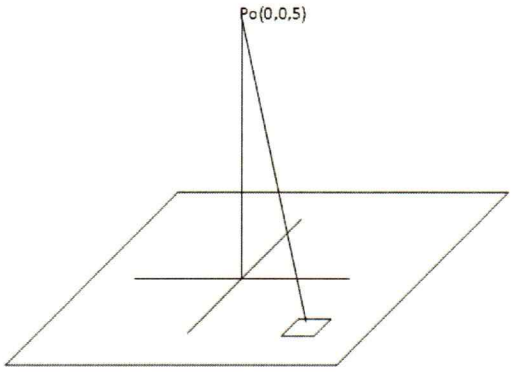
EE 3310 – EM I – hearn
Homework #4 – Charge density example

Due February 10, 2023

Use the numerical computation approach (discussed in class) to estimate the E-field due to a L=4m square plate centered in the z=0 plane with a total charge of Q=500uC distributed uniformly.

Recall the answer (Schaum's)

$$\bar{E} = \frac{\bar{F}}{q_o} = \frac{4.66\,N}{30\,\mu C}\hat{a}_z = 155\frac{kV}{m}\hat{a}_z$$



The resultant field will be in the z-direction. The incremental field will be of the form,

$$\Delta\bar{E} = \left(\frac{1}{4\pi\varepsilon}\right)\cdot\frac{\Delta q}{\left|\bar{R}_i\right|^2}\hat{a}_i \bullet \hat{a}_z$$

- Repeat the process of improving the estimate from the point-source at the origin. Show your work.
- Break the plate into four sectors using symmetry. Calculate the total E-field as the sum of 4 point charges centered at each sector.
- Divide sector I (x+, y+) into 4 sub-sectors to calculate the total E-field.
- Demonstrate the answers converge as the segment-size (or resolution) decreases.

Extra credit:
Write a program to solve if sector I was divided into 8 sub-sectors