'No',1);
15 Ass=AddBoundary(Ass,1,'No',61);
16 Ass=AddBoundary(Ass,1,'No',141);
17 Ass=AddBoundary(Ass,1,'No',201);
18 Bound1=[1,1,0,0,0,0];
19 Bound2=[0,1,0,0,0,0];
20 Ass=SetBoundaryType(Ass,1,Bound2);

```

```

21 Ass=SetBoundaryType(Ass,2,Bound1);
22 Ass=SetBoundaryType(Ass,3,Bound2);
23 Ass=SetBoundaryType(Ass,4,Bound2);
24 % Material
25 mat.table=[ "EX",3.5e10; "PRXY",0.2];
26 Ass=AddMaterial(Ass,mat);
27 Ass=SetMaterial(Ass,1,1);
28 % Add load
29 Ass=AddLoad(Ass,1,'No',(1:201)');
30 Load1=[0,-1,0,0,0,0];
31 Ass=SetLoad(Ass,1,Load1);
32 % Divide part
33 Temp=1:200;
34 Matrix=num2cell(Temp');
35 Ass=DividePart(Ass,1,Matrix);
36 % Element type
37 b=2;
38 h1=2:2/60:4-2/60;
39 h2=4:-2/40:2+2/40;
40 h3=2:2/40:4-2/40;
41 h4=4:-2/60:2+2/60;
42 H1=[h1 h2 h3 h4];
43 H2=[H1(2:end),2];
44 Area1=H1.*b;
45 Area2=H2.*b;
46 Iz1=b.*H1.^3/12;
47 Iz2=b.*H2.^3/12;
48 Hyt1=H1/2;
49 Hyt2=H2/2;
50 Hyb1=H1/2;
51 Hyb2=H2/2;
52 Dy1=-H1/2+1;
53 Dy2=-H2/2+1;
54 for i=1:200
55 ET.name='54';
56 ET.opt=[];
57 ET.R=[Area1(i),Iz1(i),Hyt1(i),Hyb1(i),...
58 Area2(i),Iz2(i),Hyt2(i),Hyb2(i),...
59 0,Dy1(i),0,Dy2(i)];
60 Ass=AddET(Ass,ET);
61 Ass=SetET(Ass,i,i);
62 end
63 Plot(Ass,'boundary',1,'load',1,'load_scale',0.1);
64 % Static analysis
65 opt.ANTYPE=0;
66 Ass=AddSolu(Ass,opt);
67 % Add sensor
68 Ass=AddSensor(Ass,'U',1);
69 % Output to ANSYS
70 ANSYS_Output(Ass);
71 if Cal
72 ANSYSSolve(Ass);
73 PlotSensor(Ass,1);
74 end

```



2.16 Beam188 I-shaped section cantilever beam (Flag=16)

```

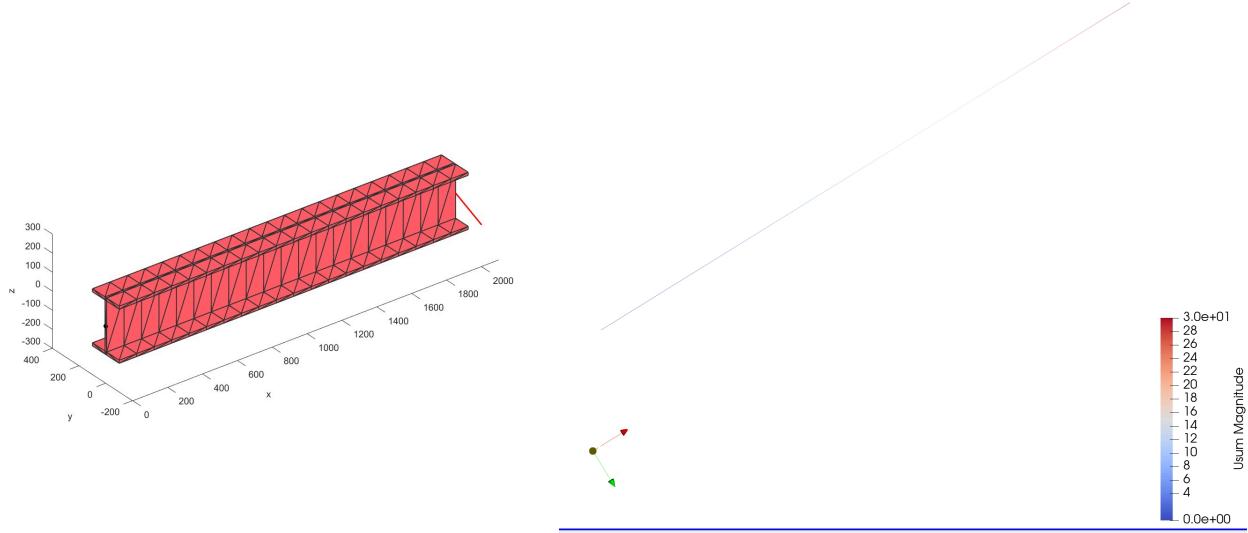
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:100:2000)',zeros(21,1));
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 b=Meshoutput(b);
8 % Add assembly
9 Ass=Assembly('I-shaped_section_beam');
10 pos=[0,0,0,-90,0,0];
11 Ass=AddPart(ass,b.Meshoutput,'position',pos);
12 % Boundary
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',21);
22 Load1=[0,-5e4,-2e4,0,0,0];
23 Ass=SetLoad(ass,1,Load1);
24 % Element type
25 ET.name='188';
26 ET.opt=[4,2];
27 ET.R=[];
28 Ass=AddET(ass,ET);
29 Ass=SetET(ass,1,1);
30 % Section
31 Sec.type="beam";
32 Sec.subtype="I";
33 Sec.data=[200,200,300,16,16,12];
34 Ass=AddSection(ass,Sec);
35 Ass=SetSection(ass,1,1);
36 Ass=BeamK(ass,1);
37 Plot(ass,'boundary',1,'load',1,'load_scale',0.02,'ylim',[-200,400],'zlim',
[-300,300],'BeamGeom',1);

```

```

38 % Static analysis
39 opt.ANTYPE=0;
40 Ass=AddSolu(Ass,opt);
41 % Add sensor
42 Ass=AddSensor(Ass, 'U',1);
43 % Output to ANSYS
44 ANSYS_Output(Ass);
45 if Cal
46 ANSYSSolve(Ass);
47 PlotSensor(Ass,1);
48 end

```



2.17 Pipe16 Static calculation of cantilever tube (Flag=17)

```

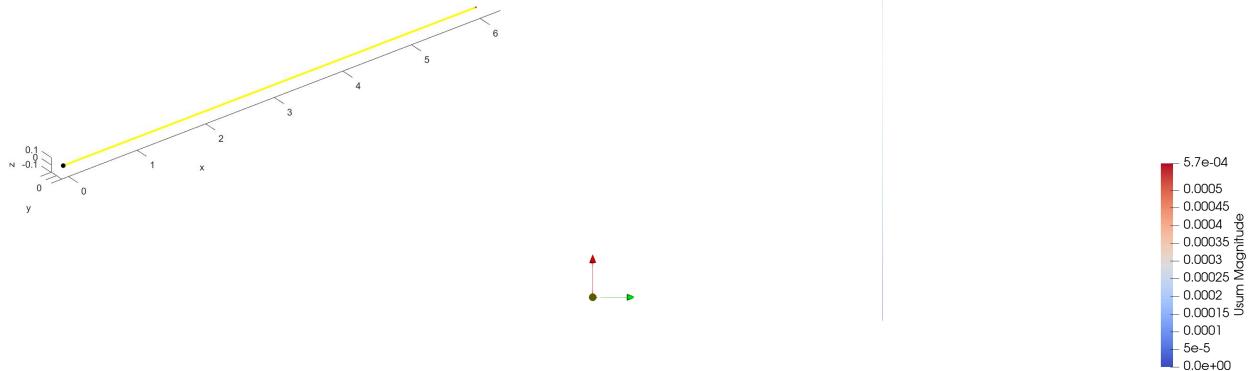
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:0.1:6)',zeros(61,1));
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 b=Meshoutput(b);
8 % Add assembly
9 Ass=Assembly('Cantilever_tube');
10 Ass=AddPart(Ass,b.Meshoutput);
11 % Boundary
12 Ass=AddBoundary(Ass,1,'No',1);
13 Bound1=[1,1,1,1,1,1];
14 Ass=SetBoundaryType(Ass,1,Bound1);
15 % Material
16 mat.table=["EX",2.1e11;"PRXY",0.3;"DENS",7800];
17 Ass=AddMaterial(Ass,mat);
18 Ass=SetMaterial(Ass,1,1);
19 % Add load
20 Ass=AddLoad(Ass,1,'No',61);
21 Load1=[-1e6,0,0,4e5,0,0];
22 Ass=SetLoad(Ass,1,Load1);
23 % Add SF
24 Ass=AddSF(Ass,1,(1:60)', 'type', 'SFE');
25 Ass=AddSF(Ass,1,(1:60)', 'type', 'SFE');

```

```

26 value1=[3,0,-5e4];
27 value2=[4,0,4e4];
28 Ass=SetSF(Ass,1,value1);
29 Ass=SetSF(Ass,2,value2);
30 % Element type
31 ET.name='16';
32 ET.opt=[];
33 ET.R=[0.6,0.016,0,0,0,1000,2500,0.05];
34 Ass=AddET(Ass,ET);
35 Ass=SetET(Ass,1,1);
36 Plot(Ass,'boundary',1,'load',1,'load_scale',0.1);
37 % Static analysis
38 opt.ANTYPE=0;
39 Ass=AddSolu(Ass,opt);
40 % Add sensor
41 Ass=AddSensor(Ass,'U',1);
42 % Output to ANSYS
43 ANSYS_Output(Ass);
44 if Cal
45 ANSYSSolve(Ass);
46 PlotSensor(Ass,1);
47 end
48 end

```



2.18 Pipe20 Steel pipe plastic analysis (Flag=18)

```

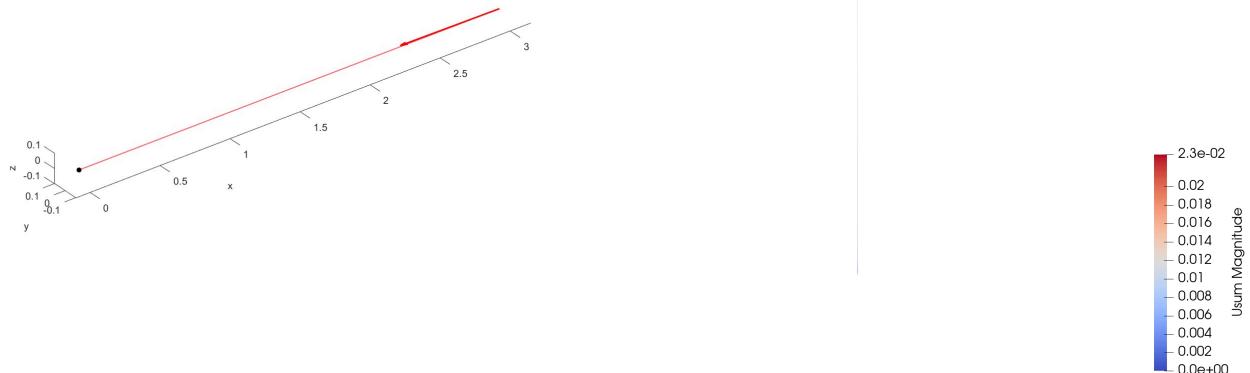
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,(0:0.1:3)',zeros(31,1));
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 b=Meshoutput(b);
8 % Add assembly
9 Ass=Assembly('Plastic_tube');
10 Ass=AddPart(Ass,b.Meshoutput);
11 % Boundary
12 Ass=AddBoundary(Ass,1,'No',1);
13 Bound1=[1,1,1,1,1,1];

```

