No.

Date 18 . 03.2024

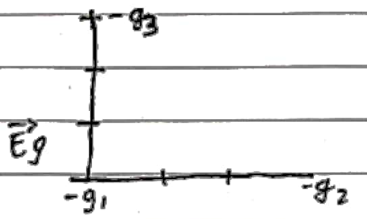
Pertemuan 5

KALISMA
Medan Listrik

Gaya → adanya interaksi
Medan listrik ($\vec{E}$)

$\vec{E} \nearrow$ + $\quad\quad \vec{E} \swarrow$ −

aliran energi
gelombang bunyi



$$\vec{E}q = \frac{\Sigma \vec{F}}{q_1}$$

$$= \frac{Fq_3}{q_1} + \frac{Fq_2}{q_1}$$

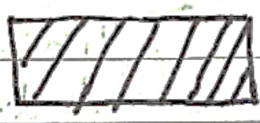
$$\vec{E} = k\frac{q_3}{r_2} + k\frac{q_2}{r^2}$$

Distribusi muatan

1). $\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}_0$

$= k\frac{q}{r^2}$ → oleh muatan diskrit.

2). $\vec{E} = \frac{1}{4\pi\varepsilon_0}\int\frac{\pi\, dr}{r^2}\hat{r}_0 \rightarrow q = \lambda \cdot l$ muatan terdistribusi pada penggaris.

3). $\vec{E} = \frac{1}{4\pi\varepsilon_0}\iint\frac{\sigma da}{r^2}\hat{r}_0$  Luas Permukaan

4). $\vec{E} = \frac{1}{4\pi\varepsilon_0}\iiint\frac{\rho\, d\sigma}{r^2}\hat{T}_1$

Contoh 1 :

$d\vec{E} = dE_y$

$d\vec{E} = dE_y$

$dE_y = dE \cos\theta$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_{-L}^{L}\frac{x\,dL}{r^2}\cos\theta$$

$$= \frac{2}{4\pi\varepsilon_0}\int_0^L \frac{x\,dx}{(x^2+z^2)^{2\cdot\frac{1}{2}}}$$

$$= \frac{2}{4\pi\varepsilon_0}\int_0^L \frac{dx}{(x^2+z^2)^{3/2}} \rightarrow \frac{dx}{(x^2+z^2)^{3/2}} = \frac{x}{z^2\sqrt{x^2+z^2}}.$$

$$= \frac{2\lambda z}{4\pi\varepsilon_0}\left(\frac{x}{z^2\sqrt{x^2+z^2}}\right)\Bigg|_0^L$$

$$= \frac{2\lambda z}{4\pi\varepsilon_0}\;\frac{1}{z^2\sqrt{x^2+z^2}} - \frac{0}{z^2\sqrt{0+z^2}}$$

$$= \frac{2\lambda z}{4\pi\varepsilon_0}\left[\frac{L}{z^2\sqrt{L^2+z^2}}\right]$$

Contoh 2 :

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_0^L \frac{x\,dx}{(x_0-x)^2}$$

$$= \frac{1}{4\pi\varepsilon_0}\times\int_0^L (x_0-x)^{-2}\,dx$$

$$= \frac{1}{4\pi\varepsilon_0}\left((x_0-x)^{-1}\right)\Big|_0^L$$

$$= \frac{1}{4\pi\varepsilon_0}\left(\frac{1}{(x_0-x)}\right)\Bigg|_0^L$$

$$= \frac{1}{4\pi\varepsilon_0}\left(\frac{1}{(x_0-L)} - \frac{1}{(x_0-0)}\right)$$

Untuk memperdeh ini digunakan

$$\int\frac{dx}{x^2} = \int x^{-2}\,dx$$

$$= 1x^{-2}\Big|_0^2 = \frac{1}{x}\Big|_0^L$$

$$= \frac{1}{4\pi\varepsilon_0}\left[\frac{x_0-(x_0-L)}{x_0(x_0-L)}\right]$$

$$= \frac{L}{x_0(x_0-L)}$$