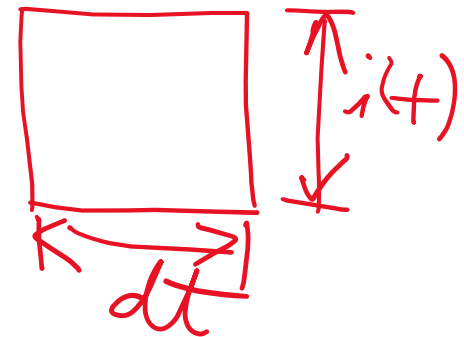


$$Q(t) = \int_0^t i(t) dt$$



$$1.1) \quad \bar{i} = \frac{1}{T} \int_0^{12} i(t) dt$$

$$\text{mit } T = 12 \text{ ms}$$

$$\Rightarrow \bar{i} = \frac{1}{12 \text{ ms}} \left( \frac{8 \cdot 3}{2} + 8 \cdot 2 + \frac{8 \cdot 3}{2} + \frac{-4 \cdot 1}{2} + \frac{-4 \cdot 2}{2} + \frac{-4 \cdot 1}{2} \right) \text{ A} \cdot \text{ms}$$

$$= \frac{28 \text{ A} \cdot \text{ms}}{12 \text{ ms}} = 2,33 \text{ A}$$

1.2)

$$I = \sqrt{\frac{1}{T} \cdot \int i^2 dt}$$

$$\Rightarrow \sqrt{\frac{1}{T} \int i^2 dt} = \sqrt{\frac{1}{12ms} \cdot \left( \frac{64 \cdot 3}{3} + 64 \cdot 2 + \frac{64 \cdot 3}{3} + \frac{16 \cdot 1}{3} + 16 \cdot 2 + \frac{16 \cdot 1}{3} \right)}$$

$$\cdot \sqrt{A^2 ms}$$

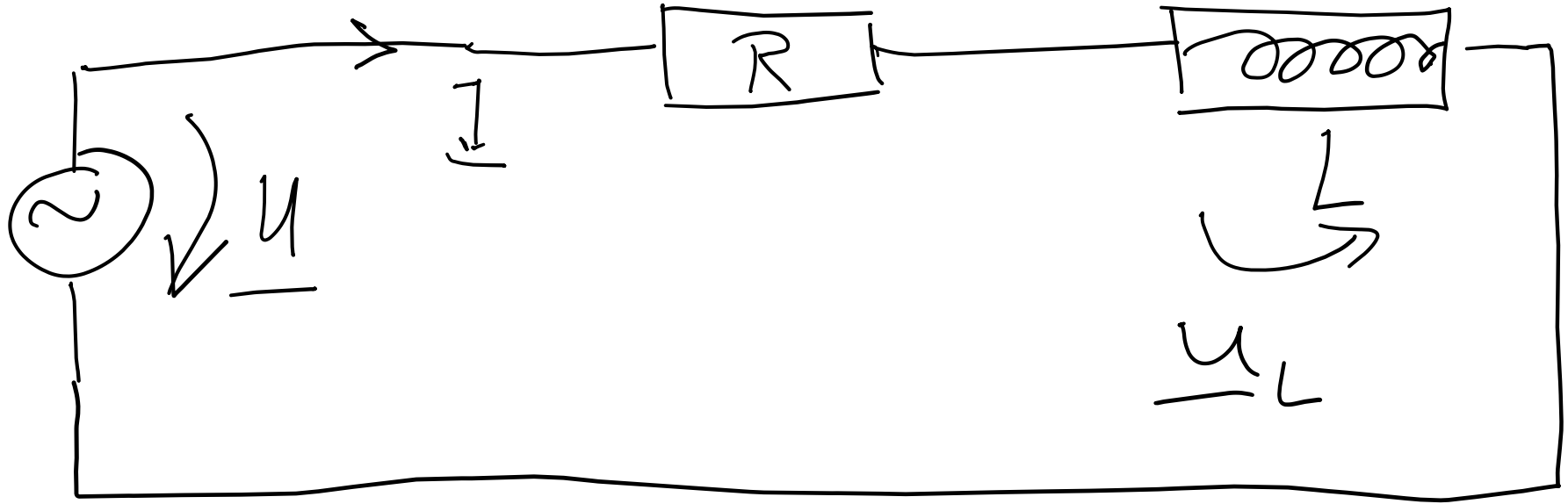
$$\Rightarrow I = \sqrt{\frac{1}{12ms} \cdot 2987 A^2 ms} \approx 5 A$$