```

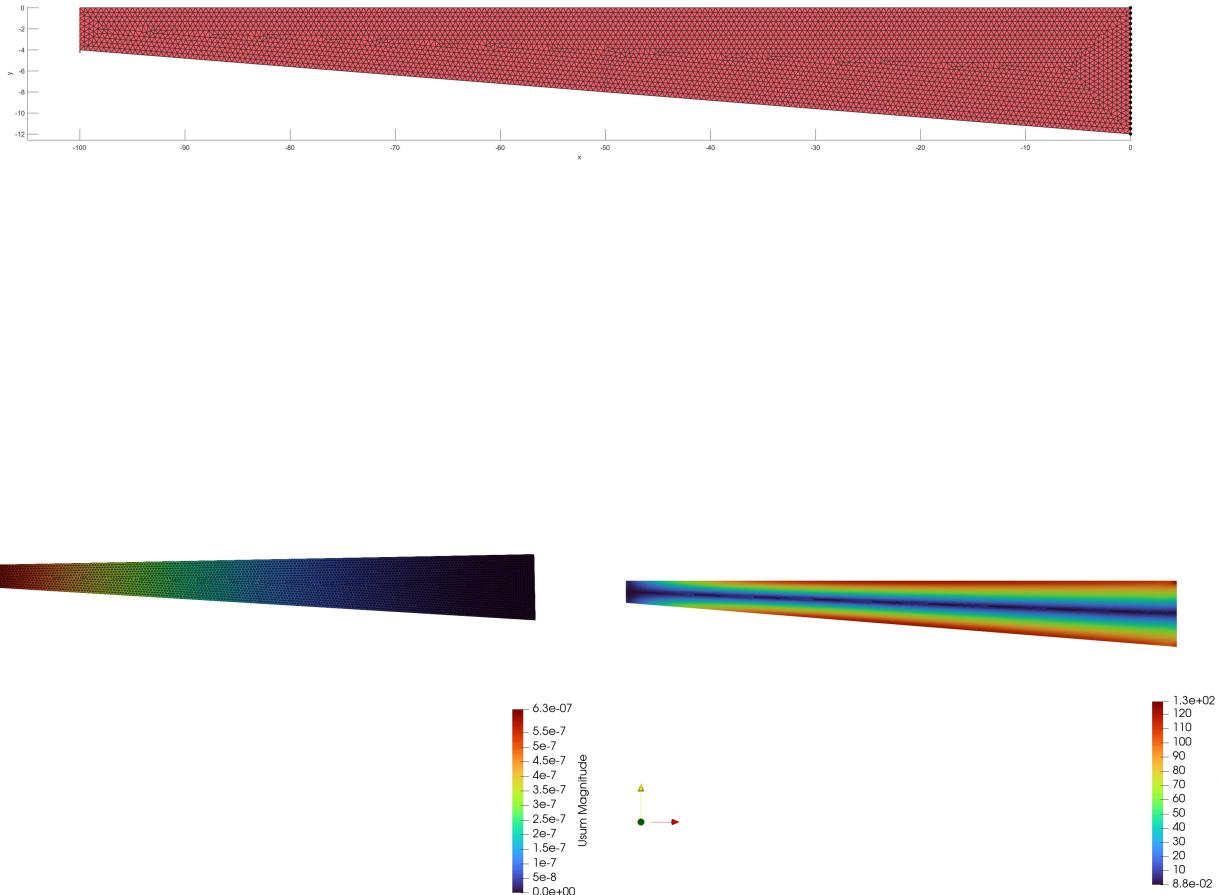
14 Ass=SetBoundaryType(Ass,1,Bound1);
15 % Material
16 mat.table=[ "EX",2.1e11;"PRXY",0.3;"DENS",7800];
17 mat.TBlab="BKIN";
18 mat.TBtable=[235e6,0];
19 Ass=AddMaterial(Ass,mat);
20 Ass=SetMaterial(Ass,1,1);
21 % Add load
22 Ass=AddLoad(Ass,1,'No',31);
23 Load1=[ -7e5,1e4,0,0,0,0];
24 Ass=SetLoad(Ass,1,Load1);
25 % Element type
26 ET.name='20';
27 ET.opt=[];
28 ET.R=[0.2,0.005];
29 Ass=AddET(Ass,ET);
30 Ass=SetET(Ass,1,1);
31 Plot(Ass,'boundary',1,'load',1,'load_scale',0.000001);
32 % Static analysis
33 opt.ANTYPE=0;
34 opt.NLGEOM=1;
35 opt.NSUBST=50;
36 opt.ARCLEN=[1,5];
37 Ass=AddSolu(Ass,opt);
38 % Add sensor
39 Ass=AddSensor(Ass,'U',1);
40 % Output to ANSYS
41 ANSYS_Output(Ass);
42 if Cal
43 ANSYSSolve(Ass);
44 PlotSensor(Ass,1);
45 end

```



2.19 Plane42 Variable section beam (Flag=19)

```
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,[0;0;-100;-100;0],[0;-12;-4;0;0]);
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 % Create surface2D
8 S=Surface2D(b);
9 % Create Mehs2D
10 m=Mesh2D('Variable section beam');
11 m=AddSurface(m,S);
12 m=SetSize(m,0.5);
13 m=Mesh(m);
14 Plot(m);
15 % Add assembly
16 Ass=Assembly('Variable_section_beam');
17 Ass=AddPart(ass,m.Meshoutput);
18 % Boundary
19 Ass=AddBoundary(Ass,1,'locx',0);
20 Bound1=[1,1,0,0,0,0];
21 Ass=SetBoundaryType(Ass,1,Bound1);
22 % Material
23 mat.table=["EX",2.1e11;"PRXY",0.3;"DENS",7800];
24 Ass=AddMaterial(Ass,mat);
25 Ass=SetMaterial(Ass,1,1);
26 % Add load
27 Ass=AddLoad(Ass,1,'locx',-100);
28 Load1=[0,-80,0,0,0,0];
29 Ass=SetLoad(Ass,1,Load1);
30 % Element type
31 ET.name='42';
32 ET.opt=[3,3;6,2];
33 ET.R=3;
34 Ass=AddET(Ass,ET);
35 Ass=SetET(Ass,1,1);
36 Plot(Ass,'boundary',1,...
37 'load',1,'load_scale',0.2,...
38 'view',[0,90]);
39 % Static analysis
40 opt.ANTYPE=0;
41 Ass=AddSolu(Ass,opt);
42 % Add sensor
43 Ass=AddSensor(Ass,'U',1);
44 Ass=AddSensor(Ass,'Stress',1);
45 % Output to ANSYS
46 ANSYS_Output(Ass);
47 if Cal
48 ANSYSSolve(Ass);
49 PlotSensor(Ass,1);
50 PlotSensor(Ass,2);
51 end
```



2.20 Plane42 Plate with hole (Flag=20)

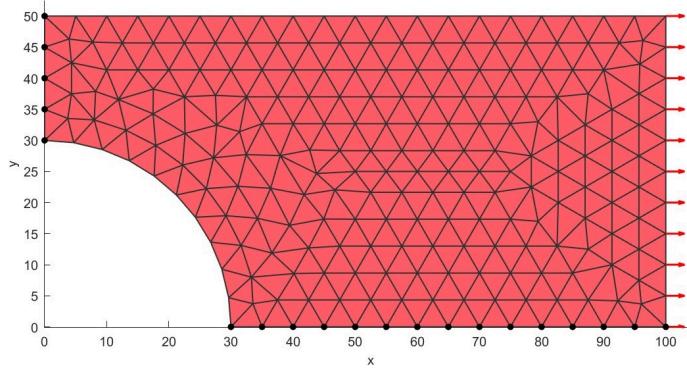
```

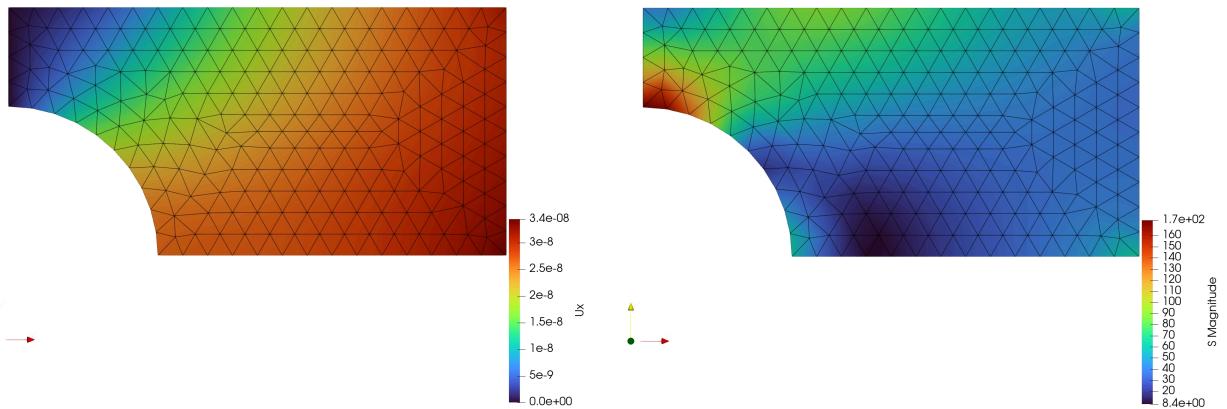
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,0,0);
4 a=AddPoint(a,[0;0;100;100;30],[30;50;50;0;0]);
5 % Create lines
6 b=Line2D('Line1');
7 b=AddCircle(b,30,a,1,'sang',0,'ang',90);
8 b=AddCurve(b,a,2);
9 Plot(b,'equal',1);
10 % Create surface2D
11 S=Surface2D(b);
12 % Create Mehs2D
13 m=Mesh2D('Plate with hole');
14 m=AddSurface(m,S);
15 m=SetSize(m,5);
16 m=Mesh(m);
17 Plot(m);
18 % Add assembly
19 Ass=Assembly('Plate_with_hole');
```

```

20 Ass=AddPart(ass,m.Meshoutput);
21 % Boundary
22 Ass=AddBoundary(ass,1,'locx',0);
23 Bound1=[1,0,0,0,0,0];
24 Ass=SetBoundaryType(ass,1,Bound1);
25 Ass=AddBoundary(ass,1,'locy',0);
26 Bound2=[0,1,0,0,0,0];
27 Ass=SetBoundaryType(ass,2,Bound2);
28 % Material
29 mat.table=[ "EX",2.1e11; "PRXY",0.3; "DENS",7800];
30 Ass=AddMaterial(ass,mat);
31 Ass=SetMaterial(ass,1,1);
32 % Add load
33 Ass=AddLoad(ass,1,'locx',100);
34 Load1=[12000,0,0,0,0,0];
35 Ass=SetLoad(ass,1,Load1);
36 % Element type
37 ET.name='42';
38 ET.opt=[3,3];
39 ET.R=6;
40 Ass=AddET(ass,ET);
41 Ass=SetET(ass,1,1);
42 Plot(ass,'boundary',1,...
43 'load',1,'load_scale',0.2,...
44 'view',[0,90]);
45 % Static analysis
46 opt.ANTYPE=0;
47 Ass=AddSolu(ass,opt);
48 % Add sensor
49 Ass=AddSensor(ass,'U',1);
50 Ass=AddSensor(ass,'Stress',1);
51 % Output to ANSYS
52 ANSYS_Output(ass);
53 if Cal
54 ANSYSSolve(ass);
55 PlotSensor(ass,1);
56 PlotSensor(ass,2);
57 end

```





2.21 Plane82 Flat bar with shoulder fillets (Flag=21)

