

Problem Set 5
Electrodynamics
Due: Feb. 11, 2005

Problem 1: The most common grid shape for a finite element analysis in 2D is a set of triangles. Show that if there are six nearest neighbors to each grid point and that they are all equidistant from the grid point each offset by an angle of 60° to the other two nearest points (the grid is a grid of equilateral triangles), then the discrete approximation solution to Laplace's equation is:

$$\phi_{center} = \frac{1}{6} \sum_{i=1}^6 \phi_{nearest,i} .$$

Problem 2: Use the finite element method on a square 2D grid to solve the following problem. Find the potential inside a square tube with 1 cm sides where two adjacent sides are held at 100 volts and the other two sides are grounded. Solve this problem with both matrix inversion and by re-iteration. You may use my notebook `mlaplace.nb` which can be found at

<http://www.physics.uc.edu/~johnson/EM/quarter1/finite.element/mlaplace.nb>
as a starting point.

Problem 3: Jackson 1.22

Problem 4: Jackson 1.23, Parts (a) and (b). Make a suggestion for simplifying `mlaplace.nb` for the problem that it solves given the symmetry in the problem.