# Surface2D

Xie Yu

1 介绍

Surface2D用来创建2D的封闭面，类似于三维软件的草图。

2 案例

2.1 Create gear obj (Flag=1)

```
1  a=Point2D('Point Ass1');
2  neg=8;
3  OR1=2.5;OR2=2;IR=1;
4  D_theta=3/180*pi;
5  a=AddPoint(a,0,0);
6  for i=1:neg
7  x1=OR1*cos(pi/neg/2-D_theta-pi/neg*2*(i-1));
8  y1=OR1*sin(pi/neg/2-D_theta-pi/neg*2*(i-1));
9  x2=OR1*cos(-pi/neg/2+D_theta-pi/neg*2*(i-1));
10 y2=OR1*sin(-pi/neg/2+D_theta-pi/neg*2*(i-1));
11 x3=OR2*cos(-pi/neg/2-pi/neg*2*(i-1));
12 y3=OR2*sin(-pi/neg/2-pi/neg*2*(i-1));
13 x4=OR2*cos(-pi/neg/2*3-pi/neg*2*(i-1));
14 y4=OR2*sin(-pi/neg/2*3-pi/neg*2*(i-1));
15 x5=OR1*cos(pi/neg/2-D_theta-pi/neg*2*i);
16 y5=OR1*sin(pi/neg/2-D_theta-pi/neg*2*i);
17 xx=[x1;x2];yy=[y1;y2];
18 a=AddPoint(a,xx,yy);
19 xx=[x2;x3];yy=[y2;y3];
20 a=AddPoint(a,xx,yy);
21 xx=[x3;x4];yy=[y3;y4];
22 a=AddPoint(a,xx,yy);
23 xx=[x4;x5];yy=[y4;y5];
24 a=AddPoint(a,xx,yy);
25 end
26 Plot(a);
27 b=Line2D('Line Ass1');
28 for i=1:neg
29 b=AddLine(b,a,2+(i-1)*4);
30 b=AddLine(b,a,3+(i-1)*4);
31 b=AddCircle(b,OR2,a,1,'sang',-180/neg/2-180/neg*2*(i-1),'ang',-180/neg);
32 b=AddLine(b,a,5+(i-1)*4);
33 end
34 Plot(b);
35 S=Surface2D(b);
36 Plot(S);
37 a1=Point2D('Point Group2');
38 a1=AddPoint(a1,0,0);
39 h=Line2D('Hole Group1');
40 h=AddCircle(h,IR,a1,1);
41 S=AddHole(S,h);
42 Plot(S);
```