$$1.3) \quad T = 12 \text{ ms}$$

$$f = \frac{1}{T} = \frac{1}{12 \text{ ms}} = \frac{1}{0,012} \text{ s}^{-1}$$

$$= 83,3 \text{ s}^{-1} \quad (\text{oder Hz})$$

2)



$$\omega = 2\pi \cdot f$$

$$2a) \underline{z} = R + j\omega \cdot L$$

$$2b) \underline{I} = \frac{\underline{u}}{R + j\omega L}$$

$$2c) \underline{u}_L = \underline{I} \cdot j\omega L = \frac{\underline{u} \cdot j\omega L}{R + j\omega L}$$
$$= \frac{\underline{u} j\omega L}{R + j\omega L + j\omega L} = \frac{\underline{u}}{1 + \frac{R}{j\omega L}}$$

2d)

$$1 \text{ G} =$$

$$\frac{u_L}{u}$$



$$\frac{1}{1 + \frac{R}{j\omega L}}$$

mit

$$\frac{u_L}{u} =$$

$$\frac{u}{1 + \frac{R}{j\omega L}}$$

$$2e) \quad |G| = \frac{\sqrt{1^2}}{\sqrt{1^2 + \frac{R^2}{j^2 \omega^2 L^2}}}$$

$$= \frac{1}{\sqrt{1 + \frac{R^2}{-1 \cdot \omega^2 \cdot L^2}}} = \frac{1}{\sqrt{1 - \frac{R^2}{\omega^2 L^2}}}$$



$$2 f) G_{dB} = 20 \cdot \log \cdot \frac{1}{\sqrt{1 - \frac{R^2}{\omega^2 L^2}}}$$

$$3.1) \quad L = \frac{N^2}{R_m} \Rightarrow R_m = \frac{N^2}{L} = \frac{10^6}{100 \cdot 10^{-3}} \text{ H} \\ = 10^7 \text{ H}^{-1}$$

$$3.2) \quad W_{\text{magn}} = \frac{1}{2} \cdot L \cdot i^2 \\ = \frac{1}{2} \cdot 100 \cdot 10^{-3} \frac{\text{Vs}}{\text{A}} \cdot 100^2 \text{ A}^2 \\ = 500 \text{ VAs}$$

$$3.3) U_L = L \cdot \frac{di}{dt} = 0 \quad (\text{mit } L = \text{const.})$$

$$3.4) i = \text{const.} \Rightarrow \frac{di}{dt} = 0$$

$$\Rightarrow U_L = L \cdot 0 = 0$$

$$2.5) \quad i = \frac{1}{L} \int u \cdot dt$$

$$= \frac{1}{L} \cdot u \cdot \Delta t + i_0$$

für  $u = \text{const.}$

↳ Integrations-  
konstante

$$\Rightarrow i_{\text{end}} = \frac{1}{0,1 \frac{\text{Vs}}{\text{A}}} \cdot 100 \text{ V} \cdot 0,01 \text{ s} + 100 \text{ A}$$

$$\Rightarrow i_{\text{end}} = 110 \text{ A}$$

Strom steigt linear  
von 100 auf 110 A.

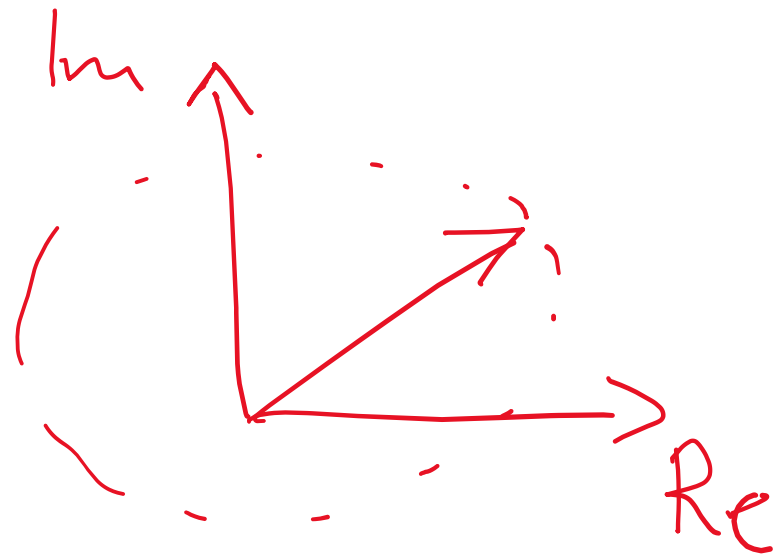
$$4.1) \hat{u} = 20V \quad \hat{i} = 15A$$