```

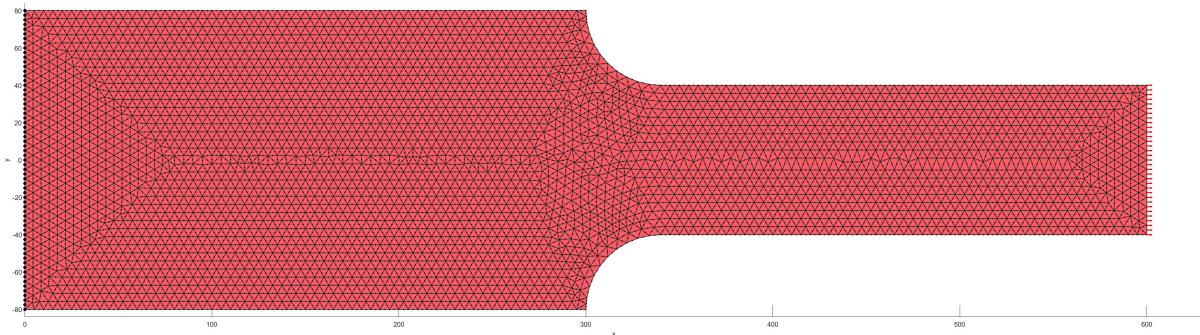
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,[0;300],[80;80]);
4 a=AddPoint(a,[300;300],[80;40]);
5 a=AddPoint(a,[300;450;600;600],[40;40;40;-40]);
6 a=AddPoint(a,[600;300],[-40;-40]);
7 a=AddPoint(a,[300;300],[-40;-80]);
8 a=AddPoint(a,[300;0;0],[-80;-80;80]);
9 % Create lines
10 b=Line2D('Line1');
11 b=AddLine(b,a,1);
12 b=AddLine(b,a,2);
13 b=AddCurve(b,a,3);
14 b=AddLine(b,a,4);
15 b=AddLine(b,a,5);
16 b=AddCurve(b,a,6);
17 b=CreateRadius(b,2,40);
18 b=CreateRadius(b,5,40);
19 Plot(b,'equal',1)
20 % Create surface2D
21 S=Surface2D(b);
22 % Create Mehs2D
23 m=Mesh2D('Flat bar with shoulder fillets');
24 m=AddSurface(m,S);
25 m=SetSize(m,5);
26 m=Mesh(m);
27 m=Convert2Order2(m);
28 % Add assembly
29 Ass=Assembly('Flat_bar_with_shoulder_fillet');
30 Ass=AddPart(ass,m.Meshoutput);
31 % Boundary
32 Ass=AddBoundary(ass,1,'locx',0);
33 Bound1=[1,1,0,0,0,0];
34 Ass=SetBoundaryType(ass,1,Bound1);
35 % Material
36 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
37 Ass=AddMaterial(ass,mat);
38 Ass=SetMaterial(ass,1,1);
39 % Add load
40 Ass=AddLoad(ass,1,'locx',600);

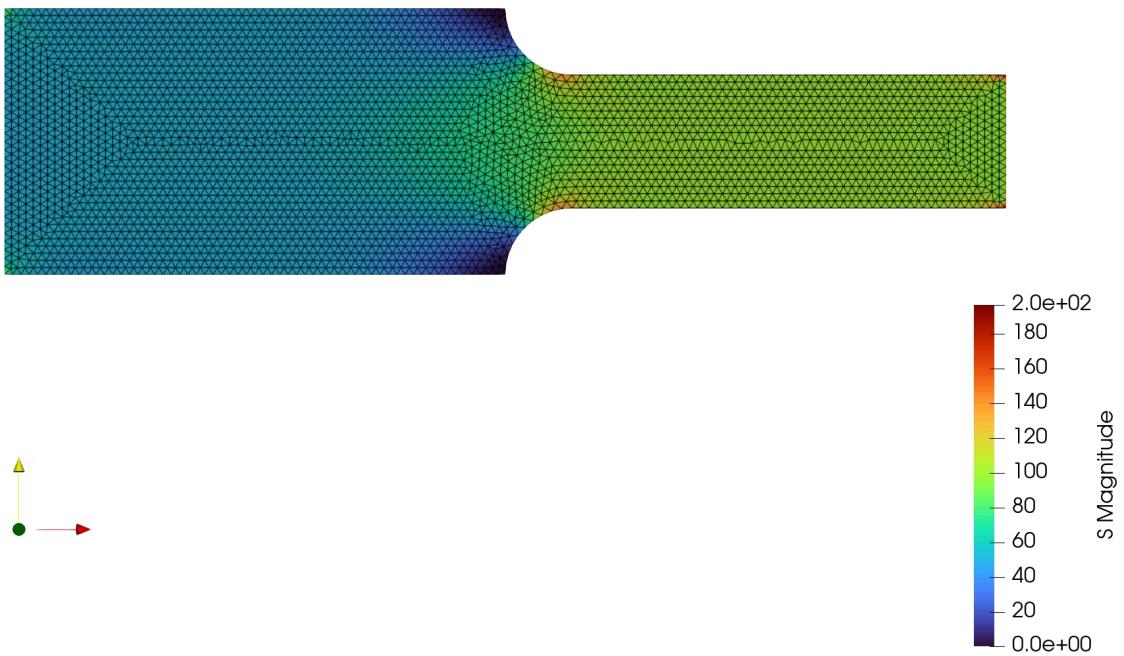
```

```

41 Load1=[96e3,0,0,0,0,0];
42 Ass=SetLoad(Ass,1,Load1);
43 % Element type
44 ET.name='82';
45 ET.opt=[3,3;5,1];
46 ET.R=12;
47 Ass=AddET(Ass,ET);
48 Ass=SetET(Ass,1,1);
49 Plot(Ass,'boundary',1,...
50 'load',1,'load_scale',0.2,...
51 'view',[0,90]);
52 % Static analysis
53 opt.ANTYPE=0;
54 Ass=AddSolu(Ass,opt);
55 % Add sensor
56 Ass=AddSensor(Ass,'U',1);
57 Ass=AddSensor(Ass,'Stress',1);
58 % Output to ANSYS
59 ANSYS_Output(Ass);
60 if Cal
61 ANSYSSolve(Ass);
62 PlotSensor(Ass,2);
63 end

```





2.22 Plane182 Variable section beam (Flag=22)

```

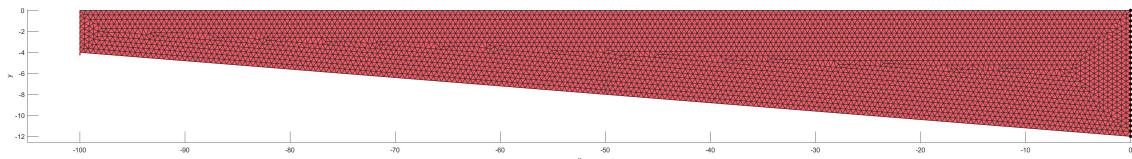
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,[0;0;-100;-100;0],[0;-12;-4;0;0]);
4 % Create lines
5 b=Line2D('Line1');
6 b=AddCurve(b,a,1);
7 % Create surface2D
8 S=Surface2D(b);
9 % Create Mesh2D
10 m=Mesh2D('Variable section beam');
11 m=AddSurface(m,S);
12 m=SetSize(m,0.5);
13 m=Mesh(m);
14 Plot(m);
15 % Add assembly
16 Ass=Assembly('Variable_section_beam');
17 Ass=AddPart(ass,m.Meshoutput);
18 % Boundary
19 Ass=AddBoundary(ass,1,'locx',0);
20 Bound1=[1,1,0,0,0,0];
21 Ass=SetBoundaryType(ass,1,Bound1);
22 % Material
23 mat.table=[ "EX",2.1e11;"PRXY",0.3;"DENS",7800];
24 Ass=AddMaterial(ass,mat);
25 Ass=SetMaterial(ass,1,1);
26 % Add load
27 Ass=AddLoad(ass,1,'locx',-100);

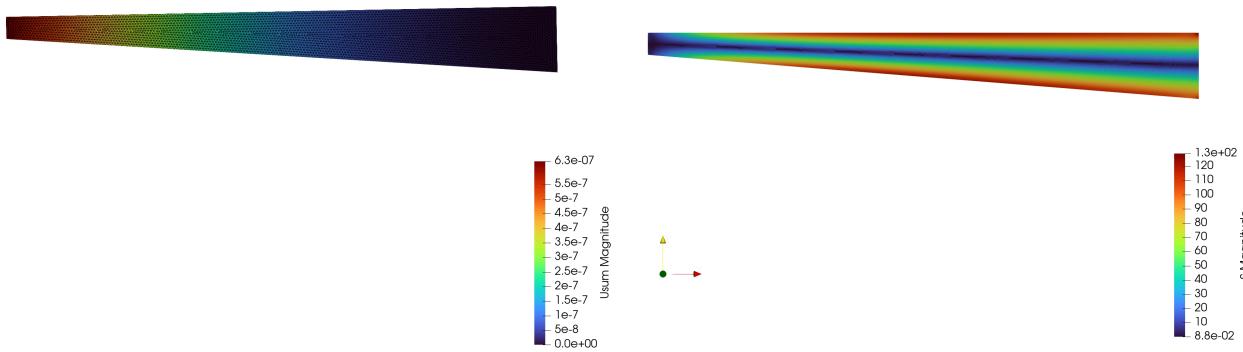
```

```

28 Load1=[0,-80,0,0,0,0];
29 Ass=SetLoad(Ass,1,Load1);
30 % Element type
31 ET.name='182';
32 ET.opt=[3,3];
33 ET.R=3;
34 Ass=AddET(Ass,ET);
35 Ass=SetET(Ass,1,1);
36 Plot(Ass,'boundary',1,...
37 'load',1,'load_scale',0.2,...
38 'view',[0,90]);
39 % Static analysis
40 opt.ANTYPE=0;
41 Ass=AddSolu(Ass,opt);
42 % Add sensor
43 Ass=AddSensor(Ass,'U',1);
44 Ass=AddSensor(Ass,'Stress',1);
45 % Output to ANSYS
46 ANSYS_Output(Ass);
47 if Cal
48 ANSYSSolve(Ass);
49 PlotSensor(Ass,1);
50 PlotSensor(Ass,2);
51 end

```





2.23 Plane183 Flat bar with shoulder fillets (Flag=23)

