

Electromagnetic Oscillator (LC Circuit)



- loop rule: $\frac{Q}{C} + L \frac{dI}{dt} = 0, I = \frac{dQ}{dt}$
- equation of motion: $\frac{d^2 Q}{dt^2} = -\frac{1}{LC} Q$
- charge on capacitor: $Q(t) = Q_{max} \cos(\omega t)$
- current through inductor: $I(t) = -\omega Q_{max} \sin(\omega t)$
- angular frequency: $\omega = \frac{1}{\sqrt{LC}}$
- magnetic energy: $U_B = \frac{1}{2} L I^2$ (stored on inductor)
- electric energy: $U_E = \frac{Q^2}{2C}$ (stored on capacitor)
- total energy: $E = U_B + U_E = \text{const.}$

