目录

【一维插值】interp1

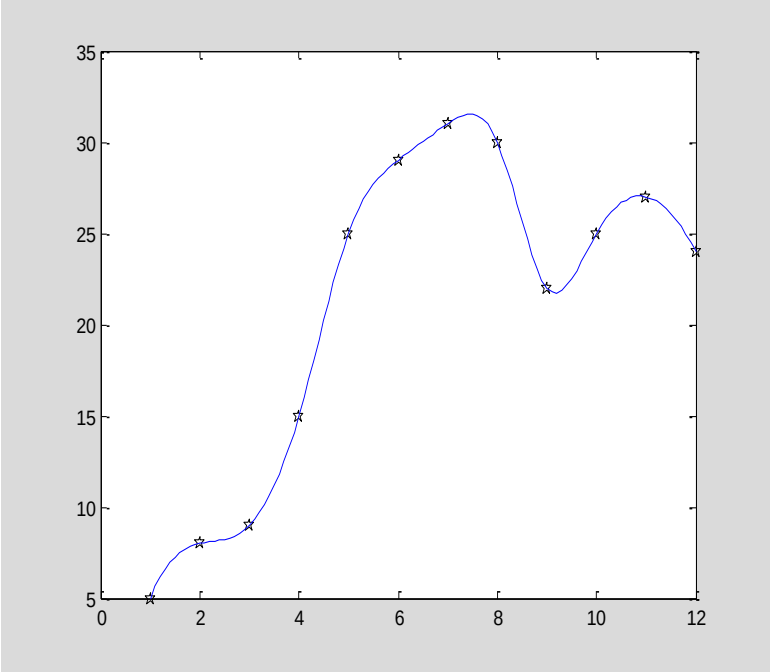
yi = interp1(x,y,xi,method)

例 1

在 1-12 的 11 小时内，每隔 1 小时测量一次温度，测得的温度依次为：5，8，9，15，25，29，31，30，22，25，27，24。试估计每隔 1/10 小时的温度值。

建立 M 文件 temp.m

```
hours=1:12;
temps=[5 8 9 15 25 29 31 30 22 25 27 24];
h=1:0.1:12;
t=interp1(hours,temps,h,'spline');
plot(hours,temps,'kp',h,t,'b');
```



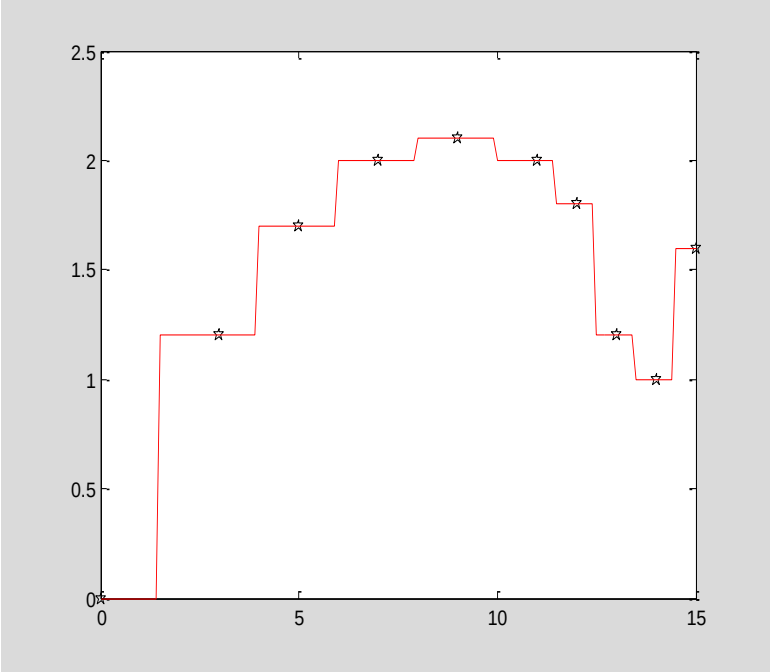
例 2

已知飞机下轮廓线上数据如下，求 x 每改变 0.1 时的 y 值。

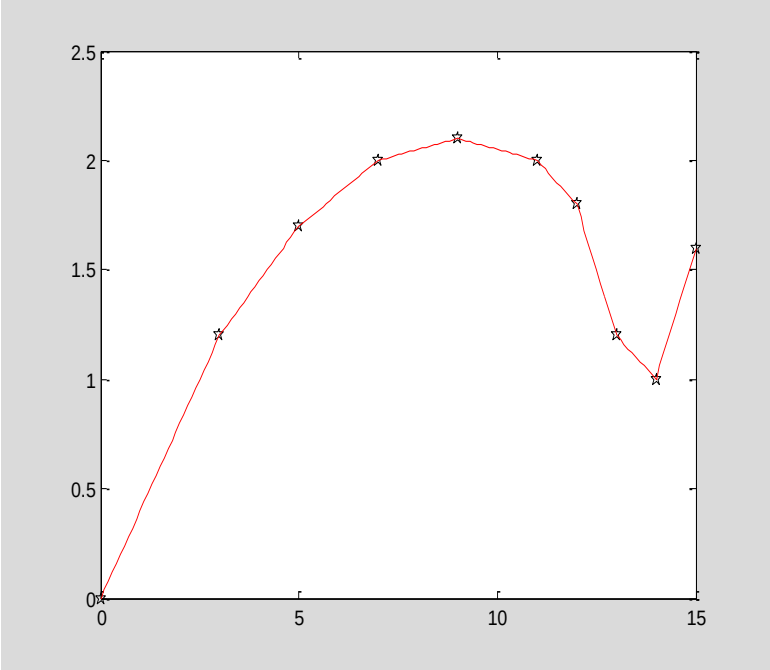
X	0	3	5	7	9	11	12	13	14	15
Y	0	1.2	1.7	2.0	2.1	2.0	1.8	1.2	1.0	1.6