```

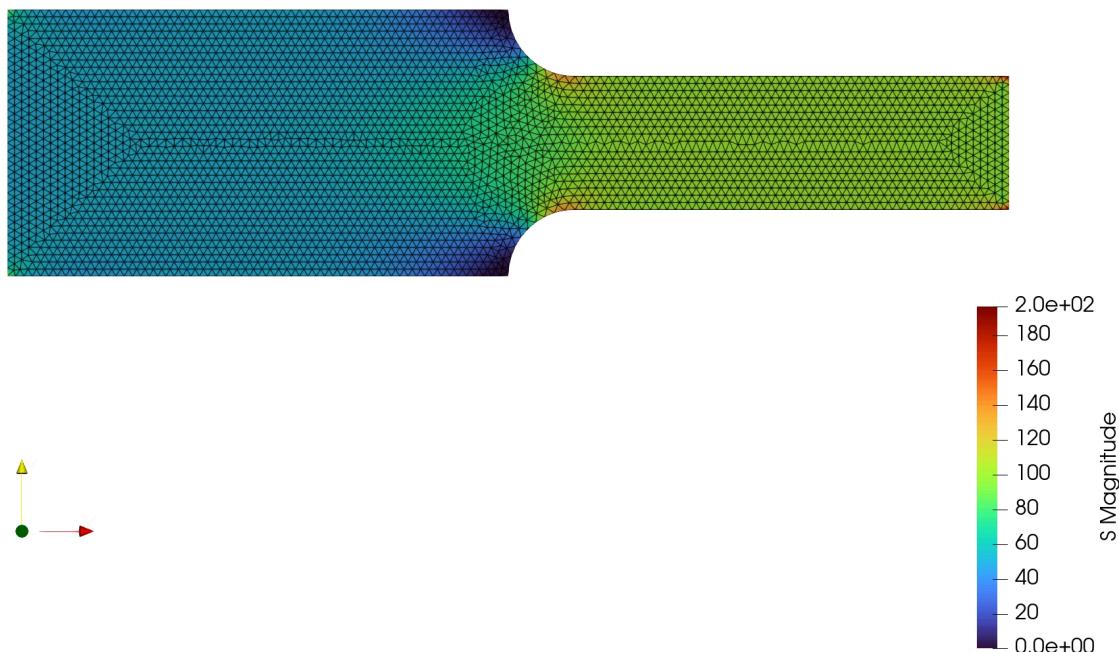
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,[0;300],[80;80]);
4 a=AddPoint(a,[300;300],[80;40]);
5 a=AddPoint(a,[300;450;600;600],[40;40;40;-40]);
6 a=AddPoint(a,[600;300],[-40;-40]);
7 a=AddPoint(a,[300;300],[-40;-80]);
8 a=AddPoint(a,[300;0;0],[-80;-80;80]);
9 % Create lines
10 b=Line2D('Line1');
11 b=AddLine(b,a,1);
12 b=AddLine(b,a,2);
13 b=AddCurve(b,a,3);
14 b=AddLine(b,a,4);
15 b=AddLine(b,a,5);
16 b=AddCurve(b,a,6);
17 b=CreateRadius(b,2,40);
18 b=CreateRadius(b,5,40);
19 Plot(b,'equal',1)
20 % Create surface2D
21 S=Surface2D(b);
22 % Create Mehs2D
23 m=Mesh2D('Flat bar with shoulder fillets');
24 m=AddSurface(m,S);
25 m=SetSize(m,5);
26 m=Mesh(m);
27 m=Convert2Order2(m);
28 Plot(m);
29 % Add assembly
30 Ass=Assembly('flat_bar_with_shoulder_fillet');
31 Ass=AddPart(ass,m.Meshoutput);
32 % Boundary
33 Ass=AddBoundary(ass,1,'locx',0);
34 Bound1=[1,1,0,0,0,0];
35 Ass=SetBoundaryType(ass,1,Bound1);
36 % Material
37 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
38 Ass=AddMaterial(ass,mat);
39 Ass=SetMaterial(ass,1,1);
40 % Add load

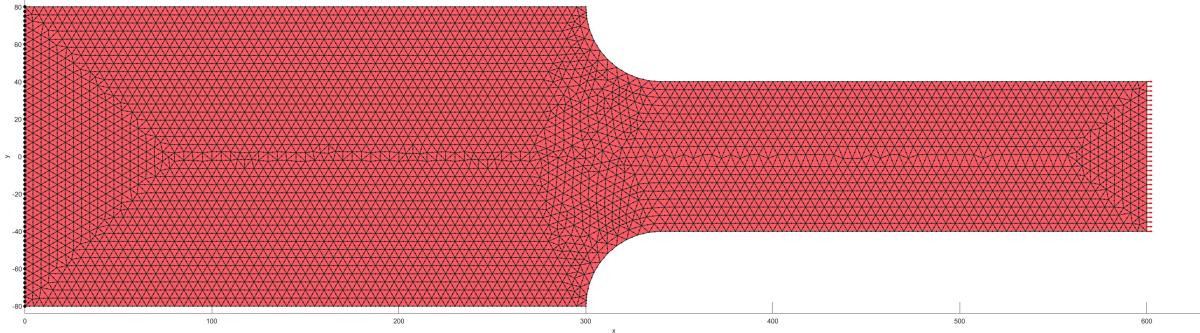
```

```

41 Ass=AddLoad(Ass,1,'locx',600);
42 Load1=[96e3,0,0,0,0,0];
43 Ass=SetLoad(Ass,1,Load1);
44 % Element type
45 ET.name='183';
46 ET.opt=[3,3];
47 ET.R=12;
48 Ass=AddET(Ass,ET);
49 Ass=SetET(Ass,1,1);
50 Plot(Ass,'boundary',1,...
51 'load',1,'load_scale',0.2,...
52 'view',[0,90]);
53 % Static analysis
54 opt.ANTYPE=0;
55 Ass=AddSolu(Ass,opt);
56 % Add sensor
57 Ass=AddSensor(Ass,'U',1);
58 Ass=AddSensor(Ass,'Stress',1);
59 % Output to ANSYS
60 ANSYS_Output(Ass);
61 if Cal
62 ANSYSSolve(Ass);
63 PlotSensor(Ass,1);
64 PlotSensor(Ass,2);
65 end

```





2.24 Solid45 Variable solid beam (Flag=24)

```

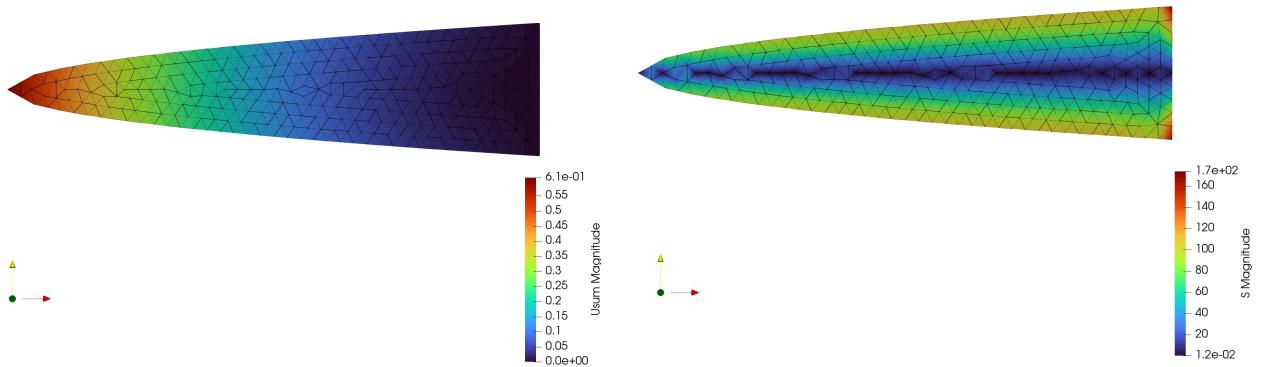
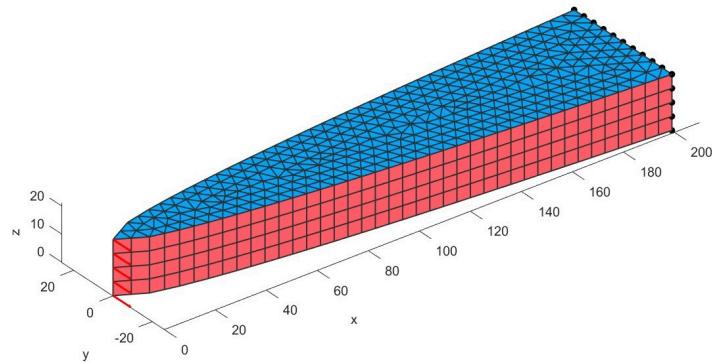
1 B=20;
2 h0=50;
3 x1=0:10:200;
4 y1=h0/2*sqrt(abs(x1)./200);
5 x2=200:-10:0;
6 y2=-h0/2*sqrt(abs(x2)/200);
7 % Create points
8 a=Point2D('Point1');
9 a=AddPoint(a,x1',y1');
10 a=AddPoint(a,x2',y2');
11 a=AddPoint(a,[200;200],[-h0/2;h0/2]);
12 % Create lines
13 b=Line2D('Line1');
14 b=AddCurve(b,a,1);
15 b=AddCurve(b,a,2);
16 b=AddLine(b,a,3);
17 Plot(b,'equal',1)
18 % Create surface2D
19 S=Surface2D(b);
20 % Create Mehs2D
21 m=Mesh2D('Variable solid beam');
22 m=AddSurface(m,S);
23 m=SetSize(m,5);
24 m=Mesh(m);
25 Plot(m);
26 % Create Mesh
27 mm=Mesh('Mesh');
28 mm=Extrude2Solid(mm,m,B,4);
29 PlotFace(mm);
30 % Add assembly
31 Ass=Assembly('Variable_solid_beam');
32 Ass=AddPart(ass,mm.Meshoutput);
33 % Boundary
34 Ass=AddBoundary(ass,1,'locx',200);
35 Bound1=[1,1,1,0,0,0];

```

