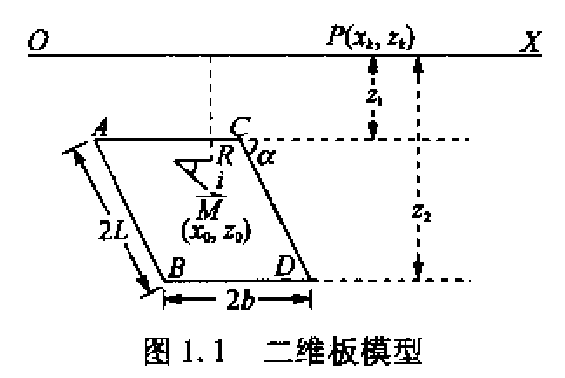
1. 二维板模型重磁异常

求如下的平面板ABCD对在OX轴上的P点的重磁异常，参数在下面给出，



其中，，测量点为101个。

解：

求出ABCD四个点分别对P点()的距离即，根据几何关系有：

并求出与X轴正向的夹角，由X轴顺时针起算：

1. 对于重力异常，假设地质体的密度是均匀的，则有：

考虑如图情况，则有：

1. 对于磁异常，看成由许多体积微小的元磁体所组成，则有：

考虑如图情况，得到磁异常的X和Z分量的值：

其总磁异常为：

其中，为地磁场倾角，为地磁场偏角，有：

对于上式，只需将P点的坐标带入即可得到对应的重力异常和磁异常，用数组记录下来，并绘图可视化显示，值得注意的是，数学上，的主值应在区间内，但是这里所讨论的实际为由坐标原点对多边形第边的夹角，这样它就有可能在之间变动，因此需要进行奇异值分解以保证数值稳定，即：

Code：

clear, clc, close all;

% 参数

x0 = 1000.0;

z0 = 1000.0;

b = 200;

l = 200;

angle\_alpha = 90;

angle\_i = 90;

M = 2000.0; % 磁化强度

xk = linspace(0, 2000, 101); % xk 即P点的横坐标

zk = 0; % P点的纵坐标始终为0

sigma = 2.67; % 剩余密度大小

G = 6.67e-5;

% 转化为弧度制

rad\_alpha = deg2rad(angle\_alpha);

rad\_angle\_i = deg2rad(angle\_i);

z1 = z0 - l \* sin(rad\_angle\_i);

z2 = z0 + l \* sin(rad\_angle\_i);

% 创建不同位置P点所受磁异常的X分量和Y分量

DeltaX = zeros(size(xk));

DeltaY = zeros(size(xk));

DeltaZ = zeros(size(xk));

Deltag = zeros(size(xk));

DeltaT = zeros(size(xk));

% 奇异值特判

% 对P点位置进行枚举循环

for index = 1: length(xk)

r1 = sqrt((xk(index) - x0 + b + l\*cos(rad\_alpha)).^2 + (z0 - zk - l\*sin(rad\_alpha)).^2);

r2 = sqrt((xk(index) - x0 + b - l\*cos(rad\_alpha)).^2 + (z0 - zk + l\*sin(rad\_alpha)).^2);

r3 = sqrt((xk(index) - x0 - b + l\*cos(rad\_alpha)).^2 + (z0 - zk - l\*sin(rad\_alpha)).^2);

r4 = sqrt((xk(index) - x0 - b - l\*cos(rad\_alpha)).^2 + (z0 - zk + l\*sin(rad\_alpha)).^2);

% 决定是否奇异

% phi1 = pi - atan((z0 - zk - l\*sin(rad\_alpha)) / (xk(index) - x0 + b + l\*cos(rad\_alpha)));

% phi2 = pi - atan((z0 - zk + l\*sin(rad\_alpha)) / (xk(index) - x0 + b - l\*cos(rad\_alpha)));

% phi3 = pi - atan((z0 - zk - l\*sin(rad\_alpha)) / (xk(index) - x0 - b + l\*cos(rad\_alpha)));

% phi4 = pi - atan((z0 - zk + l\*sin(rad\_alpha)) / (xk(index) - x0 - b - l\*cos(rad\_alpha)));

phi1 = cal\_phi(z0, zk, l, rad\_alpha, xk(index), x0, b, 1);

phi2 = cal\_phi(z0, zk, l, rad\_alpha, xk(index), x0, b, 2);

phi3 = cal\_phi(z0, zk, l, rad\_alpha, xk(index), x0, b, 3);

phi4 = cal\_phi(z0, zk, l, rad\_alpha, xk(index), x0, b, 4);

res\_X = (M / 2\*pi) \* sin(rad\_alpha) \* (log(r2 \* r3) / (r1 \* r4) \* cos(rad\_alpha - rad\_angle\_i) - ...