建立 M 文件 plane.m

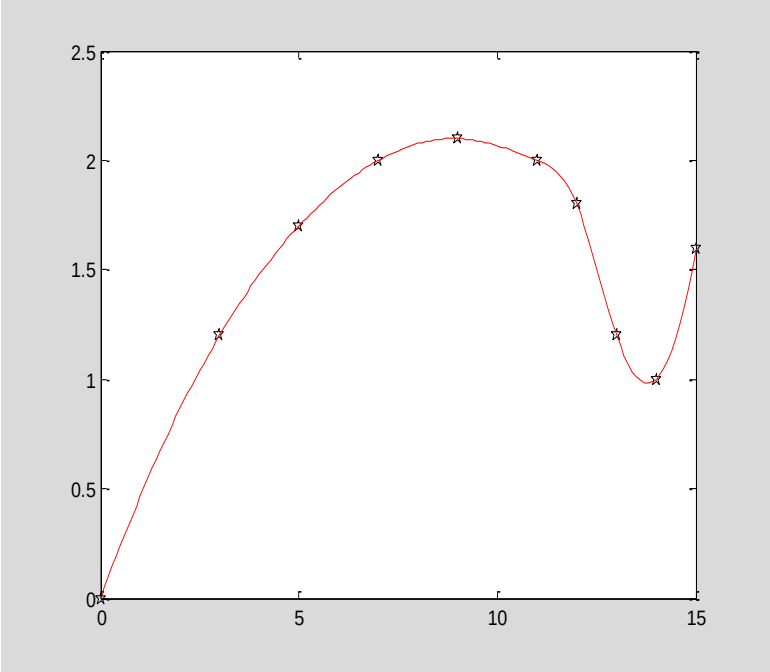
```
x0=[0 3 5 7 9 11 12 13 14 15 ];
y0=[0 1.2 1.7 2.0 2.1 2.0 1.8 1.2 1.0 1.6 ];
x=0:0.1:15;
y1=interp1(x0,y0,x,'nearest');
y2=interp1(x0,y0,x);
y3=interp1(x0,y0,x,'spline');
plot(x0,y0,'kp',x,y1,'r')
```




```
plot(x0,y0,'kp',x,y2,'r')
```




```
plot(x0,y0,'kp',x,y3,'r')
```



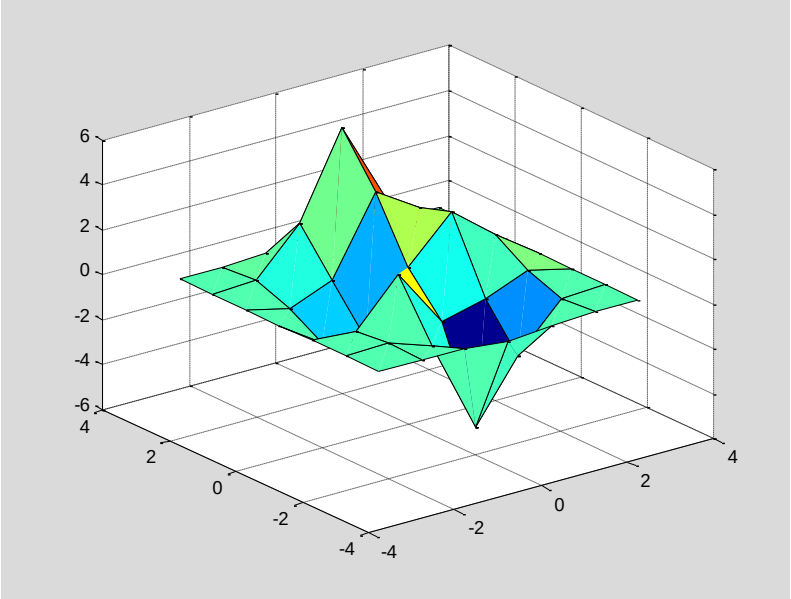
【二维插值】interp2

ZI = interp2(X,Y,Z,XI,YI,method)

插值方式比较示例

- 用较大间隔产生 peaks 函数数据点

```
[x,y] = meshgrid(-3:1:3);
z = peaks(x,y);
surf(x,y,z)
```