```

36 Ass=SetBoundaryType(Ass,1,Bound1);
37 % Material
38 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
39 Ass=AddMaterial(Ass,mat);
40 Ass=SetMaterial(Ass,1,1);
41 % Add load
42 Ass=AddLoad(Ass,1,'locx',0);
43 Load1=[0,-5000,0,0,0,0];
44 Ass=SetLoad(Ass,1,Load1);
45 % Element type
46 ET.name='45';
47 ET.opt=[];
48 ET.R=[];
49 Ass=AddET(Ass,ET);
50 Ass=SetET(Ass,1,1);
51 Plot(Ass,'boundary',1,...
52 'load',1,'load_scale',1);
53 % Static analysis
54 opt.ANTYPE=0;
55 Ass=AddSolu(Ass,opt);
56 % Add sensor
57 Ass=AddSensor(Ass,'U',1);
58 Ass=AddSensor(Ass,'Stress',1);
59 % Output to ANSYS
60 ANSYS_Output(Ass);
61 if Cal
62 ANSYSSolve(Ass);
63 PlotSensor(Ass,1);
64 PlotSensor(Ass,2);
65 end

```



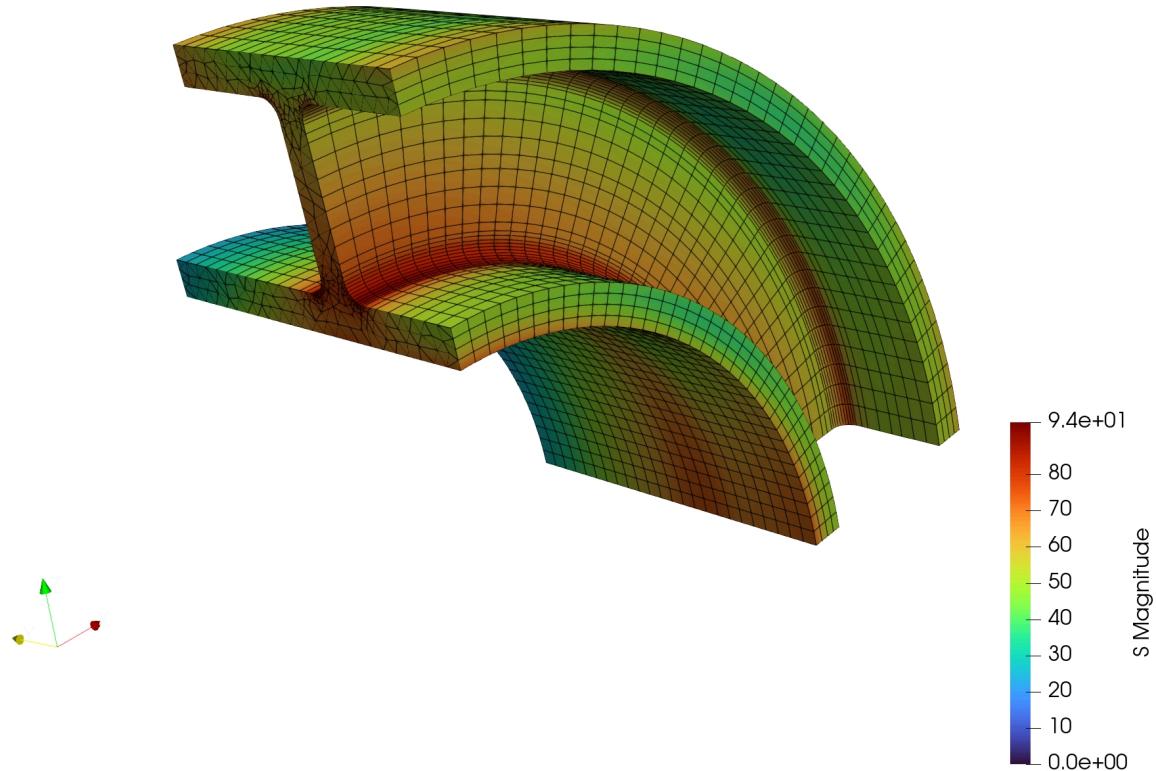
2.25 Solid95 Rotating part (Flag=25)

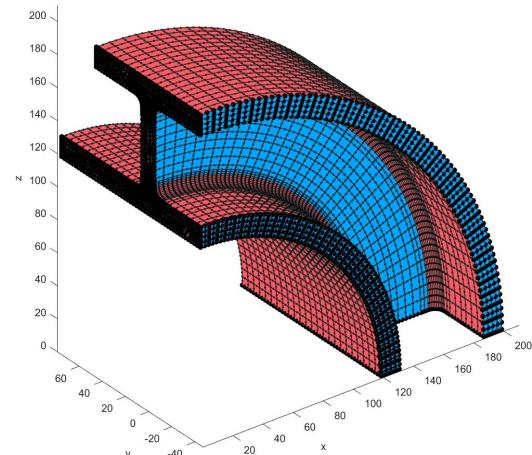
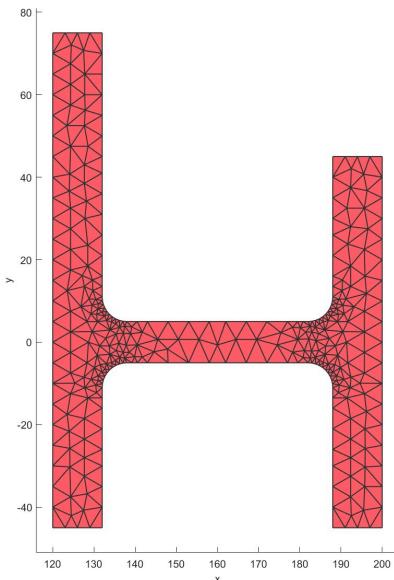
```
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,[120;120],[0;75]);
4 a=AddPoint(a,[120;132],[75;75]);
5 a=AddPoint(a,[132;132],[75;5]);
6 a=AddPoint(a,[132;188],[5;5]);
7 a=AddPoint(a,[188;188],[5;45]);
8 a=AddPoint(a,[188;200],[45;45]);
9 a=AddPoint(a,[200;200],[45;-45]);
10 a=AddPoint(a,[200;188],[-45;-45]);
11 a=AddPoint(a,[188;188],[-45;-5]);
12 a=AddPoint(a,[188;132],[-5;-5]);
13 a=AddPoint(a,[132;132],[-5;-45]);
14 a=AddPoint(a,[132;120],[-45;-45]);
15 a=AddPoint(a,[120;120],[-45;0]);
16 % Create lines
17 b=Line2D('Line1');
18 for i=1:13
19 b=AddLine(b,a,i);
20 end
21 b=CreateRadius(b,3,6);
22 b=CreateRadius(b,5,6);
23 b=CreateRadius(b,11,6);
24 b=CreateRadius(b,13,6);
25 Plot(b,'equal',1)
26 % Create surface2D
27 S=Surface2D(b);
28 % Create Mehs2D
29 m=Mesh2D('Rotating part');
30 m=AddSurface(m,S);
31 m=SetSize(m,5);
32 m=Mesh(m);
33 Plot(m);
34 % Create Mesh
35 mm=Mesh('Mesh');
36 mm=Revolve2Solid(mm,m,'Type',2,'Degree',90);
37 mm=Convert2Order2(mm);
38 PlotFace(mm,'marker',1);
39 PlotElement(mm);
40 % Add assembly
41 Ass=Assembly('Rotating_part');
42 Ass=AddPart(ass,mm.Meshoutput);
43 % Boundary
44 Ass=AddBoundary(Ass,1,'locx',0);
45 Ass=AddBoundary(Ass,1,'locz',0);
46 Ass=AddBoundary(Ass,1,'locy',-45);
47 Bound1=[1,0,0,0,0,0];
48 Bound2=[0,0,1,0,0,0];
49 Bound3=[0,1,0,0,0,0];
50 Ass=SetBoundaryType(Ass,1,Bound1);
51 Ass=SetBoundaryType(Ass,2,Bound2);
52 Ass=SetBoundaryType(Ass,3,Bound3);
53 % Material
54 mat.table=["EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
```

```

55 Ass=AddMaterial(Ass,mat);
56 Ass=SetMaterial(Ass,1,1);
57 % Element type
58 ET.name='95';
59 ET.opt=[];
60 ET.R=[];
61 Ass=AddET(Ass,ET);
62 Ass=SetET(Ass,1,1);
63 Plot(Ass,'boundary',1);
64 % Static analysis
65 opt.ANTYPE=0;
66 n=5000;%RPM
67 w=n*2*pi/60;
68 opt.OMEGA=[0,w,0];
69 Ass=AddSolu(Ass,opt);
70 % Add sensor
71 Ass=AddSensor(Ass,'Stress',1);
72 % Output to ANSYS
73 ANSYS_Output(Ass);
74 if Cal
75 ANSYSSolve(Ass);
76 PlotSensor(Ass,1);
77 end

```





2.26 Solid185 Ellipse beam (Flag=26)

```

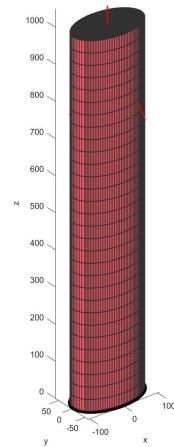
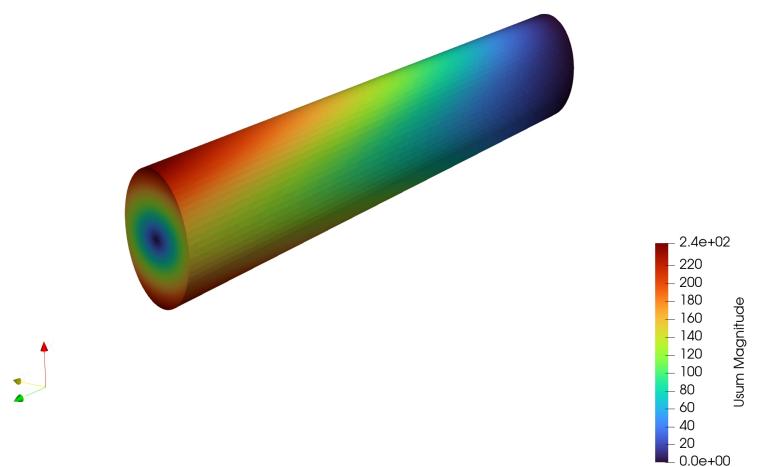
1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,0,0);
4 % Create lines
5 b=Line2D('Line1');
6 b=AddEllipse(b,100,60,a,1);
7 Plot(b,'equal',1)
8 % Create surface2D
9 S=Surface2D(b);
10 % Create Mesh2D
11 m=Mesh2D('Ellipse beam');
12 m=AddSurface(m,S);
13 m=SetSize(m,5);
14 m=Mesh(m);
15 Plot(m);
16 % Create Mesh
17 mm=Mesh('Mesh');
18 mm=Extrude2Solid(mm,m,1000,30);
19 PlotFace(mm);
20 % Add assembly
21 Ass=Assembly('Ellipse_beam');
22 Ass=AddPart(ass,mm.Meshoutput);
23 % Boundary
24 Ass=AddBoundary(ass,1,'locz',0);
25 Bound1=[1,1,1,0,0,0];
26 Ass=SetBoundaryType(ass,1,Bound1);
27 % Material
28 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
29 Ass=AddMaterial(ass,mat);
30 Ass=SetMaterial(ass,1,1);
31 % Element type
32 ET.name='185';
33 ET.opt=[];
34 ET.R=[];
35 Ass=AddET(ass,ET);

```

```

36 Ass=SetET(Ass,1,1);
37 ET1.name='21';ET1.opt=[3,0];ET1.R=[0,0,0,0,0,0];
38 AddET(Ass,ET1);
39 % Cnode
40 Ass=AddCnode(Ass,0,0,1000);
41 Ass=SetCnode(Ass,1,2);
42 % Connection
43 Ass=AddMaster(Ass,0,1);
44 Ass=AddSlaver(Ass,1,'face',3);
45 % Rbe2
46 Ass=SetRbe2(Ass,1,1);
47 % Add load
48 Ass=AddLoad(Ass,0,'No',1);
49 Load1=[0,0,0,0,0,1e10];
50 Ass=SetLoad(Ass,1,Load1);
51 Plot(Ass,'boundary',1,...
52 'load',1,'load_scale',0.2);
53 % Static analysis
54 opt.ANTYPE=0;
55 Ass=AddSolu(Ass,opt);
56 % Add sensor
57 Ass=AddSensor(Ass,'U',1);
58 Ass=AddSensor(Ass,'Stress',1);
59 % Output to ANSYS
60 ANSYS_Output(Ass);
61 if Cal
62 ANSYSSolve(Ass);
63 PlotSensor(Ass,1);
64 PlotSensor(Ass,2);
65 end

```



2.27 Solid186 Variable solid beam (Flag=27)

```

1 % Create points
2 a=Point2D('Point1');
3 a=AddPoint(a,[120;120],[0;75]);
4 a=AddPoint(a,[120;132],[75;75]);
5 a=AddPoint(a,[132;132],[75;5]);
6 a=AddPoint(a,[132;188],[5;5]);
7 a=AddPoint(a,[188;188],[5;45]);

```

