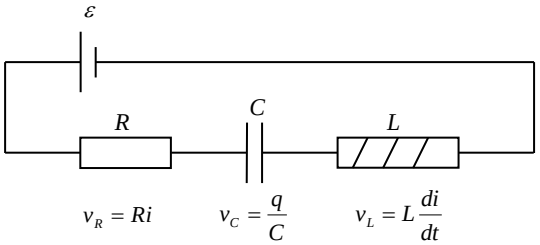
Kap 30 Induktans

Potensialf all over ulike komponente r $v_R = Ri \quad v_C = \frac{q}{C} \quad v_L = L\frac{di}{dt} \qquad i = \frac{dq}{dt}$



$$\varepsilon - Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$

RC - krets Tidskonsta nt : $\tau = RC$

Lading : $\varepsilon - Ri - \frac{q}{C} = 0 \qquad q = C\varepsilon(1 - e^{-t/RC}) \qquad i = \frac{\varepsilon}{R}e^{-t/RC}$

Utlading : $-Ri - \frac{q}{C} = 0 \qquad q = Q_0 e^{-t/RC} \qquad i = -\frac{Q}{RC}e^{-t/RC} = -\frac{V_C}{R}e^{-t/RC} = I_0 e^{-t/RC}$

RL - krets Tidskonsta nt : $\tau = \frac{L}{R}$

$\varepsilon - Ri - L\frac{di}{dt} = 0 \qquad i = \frac{\varepsilon}{R}(1 - e^{-\frac{R}{L}t})$

$-Ri - L\frac{di}{dt} = 0 \qquad i = I_0 e^{-\frac{R}{L}t}$

LC - krets $-L\frac{di}{dt} - \frac{q}{C} = 0 \qquad q = Q_0\cos(\omega t + \varphi) \qquad i = -\omega Q_0 \sin(\omega t + \varphi)$

$\omega = \sqrt{\frac{1}{LC}} \qquad f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{1}{LC}} \qquad T = \frac{2\pi}{\omega} = 2\pi\sqrt{LC}$

LRC - krets $-Ri - L\frac{di}{dt} - \frac{q}{C} = 0 \qquad q = Q_0 e^{-\frac{R}{2L}t}\cos(\omega t + \varphi)$

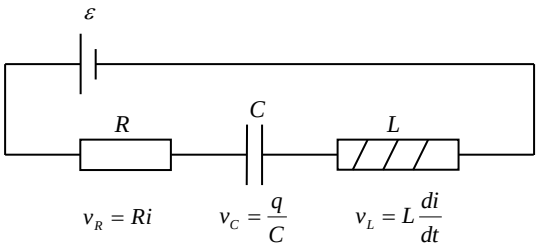
$\omega = \sqrt{\omega_0^{\,2} - \frac{R}{4L^2}} \qquad \omega_0 = \sqrt{\frac{1}{LC}}$

$f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R}{4L^2}} \qquad T = \frac{2\pi}{\omega} = 2\pi\frac{1}{\sqrt{\frac{1}{LC} - \frac{R}{4L^2}}}$

R : [Ω]
C : [F]
L : [H]

Kap 30 Induktans (forts.)

Potensialf all over ulike komponente r $v_R = Ri \quad v_C = \frac{q}{C} \quad v_L = L\frac{di}{dt} \qquad i = \frac{dq}{dt}$



$v_R = Ri \qquad v_C = \frac{q}{C} \qquad v_L = L\frac{di}{dt}$

$$\varepsilon - Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$

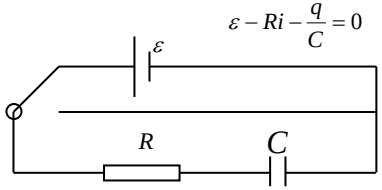
RC - krets Tidskonsta nt : $\tau = RC$

Lading :