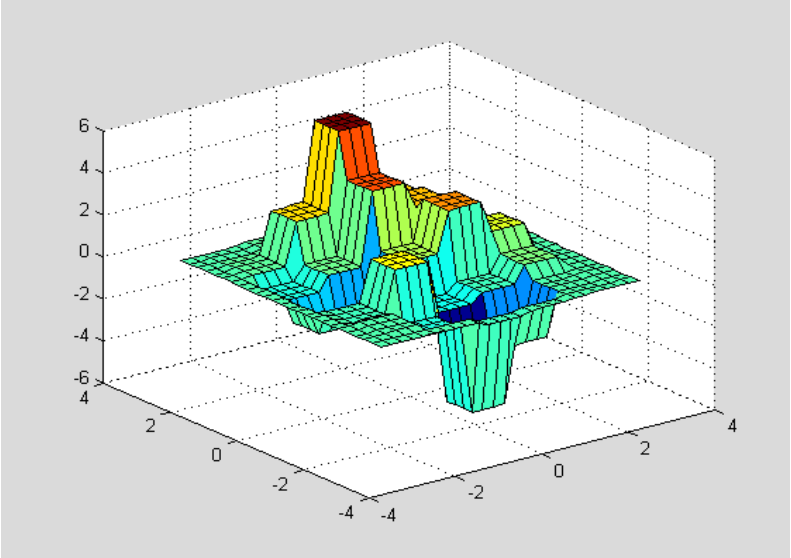


- 产生一个较好的网格

```
[xi,yi] = meshgrid(-3:0.25:3);
```

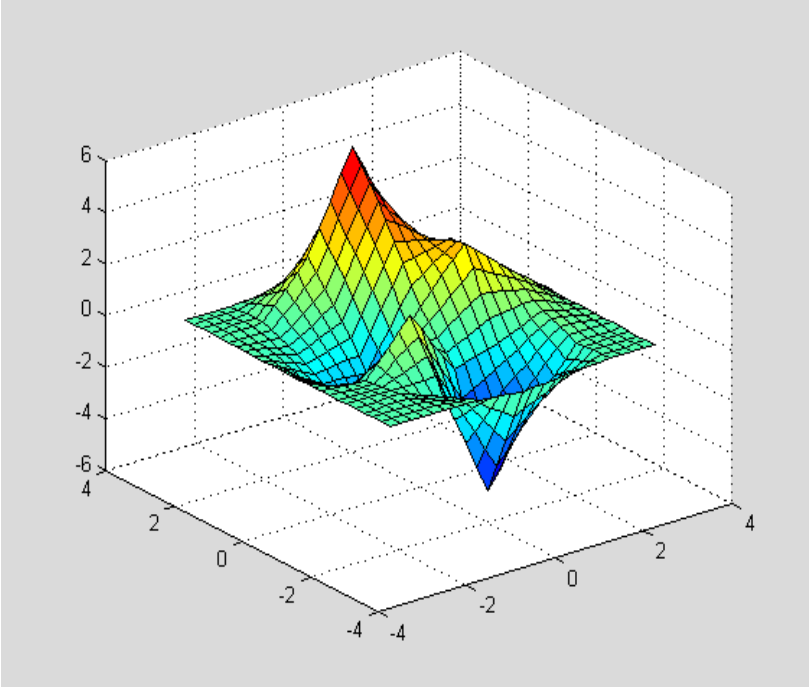
- 利用最近邻方式插值

```
zi1 = interp2(x,y,z,xi,yi,'nearest');surf(xi,yi,zi1)
```



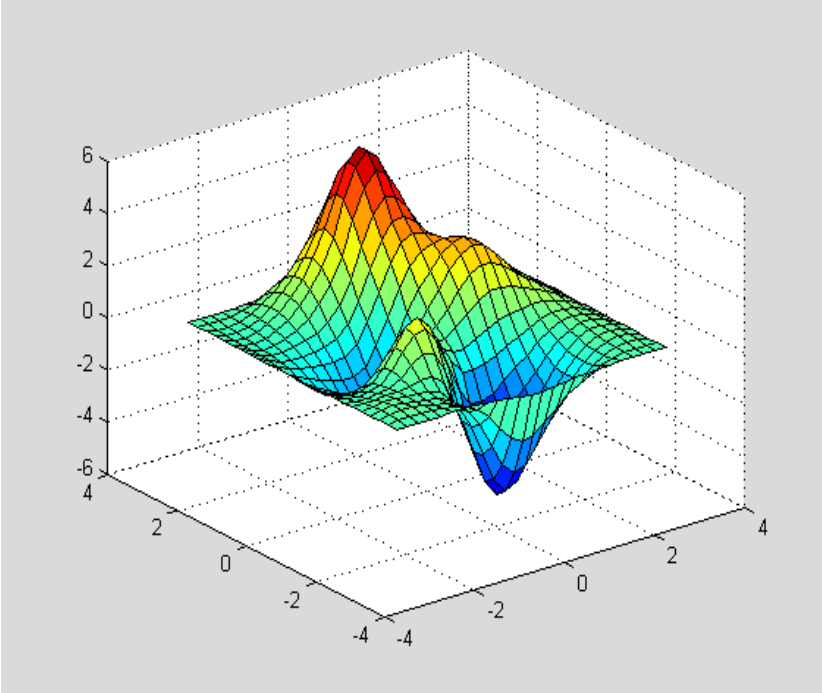
- 双线性插值方式

```
zi2 = interp2(x,y,z,xi,yi,'bilinear');surf(xi,yi,zi2)
```



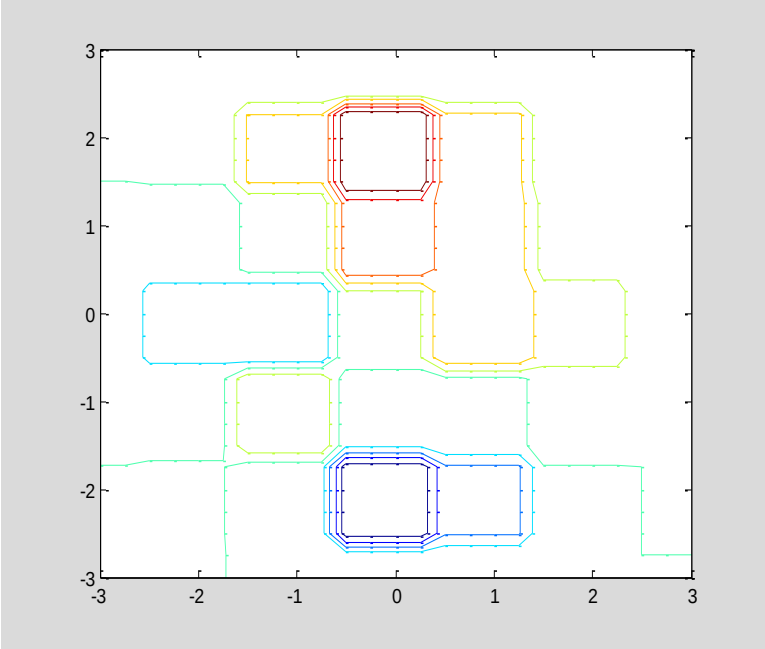
- 双立方插值方式

```
zi3 = interp2(x,y,z,xi,yi,'bicubic');surf(xi,yi,zi3)
```

