

Physics-305 Homework Set (4)

This homework set is due on Thursday, 15th Muharram, 1437 (Oct. 29th, 2015) at 10.00 p.m. [e-mail me your codes and outputs]

Question #1:

In class, we discussed the problem of stability in a 3-D network of charges, and concluded that electrostatics alone can not be used to contain electric charges. Develop a code that solves the same problem in 2-D, for a set of identical charges at the corners of a square, by:

- Plotting in 3-D the potential as a function of (x,y).
- Plotting the potential across cuts in the 2-D plane
 - o along a side,
 - o from one side to another across the center,
 - o from one point on one side to another point on another side,
 - o across the diagonal.
- Contrasting the results of this problem with the one studied in class (i.e. 2-D vs. 3-D)

Hint: modify the 3-dimensional code at

<http://faculty.kfupm.edu.sa/phys/zhyamani/teaching/phys-305/Math/cube.nb> into (a simpler) 2-D code.

Question #2:

In class, we demonstrated how to use the relaxation method to solve for Laplace's equation on a 5 x 9 rectangular boundary.

Develop a code, or make use of the existing one (*), to solve for the same problem when the conditions are:

- a- Constant = 0 at the two short sides of the rectangle, and identical sinusoids along the long sides of the rectangle, with two maximum.
- b- Constant = -10 at the two short sides of the rectangle, with one long side having a sinusoidal boundary condition with one maximum while the opposite (also long) side has 36 maxima.
- c- Qualitatively elaborate on the benefits and restrictions of using such

You should plot in 3-D, and comment on interesting results.

(*) <http://faculty.kfupm.edu.sa/phys/zhyamani/teaching/phys-305/Math/relaxation%20method.nb>

Feel free to discuss with your colleagues, but make sure that your submission is your *own*. Visit me if you need help.