```

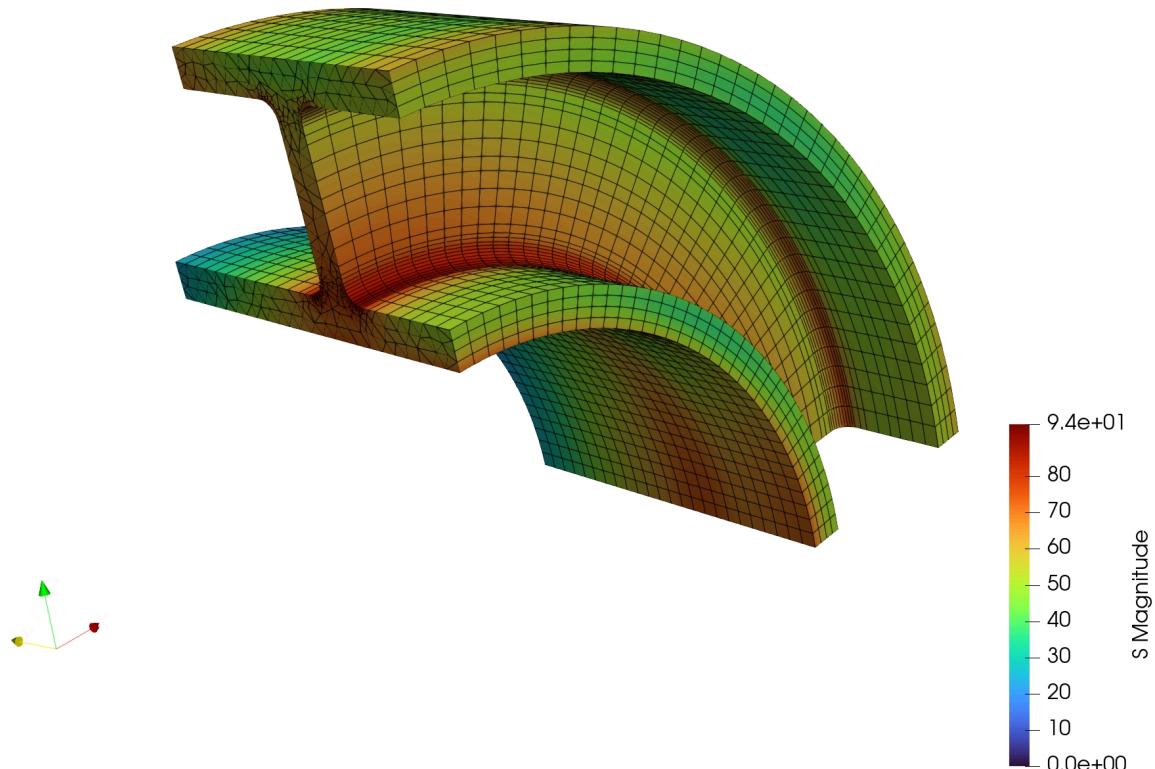
8 a=AddPoint(a,[188;200],[45;45]);
9 a=AddPoint(a,[200;200],[45;-45]);
10 a=AddPoint(a,[200;188],[-45;-45]);
11 a=AddPoint(a,[188;188],[-45;-5]);
12 a=AddPoint(a,[188;132],[-5;-5]);
13 a=AddPoint(a,[132;132],[-5;-45]);
14 a=AddPoint(a,[132;120],[-45;-45]);
15 a=AddPoint(a,[120;120],[-45;0]);
16 % Create lines
17 b=Line2D('Line1');
18 for i=1:13
19 b=AddLine(b,a,i);
20 end
21 b=CreateRadius(b,3,6);
22 b=CreateRadius(b,5,6);
23 b=CreateRadius(b,11,6);
24 b=CreateRadius(b,13,6);
25 Plot(b,'equal',1)
26 % Create surface2D
27 S=Surface2D(b);
28 % Create Mehs2D
29 m=Mesh2D('Rotating part');
30 m=AddSurface(m,S);
31 m=SetSize(m,5);
32 m=Mesh(m);
33 Plot(m);
34 % Create Mesh
35 mm=Mesh('Mesh');
36 mm=Revolve2Solid(mm,m,'Type',2,'Degree',90);
37 mm=Convert2Order2(mm);
38 PlotFace(mm,'marker',1);
39 PlotElement(mm);
40 % Add assembly
41 Ass=Assembly('Rotating_part');
42 Ass=AddPart(ass,mm.Meshoutput);
43 % Boundary
44 Ass=AddBoundary(Ass,1,'locx',0);
45 Ass=AddBoundary(Ass,1,'locz',0);
46 Ass=AddBoundary(Ass,1,'locy',-45);
47 Bound1=[1,0,0,0,0,0];
48 Bound2=[0,0,1,0,0,0];
49 Bound3=[0,1,0,0,0,0];
50 Ass=SetBoundaryType(Ass,1,Bound1);
51 Ass=SetBoundaryType(Ass,2,Bound2);
52 Ass=SetBoundaryType(Ass,3,Bound3);
53 % Material
54 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
55 Ass=AddMaterial(Ass,mat);
56 Ass=SetMaterial(Ass,1,1);
57 % Element type
58 ET.name='186';
59 ET.opt=[];
60 ET.R=[];
61 Ass=AddET(Ass,ET);
62 Ass=SetET(Ass,1,1);
63 Plot(Ass,'boundary',1);

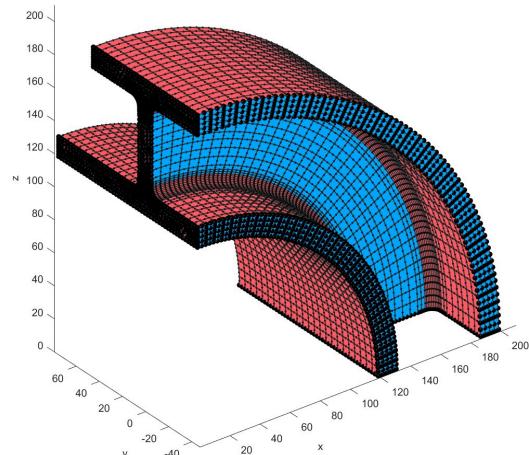
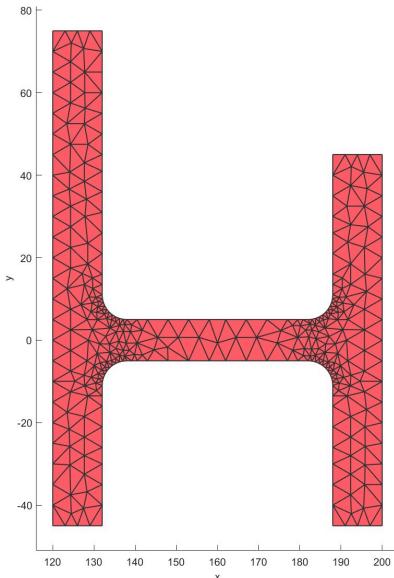
```

```

64 % Static analysis
65 opt.ANTYPE=0;
66 n=5000;%RPM
67 w=n*2*pi/60;
68 opt.OMEGA=[0,w,0];
69 Ass=AddSolu(Ass,opt);
70 % Add sensor
71 Ass=AddSensor(Ass,'Stress',1);
72 % Output to ANSYS
73 ANSYS_Output(Ass);
74 if Cal
75 ANSYSSolve(Ass);
76 PlotSensor(Ass,1);
77 end

```





2.28 Solid187 Cylinder Beam (Flag=28)

```

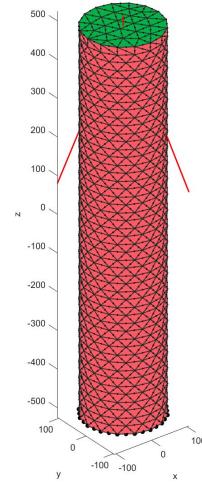
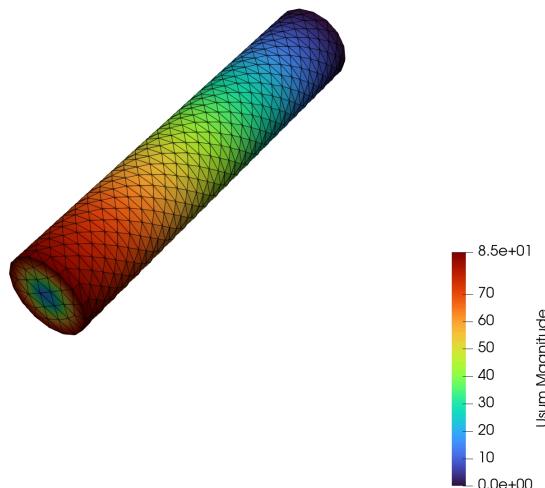
1 mm=Mesh('Cylinder Beam');
2 mm=MeshCylinder(mm,20,100,1000);
3 % The cylinder is meshed using tetrahedral elements using tetgen
4 mm=Mesh3D(mm);
5 mm=Convert2Order2(mm);
6 PlotElement(mm);
7 % Add assembly
8 Ass=Assembly('Cylinder_beam');
9 Ass=AddPart(ass,mm.Meshoutput);
10 % Boundary
11 Ass=AddBoundary(ass,1,'locz',-500);
12 Bound1=[1,1,1,0,0,0];
13 Ass=SetBoundaryType(ass,1,Bound1);
14 % Material
15 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
16 Ass=AddMaterial(ass,mat);
17 Ass=SetMaterial(ass,1,1);
18 % Element type
19 ET.name='187';
20 ET.opt=[];
21 ET.R=[];
22 Ass=AddET(ass,ET);
23 Ass=SetET(ass,1,1);
24 ET1.name='21';ET1.opt=[3,0];ET1.R=[0,0,0,0,0,0];
25 AddET(ass,ET1);
26 % Cnode
27 Ass=AddCnode(ass,0,0,500);
28 Ass=SetCnode(ass,1,2);
29 % Connection
30 Ass=AddMaster(ass,0,1);
31 Ass=AddSlaver(ass,1,'face',2);
32 % Rbe2
33 Ass=SetRbe2(ass,1,1);
34 % Add load
35 Ass=AddLoad(ass,0,'No',1);

```

```

36 Load1=[0,0,0,0,0,1e10];
37 Ass=SetLoad(Ass,1,Load1);
38 Plot(Ass, 'boundary',1, ...
39 'load',1,'load_scale',0.2);
40 % Static analysis
41 opt.ANTYPE=0;
42 Ass=AddSolu(Ass,opt);
43 % Add sensor
44 Ass=AddSensor(Ass,'U',1);
45 % Output to ANSYS
46 ANSYS_Output(Ass);
47 if Cal
48 ANSYSSolve(Ass);
49 PlotSensor(Ass,1);
50 end

```



2.29 Shell63 Plate under pressure (Flag=29)