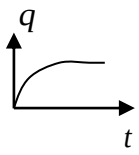
$$\varepsilon - Ri - \frac{q}{C} = 0$$

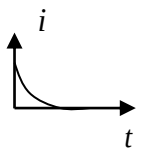
$$q = C\varepsilon(1 - e^{-t/RC})$$

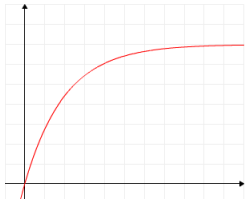
$$i = \frac{\varepsilon}{R}e^{-t/RC}$$

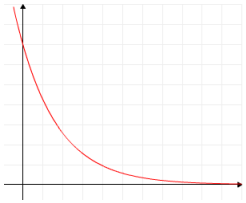


$$\varepsilon - Ri - \frac{q}{C} = 0$$







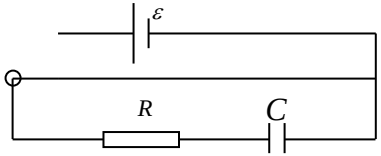


Utlading :

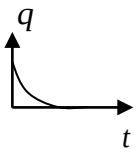
$$-Ri - \frac{q}{C} = 0$$

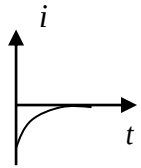
$$q = Q_0 e^{-t/RC}$$

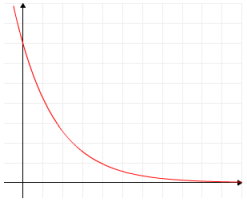
$$i = -\frac{Q}{RC}e^{-t/RC} = -\frac{V_C}{R}e^{-t/RC} = I_0 e^{-t/RC}$$

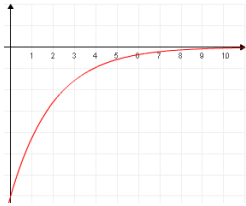


$$-Ri - \frac{q}{C} = 0$$



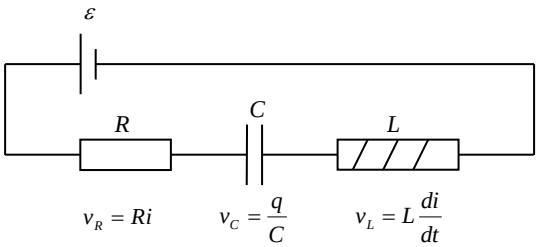






Kap 30 Induktans (forts.)

Potensialf all over ulike komponente r $\quad v_R = Ri \quad v_C = \frac{q}{C} \quad v_L = L\frac{di}{dt} \qquad i = \frac{dq}{dt}$

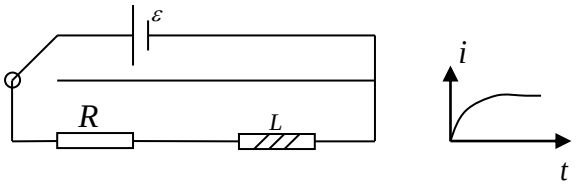


$v_R = Ri \qquad v_C = \frac{q}{C} \qquad v_L = L\frac{di}{dt}$

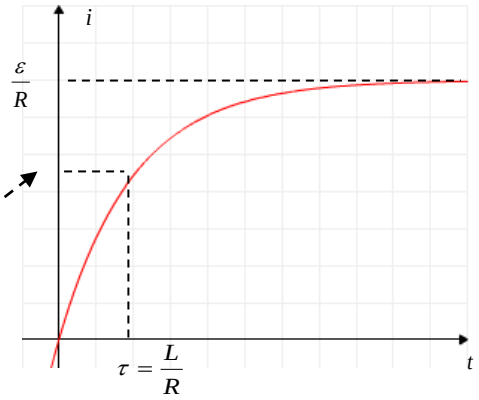
$$\varepsilon - Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$

RL - krets Tidskonsta nt : $\tau = \frac{L}{R}$

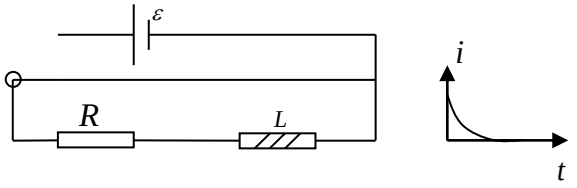
$\varepsilon - Ri - L\frac{di}{dt} = 0 \qquad i = \frac{\varepsilon}{R}(1 - e^{-\frac{R}{L}t})$



