

A6 a) i. $|\underline{z}| = 2 \quad \arg(\underline{z}) = \frac{2\pi}{3}$

ii. $|\underline{z}| = 2\sqrt{2} \quad \arg(\underline{z}) = \frac{5\pi}{4}$

iii. $|\underline{F}(j\Omega)| = \frac{\Omega}{\sqrt{1+\Omega^2}}$

$\varphi(\Omega) = \arg(\underline{F}(j\Omega)) = \frac{\pi}{2} - \arctan(\Omega)$

iv. $|\underline{F}(j\Omega)| = \frac{1}{\sqrt{1+(a^2-2)\Omega^2+\Omega^4}}$

$$\varphi(\Omega) = \arg(\underline{F}(j\Omega)) = \begin{cases} -\arctan\left(\frac{a\Omega}{1-\Omega^2}\right) & , \Omega < 1 \\ -\frac{\pi}{2} & , \Omega = 1 \\ -\pi - \arctan\left(\frac{a\Omega}{1-\Omega^2}\right) & , \Omega > 1 \end{cases}$$

b) $\underline{I} = 0,5 \cdot e^{j20^\circ} \text{ A} \quad \underline{U} = 1,0 \cdot e^{j50^\circ} \text{ V}$

$\underline{Z} = \frac{\underline{U}}{\underline{I}} = 2 \cdot e^{j30^\circ} \Omega = (\sqrt{3} + j) \Omega$

$R = \sqrt{3} \Omega$

$X = j\Omega > 0 \rightarrow \text{induktiv}$

A7 a) (a) $\underline{F}(j\omega) = \frac{j\omega \frac{L_1}{R_1}}{1 + j\omega \frac{L_1}{R_1}}$

(b) $\underline{F}(j\omega) = \frac{1}{1 + j\omega C_1 R_1}$

(c) $\underline{F}(j\omega) = \frac{1}{1 + j\omega \frac{L_1}{R_1}}$

(d) $\underline{F}(j\omega) = \frac{j\omega L_1 R_1}{1 + j\omega C_1 R_1}$

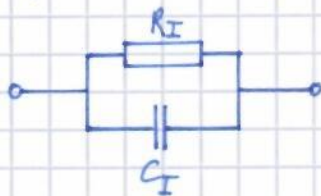
(e) $\underline{F}(j\omega) = \frac{1 + (j\omega C_1 R_1)^2}{3(1 + j\omega 3C_1 R_1 + (j\omega C_1 R_1)^2)}$

$$(f) \quad \underline{F}(j\omega) = \frac{j\omega \frac{L_2}{R_1}}{1 + j\omega(C_2 R_1 + \frac{L_2}{R_1}) + (j\omega)^2 Z C_2 L_2}$$

b) Schaltungspaar 1: (b) und (c) für $R_1 C_1 = \frac{L_1}{R_1}$

Schaltungspaar 2: (a) und (d) für $R_1 C_1 = \frac{L_1}{R_1}$

c) Äquivalente Zweipole:



Dimensionierung:

$$R_I = 3,53 \text{ k}\Omega \quad C_I = 7,17 \text{ pF} \quad R_{II} = 7,17 \Omega \quad C_{II} = 35,3 \text{ pF}$$

A8 a)

$$u_1(t) = L_1 \frac{di_1(t)}{dt} - M \cdot \frac{di_2(t)}{dt}$$

$$\underline{U}_1 = j\omega L_1 \underline{I}_1 - j\omega M \underline{I}_2$$

$$u_2(t) = -M \frac{di_1(t)}{dt} + L_2 \frac{di_2(t)}{dt}$$

$$\underline{U}_2 = -j\omega M \underline{I}_1 + j\omega L_2 \underline{I}_2$$

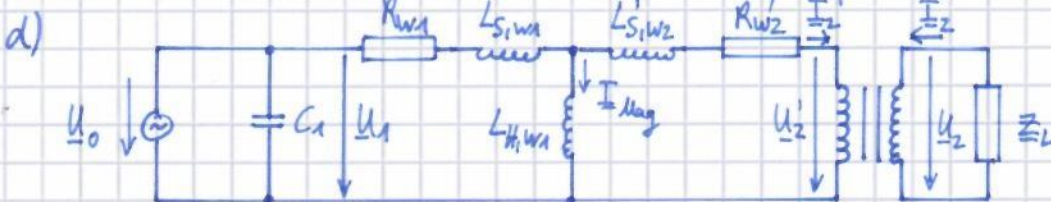
$$L_i = \mu_i^2 \frac{\mu_0 \mu_r A}{l} \quad i=1,2$$

$$M = \sqrt{L_1 L_2} = \mu_1 \mu_2 \cdot \frac{\mu_0 \mu_r A}{l}$$

$$b) \quad L_{ges,1} = L_1 + 2M + L_2$$

$$L_{ges,2} = L_1 - 2M + L_2$$

$$c) \quad \underline{Z}_1 = \frac{\underline{U}_1}{\underline{I}_1} = \frac{j\omega L_1}{1 + j\omega \frac{L_2}{R}}$$



$$e) \quad \underline{U}_2 = \bar{u} \underline{U}_2' \quad \underline{I}_2' = -\bar{u} \underline{I}_2 \quad \underline{Z}_L' = \frac{1}{\bar{u}^2} \underline{Z}_L$$

$$R_{w2}' = \frac{1}{\bar{u}^2} R_{w2} \quad L_{S1,w2}' = \frac{1}{\bar{u}^2} L_{S1,w2} \quad L_{H1,w1} = \frac{1}{\bar{u}^2} L_{H1,w2}$$

$$f) \quad \underline{I}_{Mag} = \frac{U_0}{j\omega L_{H1,w1}} \Rightarrow \text{lastunabhängig}$$

$$\underline{U}_2 = \bar{u} \cdot \frac{j\omega L_{H1,w1} \frac{1}{\bar{u}^2} \underline{Z}_L}{j\omega L_{H1,w1} \cdot \frac{1}{\bar{u}^2} \underline{Z}_L + (R_{w1} + j\omega L_{S1,w1})(j\omega L_{H1,w1} + \frac{1}{\bar{u}^2} \underline{Z}_L)} \underline{U}_0$$