**ELEC4700**

**ASSIGNMNENT 2**

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**101031041**

**Question1**

clearvars

clearvars -GLOBAL

close all

%set(0,'DefaultFigureWindowStyle', 'docked')

global C

global CuCond

global nx ny

C.q\_0 = 1.60217653e-19; % electron charge

C.hb = 1.054571596e-34; % Dirac constant

C.h = C.hb \* 2 \* pi; % Planck constant

C.m\_0 = 9.10938215e-31; % electron mass

C.kb = 1.3806504e-23; % Boltzmann constant

C.eps\_0 = 8.854187817e-12; % vacuum permittivity

C.mu\_0 = 1.2566370614e-6; % vacuum permeability

C.c = 299792458; % speed of light

C.g = 9.80665; % metres (32.1740 ft) per sÂ²

nx = 90;

ny = 65;

CuCond = 1.7e-8;

%Conductivity Map

cMap = zeros(nx,ny);

for i = 1:nx

for j = 1: ny

cMap(i,j) = CuCond;

end

end

G = sparse(nx\*ny, nx\*ny);

F = zeros(1, nx\*ny);

% G - Matrix Formulation

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

if i == 1

G(n,:) = 0;

G(n,n) = 1;

F(n) = 1;

elseif i == nx

G(n,:) = 0;

G(n,n) = 1;

elseif j == 1

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (cMap(i,j) + cMap(i-1,j))/2.0;

rxp = (cMap(i,j) + cMap(i+1,j))/2.0;

ryp = (cMap(i,j) + cMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nyp) = ryp;

elseif j == ny

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

rxm = (cMap(i,j) + cMap(i-1,j))/2.0;

rxp = (cMap(i,j) + cMap(i+1,j))/2.0;

rym = (cMap(i,j) + cMap(i,j-1))/2.0;

G(n,n) = -(rxm + rxp + rym);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

else

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (cMap(i,j) + cMap(i-1,j))/2.0;

rxp = (cMap(i,j) + cMap(i+1,j))/2.0;

rym = (cMap(i,j) + cMap(i,j-1))/2.0;

ryp = (cMap(i,j) + cMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + rym + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

G(n, nyp) = ryp;

end

end

end

% for i = 1:nx

%

% for j = 1:length\_y

% n = j + (i - 1) \* length\_y;

% nxm = j + ((i-1) - 1) \* length\_y;

% nxp = j + ((i+1) - 1) \* length\_y;

% nym = (j-1) + (i - 1) \* length\_y;

% nyp = (j+1) + (i - 1) \* length\_y;

%

% if (i == 1)

% G(n, :) = 0;

% G(n, n) = 1;

% V(1, n) = 1;

% elseif (i == nx)

% G(n, :) = 0;

% G(n, n) = 1;

%

% elseif (j == 1 && i > 1 && i < nx)

% G(n, n) = -1;

% G(n, nyp) = 1;

%

% elseif (j == length\_y && i > 1 && i < nx)

%

% G\_matrix(n, n) = -1;

% G\_matrix(n, nym) = 1;

%

% else

% G(n, n) = -4;

% G(n, nxm) = 1;

% G(n, nxp) = 1;

% G(n, nym) = 1;

% G(n, nyp) = 1;

%

% end

% end

%

%

% end

% Using Finite Difference

V = G\F';

for i = 1:nx

for j = 1:ny

n = j + (i-1) \* ny;

VG(i,j) = V(n);

end

end

figure

set(surf(VG),'linestyle', 'none');

Chart, surface chart

Description automatically generated

**Question 1 B**

clc

clear

set(0,'DefaultFigureWindowStyle','docked')

nx=90;

ny=65;

G = sparse((nx \* ny), (nx \* ny));

V = zeros(1, (nx \* ny));

vo = 1;

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

nxm = j + ((i-1) - 1) \* ny;

nxp = j + ((i+1) - 1) \* ny;

nym = (j-1) + (i - 1) \* ny;

nyp = (j+1) + (i - 1) \* ny;

if i == 1

G(n, :) = 0;

G(n, n) = 1;

