```
% Question 3 b and c
% used code from assignment 2 in seperate section
%Plotting Current Vs. Bottleneck

Length=150;
Width=(2/3)*Length;
I = zeros(1,10);
sigmaMap = zeros(Length,Width);

for bottleneck =1:10

    bottle=bottleneck;



    G=sparse(Length*Width,Length*Width);
    F=zeros(Length*Width,1);

    sigOut= 1;
    sigIn= 1e-2;

    % Using method from part A because I wasnt able to get Box[]
 method to
    % work for narrowing  bottleneck

    %setting bottleneck dimensions
    midX = Length/2;
    midY = Width/2;

    boxW = Width*2/3;
    spaceW = Width - boxW;
    boxL = Length/4;
    boxW = spaceW/bottle;

    leftBC = midX - boxL/2;
    rightBC = midX + boxL/2;
    topBC = midY + boxW/2;
    bottomBC = midY - boxW/2;

    %Populating G matrix and sigma matrix

    for x=1:Length
        for y=1:Width
            n=y+(x-1)*Width; %Current Position

            nxm = y+(x-2)*Width;
            nxp = y+(x)*Width;
            nym = (y-1)+(x-1)*Width;
            nyp = (y+1)+(x-1)*Width;
              if x == 1
                G(n,n) = 1;
                F(n) = 1;
```

```
                sigmaMap(x,y) = sigOut;
            elseif x == Length
                G(n,n) = 1;
                F(n) = 0;
                sigmaMap(x,y) = sigOut;
            elseif (y == Width)
                G(n,n) = -3;
                if(x>leftBC && x<rightBC)
                    G(n,nxm) = sigIn;
                    G(n,nxp) = sigIn;
                    G(n,nym) = sigIn;
                    sigmaMap(x,y) = sigIn;
                else
                    G(n,nxm) = sigOut;
                    G(n,nxp) = sigOut;
                    G(n,nym) = sigOut;
                    sigmaMap(x,y) = sigOut;
                end
            elseif (y == 1)
                G(n,n) = -3;
                if(x>leftBC && x<rightBC)
                    G(n,nxm) = sigIn;
                    G(n,nxp) = sigIn;
                    G(n,nyp) = sigIn;
                    sigmaMap(x,y) = sigIn;
                else
                    G(n,nxm) = sigOut;
                    G(n,nxp) = sigOut;
                    G(n,nyp) = sigOut;
                    sigmaMap(x,y) = sigOut;
                end
            else
                G(n,n) = -4;
                if( (y>topBC || y<bottomBC) && x>leftBC && x<rightBC)
                    G(n,nxp) = sigIn;
                    G(n,nxm) = sigIn;
                    G(n,nyp) = sigIn;
                    G(n,nym) = sigIn;
                    sigmaMap(x,y) = sigIn;
                else
                    G(n,nxp) = sigOut;
                    G(n,nxm) = sigOut;
                    G(n,nyp) = sigOut;
                    G(n,nym) = sigOut;
                    sigmaMap(x,y) = sigOut;
                end
            end
        end
    end

    SolV = G\F;
    SolVmatrix=zeros(Length,Width);

    for x=1:Length
```

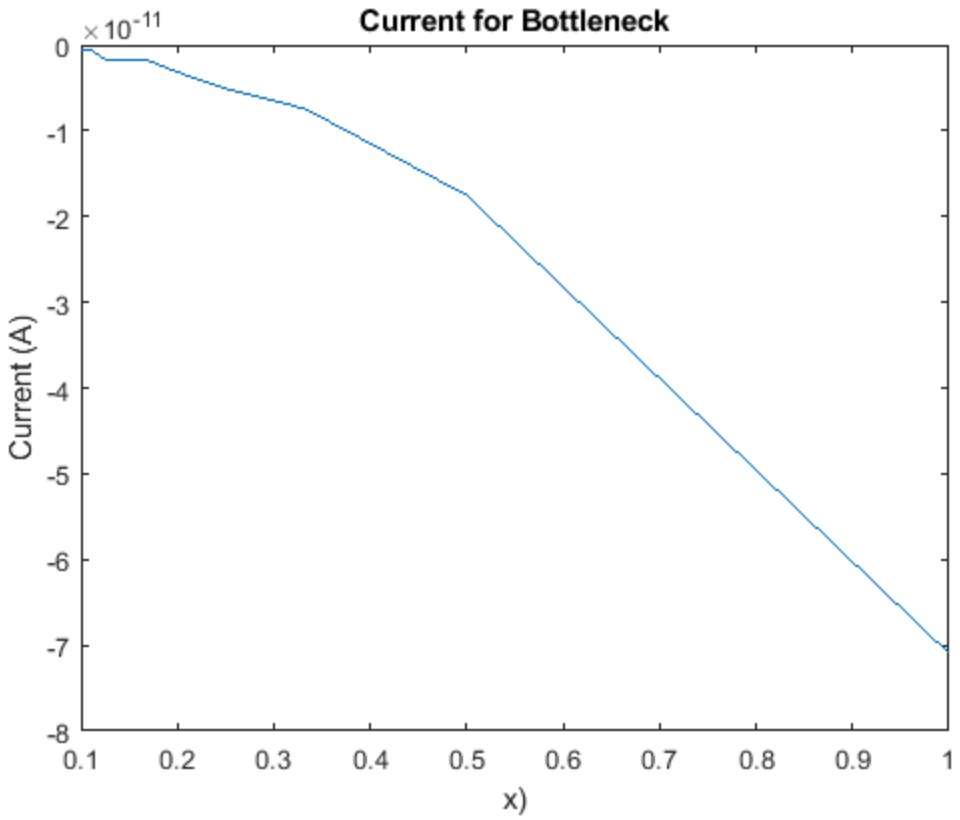
```
        for y=1:Width
            n=y+(x-1)*Width;
            SolVmatrix(x,y)= SolV(n);
        end
    end

    [Ey,Ex] = gradient(SolVmatrix);
    E = gradient(SolVmatrix);
    J = sigmaMap.* E;


    area = Length*Width;
    I(bottleneck)= (sum(sum(J))/(Length*Width))/area;
end

x = 1./linspace(1,10,10);

%Plot current vs narrowing of bottleneck
% As bottleneck is narrowed, the current decreases
figure(1)
plot(x,I);
title('Current for Bottleneck')
xlabel('x)')
ylabel('Current (A)')
```



Published with MATLAB® R2019b