创建一个近似于齿轮的截面，首先生成点，有点连接成线，由线再围成封闭的平面。
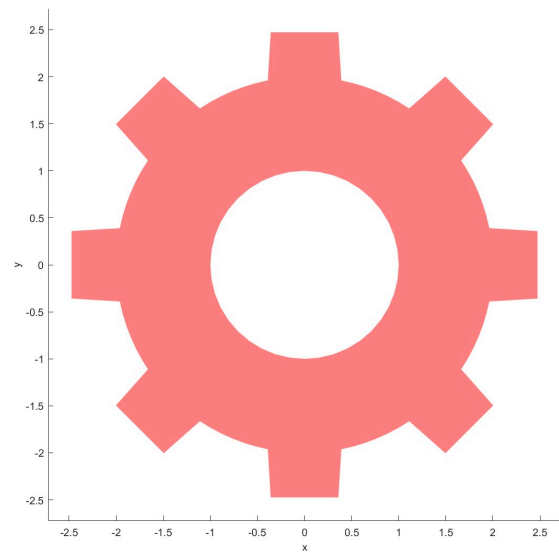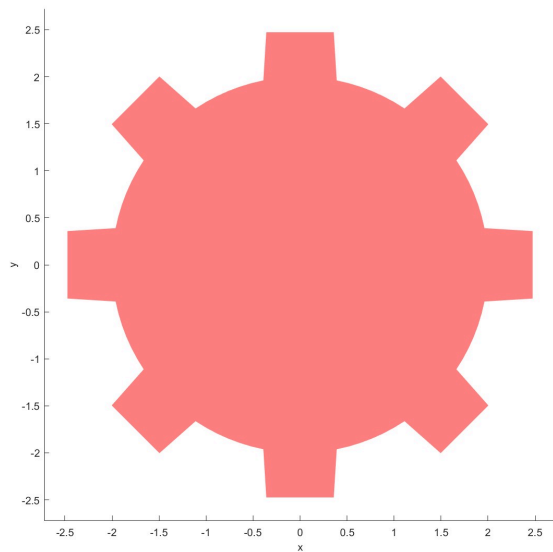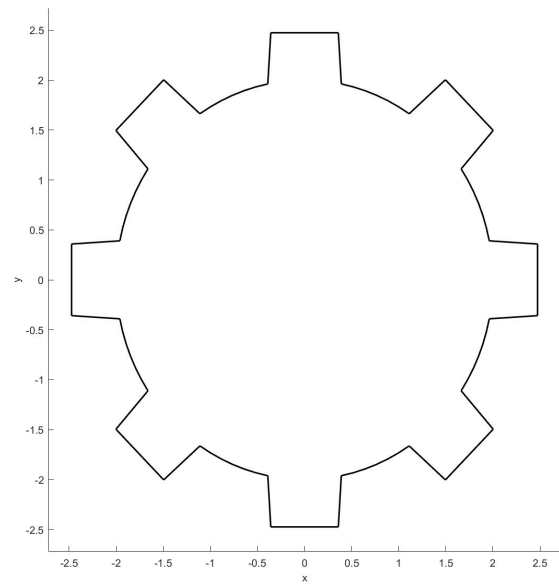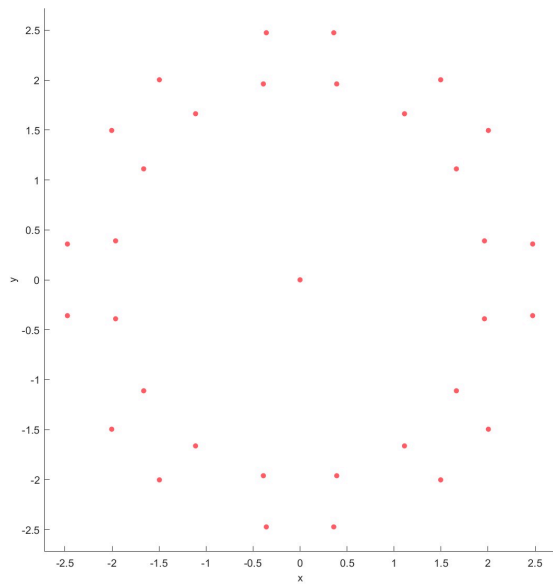
## 2.2 Create plate obj (Flag=2)

```
1   IR=211/2;
2   OR=801/2;
3   radius1=300/2;
4   radius2=600/2;
5   num=6;
6   par1=100;
7   ang1=360/num-asin(par1/2/radius1)/pi*180*2;
8   ang2=360/num-asin(par1/2/radius2)/pi*180*2;
9   a=Point2D('Point Ass1');
10  b=Line2D('Line Ass1');
11  a=AddPoint(a,0,0);
12  a=AddPoint(a,par1,0);
13  a=AddPoint(a,[radius1*cos(ang1/2/180*pi);radius2*cos(ang2/2/180*pi)],...
14  [radius1*sin(ang1/2/180*pi);radius2*sin(ang2/2/180*pi)]);
15  a=AddPoint(a,[radius2*cos(-ang2/2/180*pi);radius1*cos(-ang1/2/180*pi)],...
```

```
16    [radius2*sin(-ang2/2/180*pi);radius1*sin(-ang1/2/180*pi)]);
17    b=AddCircle(b,OR,a,1);
18    S=Surface2D(b);
19    h1=Line2D('Hole Group1');
20    h1=AddCircle(h1,IR,a,1);
21    S=AddHole(S,h1);
22    h2=Line2D('Hole Group2');
23    h2=AddCircle(h2,radius1,a,1,'sang',-ang1/2,'ang',ang1);
24    h2=AddLine(h2,a,3);
25    h2=AddCircle(h2,radius2,a,1,'sang',ang2/2,'ang',-ang2);
26    h2=AddLine(h2,a,4);
27    h2=CreateRadius(h2,1,10);
28    h2=CreateRadius(h2,3,10);
29    h2=CreateRadius(h2,5,10);
30    h2=CreateRadius(h2,7,10);
31    for i=1:num
32    S=AddHole(S,h2,'rot',360/num*(i-1));
33    end
34    Plot(S);
```

