ECE 2300
Recitation Class 6

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Pre-class

- Quiz 4 this week!
  - After Thursday lecture (June 29th, 8:00 pm – 8:40 pm)
  - Same format as last quiz. Online student need to turn on at least one camara.
  - If you want to take online quiz, notify us beforehand!

- Midterm 2 next week!
  - July 6th, Thursday 7:00 pm – 8:40 pm
  - Location is still under arrangement, will be announced soon

Quiz 3 Recap:

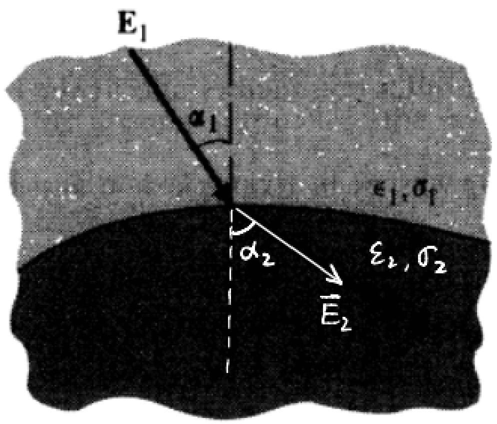
Question 1

Two lossy dielectric media with permittivities and conductivities (ϵ_1, σ_1) and (ϵ_2, σ_2) are in contact. An electric field with a magnitude E_1 is incident from medium 1 upon the interface at an angle α_1 measured from the common normal, as shown in the figure.

a) Find the magnitude and direction of $\mathbf{E}_2$ in medium 2.

b) Find the surface charge density at the interface.

c) Compare the results in parts (a) and (b) with the case in which both media are perfect dielectrics.



Quiz 3 Recap:

Question 2

A d-c voltage V_0 is applied across a cylindrical capacitor of length L. The radii of the inner and outer conductors are a and b, respectively. The space between the conductors is filled with two different lossy dielectrics having, respectively, permittivity ϵ_1 and conductivity σ_1 in the region $a < r < c$, and permittivity ϵ_2 and conductivity σ_2 in the region $c < r < b$. Determine

a) the current density in each region,

b) the surface charge densities on the inner and outer conductors and at the interface between the two dielectrics.

6.1 Fundamental Postulates

6.2 Ampere’s Circuit Law

6.3 Vector Magnetic Potential

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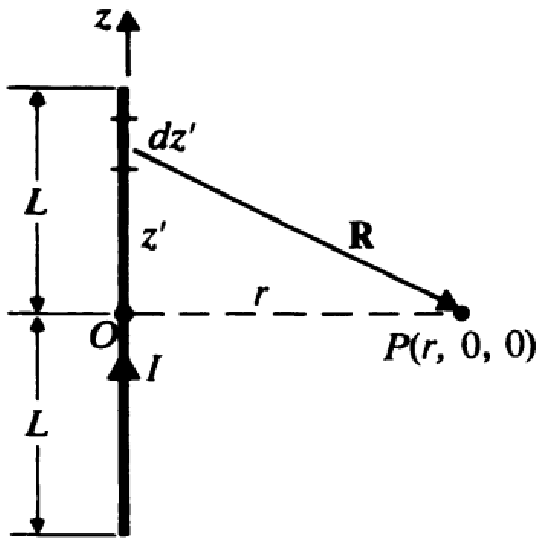
Ex.1 Vector magnetic potential

A direct current I flows in a straight wire of length $2L$. Find the magnetic flux density $\boldsymbol{B}$ at a point located at a distance r from the wire in the bisecting plane:

- by determining the vector magnetic potential $\boldsymbol{A}$ first,
- by applying Biot-Savart law.



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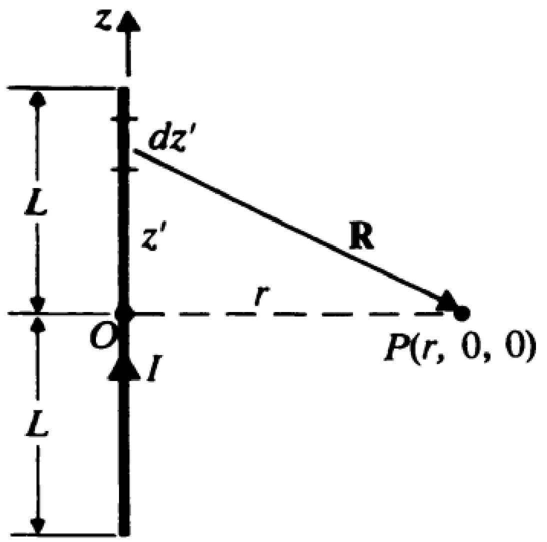
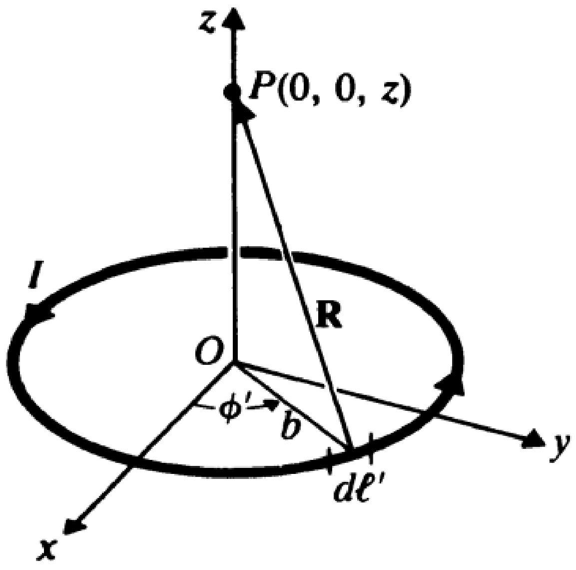


Ex.2 Vector magnetic potential



Find the magnetic flux density at a point on the axis of a circular loop of radius b that carries a direct current I

6.4 Scalar Magnetic Potential

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Analogous to electric potential

$$\boxed{\mathbf{E} = -\nabla V}$$

$$\mathbf{B} = -\mu_0 \nabla V_m,$$

$$V_2 - V_1 = -\int_{P_1}^{P_2} \mathbf{E} \cdot d\ell \qquad \text{(V)}.$$

$$V_{m2} - V_{m1} = -\int_{P_1}^{P_2} \frac{1}{\mu_0} \mathbf{B} \cdot d\ell.$$

E $\rightarrow$ $1/(4\pi\varepsilon_0)$

$\mathbf{B}/\mu_0$ $\rightarrow$ $(\mu_0/(4\pi))/\mu_0$

$$V = \frac{1}{4\pi\epsilon_0} \int_{V'} \frac{\rho}{R}\, dv' \qquad \text{(V)}.$$

$$V_m = \frac{1}{4\pi} \int_{V'} \frac{\rho_m}{R}\, dv' \qquad \text{(A)}.$$

No μ_0 in V_m

If there *were* magnetic charges

Thank You

Credit to Deng Naihao for this slides & information