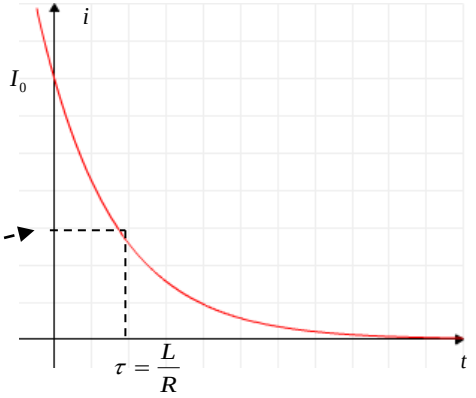
$$i = \frac{\varepsilon}{R}(1 - e^{-\frac{R}{L}\tau}) = \frac{\varepsilon}{R}(1 - e^{-\frac{RL}{LR}}) = \frac{\varepsilon}{R}(1 - e^{-1}) = \frac{\varepsilon}{R}(1 - \frac{1}{e})$$



$-Ri - L\frac{di}{dt} = 0 \qquad i = I_0 e^{-\frac{R}{L}t}$



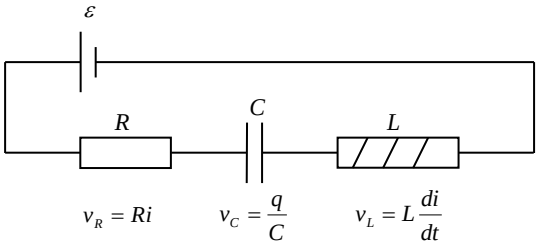
$$i = I_0 e^{-\frac{R}{L}\tau} = I_0 e^{-\frac{RL}{LR}} = I_0 e^{-1} = \frac{1}{e} I_0$$



Stabil strøm (med batteri påkoblet) vil si strøm ved $t = \infty$, dvs $i = \frac{\varepsilon}{R}$

Kap 30 Induktans (forts.)

Potensialf all over ulike komponente r $v_R = Ri \quad v_C = \frac{q}{C} \quad v_L = L\frac{di}{dt} \qquad i = \frac{dq}{dt}$



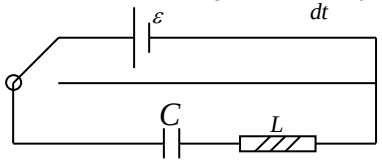
$v_R = Ri \qquad v_C = \frac{q}{C} \qquad v_L = L\frac{di}{dt}$

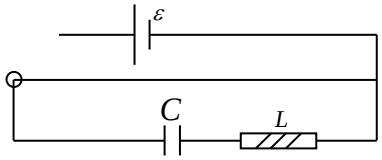
$$\varepsilon - Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$

LC - krets $-L\frac{di}{dt} - \frac{q}{C} = 0 \qquad q = Q_0\cos(\omega t + \varphi) \qquad i = -\omega Q_0 \sin(\omega t + \varphi)$

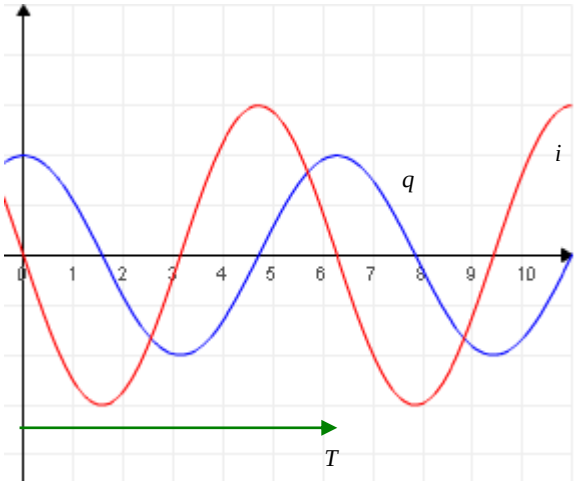
$$\omega = \sqrt{\frac{1}{LC}} \qquad f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{1}{LC}} \qquad T = \frac{2\pi}{\omega} = 2\pi\sqrt{LC}$$

$$\varepsilon - Ri - L\frac{di}{dt} = 0$$



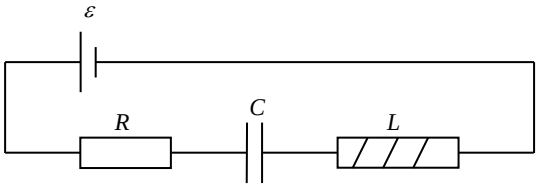


$$-Ri - L\frac{di}{dt} = 0$$



Kap 30 Induktans (forts.)

