Homework: INTRO to FINITE DIFFERENCE (FD) METHOD

1. (10 points) Write a program to compute the 1st and 2nd derivatives using the central difference method.

    a. Use your program to compute df/dx and df^2/dx^2 where f(x) = sin(x). Compute these derivatives in the range $0 \leq x \leq 2\pi$.
    b. What should these derivatives be (what is their analytical or expected value)? Plot them with a solid line. Plot all the first derivatives on one plot, and all of the second derivatives on another. Label all plots, their axes, etc. Use legends as needed.
    c. Plot the values of the numerical derivatives against the analytical values (plotted above) using n=5, 10,20,1000 divisions ($h= 2\pi/n$). Use open circles, dashed lines, etc. to show how well the numerical derivatives agree with the analytical values.
    d. Describe comparisons between the derivatives calculated with different resolutions.

2. (10 points) Experiment with what happens when you take the derivatives of a function where the first or second derivative goes to infinity. An example would be the sin(x) function above, if it is multiplied by a "rect" function, which makes it go to zero part way through the sine wave. You may try any function(s) of interest to you. Describe your results.

2. (10 points) Do problem 3.13 in the text. Write the matrix and solve it. You may use any method to solve the matrix (Matlab, calculator, etc.)

3.13 For a long hollow conductor with a uniform U-shape cross section shown in Figure 3.50, find the potential at points A, B, C, D, and E.

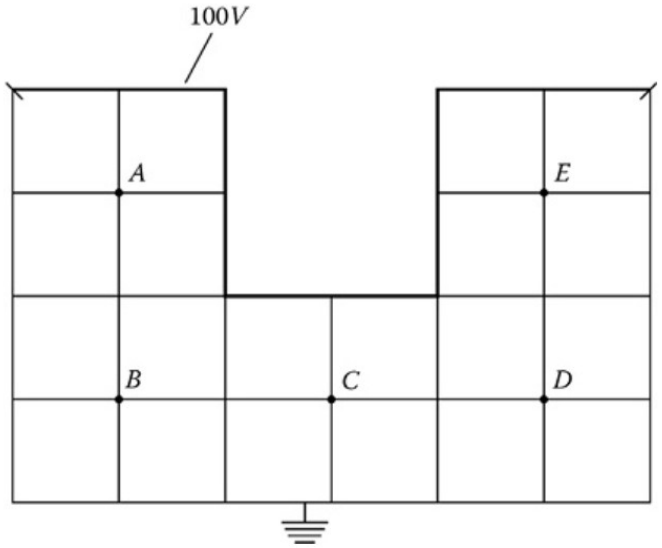

FIGURE 3.50
For Problem 3.13.