V(1, n) = vo;

elseif i == nx

G(n, :) = 0;

G(n, n) = 1;

V(1, n) = vo;

elseif j == 1

G(n, :) = 0;

G(n, n) = 1;

elseif j == ny

G(n, :) = 0;

G(n, n) = 1;

else

G(n, :) = 0;

G(n, n) = -4;

G(n, nxm) = 1;

G(n, nxp) = 1;

G(n, nym) = 1;

G(n, nyp) = 1;

end

end

end

NewV = G\V';

figure (3);

surface2 = zeros(nx, ny);

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

nxm = j + ((i-1) - 1) \* ny;

nxp = j + ((i+1) - 1) \* ny;

nym = (j-1) + (i - 1) \* ny;

nyp = (j+1) + (i - 1) \* ny;

surface2(i, j) = NewV(n);

end

end

surf(surface2);

title('The Numerical Approach');

%newV =zeros(90,65);

newV = zeros(65, 30);

a = 65;

b = 25;

x = linspace(-25,25,30);

y = linspace(0,65,65);

[x\_mesh, y\_mesh] = meshgrid(x, y);

for n = 1:2:200

newV = (newV + (4 \* vo/pi).\*(cosh((n \* pi \* x\_mesh)/a) .\* sin((n \* pi \* y\_mesh)/a)) ./ (n \* cosh((n \* pi \* b)/a)));

figure(4);

surf(x, y, newV);

title('The Analytical Approach Solution');

pause(0.05);

end

Chart, surface chart

Description automatically generated

Chart, surface chart

Description automatically generated

**Advantage (numerical)**

For the numerical approach to have a precise plot it needs to use smaller space step.

**Disadvantage(numerical)**

For the numerical approach much approximation is needed.

**Advantage (analytical)**

For the analytical approach less, approximation is being done because the factual equation is being utilized.

**Disadvantage (analytical)**

For the analytical approach much simulation is needed to get a precise plot

Basically, I utilized different number during the simulation, and I noticed as the numbers were increased the plots were also changing. Mesh method is good when working with approximations.

**Question 2**

clearvars

clearvars -GLOBAL

close all

set(0,'DefaultFigureWindowStyle', 'docked')

global CuCond NoCond

global nx ny

nx = 30;

ny = 30;

Lb = floor(nx/3);

Wb = floor(ny/3);

CuCond = 100;

NoCond = 10e-9;

%Conductivity map

conductivityMap = zeros(nx,ny);

for i = 1:nx

for j = 1: ny

conductivityMap(i,j) = CuCond;

end

end

for i = 1:nx

for j = 1:ny

if (i>=1 && i<=Wb && j>Lb && j<=(2\*Lb))

conductivityMap(i,j) = NoCond;

end

% if(i > 1 && i < wb && ((j < Lb || (j > 2\*Lb)))

% conductivity\_mapping(i,j) = Nocond;

% end

if (i<=ny && i>=(ny-Wb) && j>Lb && j<=(2\*Lb))

conductivityMap(i,j) = NoCond;

end

end

end

G = sparse(nx\*ny, nx\*ny);

F = zeros(1, nx\*ny);

%

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

%n1 = j + ((i+1) - 1) \* ny;

%n2 = (j-1) + (i - 1) \* ny;

% n3 = (j+1) + (i - 1) \* ny;

if i == 1

G(n,:) = 0;

G(n,n) = 1;

F(n) = 1;

elseif i == nx %(i == 1 && i > 1 && i < nx)

G(n,:) = 0;

G(n,n) = 1;

elseif j == 1

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

ryp = (conductivityMap(i,j) + conductivityMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nyp) = ryp;

elseif j == ny %(j == ny && i > 1 && i < nx)

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

rym = (conductivityMap(i,j) + conductivityMap(i,j-1))/2.0;

G(n,n) = -(rxm + rxp + rym);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

else

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

rym = (conductivityMap(i,j) + conductivityMap(i,j-1))/2.0;

ryp = (conductivityMap(i,j) + conductivityMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + rym + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

