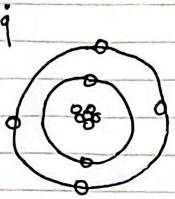
No. Jumat

Date 12 sept 2025

pertemuan ke 3

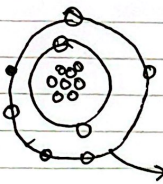
Medan Elektromagnetic

$\vec{E}$ oleh muatan diskrit



$q = \pm n\bar{e}$

$= 2\bar{e}$



$q = 2e$

$+q = 2e$

muatan terperangkap

di sistem koordinat

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

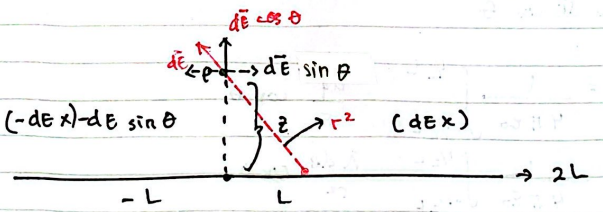
muatan adlh kata sifat dari atom elektron

$\vec{E}$ (medan) terdistribusi dalam bahan

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

$$1.\ \vec{E} = \frac{1}{4\pi\varepsilon_0}\int \frac{q}{r^2}\,dl \rightarrow \text{berbentuk garis}$$

Contoh



$d\vec{E} = dE_y + d\vec{E}_x^{\,0}$

$= dE_y$

$dE = dE\cos\theta$

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

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

$$= \frac{1}{4\pi\varepsilon_0}\int_{0}^{2L}\frac{x\,dl}{r^2}\cos\theta \;\frac{1}{4\pi\varepsilon_0}\int_{0}^{2l}\frac{x\,dl\cos\theta}{r^2}$$

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$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_0^{2L} \frac{x\, z\, dl}{r^5} \qquad r = (z^2 + l)^{1/2}$$

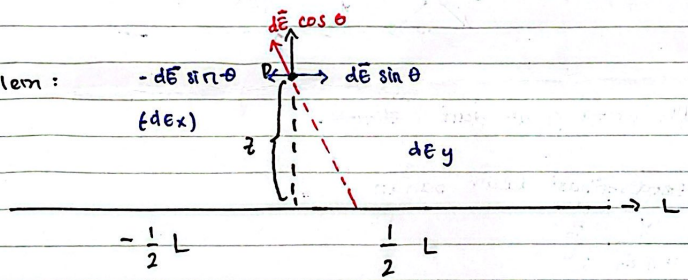
$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_0^{2L} \frac{x\, z\, dl}{(z^2+l)^{3/2}}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0}\int \frac{dl}{(z^2+l)^{3/2}}$$

$$= \frac{z\,\lambda}{4\pi\varepsilon_0}\left[\frac{l}{z^2(z^2+l)^{1/2}}\right]_0^{2L}$$

$$E = \frac{z\lambda}{4\pi\varepsilon_0}\left[\frac{2L}{z^2(z^2+l)^{1/2}}\right]$$

Problem :



$$d\vec{E} = d\epsilon + d\varepsilon_x \quad (\to 0)$$

$$= d\vec{\varepsilon}_y$$

$$d\vec{E} = d\vec{E}\cos\theta$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_{-1/2L}^{1/2L} \frac{dq}{c}\cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0}\int_{-1/2L}^{1/2L} \frac{\lambda\, dl}{r^2}\cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0}\int_0^{L} \frac{\lambda\, dl}{r^2}\cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0}\int_0^{L} \frac{\lambda\, dl}{r^2}\cos\theta$$

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$$= \frac{1}{4\pi\varepsilon_0} \int_0^L \frac{dz}{r^3}\, dl$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_0^L \frac{\lambda z\, dl}{(z^2 + l^2)^{3/2}}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0} \int_0^L \frac{dl}{(z^2 + l^2)^{5/2}}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0} \left[\frac{dl}{z^2(z^2 + l^2)^{1/2}} \right]_0^L$$

$$\vec{E} = \frac{z\lambda}{4\pi\varepsilon_0} \left[\frac{L}{z^2(z^2 + L^2)} \right]$$

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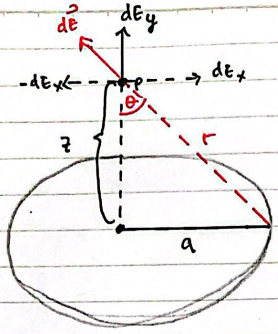
Medan Elektromagnetik



saling meniadakan

$d\vec{E} = dE_x + dE_y$

$= dE_y$

$= dE \cos\theta$

$\vec{E} = dE \cos\theta$

$= \frac{1}{4\pi\varepsilon_0} \int_a^{2\pi a} \frac{a\,dl \cos\theta}{r^2}$

$= \frac{1}{4\pi\varepsilon_0} \int_0^{2\pi a} \frac{\lambda z}{r^3}\, dl$

$= \frac{1}{4\pi\varepsilon_0} \int_0^{2\pi a} \frac{\lambda z}{(z^2+a^2)^{3/2}}\, dl$

$= \frac{\lambda z}{4\pi\varepsilon_0 (z^2+a^2)^{3/2}}\, l \Big|_0^{2\pi a}$

$\vec{E} = \frac{\lambda z}{4\pi\varepsilon_0} \frac{2\pi a}{(z^2+a^2)^{3/2}}$

$= \frac{\lambda z\, a}{2\varepsilon_0 (z^2+a^2)^{3/2}}$