end of friday Finals week.
10-12 am Friday 13 June
3rd floor Eng. gateway

University of California, Irvine Spring 2003

MAE 185 Numerical Methods for Mechanical Engineers

Project #4

Solve a two dimensional potential problem in an unbounded region using
a. Finite Difference Method
b. Finite Element Method
along with the conformal transformation to bring infinity to zero.

The Geometry:

Geometry 1: Parallel Plate Capacitor.

The potential field of infinitely long parallel strips embedded in uniform medium is to be determined. The strips are 4 cm wide and have a separation of 2 cm. The voltages on the strips are 100 volts and -100 volts.

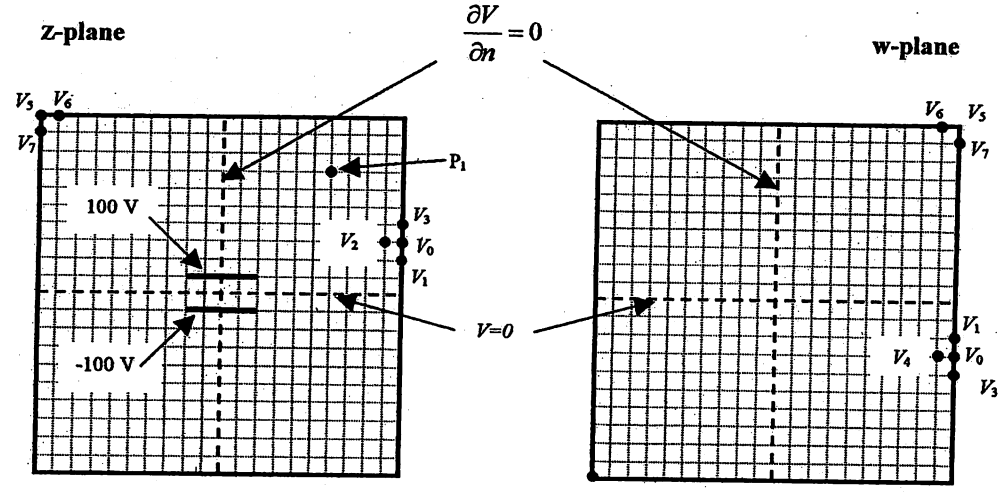

Fig. 1 *Parallel Plate Capacitor.*

The strips are placed at the center of the z-plane, parallel to the x-axis, as shown in Figure 1. A square is drawn with its center at the origin with each side = 10 cm. A corresponding square is drawn in the w-plane, inside of which represents the region outside the z-plane square.

Geometry 2: A microstrip line.

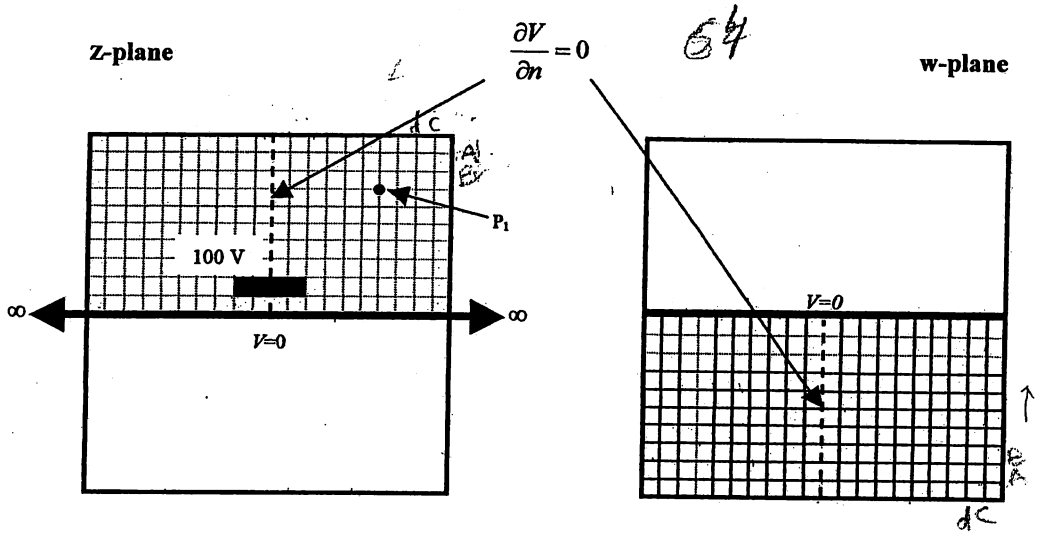

Fig. 2 *Microstrip line example.*

Here, the potential field of the microstrip line is to be determined, as shown in Figure 2. The strip line consists of an infinite ground plane and a parallel strip 1 cm thick and 4 cm wide located 1 cm above the ground plane having potential of 100 volts.

A square is drawn with its center at the origin with each side = 10 cm. A corresponding square is drawn in the *w*-plane, inside of which represents the region outside the *z*-plane square.

To solve both problems using finite difference method, grids of squares of size 1 cm are created inside of both the circles. Four point equations are appropriately applied to each of the grid points.

To solve the problems using finite element method, triangular elements can be created and finite element equations can be written for each node. Generate elements having length no more than 2 cm.

For both techniques, use δ of .0001.

Output:

The output of the program for both Finite Difference and Finite Element methods is to be printout of the coordinates of all the points with the corresponding voltages. The Finite Element part should also printout the voltage function for each element.

General Comments:

The output should be well formatted, presentable and easily readable.

Submit:

1. Printout of the program, if possible.
2. One page explanation of your work and how to use the program.
3. Floppy contain the program with the file name written on it.

Submission Date: TBD.