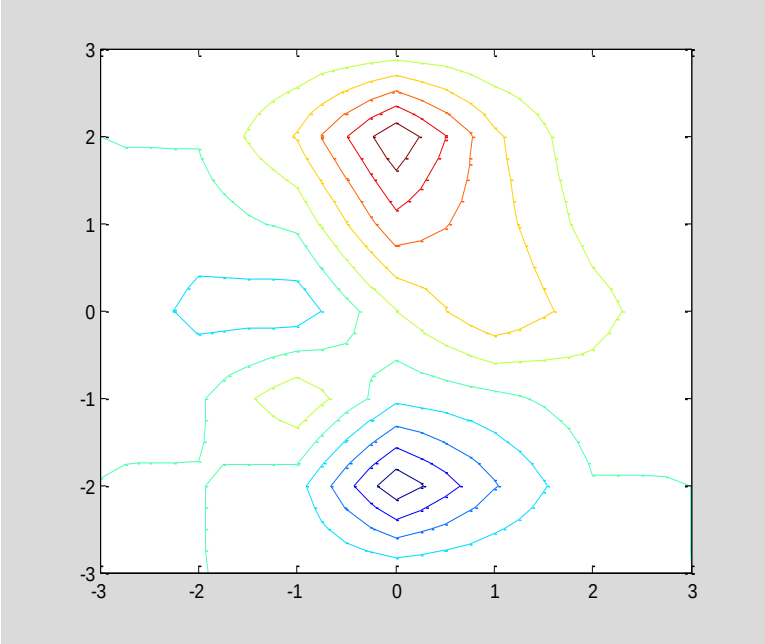


- 不同插值方式构造的等高线图对比

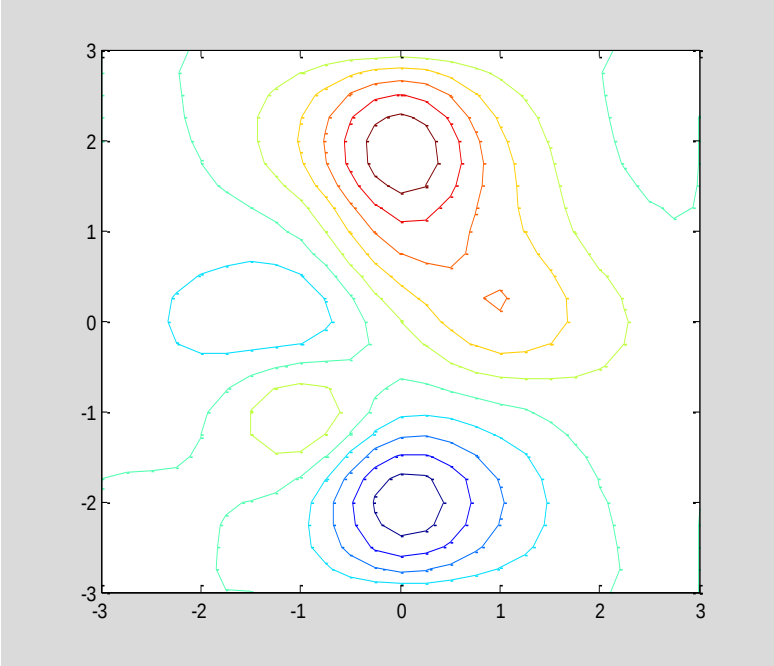
```
contour(xi,yi,zi1)
```




```
contour(xi,yi,zi2)
```




```
contour(xi,yi,zi3)
```



例 3

测得平板表面 3*5 网格点处的温度分别为：

82 81 80 82 84

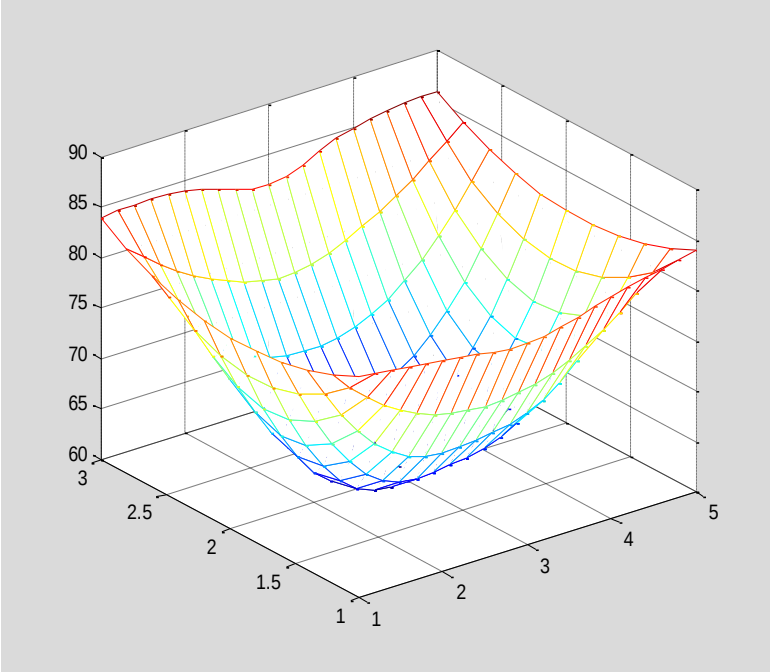
79 63 61 65 81

84 84 82 85 86

试作出平板表面的温度分布曲面 z=f(x,y)的图形。

建立 M 文件 wendu.m

```
xi=1:0.2:5;

yi=1:0.2:3;

zi=interp2(x,y,temps,xi',yi,'cubic');

mesh(xi,yi,zi);
```



例 4

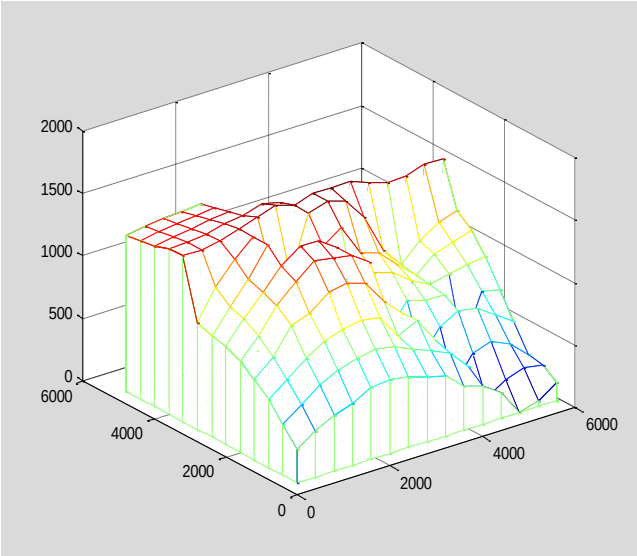
某山区测得一些地点的高度如下表所示，平面区域为$1200 \le x \le 4000, 1200 \le y \le 3600$，试作出该山区的地貌图和等高线图。比较几种插值方法。

