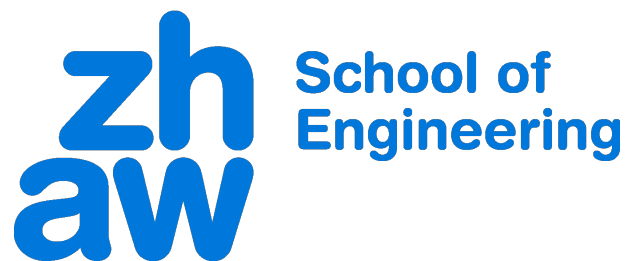


ZHAW Zurich University of Applied Sciences
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Zusammenfassung EL2

Studienwochen 1-5

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Zf. EL2 SW 1-5

1 Inductor

$$\begin{aligned} u(t) &= L \cdot \frac{di(t)}{dt} \\ &= L \cdot \dot{i}(t) \end{aligned}$$

1.1 Discharge

$$\begin{aligned} \tau &= \frac{L}{R} \\ i_L(t) &= I_0 \cdot \exp\left(-\frac{t}{\tau}\right) \\ u_L(t) &= -R \cdot I_0 \cdot \exp\left(-\frac{t}{\tau}\right) \end{aligned}$$

1.2 Charge

$$\begin{aligned} \tau &= \frac{L}{R} \\ i_L(t) &= I_0 \cdot \left(1 - \exp\left(-\frac{t}{\tau}\right)\right) \\ u_L(t) &= R \cdot I_0 \cdot \exp\left(-\frac{t}{\tau}\right) \end{aligned}$$

2 Complex signals

2.1 Impedances

$$\begin{aligned} \underline{Z} &= \frac{\underline{U}(t)}{\underline{I}(t)} \\ &= \frac{\underline{U} \cdot e^{j \cdot \omega \cdot t}}{\underline{I} \cdot e^{j \cdot \omega \cdot t}} \end{aligned}$$

2.2 Admittance

$$\begin{aligned} \underline{Y} &= \frac{1}{\underline{Z}} \\ &= \frac{\underline{I}(t)}{\underline{U}(t)} \\ &= \frac{\underline{I} \cdot e^{j \cdot \omega \cdot t}}{\underline{U} \cdot e^{j \cdot \omega \cdot t}} \end{aligned}$$

2.3 Resistor

$$\begin{aligned} \underline{Z} &= R \\ \underline{Y} &= \frac{1}{R} \end{aligned}$$

2.4 Capacitor

$$\begin{aligned} \underline{Z} &= \frac{1}{j \cdot \omega \cdot C} \\ \underline{Y} &= j \cdot \omega \cdot C \end{aligned}$$

2.5 Inductor

$$\underline{Z} = j \cdot \omega \cdot L$$
$$\underline{Y} = \frac{1}{j \cdot \omega \cdot L}$$

2.6 Resonance

$$\operatorname{Im}(\underline{Z}) = 0$$

3 Power

3.1 Momentary power

$$p(t) = u(t) \cdot i(t)$$

3.2 Effective power

$$P = \frac{1}{T} \cdot \int_T u(t) \cdot i(t) dt$$

3.3 Complex power

$$\underline{S} = \underline{U}(t) \cdot \underline{I}^*(t)$$
$$= U \cdot I \cdot e^{j\varphi}$$
$$= P + j \cdot Q$$

3.3.1 Blind power

$$P = \operatorname{Re}(\underline{S})$$
$$= U \cdot I \cdot \cos(\varphi)$$

3.3.2 Apparent power

$$Q = \operatorname{Im}(\underline{S})$$
$$= U \cdot I \cdot \sin(\varphi)$$