G(n, nyp) = ryp;

end

end

end

V = G\F';

vmap= zeros (nx,ny);

for i = 1:nx %Converting V to matrix to plot

for j = 1:ny

n = j + (i-1) \* ny;

VG(i,j) = V(n);

end

end

N =150;

a = ny;

b = nx/2;

new = zeros(nx,ny);

for i = 1:nx %Electric Field calculation

for j = 1:ny

if i == 1

Ex(i, j) = (VG(++i, j) - VG(i, j));

elseif i == nx

Ex(i, j) = (VG(i, j) - VG(--i, j));

else

Ex(i, j) = (VG(i + 1, j) - VG(--i, j)) \* 0.5;

end

if j == 1

Ey(i, j) = (VG(i, j + 1) - VG(i, j));

elseif j == ny

Ey(i, j) = (VG(i, j) - VG(i, j - 1));

else

Ey(i, j) = (VG(i, j + 1) - VG(i, j - 1)) \* 0.5;

end

end

end

Ex = -Ex;

Ey = -Ey;

Densitymapx = conductivityMap .\* Ex;

Densitymapy = conductivityMap .\* Ey;

figure

H = surf(conductivityMap');

title('The Conductivity Map')

%set(H, 'linestyle', 'none');

set(gcf,'DefaultTextColor','r')

view(0, 90) % 2D view

figure

H = surf(VG');

title('The Vmap with bottle neck')

set(H, 'linestyle', 'none');

%set(gcf,'DefaultTextColor','r')

view(0, 90) %2D view

figure

quiver(Ex', Ey');

title('The Electric field Map')

axis([0 nx 0 ny]);

figure

quiver(Densitymapx', Densitymapy');

title(' The Current Density Map')

axis([0 nx 0 ny]);

Current1 = sum(Densitymapx(1, :));

Current2 = sum(Densitymapx(nx, :));

total = (Current1 + Current2) \* 1;

%

Chart

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**Question 2B**

clearvars

clearvars -GLOBAL

close all

set(0,'DefaultFigureWindowStyle', 'docked')

global CuCond NoCond

global nx ny

nx = 30;

ny = 30;

conductivityset = 100;

newcurr = zeros(1,conductivityset);

newsize = zeros(1,conductivityset);

for k = 1:conductivityset

newsize(k) = nx;

Lb = floor(nx/3);

Wb = floor(ny/3);

CuCond = 1;

NoCond = 10e-2;

%Conductivity map

cMap = zeros(nx,ny);

for i = 1:nx

for j = 1: ny

cMap(i,j) = CuCond;

end

end

for i = 1:nx

for j = 1:ny

if (i>=1 && i<=Wb && j>Lb && j<=(2\*Lb))

cMap(i,j) = NoCond;

end

if (i<=ny && i>=(ny-Wb) && j>Lb && j<=(2\*Lb))

cMap(i,j) = NoCond;

end

end

end

G = sparse(nx\*ny, nx\*ny);

F = zeros(1, nx\*ny);

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

if i == 1

G(n,:) = 0;

G(n,n) = 1;

F(n) = 1;

elseif i == nx

G(n,:) = 0;

G(n,n) = 1;

elseif j == 1

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (cMap(i,j) + cMap(i-1,j))/2.0;

rxp = (cMap(i,j) + cMap(i+1,j))/2.0;

ryp = (cMap(i,j) + cMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nyp) = ryp;

elseif j == ny

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

rxm = (cMap(i,j) + cMap(i-1,j))/2.0;

rxp = (cMap(i,j) + cMap(i+1,j))/2.0;

rym = (cMap(i,j) + cMap(i,j-1))/2.0;

G(n,n) = -(rxm + rxp + rym);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

else

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (cMap(i,j) + cMap(i-1,j))/2.0;

rxp = (cMap(i,j) + cMap(i+1,j))/2.0;

rym = (cMap(i,j) + cMap(i,j-1))/2.0;

ryp = (cMap(i,j) + cMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + rym + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

G(n, nyp) = ryp;

end

end

end

V = G\F';

for i = 1:nx

for j = 1:ny

n = j + (i-1) \* ny;