X / Y	1200	1600	2000	2400	2800	3200	3600	4000
1200	1130	1250	1280	1230	1040	900	500	700
1600	1320	1450	1420	1400	1300	700	900	850
2000	1390	1500	1500	1400	900	1100	1060	950
2400	1500	1200	1100	1350	1450	1200	1150	1010
2800	1500	1200	1100	1550	1600	1550	1380	1070
3200	1500	1550	1600	1550	1600	1600	1600	1550
3600	1480	1500	1550	1510	1430	1300	1200	980

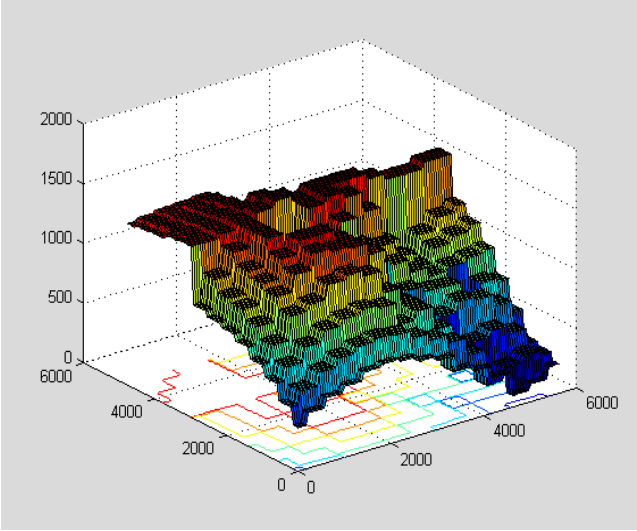
建立 M 文件 moutain.m

```
x=0:400:5600;
y=0:400:4800;
z=[370 470 550 600 670 690 670 620 580 450 400 300 100 150 250;...
       510 620 730 800 850 870 850 780 720 650 500 200 300 350 320;...
       650 760 880 970 1020 1050 1020 830 900 700 300 500 550 480 350;...
```

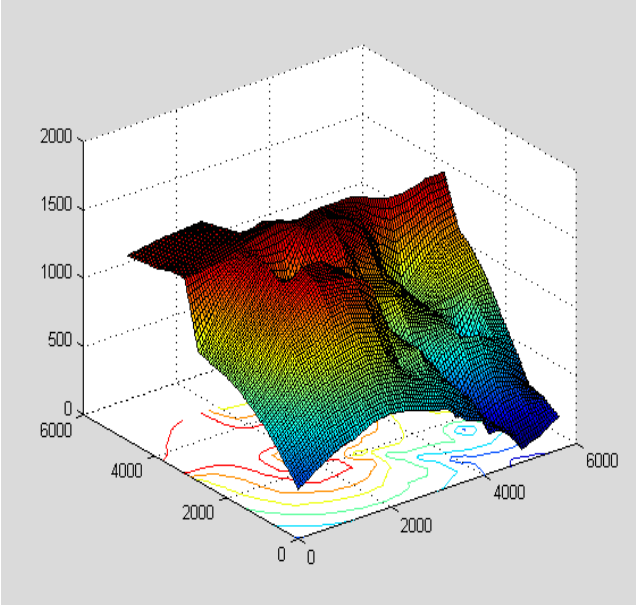
```
      740 880 1080 1130 1250 1280 1230 1040 900 500 700 780 750 650
550;...
      830 980 1180 1320 1450 1420 1400 1300 700 900 850 840 380 780
750;...
      880 1060 1230 1390 1500 1500 1400 900 1100 1060 950 870 900 930
950;...
      910 1090 1270 1500 1200 1100 1350 1450 1200 1150 1010 880 1000
1050 1100;...
      950 1190 1370 1500 1200 1100 1550 1600 1550 1380 1070 900 1050
1150 1200;...
      1430 1430 1460 1500 1550 1600 1550 1600 1600 1600 1550 1500 1500
1550 1550;...
      1420 1430 1450 1480 1500 1550 1510 1430 1300 1200 980 850 750 550
500;...
      1380 1410 1430 1450 1470 1320 1280 1200 1080 940 780 620 460 370
350;...
      1370 1390 1410 1430 1440 1140 1110 1050 950 820 690 540 380 300
210;...
      1350 1370 1390 1400 1410 960 940 880 800 690 570 430 290 210 150];

figure(1);
meshz(x,y,z)
```



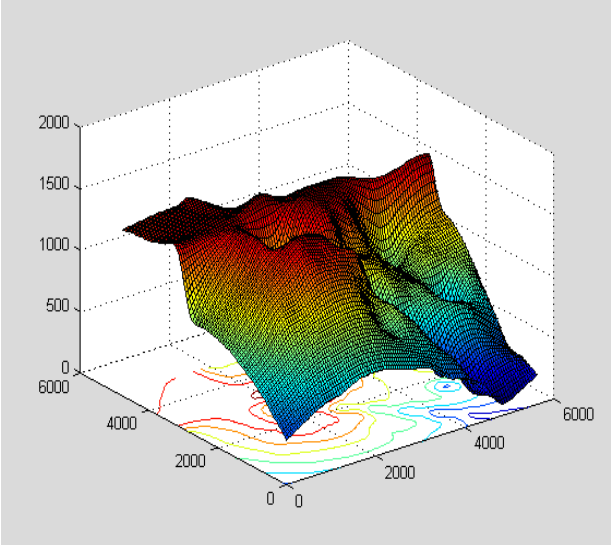

```
xi=0:50:5600;

yi=0:50:4800;


figure(2)

z1i=interp2(x,y,z,xi,yi','nearest');

surfc(xi,yi,z1i)
```



