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%Assignment 2 Part 1 A%
%ELEC 4700 RICHARD FINNEY 100967048%

%initiailizing the dimensions of our matrices, ensuring ny is 3/2
 times nx
nx = 50;
ny = (3/2)*50;

%we are going to need two matrices for this part. Not just a G matrix,
 but
%a matrix we can use for the operations of the G matrix. the solution
 will
%be in the form Ax = b, and to get x this will be  b\A, in this case
 it
%will be G\Op.


G = sparse(nx*ny,nx*ny);
Op = zeros(nx*ny,1);

%filling in the G matrix's bulk nodes and BC's using a loop, similar
%to what we did in PA-5 using the Finite Difference method
for x = 1:nx
    for y = 1:ny

        n = y + (x-1)*ny;

        if x == 1

            G(n,:) = 0;
            G(n,n) = 1;
            Op(n) = 1;

        elseif x == nx

            G(n,:) = 0;
            G(n,n) = 1;
            Op(n) = 0;

        elseif y == 1

            G(n, :) = 0;
            G(n, n) = -3;
            G(n, n+1) = 1;
            G(n, n+ny) = 1;
            G(n, n-ny) = 1;

        elseif y == ny

            G(n, n) = -3;
            G(n, n-1) = 1;
            G(n, n+ny) = 1;
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            G(n, n-ny) = 1;

        else

            G(n, n) = -4;
            G(n, n+1) = 1;
            G(n, n-1) = 1;
            G(n, n+ny) = 1;
            G(n, n-ny) = 1;

        end
    end
end

Voltage =     G\Op;



%now, need to create matrix to be surfed (x,y,voltage)

sol = zeros(nx,ny,1);

for x = 1:nx
    for y = 1:ny

        n = y + (x-1)*ny;
        sol(x,y) = Voltage(n);
    end
end

figure(1)
surf(sol)
title("Voltage plot using FD in one dimension")
xlabel("X position")
ylabel("Y position")
zlabel("Voltage")
view(-130,30)
%the end
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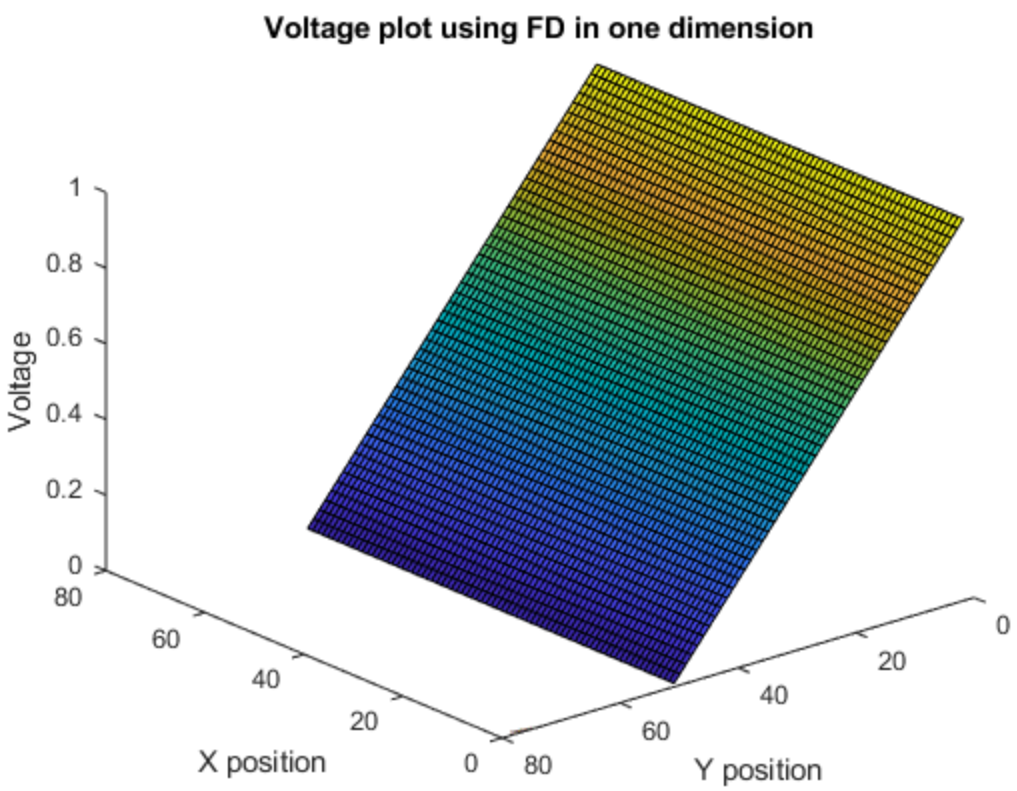

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