创建一个平板的平面图。
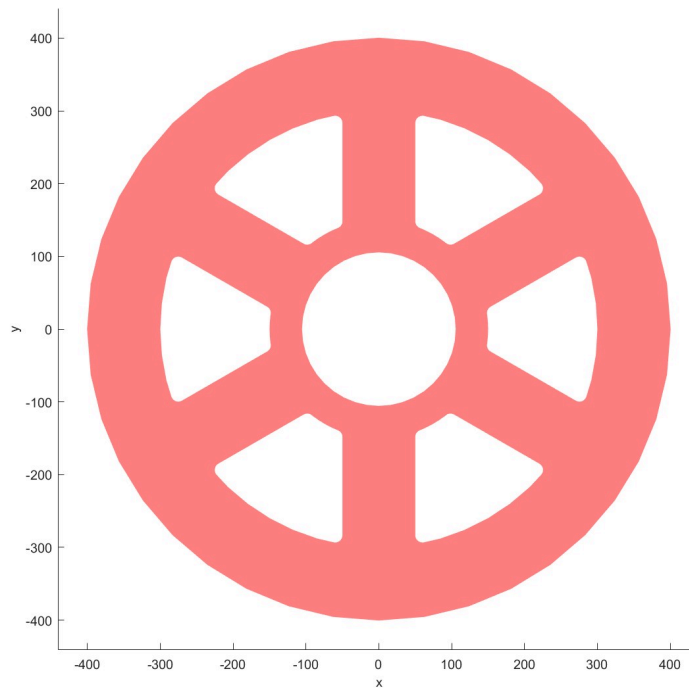
2.3 Calculate geometry (Flag=3)
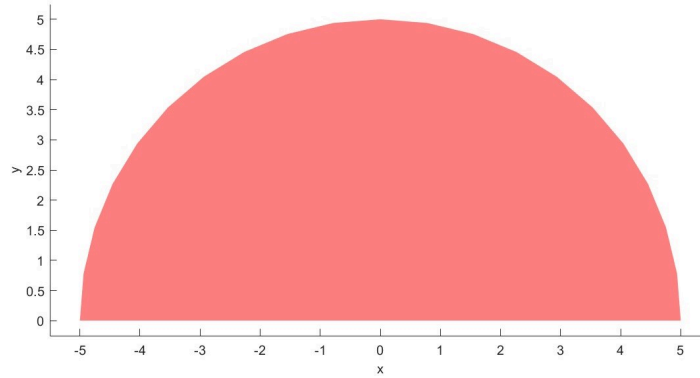
CalculateGeometry用于计算截面的几何信息包括面积、中心、截面模量。

一个半圆的面积为

$$A = \frac{\pi r^2}{2} \tag{1}$$

其中心坐标：

$$(0, \frac{4R}{3\pi}) \tag{2}$$

绕x轴的惯性矩:

$$I_x = \frac{\pi d^4}{128} \tag{3}$$


```matlab
% Semi circle
a=Point2D('Circle center');
a=AddPoint(a,0,0);
a=AddPoint(a,[-5;5],[0;0]);
b=Line2D('Semi circle');
b=AddCircle(b,5,a,1,'ang',180);
b=AddLine(b,a,2);
S=Surface2D(b);
Plot(S);
[Area,Center,Ixx,Iyy,Ixy]= CalculateGeometry(S);
disp([Area,Center,Ixx,Iyy,Ixy])
```
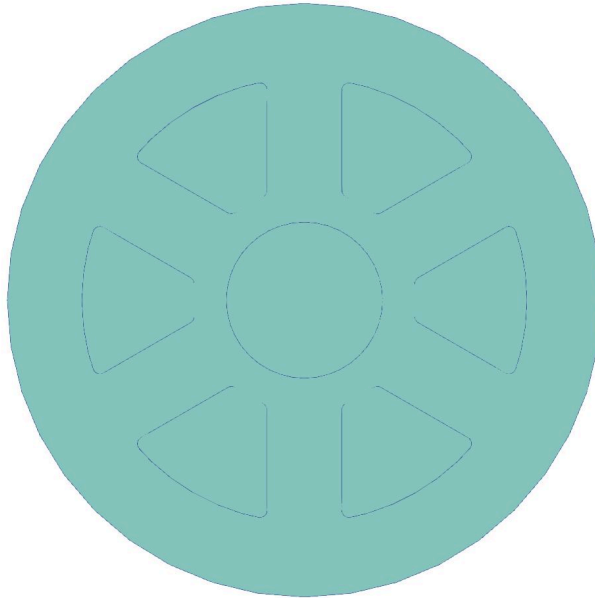
39.1086 -0.0000   2.1177 243.4257 243.4257   0.0000

