

1 Električno polje

$$\vec{F}_{12} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \hat{r}; \quad \vec{F} = \frac{1}{4\pi\epsilon_0} \sum_i \frac{q_i q}{r_i^2} \hat{r}_i$$

$$\vec{F} = q\vec{E}$$

$$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \hat{r}; \quad \vec{E} = \frac{1}{4\pi\epsilon_0} \sum_i \frac{q_i}{r_i^2} \hat{r}_i \rightarrow \frac{1}{4\pi\epsilon_0} \int \frac{dq}{r^2} \hat{r}$$

$$dq = \rho dV = \sigma dA = \lambda dL$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{qr}{R^3} (r < R); \quad E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} (r > R) \text{ (izol. krogla)}$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{xq}{(x^2 + R^2)^{\frac{3}{2}}} \text{ (prstan); } \quad E = \frac{1}{4\pi\epsilon_0} \frac{2\lambda}{r} \text{ (nesk. vodnik); } \quad E = \frac{\sigma}{2\epsilon_0} \text{ (plošča)}$$

$$\Phi_E = \oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$$

2 Električni potencial in napetost

$$\Delta W = \int \vec{F} \cdot d\vec{s}; \quad \Delta V = \int \vec{E} \cdot d\vec{s}$$

$$W = qV; \quad \Delta W = q \Delta V$$

$$V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}; \quad V = \frac{1}{4\pi\epsilon_0} \sum_i \frac{q_i}{r_i} \rightarrow \frac{1}{4\pi\epsilon_0} \int \frac{dq}{r}$$

$$V = \frac{1}{4\pi\epsilon_0} \frac{q}{2R} \left(3 - \frac{r^2}{R^2} \right) (r < R); \quad V = \frac{1}{4\pi\epsilon_0} \frac{q}{r} (r > R) \text{ (izol. krogla)}$$

$$V = \frac{1}{4\pi\epsilon_0} \frac{q}{(x^2 + R^2)^{\frac{1}{2}}} \text{ (prstan); } \quad \Delta V = \vec{E} \cdot \vec{s} = E d \text{ (homog. polje)}$$

$$q = C \Delta V; \quad C = \sum_i C_i \text{ (vzp. vezava); } \quad \frac{1}{C} = \sum_i \frac{1}{C_i} \text{ (zap. vezava)}$$

$$C = \frac{\epsilon_0 A}{d} \text{ (plošč. kond.); } \quad \frac{C}{\ell} = \frac{2\pi\epsilon_0}{\ln\left(\frac{b}{a}\right)} \text{ (koaks. kobel)}$$

$$W = \frac{1}{2} C \Delta V^2; \quad w_E = \frac{1}{2} \epsilon_0 E^2$$

3 Električni tok

$$\left[I = nqv_d A; \quad I = \vec{J} \cdot \vec{A}; \quad \vec{J} = \sigma \vec{E}; \quad \sigma = \frac{nq^2 \tau}{m_e} \right]$$

$$\Delta V = RI; \quad R = \sum_i R_i \text{ (zap. vezava); } \quad \frac{1}{R} = \sum_i \frac{1}{R_i} \text{ (vzp. vezava)}$$

$$I = \frac{dq}{dt} = \frac{\Delta q}{\Delta t}; \quad R = \frac{\rho \ell}{A} = \frac{\ell}{\sigma A}; \quad P = \Delta V I$$

$$\sum I_{\text{not}} = \sum I_{\text{ven}}; \quad \sum_{\text{zanka}} \Delta V = 0$$

4 Magnetno polje

$$\vec{F} = q \vec{v} \times \vec{B}; \quad \vec{F} = I \vec{L} \times \vec{B}; \quad \frac{F}{\ell} = \frac{\mu_0 I_1 I_2}{2\pi r}$$

$$\left[\Delta V_H = \frac{R_H I B}{d}; \quad R_H = \frac{1}{nq} \right]; \quad r = \frac{mv}{qB}; \quad \omega = \frac{qB}{m}$$

$$\vec{B} = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{s} \times \hat{r}}{r^2}$$

$$B = \frac{\mu_0 I r}{2\pi R^2} (r < R); \quad B = \frac{\mu_0 I}{2\pi r} (r > R) \text{ (nesk. vodnik)}$$

$$B = \frac{\mu_0 I R^2}{2(x^2 + R^2)^{\frac{3}{2}}} \text{ (prstan); } \quad B = \mu_0 n I \text{ (tuljava); } \quad \left[B = \frac{\mu_0 J_S}{2} \text{ (plošča)} \right]$$

$$\Phi_B = \oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$$

5 Indukcija

$$\mathcal{E} = \oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$

$$\mathcal{E} = -B\ell v$$

$$\mathcal{E} = -L \frac{dI}{dt}; \quad L = \frac{N\Phi_B}{I}; \quad \mathcal{E}_1 = -M \frac{dI_2}{dt}; \quad M = \frac{N_2\Phi_B}{I_1}$$

