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% ELEC4700 Assignment 3

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% Part2



clear

clc

L=40;

W=60;

sigma1=1;

sigma2=0.01;

k=L*W;

G=sparse(k,k);

Z = zeros(k, 1);

Vo=1; % voltage drop across the whole area = the beginning voltage

S = zeros(L, W);    % sigma

for x = 1 : L

    for y = 1 : W

        if x >= 0.4*L && x <= 0.6*L && (y <= 0.4*W || y >= 0.6*W)

            % area in the blocks

            S(x, y) = sigma2;

        else

            % area outside the blocks
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```
            S(x, y) = sigma1;
        end
    end
end
for i = 1:L
    for j = 1:W
        n = j + (i-1)*W;
        nxm = j + (i-2)*W;
        nxp = j + i*W;
        nym = j-1+(i-1)*W;
        nyp = j+1+(i-1)*W;
        if i == 1
            G(n, n) = 1;
            % assume the current flows from left to right
            Z(n) = Vo;
        elseif i == L
            G(n, n) = 1;
            % by default Z(n)=0 here
        elseif j == 1  % lower bound
            if i > 0.4*L && i < 0.6*L % inside the blocks
                G(n, n) = -3;
                G(n, nyp) = sigma2;
```

```
                G(n, nxp) = sigma2;

                G(n, nxm) = sigma2;

            else

                G(n, n) = -3;

                G(n, nyp) = sigma1;

                G(n, nxp) = sigma1;

                G(n, nxm) = sigma1;

            end

        elseif j == W % upper bound

            if i > 0.4*L && i < 0.6*L % inside the block

                G(n, n) = -3;

                G(n, nym) = sigma2;

                G(n, nxp) = sigma2;

                G(n, nxm) = sigma2;

            else

                G(n, n) = -3;

                G(n, nym) = sigma1;

                G(n, nxp) = sigma1;

                G(n, nxm) = sigma1;

            end

        else

            if i > 0.4*L && i < 0.6*L && (j < 0.4*W||j > 0.6*W)
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```
                % inside the blocks

                G(n, n) = -4;

                G(n, nyp) = sigma2;

                G(n, nym) = sigma2;

                G(n, nxp) = sigma2;

                G(n, nxm) = sigma2;

            else

                G(n, n) = -4;

                G(n, nyp) = sigma1;

                G(n, nym) = sigma1;

                G(n, nxp) = sigma1;

                G(n, nxm) = sigma1;

            end

        end

    end

end

% G*V=Z

V3 = G\Z;

V4=reshape(V3,L,W);

[Ex, Ey] = gradient(V4);

Jx = S.*Ex;

Jy = S.*Ey;
```

```
J = sqrt(Jx.^2 + Jy.^2);

% assume R=1

V=zeros(L,W);

V(:,1)=1;

for x=1:L

    for y=2:W

    V(x,y)=V(x,y-1)-J(x,y)/L;

    end

end

[X,Y]=meshgrid(1:1:W,1:1:L);

figure(1)

surf(X,Y,V);