$$4.2) U_{\text{eff}} = \frac{20V}{\sqrt{2}} = 14.14V$$

$$I_{\text{eff}} = \frac{15A}{\sqrt{2}} = 10.61A$$

$$\underline{u} = 14.14V \cdot e^{-j \cdot 60^\circ}$$

$$\underline{i} = 10.61A \cdot e^{-j \cdot 30^\circ}$$



$$4.3) \underline{Z} = \frac{\underline{U}}{\underline{I}} = \frac{14.14 \text{ V} \cdot e^{j \cdot 60^\circ}}{10.61 \text{ A} \cdot e^{j \cdot 80^\circ}}$$

$$= 1.33 \, \Omega \cdot e^{-j \cdot 30^\circ}$$

$$\frac{e^{-j \cdot 60}}{e^{-j \cdot 30}} = e^{-j \cdot 60^\circ - (-j \cdot 30^\circ)}$$

$$\underline{S} = \underline{U} \cdot \underline{I}^* = 14,14 \text{ V} \cdot e^{-j60} \cdot 10,61 \text{ A} \cdot e^{+j30}$$
$$= 150 \text{ VA} \cdot e^{-j30}$$

$$4.4. \quad \varphi = \varphi_u - \varphi_i = -60^\circ - (-30^\circ) = -30^\circ$$

$$\Rightarrow \cos \varphi = \cos(-30) = \underline{\underline{0,866}}$$

$$5) R_{AB} = R_A + R_B = (5 + 15) \Omega = 20 \Omega$$

$$\Rightarrow R_{ABEG} = \frac{1}{\frac{1}{R_{AB}} + \frac{1}{R_E} + \frac{1}{R_G}} = \frac{1}{\frac{1}{20 \Omega} + \frac{1}{60 \Omega} + \frac{1}{60 \Omega}} = 12 \Omega$$

$$R_{DF} = \frac{R_D \cdot R_F}{R_D + R_F} = \frac{15 \cdot 30}{45} \Omega = 10 \Omega$$

$$R_{CDF} = 10 \Omega + 50 \Omega = 60 \Omega$$

$$R_{CDFH} = \frac{R_{CDF} \cdot R_H}{R_{CDF} + R_H} = \frac{60 \cdot 90}{150} \Omega = 36 \Omega$$



$$\begin{aligned}\Rightarrow R_{\text{Ges}} &= R_{\text{ABEG}} + R_{\text{CDFH}} \\ &= 12\Omega + 36\Omega = \underline{\underline{48\Omega}}\end{aligned}$$

$$\Rightarrow I_Q = \frac{U_Q}{R_{\text{Ges}}} = \frac{240\text{V}}{48\Omega} = 5\text{A}$$

$$\Rightarrow U_{ABEG} = I_Q \cdot R_{ABEG} = 5A \cdot 12\Omega \\ = 60V$$

$$\Rightarrow I_A = \frac{U_{ABEG}}{R_{AB}} = \frac{60V}{20\Omega} = 3A$$

$$\Rightarrow U_A = I_A \cdot R_A = 15V, \quad U_B = I_A \cdot R_B \\ = 45V$$

$$I_c \cdot (R_H + R_{COF}) = I_Q \cdot R_H$$

$$\Leftrightarrow I_c = I_Q \cdot \frac{R_H}{R_H + R_{COF}} = 5A \cdot \frac{90}{90 + 60}$$

$$= 3A$$

$$\Rightarrow U_c = I_c \cdot R_c = 3A \cdot 50 \Omega = 150V$$

$$I_F = I_C \cdot \frac{R_D}{R_D + R_F} = 3A \cdot \frac{15}{15 + 45} = 1A$$

$$U_F = I_F \cdot R_F = 1A \cdot 30\Omega = 30V$$

$$U_Q = U_A + U_B + U_C + U_F$$

$$240V = 15V + 45V + 150V + 30V \quad \checkmark$$