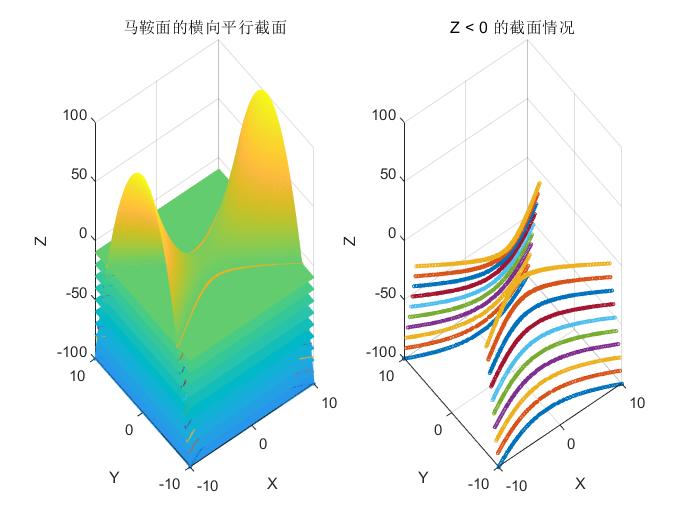
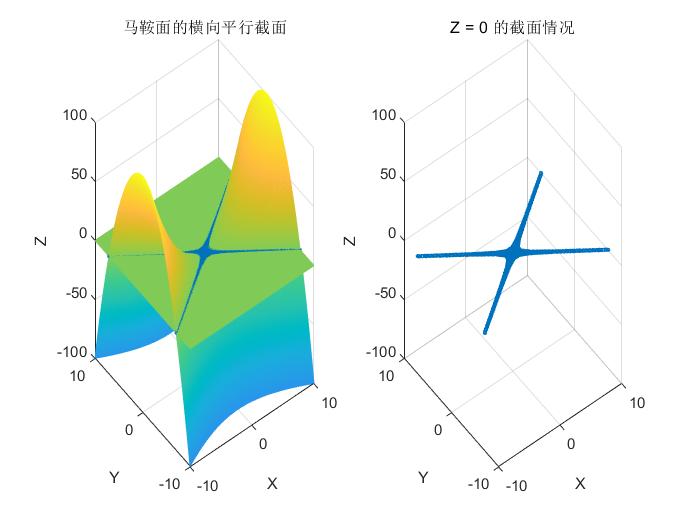
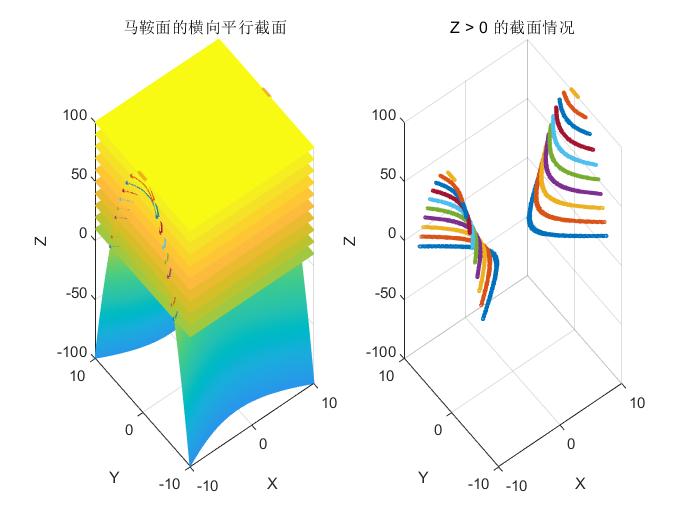
编程小作业3