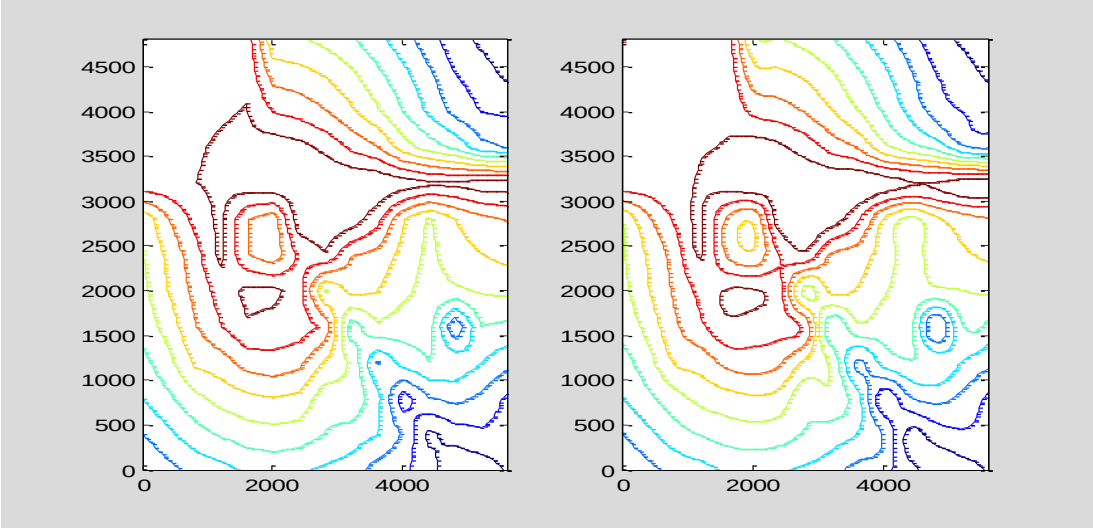
```
figure(3)

z2i=interp2(x,y,z,xi,yi');

surfc(xi,yi,z2i)
```




```
figure(4)

z3i=interp2(x,y,z,xi,yi','cubic');

surfc(xi,yi,z3i)
```



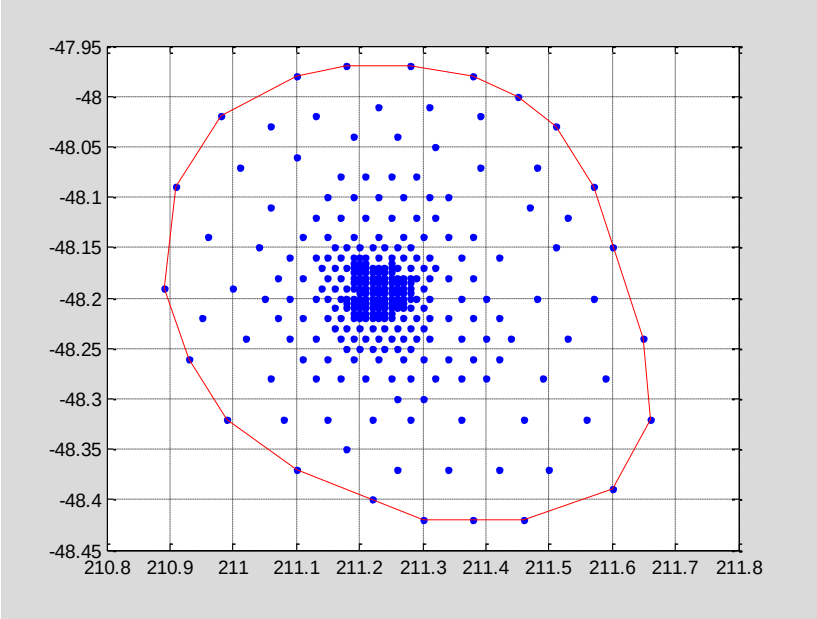

```
figure(5)
subplot(1,2,1),contour(xi,yi,z2i,10);
subplot(1,2,2),contour(xi,yi,z3i,10);
```



【三角测量和分散数据插值】

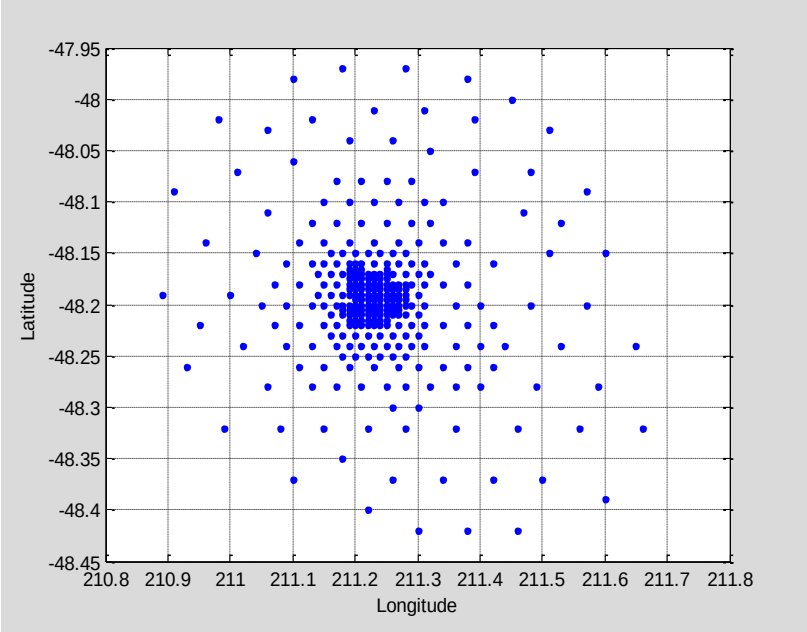
凸包（**Convex Hulls**）

```
load seamount
plot(x,y,'.','markersize',10)
k = convhull(x,y);
hold on, plot(x(k),y(k),'-r'), hold off
grid on
```

