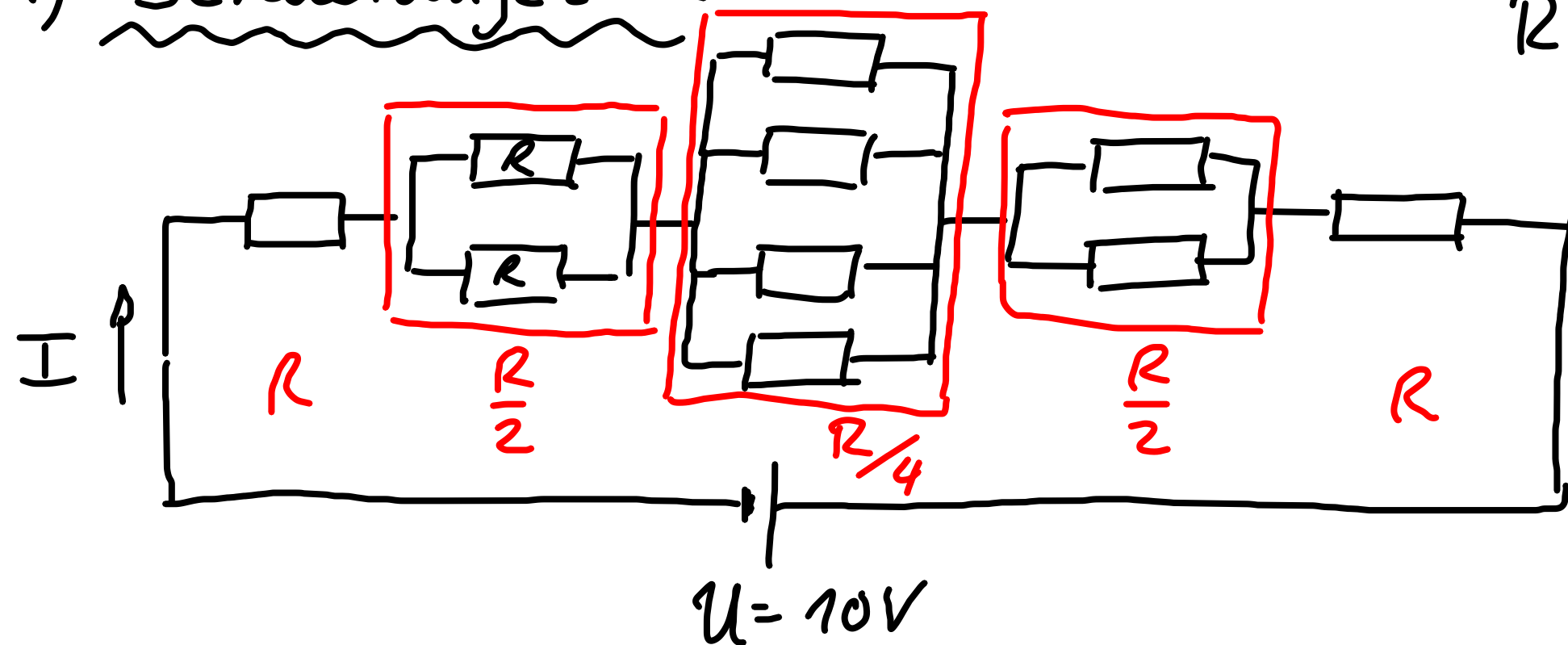


Physics hour 06

1) Schaltungen I



2 x R parallel:

$$\frac{1}{R_{tot}} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R} \Rightarrow R_{tot} = \frac{R}{2}$$

$$R_{tot} = R + \frac{R}{2} + \frac{R}{4} + \frac{R}{2} + R = 3,25R = 3,25 \cdot 40\Omega = 130\Omega$$

$$I = \frac{U}{R_{tot}} = \frac{10V}{130\Omega} = \underline{\underline{77\text{ mA}}}$$