sin(rad\_alpha - rad\_angle\_i) \* (phi1 - phi2 - phi3 + phi4));

res\_Y = 0;

res\_Z = (M / 2\*pi) \* sin(rad\_alpha) \* (sin(rad\_alpha - rad\_angle\_i) \* log(r2 \* r3) / (r1 \* r4)) + ...

cos(rad\_alpha - rad\_angle\_i) \* (phi1 - phi2 - phi3 + phi4);

% 重力异常

left = z2\*(phi2 - phi4) - z1\*(phi1 - phi3);

mid = xk(index) \* (sin(rad\_alpha).^2 \* log((r2\* r3) / (r1\*r4)) + cos(rad\_alpha) \* sin(rad\_alpha) \* (phi1 - phi2 - phi3 + phi4));

right = 2 \* b \* (sin(rad\_alpha).^2 \* log(r4/r3) + cos(rad\_alpha) \* sin(rad\_alpha) \* (phi3 - phi4));

res\_g = 2 \* G \* sigma \* (left + mid + right);

Deltag(index) = res\_g;

% 磁异常分量

DeltaX(index) = res\_X;

DeltaY(index) = res\_Y;

DeltaZ(index) = res\_Z;

D = deg2rad(atan(res\_Y / res\_X));

I = deg2rad(atan(res\_Z / (res\_X.^2 + res\_Y)));

res\_T = res\_X \* cos(I) \* cos(D) + res\_Y \* cos(I) \* sin(D) + res\_Z \* sin(I);

DeltaT(index) = res\_T;

end

% X坐标是xk

% 重力异常 g

subplot(3, 1, 1);

plot(xk, Deltag);

% X坐标是xk

% 磁异常 T

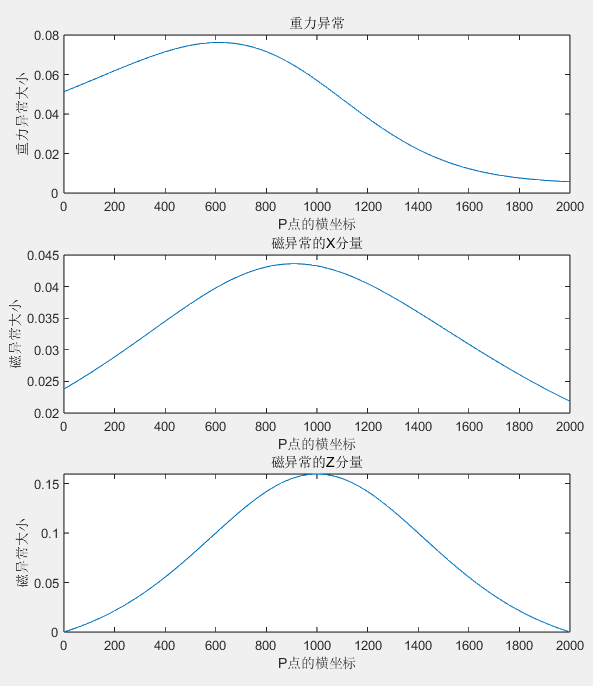
subplot(3, 1, 2);

plot(xk, DeltaX);

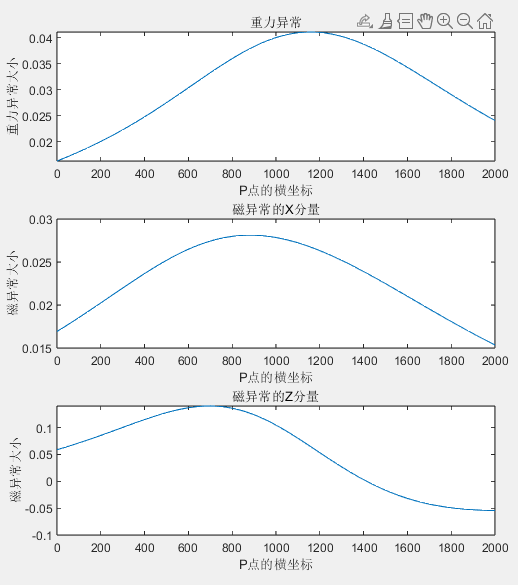
subplot(3, 1, 3);

plot(xk, DeltaZ);

Result：



90度



45度