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% ELEC4700 - Assignment 3 part 2
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global C

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;

W = 50;
L = W*3/2;

halfX = L/2;
halfY = W/2;

G = zeros(L*W,L*W);
B = zeros(L*W,1);

%conductivity
s1 = 1;
s2 = 0.01;

%resistive regions size(randomly assigned)
rL = L*1/4;
rW = W*2/5;

%map containing conductivity
Smap = zeros(L,W);
for i =1:1:L
    for j =1:1:W
        if((i > halfX-(rL/2) && i < halfX+(rL/2)) && ...
                    (j > halfY+(rW/2) || j < halfY-(rW/2)))
            Smap(i,j) = s2;
        else
            Smap(i,j) = s1;
        end
    end
end



for i =1:1:L
    for j =1:1:W
        n = j+(i-1)*W;
        nxm = j+(i-2)*W;
        nxp = j+i*W;
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            nyp = j+1+ (i-1)*W;
            nym = j-1+ (i-1)*W;

            if(i==1)
                G(n,:) = 0;
                G(n,n) = Smap(i,j);
                B(n) = 1;
            elseif(i==L)
                G(n,:) = 0;
                G(n,n) = Smap(i,j);
                B(n) = 0;
            elseif(j==1)
                G(n,:) = 0;
                G(n,nxm) = (Smap(i-1,j)+Smap(i,j))/2;
                G(n,nxp) = (Smap(i+1,j)+Smap(i,j))/2;
                G(n,nyp) = (Smap(i,j+1)+Smap(i,j))/2;
                G(n,n) = -(G(n,nxm)+G(n,nxp)+G(n,nyp));
            elseif(j==W)
                G(n,:) = 0;
                G(n,nxm) = (Smap(i-1,j)+Smap(i,j))/2;
                G(n,nxp) = (Smap(i+1,j)+Smap(i,j))/2;
                G(n,nym) = (Smap(i,j-1)+Smap(i,j))/2;
                G(n,n) = -(G(n,nxm)+G(n,nxp)+G(n,nym));
            else
                G(n,:) = 0;
                G(n,nxm) = (Smap(i-1,j)+Smap(i,j))/2;
                G(n,nxp) = (Smap(i+1,j)+Smap(i,j))/2;
                G(n,nyp) = (Smap(i,j+1)+Smap(i,j))/2;
                G(n,nym) = (Smap(i,j-1)+Smap(i,j))/2;
                G(n,n) = -(G(n,nxm)+G(n,nxp)+G(n,nyp)+G(n,nym));
            end
        end
    end

    V = G\B;

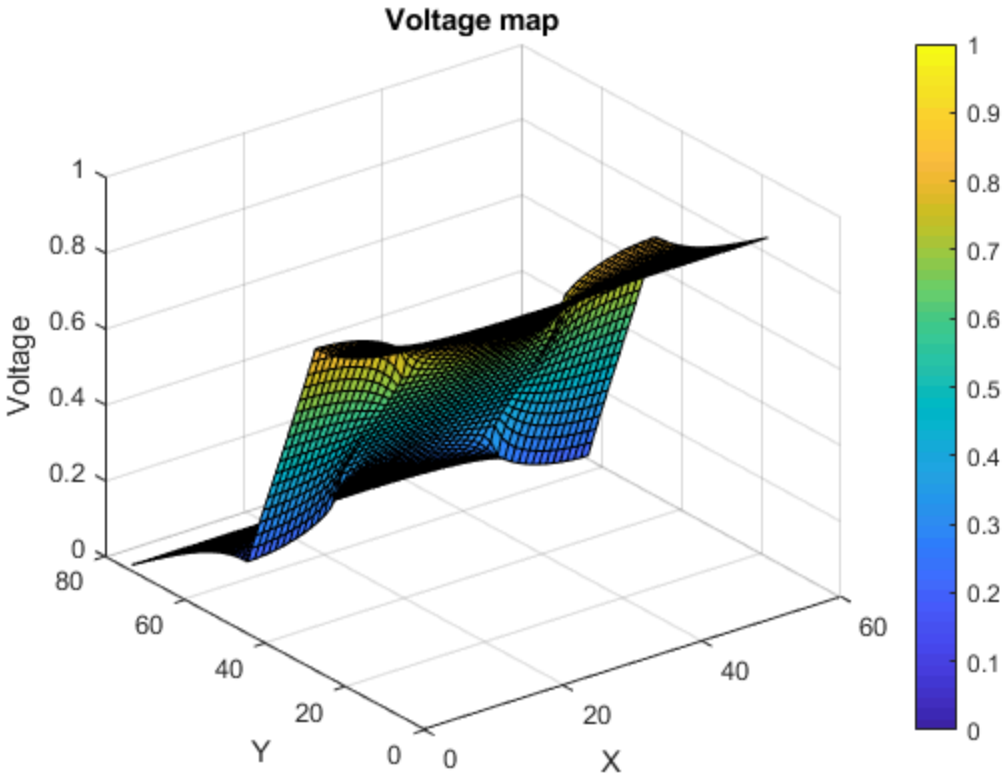
    %map
    Vmap = zeros(L,W);
    for i =1:1:L
        for j =1:1:W
            n=j+(i-1)*W;
            Vmap(i,j) =V(n);
        end
    end

