Plot Potencial Eléctrico carga puntual

CÓDIGO

clear all

close all

clc

tic

% INPUTS ================================================================

% Number of grid point [N = 1001]

N = 1001;

% Charge Q = [20, 0, 0, 0, 0]

Q = [20, 0, 0, 0, 0] .\* 1e-6;

% Radius of circular charged conductor;

a = 0.2;

% X & Y components of position of charges [0, 0, 0, 0, 0]

xC = [0, 0, 0, 0, 0];

yC = [0, 0, 0, 0, 0];

% 5 random charges uncomment to run the program for 5 random charges

% Q = (1 + 9 .\* rand(5,1)) .\* 1e-6;

% xC = -2 + 4 .\* rand(5,1);

% yC = -2 + 4 .\* rand(5,1);

% constants

eps0 = 8.854e-12;

kC = 1/(4\*pi\*eps0);

% Dimensions of region / saturation levels

% [dimensions of region -2 to 2 / minR = 1e-6 / Esat = 1e6 / Vsat = 1e6]

minX = -2;

maxX = 2;

minY = -2;

maxY = 2;

minR = 1e-6;

minRx = 1e-6;

minRy = 1e-6;

Vsat = kC \* max(abs(Q)) / a;

Esat = kC \* max(abs(Q)) / a^2;

% SETUP =================================================================

% fields

V = zeros(N,N);

Ex = zeros(N,N); Ey = zeros(N,N);

% [2D] region

x = linspace(minX,maxX,N);

y = linspace(minY, maxY,N);

% color of charged object + red / - black

col1 = [1 0 0];

if Q(1) < 0; col1 = [0 0 0]; end;

% grid positions

[xG, yG] = meshgrid(x,y);

% CALCULATION: POTENTIAL & ELECTRIC FIELD ================================

for n = 1 : 5

Rx = xG - xC(n);

Ry = yG - yC(n);

index = find(abs(Rx)+ abs(Ry) == 0);

Rx(index) = minRx; Ry(index) = minRy;

R = sqrt(Rx.^2 + Ry.^2);

R(R==0) = minR;

V = V + kC .\* Q(n) ./ (R);

R3 = R.^3;

Ex = Ex + kC .\* Q(n) .\* Rx ./ R3;

Ey = Ey + kC .\* Q(n) .\* Ry ./ R3;

end

if max(max(V)) >= Vsat; V(V > Vsat) = Vsat; end;

if min(min(V)) <= -Vsat; V(V < -Vsat) = -Vsat; end;

E = sqrt(Ex.^2 + Ey.^2);

if max(max(E)) >= Esat; E(E > Esat) = Esat; end;

if min(min(E)) <= -Esat; E(E < -Esat) = -Esat; end;

if max(max(Ex)) >= Esat; Ex(Ex > Esat) = Esat; end;

if min(min(Ex)) <= -Esat; Ex(Ex < -Esat) = -Esat; end;

if max(max(Ey)) >= Esat; Ey(Ey > Esat) = Esat; end;

if min(min(Ey)) <= -Esat; Ey(Ey < -Esat) = -Esat; end;

%%

% Calcuation LINE INTEGRAL Nx1 Nx2 Ny1 Ny2 must all be ODD numbers

Nx1 = 551; Nx2 = Nx1 + 210; % must add an EVEN number

Ny1 = 61; Ny2 = Ny1 + 730; % must add an EVEN number

f = Ex(Ny1,Nx1:Nx2); % f must have an ODD number of elements

sx1 = x(Nx1); sx2 = x(Nx2);

Vx = -simpson1d(f,sx1,sx2);

f = Ey(Ny1:Ny2,Nx2)';

sy1 = y(Ny1); sy2 = y(Ny2);

Vy = -simpson1d(f,sy1,sy2);

V21 = Vx + Vy;

dV = V(Ny2,Nx2) - V(Ny1,Nx1);

%%

% GRAPHICS ===============================================================

%%

%%

figure(2) %2222222222222222222222222222222222222222222222222222222222222

set(gcf,'units','normalized','position',[0.25 0.52 0.23 0.32]);

zP = V./1e6;

contourf(xG,yG,zP,16);

%set(gca,'xLim',[-5,5]); set(gca,'yLim', [-5, 5]);

%set(gca,'xTick',-5:5); set(gca,'yTick', -5:5);

hold on

pos = [-a, -a, 2\*a, 2\*a];

h = rectangle('Position',pos,'Curvature',[1,1]);

set(h,'FaceColor',col1,'EdgeColor',col1);

xlabel('x [m]'); ylabel('y [m]');

title('potential','fontweight','normal');

shading interp

h = colorbar;

h.Label.String = 'V [ MV ]';

colormap(parula);

set(gca,'fontsize',12);

axis square

box on

%%

Toc

SIMPSON.M

function integral = simpson1d(f,a,b)

num = length(f); % number of data points

sc = 2\*ones(num,1);

sc(2:2:num-1) = 4;

sc(1) = 1; sc(num) = 1;

h = (b-a)/(num-1);

integral = (h/3) \* f \* sc;

end

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