第一题：用平行截面法讨论由曲面z=x^2-2y^2构成的马鞍面形状，给出程序和绘图结果

横向截面

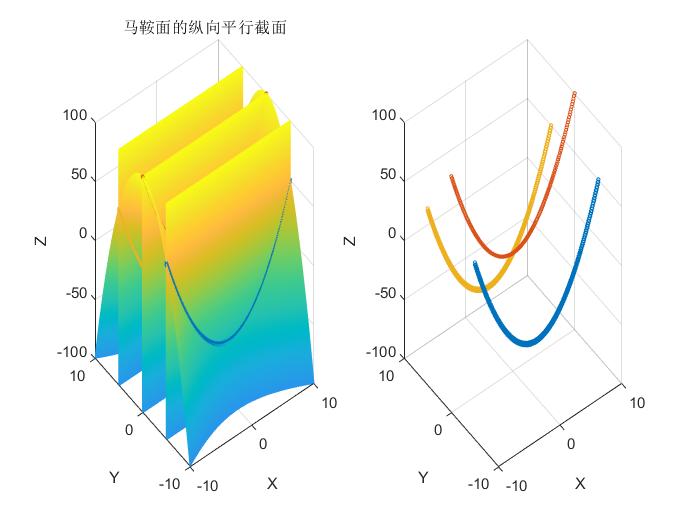






1. 当a>0时，平面与马鞍面的交线是实轴平行于轴的双曲线
2. 当a=0时，平面与马鞍面的交线是同时两条关于轴和轴的呈“x”型的直线
3. 当a<0时，平面与马鞍面的交线是实轴平行于轴的双曲线