2) Schaltungen II

$$\frac{1}{C_{tot}} = \frac{1}{C} + \frac{1}{C} \Rightarrow C_{tot} = \frac{C}{2} = 25\text{ nF} \rightarrow R_c = \frac{1}{\omega C} = \frac{1}{2\pi f C}$$

$$\Rightarrow I = \frac{U}{R_c} = U\omega C = U2\pi f C = 230V \cdot 2\pi \cdot 50\frac{1}{s} \cdot 25 \cdot 10^{-9}\text{ F} = \underline{\underline{1,8\text{ mA}}}$$

3) Wechselstromwiderstand I

$$R = R_c \quad \leftrightarrow \quad R = \frac{1}{\omega C} \quad \rightarrow \quad \omega = \frac{1}{RC} = \frac{1}{10^4 \Omega \cdot 10^{-6} \text{ F}} = 100 \text{ /s}$$

4) Wechselstromwiderstand II

$$R_L = R_c \quad \leftrightarrow \quad \omega L = \frac{1}{\omega C} \quad \rightarrow \quad \omega^2 = \frac{1}{LC} \quad \rightarrow \quad \omega = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{10^{-3} \frac{\text{Vs}}{\text{A}} \cdot 10^{-9} \frac{\text{As}}{\text{V}}}} \\ = 10^6 \frac{1}{\text{s}}$$

5) Heizleistung I

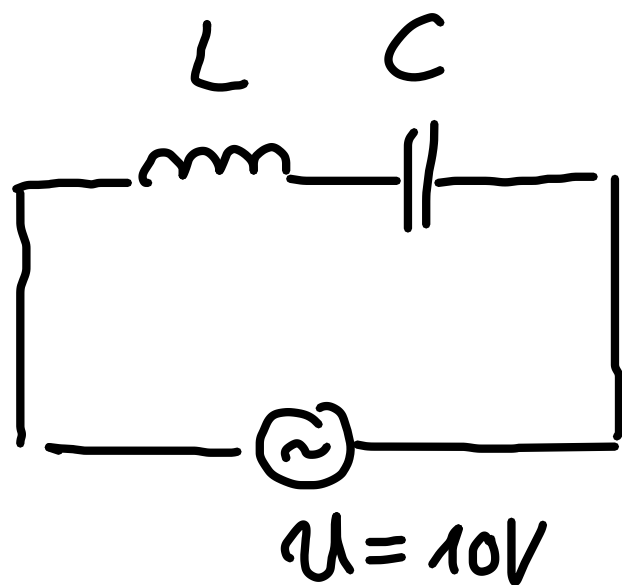
$$P_{\text{eff}} = \langle P(t) \rangle = \frac{1}{2} \frac{U_0^2}{R} = \frac{1}{2} R \cdot I_0^2 = \frac{1}{2} \cdot 1000 \Omega \cdot 1 \text{ A}^2 = 500 \text{ W}$$

$\uparrow$
 $U_0 = R \cdot I_0$

6) Heizleistung II

$$P_{\text{eff}} \text{ unabh. von Frequenz} \Rightarrow P_{\text{eff}}(2\omega) = P_{\text{eff}}(\omega)$$

7) Komplexe Impedanz



$$Z = Z_L + Z_C = i\omega L + \frac{1}{i\omega C} \cdot \frac{-i}{(-i)} = i\omega L - \frac{i}{\omega C}$$

$$= i\left(\omega L - \frac{1}{\omega C}\right) = i\left(\frac{\omega L \cdot \omega C - 1}{\omega C}\right)$$

$$Z = i \frac{\omega^2 LC - 1}{\omega C}$$

$$|Z| = \frac{\omega^2 LC - 1}{\omega C} = \frac{10^{12} \frac{1}{s} \cdot 10^{-3} \frac{Vs}{A} \cdot 10^{-6} \frac{As}{V} - 1}{10^8 \frac{1}{s} \cdot 10^{-6} \frac{As}{V}}$$

$$= \frac{1000 - 1}{A/V} = 999 \frac{V}{A} \approx 1000 \Omega$$

$$I = \frac{U}{|Z|} = \frac{10V}{1000 V/A} = 10 mA$$