$$L = \mu_0 n^2 V \text{ (tuljava); } \quad \frac{L}{\ell} = \frac{\mu_0}{2\pi} \ln\left(\frac{b}{a}\right) \text{ (koaks. kabel)}$$

$$W = \frac{1}{2} L I^2; \quad w_B = \frac{B^2}{2\mu_0}$$

$$\frac{\Delta V_2}{\Delta V_1} = \frac{N_2}{N_1} \text{ (transformator)}$$

6 Elektromagnetno valovanje

$$\left[\frac{dE}{dx} = -\frac{dB}{dt}; \quad \frac{dB}{dx} = -\mu_0 \epsilon_0 \frac{dE}{dt} \right]$$

$$E = E_0 \cos(kx - \omega t); \quad B = B_0 \cos(kx - \omega t)$$

$$\frac{1}{\mu_0 \epsilon_0} = c^2; \quad \frac{E}{B} = \frac{E_0}{B_0} = c; \quad c = \frac{\omega}{k} = \lambda \nu$$

$$\vec{S} = \frac{1}{\mu_0} \vec{E} \times \vec{B}; \quad I = \langle S \rangle = \frac{E_0 B_0}{2\mu_0}; \quad I = \frac{P}{4\pi r^2} \text{ (izotropno)}$$

$$I = c \langle u \rangle; \quad \langle u \rangle = u_E + u_B = \frac{1}{2} \epsilon_0 E_0^2 = \frac{B_0^2}{2\mu_0}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \frac{(\text{As})^2}{\text{Nm}^2}, \quad \mu_0 = 4\pi \times 10^{-7} \frac{\text{Tm}}{\text{A}}, \quad c = 3.0 \times 10^8 \frac{\text{m}}{\text{s}}, \quad q_0 = 1.6 \times 10^{-19} \text{ As}$$

$$J = \text{N m} = \text{A S v}, \quad T = \frac{\text{N}}{\text{A m}}, \quad \Omega = \frac{\text{V}}{\text{A}}, \quad F = \frac{\text{As}}{\text{V}}, \quad H = \frac{\text{Vs}}{\text{A}}$$

oznaka		enota	ime	
slo.	ang.		slo.	ang.
t	t	s	čas	time
V	V	m^3	volumen	volume
\vec{S}	\vec{A}	m^2	površina	area
L, b	L, ℓ	m	dolžina	length
\vec{s}	\vec{s}	m	pot	distance
\vec{r}	\vec{r}	m	položaj	position
\vec{F}	\vec{F}	N	sila	force
ϵ_0	ϵ_0	$(As)^2/Nm^2$	influenčna konstanta	permittivity of free space
μ_0	μ_0	Tm/A	indukcijska konstanta	permeability of free space
W	E, U	J	energija	energy, potential energy
A	W	J	delo	work
P	\mathcal{P}	W	moč	power
v	v	m/s	hitrost	velocity/speed
ω	ω	1/s	kotna hitrost	angular velocity/speed
e	q	As	naboj	charge
ρ	ρ	As/m^3	prostorska gostota naboja	volume charge density
σ	σ	As/m^2	površinska gostota naboja	surface charge density
μ	λ	As/m	vzdolžna gostota naboja	linear charge density
N	n	$1/m^3$	gostota nabojev	charge density
\vec{E}	\vec{E}	V/m	jakost električnega polja	electric field
\vec{B}	\vec{B}	T	gostota magnetnega polja	magnetic field
V	V	V	električni potencial	electric potential
U	ΔV	V	napetost	potential difference
U	\mathcal{E}	V	napetost	electromotive force
Φ_E	Φ_E	V m	električni pretok	electric flux
Φ_B	Φ_B	T m ²	magnetni pretok	magnetic flux
	u_E	J/m ³	gostota energije elek. polja	energy density of elec. field
	u_B	J/m ³	gostota energije magn.polja	energy density of magn.field
\bar{v}	v_d	m/s	popv. hitrost elektronov	drift velocity
\bar{t}	τ	s	popv. prosti čas nabojev	collision average interval
I	I	A	električni tok	electric current
\vec{j}	\vec{J}	A/m ²	(površ.) gostota elek. toka	(surface) current density
	\vec{J}_S	A/m	vzdolžna gostota elek. toka	linear current density
C	C	F	kapacitivnost	capacitance
R	R	Ω	upornost	resistance
L	L	H	induktivnost	inductance
L, M	M	H	medseb. induktivnost	mutual inductance
	σ	$1/\Omega m$	specifična prevodnost	conductivity
ζ, ρ	ρ	Ωm	specifična upornost	resistivity
	R_H	m^3/As	Hallov koeficient	Hall coefficient
	n	1/m	gostota navojev tuljave	number of turns per length
ν	f	Hz	frekvenca	frequency
λ	λ	m	valovna dolžina	wavelength
k	k	1/m	valovni vektor	angular wave number
c	c	m/s	hitrost svetlobe	speed of light
$\vec{\mathcal{P}}, \vec{S}$	\vec{S}	W/m ²	Poyntingov vektor	Poynting vector
I	I	W/m ²	intenziteta	intensity