VG(i,j) = V(n);

end

end

for i = 1:nx

for j = 1:ny

if i == 1

Ex(i, j) = (VG(i + 1, j) - VG(i, j));

elseif i == nx

Ex(i, j) = (VG(i, j) - VG(i - 1, j));

else

Ex(i, j) = (VG(i + 1, j) - VG(i - 1, j)) \* 0.5;

end

if j == 1

Ey(i, j) = (VG(i, j + 1) - VG(i, j));

elseif j == ny

Ey(i, j) = (VG(i, j) - VG(i, j - 1));

else

Ey(i, j) = (VG(i, j + 1) - VG(i, j - 1)) \* 0.5;

end

end

end

Ex = -Ex;

Ey = -Ey;

Jx = cMap .\* Ex;

Jy = cMap .\* Ey;

%

%Current

newcurrent(k) = (sum(Jx(1, :)) + sum(Jx(nx, :))) \* 0.5;

%Sizes

nx = nx+1;

ny = ny+1;

end

%Current vs Mesh Size

figure

plot(newsize, newcurrent, 'r');

title('Current vs Mesh Size')

xlabel('Mesh size')

ylabel('Current (A)')

A picture containing chart

Description automatically generated

Basically, as the mesh size used increases, the current tends to decrease.

clearvars

clearvars -GLOBAL

close all

set(0,'DefaultFigureWindowStyle', 'docked')

global CuCond NoCond

global nx ny

nx = 80;

ny = 80;

currentset = 150;

Current = zeros(1, currentset);

thenecksizes = zeros(1, currentset);

Lb = floor(nx/3);

Wb = floor(ny/3);

for K = 1: currentset

thenecksizes(K) = Wb;

CuCond = 1;

NoCond = 10e-2;

%Conductivity map

conductivityMap = zeros(nx,ny);

for i = 1:nx

for j = 1: ny

conductivityMap(i,j) = CuCond;

end

end

for i = 1:nx

for j = 1:ny

if (i>=1 && i<=Wb && j>Lb && j<=(2\*Lb))

conductivityMap(i,j) = NoCond;

end

if (i<=ny && i>=(ny-Wb) && j>Lb && j<=(2\*Lb))

conductivityMap(i,j) = NoCond;

end

end

end

G = sparse(nx\*ny, nx\*ny);

F = zeros(1, nx\*ny);

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

if i == 1

G(n,:) = 0;

G(n,n) = 1;

F(n) = 1;

elseif i == nx

G(n,:) = 0;

G(n,n) = 1;

elseif j == 1

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

ryp = (conductivityMap(i,j) + conductivityMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nyp) = ryp;

elseif j == ny

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

rym = (conductivityMap(i,j) + conductivityMap(i,j-1))/2.0;

G(n,n) = -(rxm + rxp + rym);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

else

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

rym = (conductivityMap(i,j) + conductivityMap(i,j-1))/2.0;

ryp = (conductivityMap(i,j) + conductivityMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + rym + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

G(n, nyp) = ryp;

end

end

end

V = G\F';

for i = 1:nx

for j = 1:ny

n = j + (i-1) \* ny;

VG(i,j) = V(n);

end

end

for i = 1:nx

for j = 1:ny

if i == 1

Ex(i, j) = (VG(i + 1, j) - VG(i, j));

elseif i == nx

Ex(i, j) = (VG(i, j) - VG(i - 1, j));

else

Ex(i, j) = (VG(i + 1, j) - VG(i - 1, j)) \* 0.5;

end

if j == 1

Ey(i, j) = (VG(i, j + 1) - VG(i, j));

elseif j == ny

Ey(i, j) = (VG(i, j) - VG(i, j - 1));

else

Ey(i, j) = (VG(i, j + 1) - VG(i, j - 1)) \* 0.5;

end

end

end

Ex = -Ex;

Ey = -Ey;

Jx = conductivityMap .\* Ex;

Jy = conductivityMap .\* Ey;

C0 = sum(Jx(1, :));

Cnx = sum(Jx(nx, :));

Current(K) = (C0 + Cnx) \* 0.5;

thenecksizes(K) = ny - (2\*Wb);