2.4   Plot Surface2D inParaView (Flag=4)

```matlab
IR=211/2;
OR=801/2;
radius1=300/2;
radius2=600/2;
num=6;
par1=100;
ang1=360/num-asin(par1/2/radius1)/pi*180*2;
ang2=360/num-asin(par1/2/radius2)/pi*180*2;
a=Point2D('Point Ass1');
b=Line2D('Line Ass1');
a=AddPoint(a,0,0);
a=AddPoint(a,par1,0);
a=AddPoint(a,[radius1*cos(ang1/2/180*pi);radius2*cos(ang2/2/180*pi)],...
[radius1*sin(ang1/2/180*pi);radius2*sin(ang2/2/180*pi)]);
a=AddPoint(a,[radius2*cos(-ang2/2/180*pi);radius1*cos(-ang1/2/180*pi)],...
[radius2*sin(-ang2/2/180*pi);radius1*sin(-ang1/2/180*pi)]);
b=AddCircle(b,OR,a,1);
S=Surface2D(b);
h1=Line2D('Hole Group1');
h1=AddCircle(h1,IR,a,1);
S=AddHole(S,h1);
h2=Line2D('Hole Group2');
h2=AddCircle(h2,radius1,a,1,'sang',-ang1/2,'ang',ang1);
```

```
24  h2=AddLine(h2,a,3);
25  h2=AddCircle(h2,radius2,a,1,'sang',ang2/2,'ang',-ang2);
26  h2=AddLine(h2,a,4);
27  h2=CreateRadius(h2,1,10);
28  h2=CreateRadius(h2,3,10);
29  h2=CreateRadius(h2,5,10);
30  h2=CreateRadius(h2,7,10);
31  for i=1:num
32  S=AddHole(S,h2,'rot',360/num*(i-1));
33  end
34  Plot2(S);
```
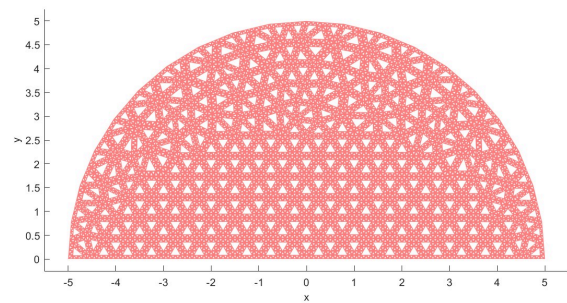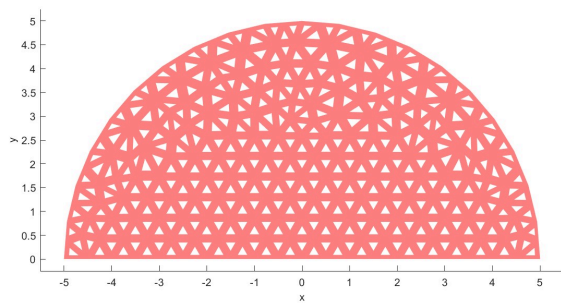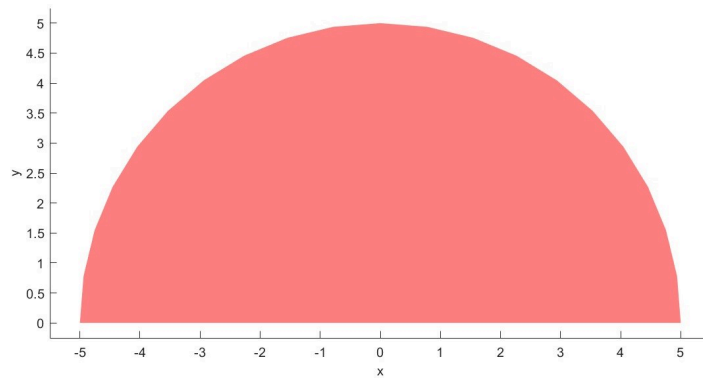