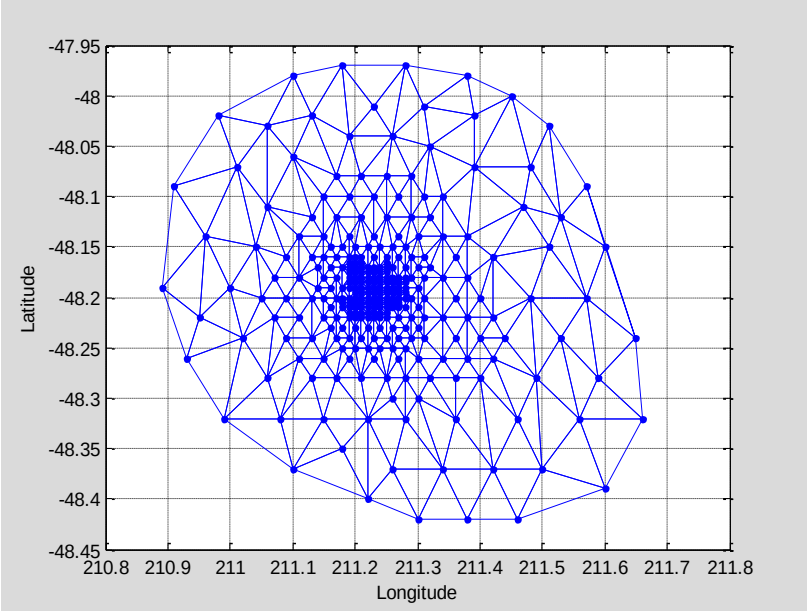


德洛涅三角（Delaunay Triangulation）

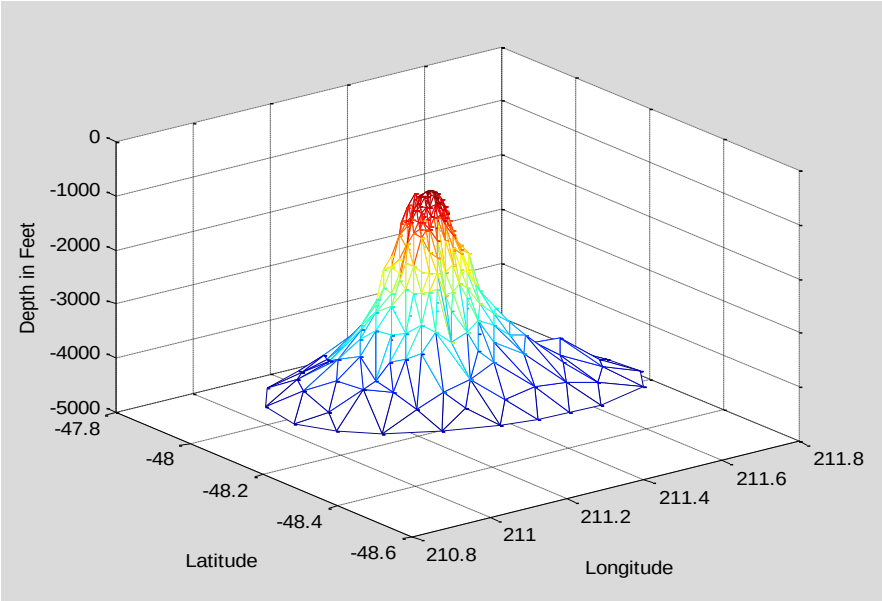
```
load seamount
plot(x,y,'.','markersize',12)
xlabel('Longitude'), ylabel('Latitude')
grid on
```



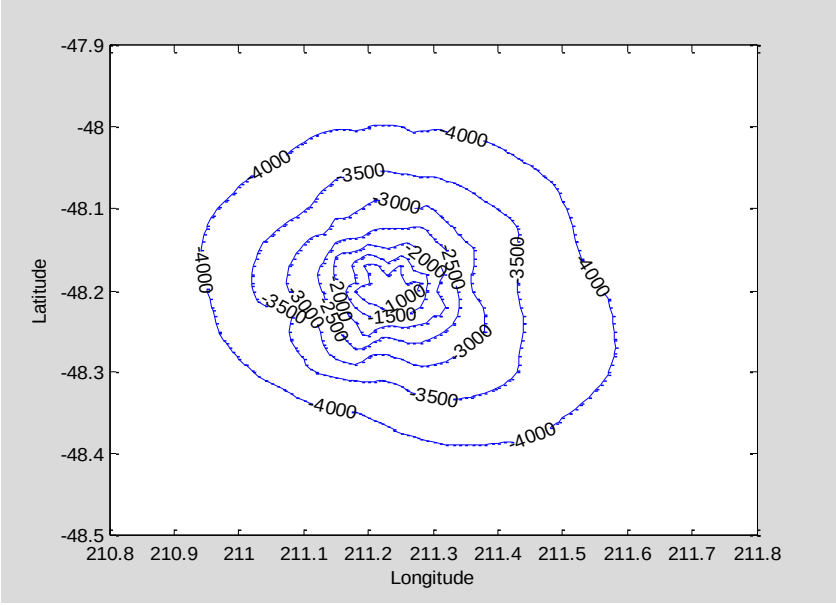

```
tri = delaunay(x,y);
hold on, triplot(tri,x,y), hold off
```




```
figure
hidden on
trimesh(tri,x,y,z)
grid on
xlabel('Longitude'); ylabel('Latitude'); zlabel('Depth in Feet')
```