```

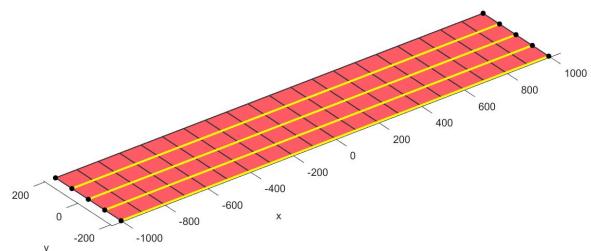
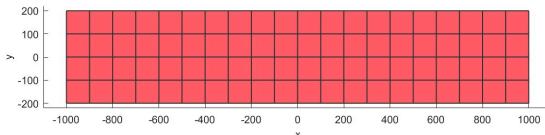
1 % Mesh plate
2 m=Mesh2D('Plate under pressure');
3 m=MeshQuadPlate(m,[2000,400],[20,4]);
4 Plot(m);
5 % Add assembly
6 Ass=Assembly('Plate_under_pressure');
7 Ass=AddPart(ass,m.Meshoutput);
8 % Boundary
9 Ass=AddBoundary(ass,1,'locx',-1000);
10 Ass=AddBoundary(ass,1,'locx',1000);
11 Bound1=[1,1,1,1,1,1];
12 Ass=SetBoundaryType(ass,1,Bound1);
13 Ass=SetBoundaryType(ass,2,Bound1);
14 % Material
15 mat.table=[ "EX",2.1e5;"PRXY",0.3;"DENS",7.85e-9];
16 Ass=AddMaterial(ass,mat);
17 Ass=SetMaterial(ass,1,1);
18 % Element type
19 ET.name='63';
20 ET.opt=[];
21 ET.R=16;

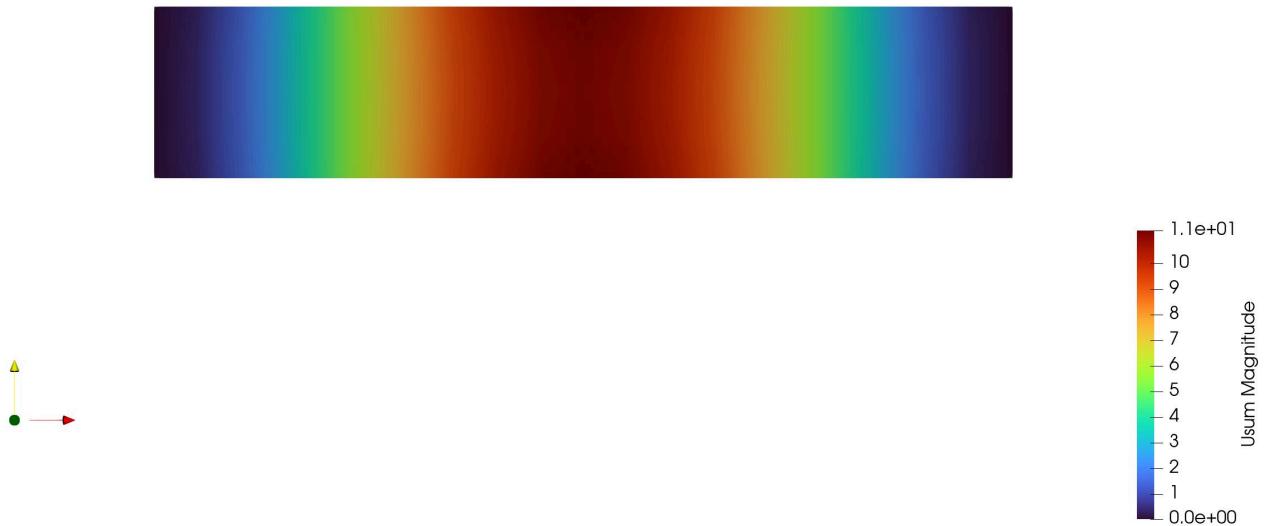
```

```

22 Ass=AddET(ass,ET);
23 Ass=SetET(ass,1,1);
24 % Add SF
25 Num=ass.Part{1,1}.NumElements;
26 Ass=AddSF(ass,1,(1:Num)', 'type', 'SFE');
27 Ass=SetSF(ass,1,-2e-2);
28 Plot(ass,'boundary',1, ...
29 'load',1,'load_scale',0.2);
30 % Static analysis
31 opt.ANTYPE=0;
32 Ass=AddSolu(ass,opt);
33 % Add sensor
34 Ass=AddSensor(ass,'U',1);
35 % Output to ANSYS
36 ANSYS_Output(ass);
37 if Cal
38 ANSYSSolve(ass);
39 PlotSensor(ass,1);
40 end

```





2.30 Shell93 Cylindrical shell (Flag=30)

```

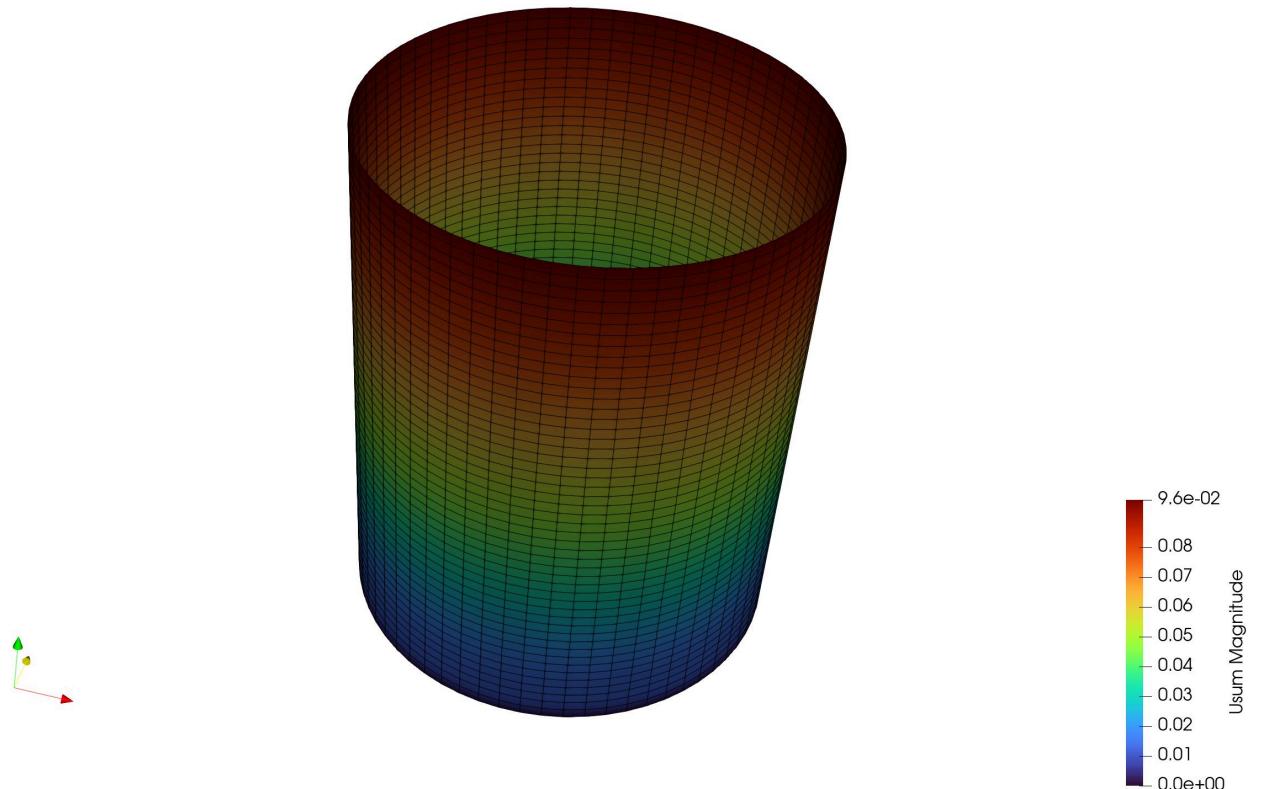
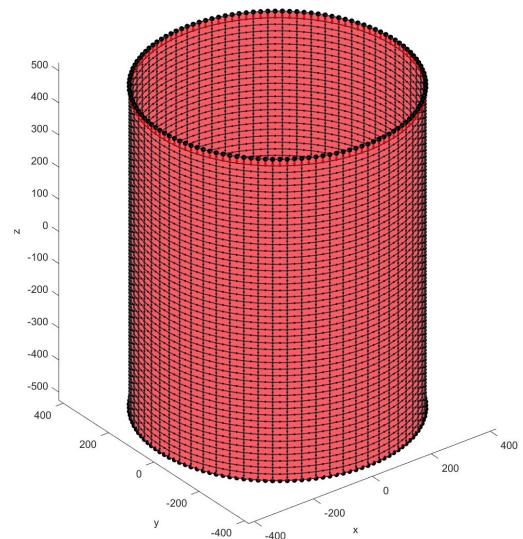
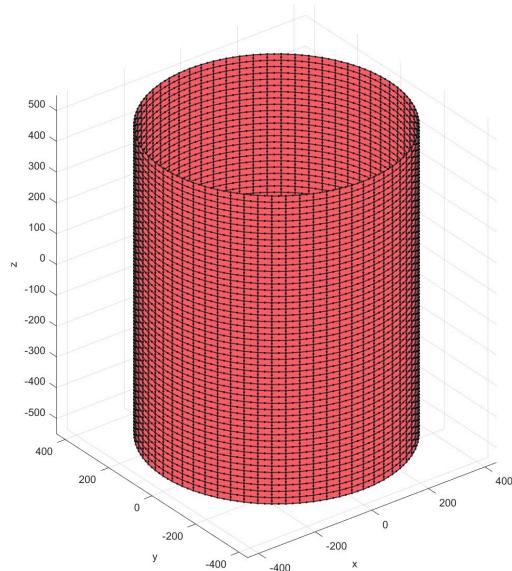
1 % Mesh cylinder
2 mm=Mesh('Cylinder Mesh');
3 mm=MeshCylinder(mm,20,400,1000,'ElementType','quad','close',0);
4 mm=Convert2Order2(mm);
5 PlotFace(mm);
6 % Add assembly
7 Ass=Assembly('Cylindrical_shell');
8 Ass=AddPart(ass,mm.Meshoutput);
9 % Boundary
10 Ass=AddBoundary(ass,1,'locz',-500);
11 Ass=AddBoundary(ass,1,'locz',500);
12 Bound1=[1,1,1,0,0,0];
13 Ass=SetBoundaryType(ass,1,Bound1);
14 Bound2=[1,1,0,0,0,0];
15 Ass=SetBoundaryType(ass,2,Bound2);
16 % Material
17 mat.table=[ "EX",2.1e5; "PRXY",0.3; "DENS",7.85e-9];
18 Ass=AddMaterial(ass,mat);
19 Ass=SetMaterial(ass,1,1);
20 % Element type
21 ET.name='93';
22 ET.opt=[];
23 ET.R=2;
24 Ass=AddET(ass,ET);
25 Ass=SetET(ass,1,1);
26 % Add load
27 Ass=AddLoad(ass,1,'locz',500);
28 Ass=SetLoad(ass,1,[0,0,-100000,0,0,0]);
29 Plot(ass,'boundary',1,...
30 'load',1,'load_scale',0.2);
31 % Static analysis
32 opt.ANTYPE=0;

```

```

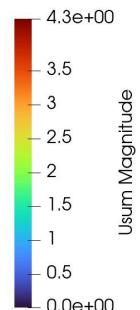
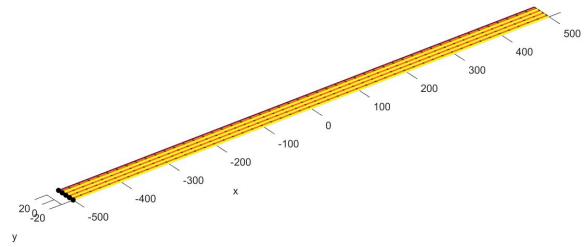
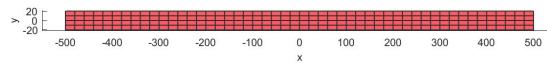
33 Ass=AddSolu(Ass,opt);
34 % Add sensor
35 Ass=AddSensor(Ass,'U',1);
36 % Output to ANSYS
37 ANSYS_Output(Ass);
38 if Cal
39 ANSYSSolve(Ass);
40 PlotSensor(Ass,1);
41 end

```



2.31 Shell181 Shell section (Flag=31)

