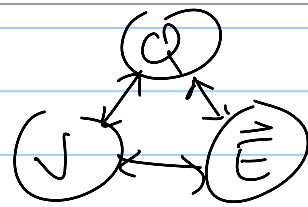
Lecture 20

Note Title 3/3/2006

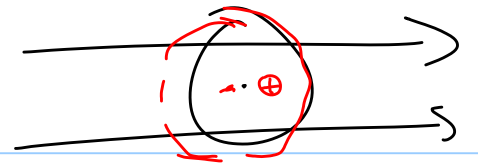
Review

- be able to cal one given other

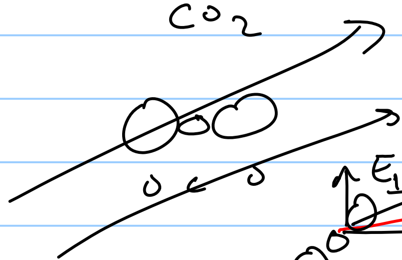


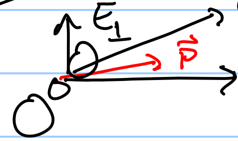
- be able to derive bndry conditions
- " " " use divergence & stokes theorems
- apply to conductors & caps
- calculate energy in assembling charge distributions in multiple ways
- understand method of images
- potential & field of dipole
- how determine V & E in materials
-

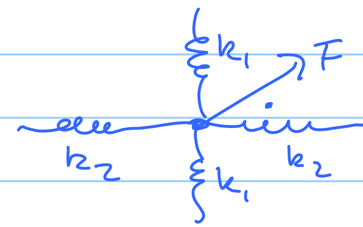
Polarizability of molecules



CO_2







$P_x = \alpha_{xx} E_x \qquad P_y = \alpha_{yx} E_x \qquad P_z = \alpha_{zx} E_x$

$P_x = \alpha_{xy} E_y \qquad P_y = \alpha_{yy} E_y \qquad P_z = \alpha_{zz} E_y$

$P_x = \alpha_{xz} E_z$

$P_x = \alpha_{xx} E_x + \alpha_{xy} E_y + \alpha_{xz} E_z$

$P_y =$

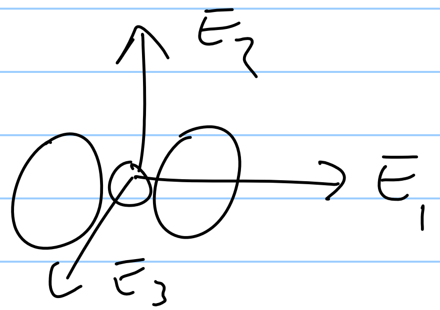
$P_z =$

$$\vec{P} = \overleftrightarrow{\alpha}\,\vec{E}$$

← tensor

$$\begin{bmatrix} \alpha_{xy} & \alpha_{xy} & \alpha_{xz} \\ \alpha_{yx} & \alpha_{yy} & - \\ - & & \cdot \end{bmatrix}\begin{bmatrix} E_x \\ E_y \\ E_z \end{bmatrix} = \lambda \begin{bmatrix} E_x \\ E_y \\ E_z \end{bmatrix}$$

Special case



} Eigenvectors

What is a scalar, vector, & tensor?

- $\vec{F} = m\vec{a}$ rotate coords

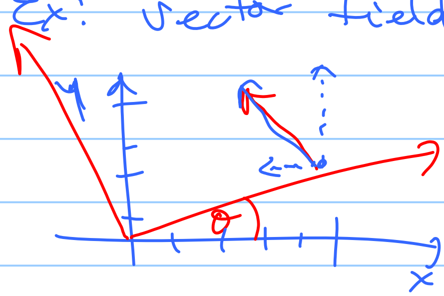
$F' = m\vec{a}'$ ⇒ vector obeys

$F'_i = A_{ij} F_j$ ← component of $\vec{F}$ $a'_i = A_{ij} a_j$

Vector relations are indep of coord. rotation defn. vector in cartesian coords represented by set of 3 #'s that transform according to $V_i' = A_{ij} V_j$ when axis rotated.

defn: scalar field: same # indep. of coord rotation

Ex: vector field $\vec{V}_1 = -y\hat{x} + x\hat{y}$



Sh

Ex: $\vec{V}_2 = x\hat{x} - y\hat{y}$

NOT the same in two coord system

$$\vec{P} = \overleftrightarrow{\alpha}\,\vec{E}$$

$\alpha(x,y,z)$

$$\vec{L} = \overleftrightarrow{I}\ \vec{\omega} \qquad r^2 = x^2 + y^2 + z^2$$

$$\overleftrightarrow{I}_{ij} \Rightarrow \begin{bmatrix} \sum m(r^2 - x^2) & -\sum mxy & -\sum mxz \\ -\sum myx & \sum m(r^2 - y^2) & - \\ - & - & - \end{bmatrix}$$

wrt axis of rotation

$$\vec{J} = \overleftrightarrow{\sigma}\ \vec{E}$$

$$\begin{pmatrix} x' \\ y' \\ z' \\ ct' \end{pmatrix} = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} \begin{pmatrix} x \\ y \\ z \\ ct \end{pmatrix}$$