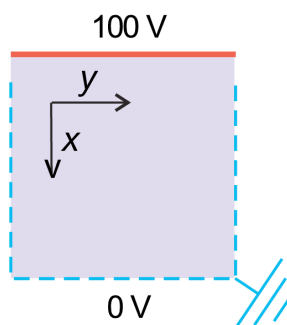


**Exercise Set #7**

due online Wednesday, May 30 at 10:10 AM

**1. Electrostatic Potentials**

This problem is the follow-up to the electrostatic potential case we analyzed in class. The top edge of the square plate is kept at 100 V potential, and the other 3 edges are kept at 0 V.



- Calculate the electrostatic potential everywhere on the square plate, as we did in class, but using 1000 iterations. (You may prefer to draw the equipotential contours instead of a 3-D surface plot.)
- Repeat the process for different step sizes  $h$  and draw conclusions about the stability and accuracy of the solution.
- Modify the program so that the iterations stop once the solution has converged. How does the number of iterations required change with the tolerance?
- Implement the successive over-relaxation technique to accelerate the convergence. What value of  $\omega$  gives the fastest convergence?
- Compare your numerical result with the analytic result given in Eqn. 19.18:

$$U(x, y) = \sum_{n=1,3,5,\dots}^{\infty} \frac{400}{n\pi} \sin\left(\frac{n\pi x}{L}\right) \frac{\sinh(n\pi y/L)}{\sinh(n\pi)}$$

Do not be surprised if you need to sum thousands of terms before the analytic solution converges!