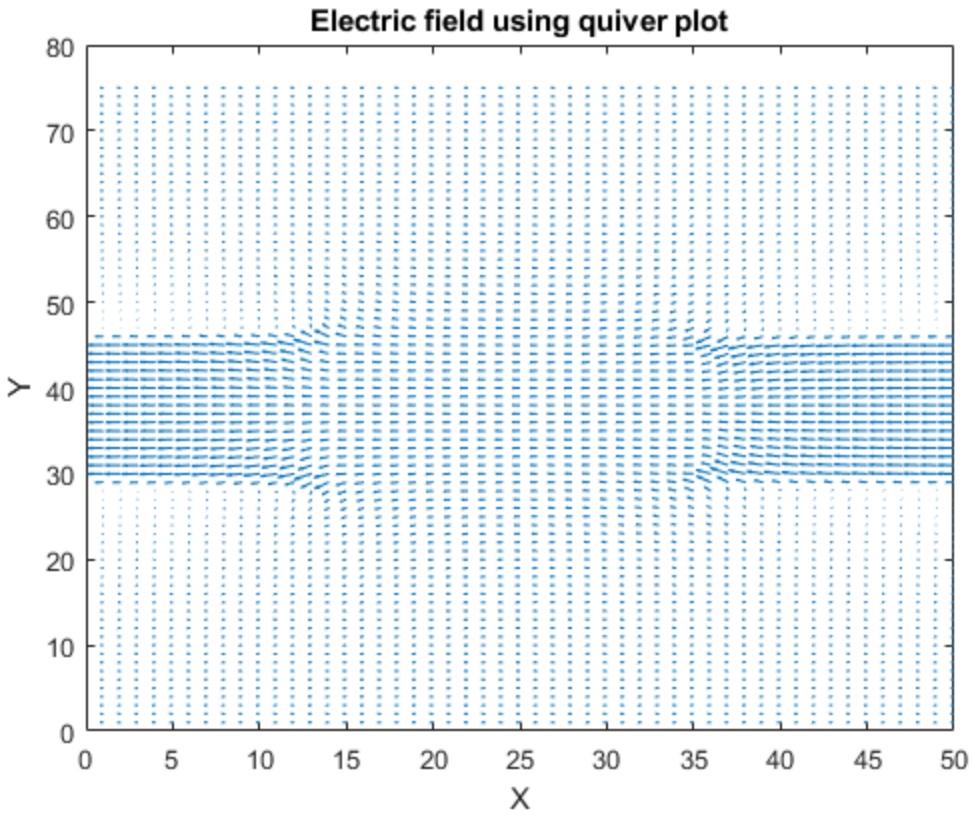
    [mx,my] = meshgrid(1:1:W,1:1:L);
    [ey,ex] = gradient(Vmap);

    figure(5)
    surf(Vmap)
    colorbar
    title('Voltage map'),xlabel('X'),ylabel('Y'),zlabel('Voltage')

    figure(6)
```

```
quiver(mx,my,ex,ey)
title('Electric field using quiver plot'),xlabel('X'),ylabel('Y')
```





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