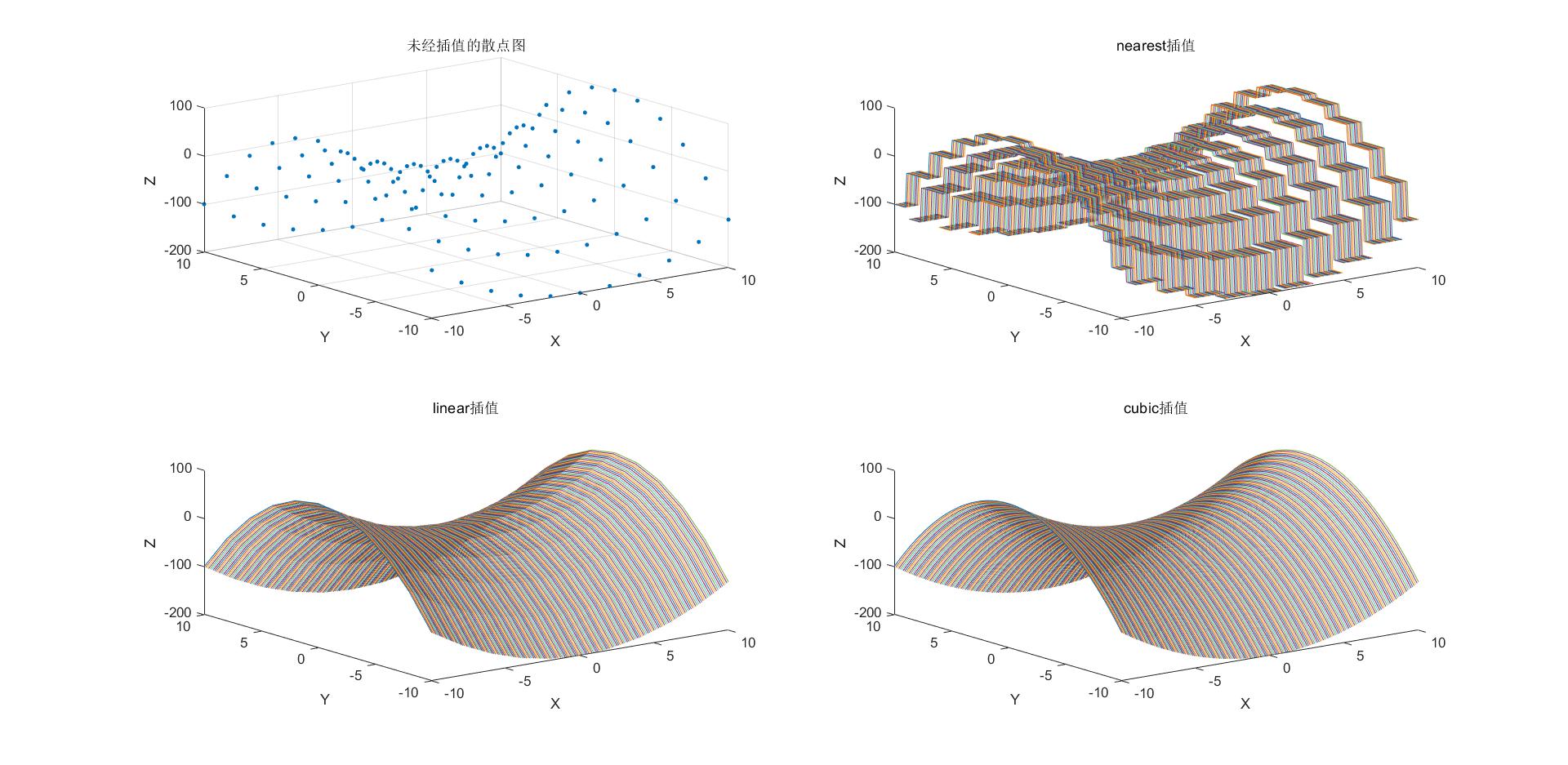
纵向截面



平面与马鞍面的交线是抛物线

类似的，平面与马鞍面的交线是抛物线

第二题：采用nearest、linear和cubic二维插值，绘制三维插值表面图



以上分别是，未经插值的散点图，以及分别采用nearest、linear和cubic二维插值，绘制三维插值三张表面图。

相比较而言，采用nearest、linear和cubic二维插值，图线依次更加平滑，越来越接近马鞍面。

因此，采用cubic二维插值法计算结果更好。

%% 第一题MATLAB 代码

clc,clear,clf,close all;

[x,y] = meshgrid(-10:0.1:10);

xyz\_limit = [-10 10 -10 10 -100 100];

z1 = x.^2-2\*y.^2;

% for slice by z

for i = -100:10:100

a = i;

z2 = a\*ones(size(x));

r0 = abs(z1-z2)<=1;

zz = r0.\*z2;

xx = r0.\*x;

yy = r0.\*y;

if a > 0

figure(1)

elseif a < 0

figure(2)

elseif a == 0

figure(3)

end

subplot(1,2,1);

mesh(x,y,z1);

grid,hold on;

mesh(x,y,z2);

hidden off;

h2=plot3(xx(r0~=0),yy(r0~=0),zz(r0~=0),'.');

xlabel('X'),ylabel('Y'),zlabel('Z');

title('马鞍面的横向平行截面');

axis(xyz\_limit);

grid on;

subplot(1,2,2);

h4=plot3(xx(r0~=0),yy(r0~=0),zz(r0~=0),'o');

xlabel('X'),ylabel('Y'),zlabel('Z');

if a > 0

title('Z > 0 的截面情况');

elseif a < 0

title('Z < 0 的截面情况');

elseif a == 0

title('Z = 0 的截面情况');

end

set(h4,'markersize',2);

hold on;

axis(xyz\_limit);

grid on;

end

% for slice by y

[X,Z] = meshgrid(-10:0.1:10,-100:100);

[x,y1] = meshgrid(-10:0.1:10);

z = x.^2-2\*y1.^2;

for i = -5:5:5

a = i;

y2 = a\*ones(size(Z));

r0 = abs(y1-y2)<=0.1;

zz = r0.\*z;

xx = r0.\*x;

yy = r0.\*y2;

figure(4)

subplot(1,2,1);

mesh(x,y1,z);

grid,hold on;

mesh(X,y2,Z);

hidden off;

h2=plot3(xx(r0~=0),yy(r0~=0),zz(r0~=0),'.');

xlabel('X'),ylabel('Y'),zlabel('Z');

title('马鞍面的纵向平行截面');

axis(xyz\_limit);

grid on;

subplot(1,2,2);

h4=plot3(xx(r0~=0),yy(r0~=0),zz(r0~=0),'o');

xlabel('X'),ylabel('Y'),zlabel('Z');

set(h4,'markersize',2);

hold on;

axis(xyz\_limit);

grid on;

end

%% 第二题MATLAB 代码

clc,clear,clf,close all;

[x,y] = meshgrid(-10:2:10);

[x1,y1] = meshgrid(-10:0.1:10);

[x2,y2] = meshgrid(-10:0.1:10);

[x3,y3] = meshgrid(-10:0.1:10);

xyz\_limit = [-10 10 -10 10 -100 100];

z = x.^2-2\*y.^2;

z1 = interp2(x,y,z,x1,y1,'nearest');

z2 = interp2(x,y,z,x2,y2,'linear');

z3 = interp2(x,y,z,x3,y3,'cubic');

figure(1);

subplot(2,2,1);

scatter3(x(:),y(:),z(:),10,'filled');

% plot3(x,y,z);

xlabel('X'),ylabel('Y'),zlabel('Z');

title('未经插值的散点图');

subplot(2,2,2);

plot3(x1,y1,z1);

xlabel('X'),ylabel('Y'),zlabel('Z');

title('nearest插值');

subplot(2,2,3);

plot3(x2,y2,z2);

xlabel('X'),ylabel('Y'),zlabel('Z');

title('linear插值');

subplot(2,2,4);

plot3(x3,y3,z3);

xlabel('X'),ylabel('Y'),zlabel('Z');

title('cubic插值');