Potensialf all over ulike komponente r $\quad v_R = Ri \quad v_C = \frac{q}{C} \quad v_L = L\frac{di}{dt} \qquad i = \frac{dq}{dt}$

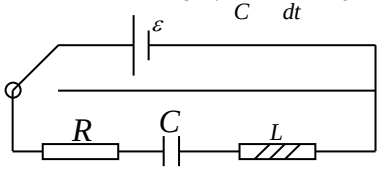


$v_R = Ri \qquad v_C = \frac{q}{C} \qquad v_L = L\frac{di}{dt}$

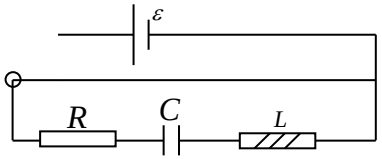
$$\varepsilon - Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$

LRC - krets

$$\varepsilon - Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$



$$-Ri - L\frac{di}{dt} - \frac{q}{C} = 0 \qquad q = Q_0 e^{-\frac{R}{2L}t}\cos(\omega t + \varphi)$$

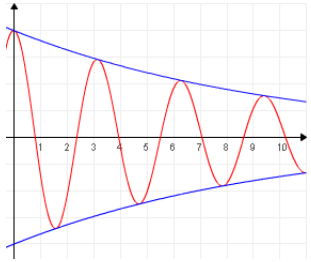


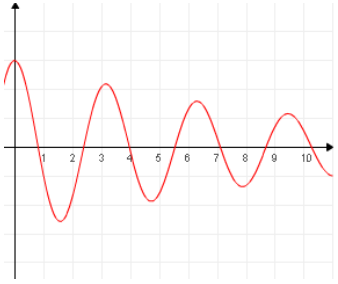
$$-Ri - \frac{q}{C} - L\frac{di}{dt} = 0$$

$$\omega = \sqrt{{\omega_0}^2 - \frac{R}{4L^2}} \qquad \omega_0 = \sqrt{\frac{1}{LC}}$$

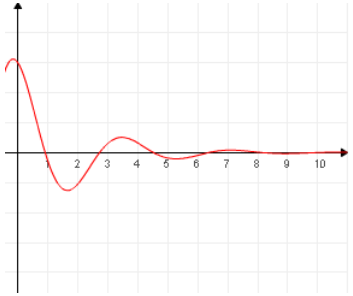
$$f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R}{4L^2}} \qquad T = \frac{2\pi}{\omega} = 2\pi\frac{1}{\sqrt{\frac{1}{LC} - \frac{R}{4L^2}}}$$

$\frac{1}{LC} > \frac{R}{4L^2}$



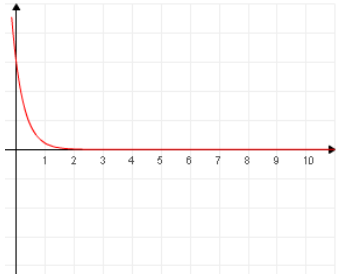


$\frac{1}{LC} > \frac{R}{4L^2}$



$\frac{1}{LC} > \frac{R}{4L^2}$

$\frac{1}{LC} = \frac{R}{4L^2}$



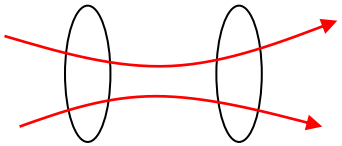
$\frac{1}{LC} < \frac{R}{4L^2}$

Kap 30 Induktans (forts.)

Gjensidig induktans

$$\varepsilon_2 = -M\frac{di_1}{dt} \qquad \varepsilon_1 = -M\frac{di_2}{dt}$$

$$M = \frac{N_2\Phi_{B2}}{i_1} = \frac{N_1\Phi_{B1}}{i_2}$$



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