Wb = Wb+1;

end

%Current vs Neck Size

figure

plot(thenecksizes, Current,'g');

title('The Current vs bottle-necks')

xlabel('The Bottle neck width')

ylabel('The Current (A)')

A picture containing chart

Description automatically generated

Basically, by increasing the bottleneck width, the current increases as well

clearvars

clearvars -GLOBAL

close all

set(0,'DefaultFigureWindowStyle', 'docked')

global CuCond NoCond

global nx ny

nx = 80;

ny = 80;

Conductivityset = 150;

newCurrent = zeros(1,Conductivityset);

CuCondVal = zeros(1,Conductivityset);

Lb = floor(nx/3);

Wb = floor(ny/3);

for i = 1:Conductivityset

CuCondVal(i) = i;

end

for u = 1:Conductivityset

CuCond = CuCondVal(u);

NoCond = 10e-2;

conductivityMap = zeros(nx,ny);

for i = 1:nx

for j = 1: ny

conductivityMap(i,j) = CuCond;

end

end

for i = 1:nx

for j = 1:ny

if (i>=1 && i<=Wb && j>Lb && j<=(2\*Lb))

conductivityMap(i,j) = NoCond;

end

if (i<=ny && i>=(ny-Wb) && j>Lb && j<=(2\*Lb))

conductivityMap(i,j) = NoCond;

end

end

end

G = sparse(nx\*ny, nx\*ny);

F = zeros(1, nx\*ny);

for i = 1:nx

for j = 1:ny

n = j + (i - 1) \* ny;

if i == 1

G(n,:) = 0;

G(n,n) = 1;

F(n) = 1;

elseif i == nx

G(n,:) = 0;

G(n,n) = 1;

elseif j == 1

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

ryp = (conductivityMap(i,j) + conductivityMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nyp) = ryp;

elseif j == ny

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

rym = (conductivityMap(i,j) + conductivityMap(i,j-1))/2.0;

G(n,n) = -(rxm + rxp + rym);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

else

nxm = j + (i-2) \* ny;

nxp = j + (i) \* ny;

nym = (j-1) + (i-1) \* ny;

nyp = (j+1) + (i-1) \* ny;

rxm = (conductivityMap(i,j) + conductivityMap(i-1,j))/2.0;

rxp = (conductivityMap(i,j) + conductivityMap(i+1,j))/2.0;

rym = (conductivityMap(i,j) + conductivityMap(i,j-1))/2.0;

ryp = (conductivityMap(i,j) + conductivityMap(i,j+1))/2.0;

G(n,n) = -(rxm + rxp + rym + ryp);

G(n,nxm) = rxm;

G(n,nxp) = rxp;

G(n, nym) = rym;

G(n, nyp) = ryp;

end

end

end

newset = G\F';

for i = 1:nx

for j = 1:ny

n = j + (i-1) \* ny;

VG(i,j) = newset(n);

end

end

for i = 1:nx

for j = 1:ny

if i == 1

Ex(i, j) = (VG(i + 1, j) - VG(i, j));

elseif i == nx

Ex(i, j) = (VG(i, j) - VG(i - 1, j));

else

Ex(i, j) = (VG(i + 1, j) - VG(i - 1, j)) \* 0.5;

end

if j == 1

Ey(i, j) = (VG(i, j + 1) - VG(i, j));

elseif j == ny

Ey(i, j) = (VG(i, j) - VG(i, j - 1));

else

Ey(i, j) = (VG(i, j + 1) - VG(i, j - 1)) \* 0.5;

end

end

end

Ex = -Ex;

Ey = -Ey;

Jx = conductivityMap .\* Ex;

Jy = conductivityMap .\* Ey;

newCurrent(u) = (sum(Jx(1, :)) + sum(Jx(nx, :))) \* 0.5;

end

%Current vs Neck Size

figure

plot(CuCondVal, newCurrent, 'g');

title('The Current vs Conductivity')

xlabel('Conductivity')

ylabel('Current (A)')

Chart, line chart

Description automatically generated

Fundamentally corresponding to the equation J = conductivity\*Electric field the relationship between current and conductivity should be linear. The plot above displays that