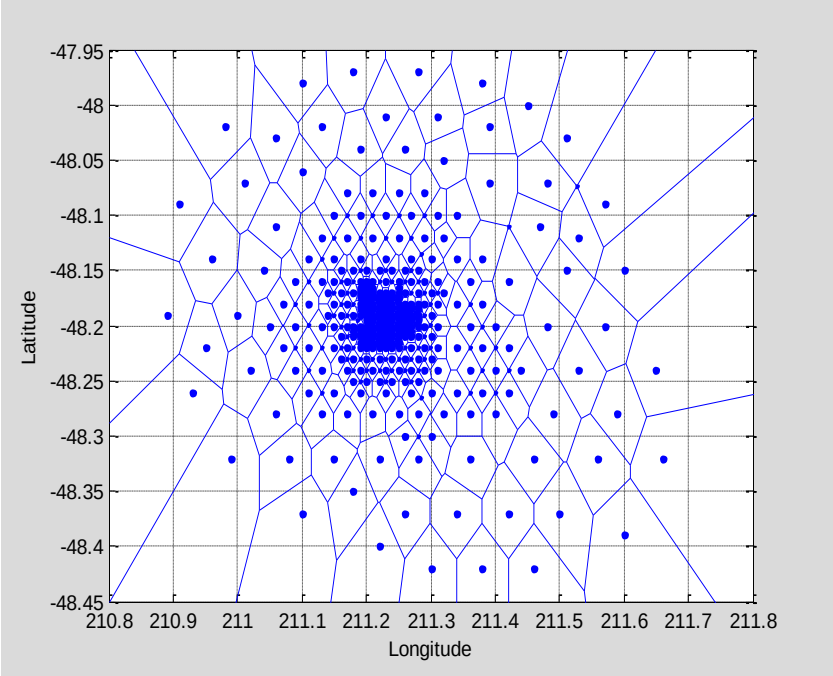



```
figure
[xi,yi] = meshgrid(210.8:.01:211.8,-48.5:.01:-47.9);
zi = griddata(x,y,z,xi,yi,'cubic');
[c,h] = contour(xi,yi,zi,'b-');
clabel(c,h)
xlabel('Longitude'), ylabel('Latitude')
```



火龙尼图形（**Voronoi Diagrams**）

```
load seamount
voronoi(x,y)
grid on
xlabel('Longitude'), ylabel('Latitude')
```



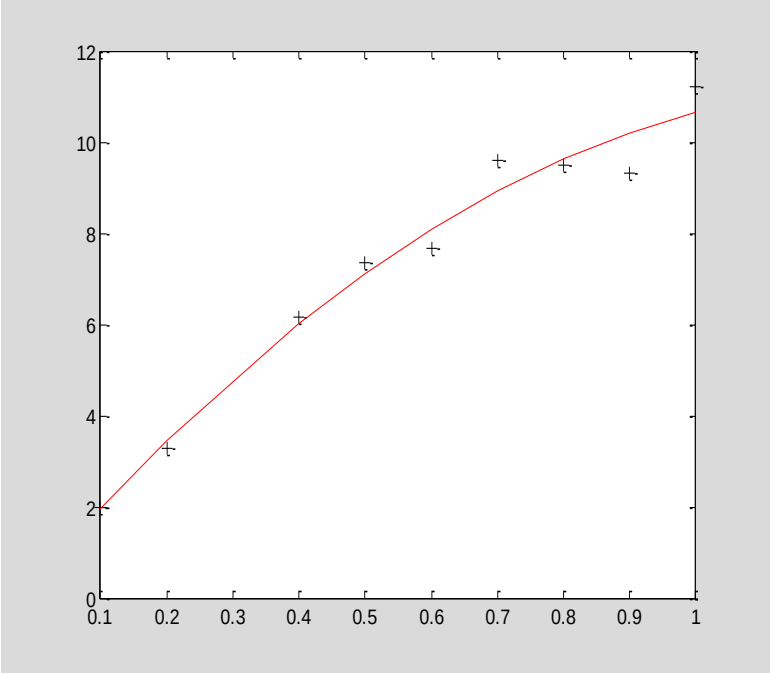
【数据拟合】

例 5

对下面一组数据作二次多项式拟合

xi	0.1	0.2	0.4	0.5	0.6	0.7	0.8	0.9	1
yi	1.978	3.28	6.16	7.34	7.66	9.58	9.48	9.30	11.2

```
x=[0.1 0.2 0.4:.1:1];
y=[1.978 3.28 6.16 7.34 7.66 9.58 9.48 9.30 11.2];
A=polyfit(x,y,2);
z=polyval(A,x);
plot(x,y,'k+',x,z,'r')
```



例 6

用下面一组数据拟合 $c(t)=a+be^{0.02kt}$ 中的参数 a，b，k。

方法 1：用 lsqcurvefit

建立 M 文件 curvefun1.m

```
function f=curvefun1(x,tdata)
f=x(1)+x(2)*exp(-0.02*x(3)*tdata)
%其中 x(1)=a;  x(2)=b；x(3)=k;
```

输入命令：

```
tdata=100:100:1000;
cdata=1e-03*[4.54,4.99,5.35,5.65,5.90,6.10,6.26,6.39,6.50,6.59];
x0=[0.2,0.05,0.05];
x=lsqcurvefit ('curvefun1',x0,tdata,cdata)
```

```
x =

    0.0063   -0.0034    0.2542
```

方法 2：用 lsqnonlin

建立 M 文件 curvefun2.m

```
function f=curvefun2(x)

tdata=100:100:1000;

cdata=1e-03*[4.54,4.99,5.35,5.65,5.90,6.10,6.26,6.39,6.50,6.59];

f=x(1)+x(2)*exp(-0.02*x(3)*tdata)- cdata
```

输入命令：

```
x0=[0.2,0.05,0.05];

x=lsqnonlin('curvefun2',x0)

x =

    0.0063   -0.0034    0.2542
```