

Electric Potential / Voltage

Reading assignment

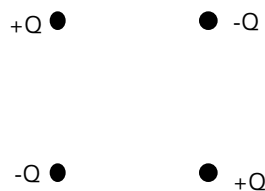
Paul, Whites, and Nasar, 3.5

Problem 1 - Determine V from E

- Take the electric field from Lesson 2.2, Problem 3. Assume that the outer cylinder is grounded.
- Find the voltage as a function of r for $r > b$ and $b > r > a$.
- Check your result by evaluating $- \int \mathbf{E} \cdot d\mathbf{l}$.
- Find the voltage at $r=0$.

Problem 2 - Equipotential lines

Plot a set of electric field lines and equipotential lines for the quadrupole set of charges below. Dipole equipotentials can be viewed with the Mathcad worksheet for 3.6.2.

**Problem 3 - Find V from charge**

- Find the electric potential at $z = 0$ as a function of r due to a line charge λ that extends from $z = -L/2 \rightarrow L/2$. You'll probably want to use Maple.
- Find the \mathbf{E} at the same locations.
- When $\lambda = 10^{-10}$ C/m and $L = 0.2$ m, numerically evaluate V at $r = 0.1$ m, and \mathbf{E} at $r = 0.105$ m.
- Approximate the line charge as a set of 4 point charges. Calculate the voltage from the 4 point charges and compare with part c.
- Calculate the voltage at $r = 0.11$ m, and use this to estimate the electric field at $r = 0.105$ m.