```
1 % Mesh plate
2 m=Mesh2D('Shell Section');
3 m=MeshQuadPlate(m,[1000,40],[50,4]);
4 Plot(m);
5 % Add assembly
6 Ass=Assembly('Shell_Section');
7 Ass=AddPart(ass,m.Meshoutput);
8 % Boundary
9 Ass=AddBoundary(ass,1,'locx',-1000/2);
10 Bound1=[1,1,1,1,1,1];
11 Ass=SetBoundaryType(ass,1,Bound1);
12 % Material
13 mat1.table=[ "EX",2e5;"PRXY",0];
14 Ass=AddMaterial(ass,mat1);
15 mat2.table=[ "EX",2e4;"PRXY",0];
16 Ass=AddMaterial(ass,mat2);
17 % Section
18 Sec.type="shell";
19 Sec.data=[6,1,0,3;60,2,0,9;6,1,0,3];
20 Sec.offset="MID";
21 Ass=AddSection(ass,Sec);
22 Ass=SetSection(ass,1,1);
23 % Element type
24 ET.name='181';
25 ET.opt=[3,2;8,1];
26 ET.R=[];
27 Ass=AddET(ass,ET);
28 Ass=SetET(ass,1,1);
29 % Add SF
30 Num=ass.Part{1,1}.NumElements;
31 Ass=AddSF(ass,1,(1:Num)', 'type', 'SFE');
32 Ass=SetSF(ass,1,0.1);
33 Plot(ass,'boundary',1,...
34 'load',1,'load_scale',0.2);
35 % Static analysis
36 opt.ANTYPE=0;
37 Ass=AddSolu(ass,opt);
38 % Add sensor
39 Ass=AddSensor(ass,'U',1);
40 % Output to ANSYS
41 ANSYS_Output(ass);
42 if Cal
43 ANSYSSolve(ass);
44 PlotSensor(ass,1);
45 end
```



2.32 Shell281 Shell section (Flag=32)

```

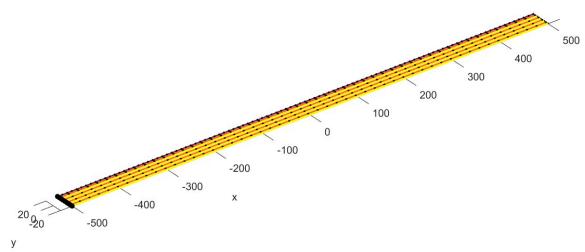
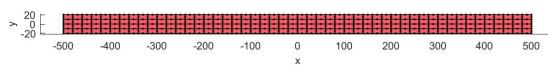
1 % Mesh plate
2 m=Mesh2D('Shell Section');
3 m=MeshQuadPlate(m,[1000,40],[50,4]);
4 m=Convert2Order2(m);
5 Plot(m);
6 % Add assembly
7 Ass=Assembly('Shell_Section');
8 Ass=AddPart(ass,m.Meshoutput);
9 % Boundary
10 Ass=AddBoundary(ass,1,'locx',-1000/2);
11 Bound1=[1,1,1,1,1,1];
12 Ass=SetBoundaryType(ass,1,Bound1);
13 % Material
14 mat1.table=[ "EX",2e5;"PRXY",0];
15 Ass=AddMaterial(ass,mat1);

```

```

16 mat2.table=[ "EX",2e4; "PRXY",0];
17 Ass=AddMaterial(ass,mat2);
18 % Section
19 Sec.type="shell";
20 Sec.data=[6,1,0,3;60,2,0,9;6,1,0,3];
21 Sec.offset="MID";
22 Ass=AddSection(ass,Sec);
23 Ass=SetSection(ass,1,1);
24 % Element type
25 ET.name='281';
26 ET.opt=[3,2;8,1];
27 ET.R=[];
28 Ass=AddET(ass,ET);
29 Ass=SetET(ass,1,1);
30 % Add SF
31 Num=ass.Part{1,1}.NumElements;
32 Ass=AddSF(ass,1,(1:Num)', 'type', 'SFE');
33 Ass=SetSF(ass,1,0.1);
34 Plot(ass, 'boundary',1, ...
35 'load',1,'load_scale',0.2);
36 % Static analysis
37 opt.ANTYPE=0;
38 Ass=AddSolu(ass,opt);
39 % Add sensor
40 Ass=AddSensor(ass,'U',1);
41 % Output to ANSYS
42 ANSYS_Output(ass);
43 if Cal
44 ANSYSSolve(ass);
45 PlotSensor(ass,1);
46 end

```



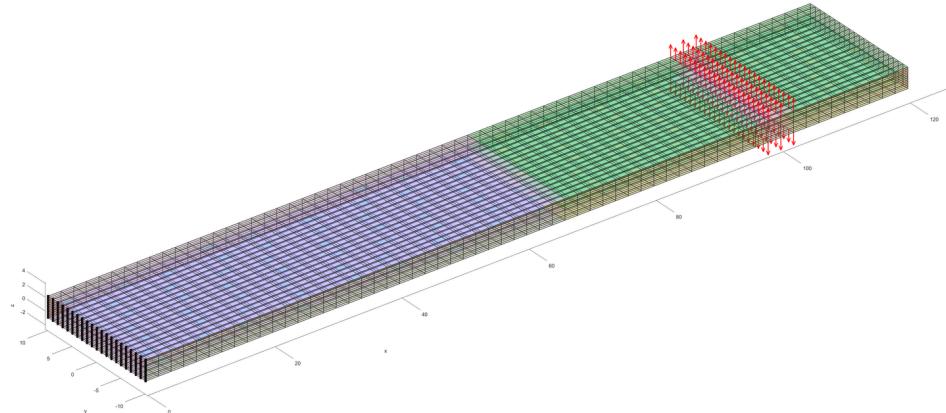
2.33 Con173 Glue contact (Flag=33)

```
1 %% Specifying dimensions and number of elements
2 m=Mesh('Mesh');
3 %% Create a box with hexahedral elements
4 beamDimensions=[120 20 1.55]; %Dimensions
5 beamElementNumbers=[60 20 6]; %Number of elements
6 m=MeshCube(m,beamDimensions,beamElementNumbers);
7 Vm = PatchCentre(m);
8 m.Cb(and(m.Cb==5,Vm(:,1)<=120-55-60),:)=11;
9 m.Cb(and(m.Cb==6,Vm(:,1)<=120-55-60),:)=12;
10 m.Cb(and(and(m.Cb==5,Vm(:,1)>=120-22-60),Vm(:,1)<=120-18-60),:)=13;
11 m.Cb(and(and(m.Cb==6,Vm(:,1)>=120-22-60),Vm(:,1)<=120-18-60),:)=14;
12 m.Meshoutput.boundaryMarker=m.Cb;
13 PlotFace(m)
14 % Add assembly
15 Ass=Assembly('Glue_plate');
16 Ass=AddPart(ass,m.Meshoutput,'position',[60,0,0,0,0,0]);
17 Ass=AddPart(ass,m.Meshoutput,'position',[60,0,1.55,0,0,0]);
18 % Boundary
19 Ass=AddBoundary(ass,1,'locx',0);
20 Ass=AddBoundary(ass,2,'locx',0);
21 Bound1=[1,1,1,0,0,0];
22 Ass=SetBoundaryType(ass,1,Bound1);
23 Ass=SetBoundaryType(ass,2,Bound1);
24 % Material
25 % mat1.table=["EX",2e5;"PRXY",0.3;"DENS",7.85e-9];
26 mat1.table=[ "DENS",1.6e-9;"EX",1.2e5;"EY",1.1e4;"EZ",1.1e4;...
27 "PRXY",0.32;"PRYZ",0.45;"PRXZ",0.32;...
28 "GXY",5500;"GYZ",5500;"GXZ",5500];
29 Ass=AddMaterial(ass,mat1);
30 Ass=SetMaterial(ass,1,1);
31 Ass=SetMaterial(ass,2,1);
32 mat2.TBlab=[ "CZM",1,0,"CBDE"];
33 % mat2.TBtable=[30,0.35,60,1,5e-4,1];
34 mat2.TBtable=[30,0.26,60,1,5e-4,1.002];
35 Ass=AddMaterial(ass,mat2);
36 % Element type
37 ET.name='185';
38 ET.opt=[];
39 ET.R=[];
40 Ass=AddET(ass,ET);
41 Ass=SetET(ass,1,1);
42 Ass=SetET(ass,2,1);
43 ET2.name='170';ET2.opt=[];ET2.R=[];
44 Ass=AddET(ass,ET2);
45 ET3.name='173';ET3.opt=[5,3;9,1;10,2;12,6];ET3.R=[]; % Standard contact
46 Ass=AddET(ass,ET3);
47 % Add Force
48 Ass=AddLoad(ass,1,'No',13);
49 Load1=[0,0,-150,0,0,0];
50 Ass=SetLoad(ass,1,Load1);
51 % Ass=AddLoad(ass,2,'No',14);
52 % Load2=[0,0,150,0,0,0];
53 % Ass=SetLoad(ass,2,Load2);
54 % Add Displacement
```

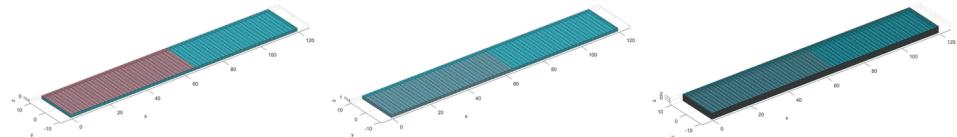
```

55 % Ass=AddDisplacement(Ass,1,'No',13);
56 % Dis1=[0,0,-2.5,0,0,0];
57 % Ass=SetDisplacement(Ass,1,Dis1);
58 % Ass=AddDisplacement(Ass,2,'No',14);
59 % Dis2=[0,0,2.5,0,0,0];
60 % Ass=SetDisplacement(Ass,2,Dis2);
61 Plot(Ass,'boundary',1,...
62     'load',1,'load_scale',1,'face_alpha',0.2,'dis',1);
63 % Define Contacts
64 Ass=AddCon(Ass,1,12);
65 Ass=AddTar(Ass,1,2,11);
66 Ass=SetConMaterial(Ass,1,2);
67 Ass=SetConET(Ass,1,3);
68 Ass=SetTarET(Ass,1,2);
69 PlotCon(Ass,1);
70 % Static analysis
71 opt.ANTYPE=0;
72 opt.NSUBST=40;
73 opt.AUTOTS="OFF";
74 opt.NLGEOM=1;
75 opt.ARCLEN=1;
76 opt.OUTRES=[ "ALL", "ALL" ];
77 Ass=AddSolu(Ass,opt);
78 % Add sensor
79 % Ass=AddSensor(Ass,'U',1);
80 % Output to ANSYS
81 ANSYS_Output(Ass);
82 if Cal
83     ANSYSSolve(Ass);
84     PlotSensor(Ass,1);
85 end

```



View of Contact Pair1
Contact Target Contact Pair



3 参考文献

[1] ANSYS结构分析单元与应用