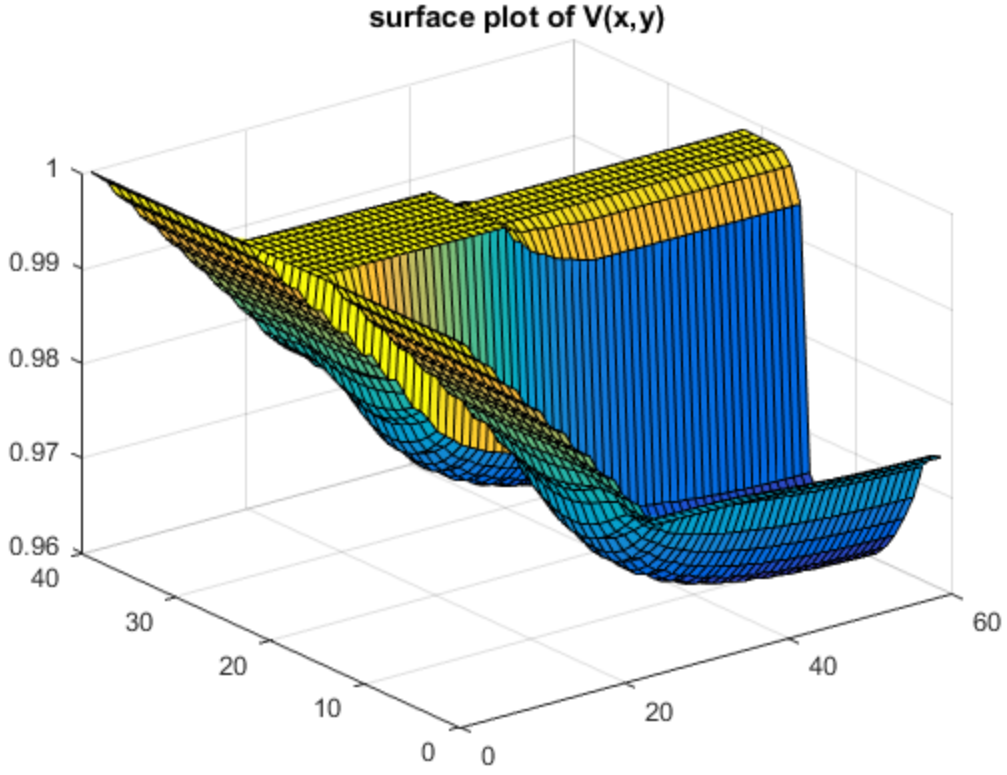
title('surface plot of V(x,y)');

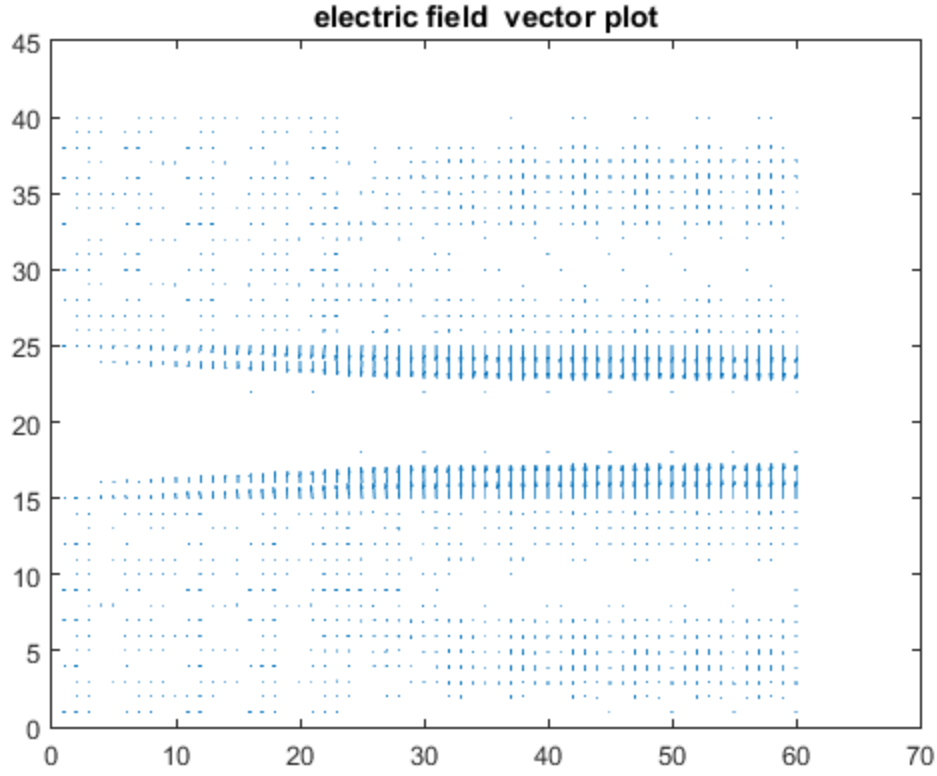
[E1,E2]=gradient(V);

figure(2)

quiver(X,Y,E1,E2);

title('electric field  vector plot');
```


surface plot of V(x,y)
1
0.99
0.98
0.97
0.96
40
30
20
10
0
0
20
40
60


electric field vector plot
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70

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