2.5   Create Mesh Hole (Flag=5)

```
1   % Semi circle
2   a=Point2D('Circle center');
3   a=AddPoint(a,0,0);
4   a=AddPoint(a,[-5;5],[0;0]);
5   b=Line2D('Semi circle');
6   b=AddCircle(b,5,a,1,'ang',180);
7   b=AddLine(b,a,2);
8   S=Surface2D(b);
9   Plot(S);
10  S=CreateMeshHole(S,0.5,'scale',0.4);
11  Plot(S);
12  S=CreateMeshHole(S,0.1,'scale',0.4);
13  Plot(S);
```

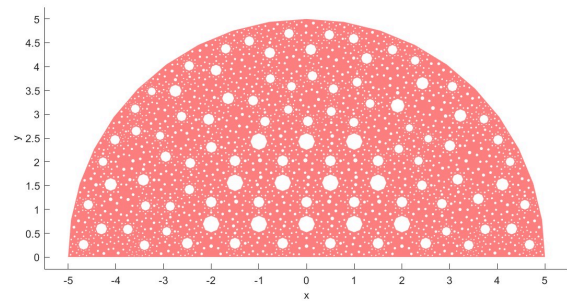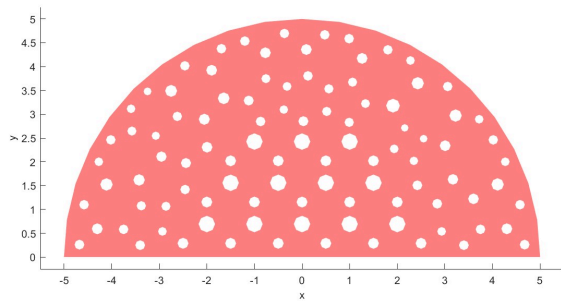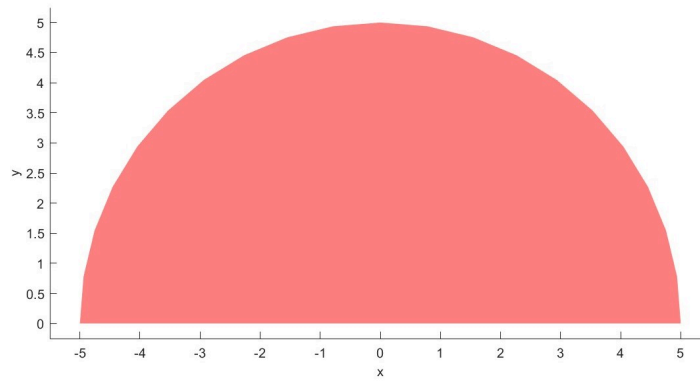再原有网格的基础上，围绕每个网格的圆心进行缩放，做成类似于镂空的结构。

2.6 Create Circle Hole (Flag=6)

```
1   % Semi circle
2   a=Point2D('Circle center');
3   a=AddPoint(a,0,0);
4   a=AddPoint(a,[-5;5],[0;0]);
5   b=Line2D('Semi circle');
6   b=AddCircle(b,5,a,1,'ang',180);
7   b=AddLine(b,a,2);
8   S=Surface2D(b);
9   Plot(S);
10  S=CreateCircleHole(S,1,'scale',0.4);
11  Plot(S);
12  S=CreateCircleHole(S,0.3,'scale',0.4);
13  Plot(S);
```

圆形镂空。

3 CheatTable

Name	Varargin	Description
AddHole(obj,Line1)	'rot','dis'	Add internal Hole
CalculateGeometry(obj)		Calculate geometry informarion of surface
CreateCircleHole(obj,Length)	'scale','seg'	Add cirle Hole
CreateMeshHole(obj,Length)	'scale'	Add mesh Hole
GetNface(obj)		Get total number of face
Plot(obj)	'face','axe','equal','grid', 'color'	Plot Surface2D object
Plot2(obj)		Plot Surface2D object in Paraview
VTKWrite(obj)		Write VTK file of Surface2D

4 参考文献