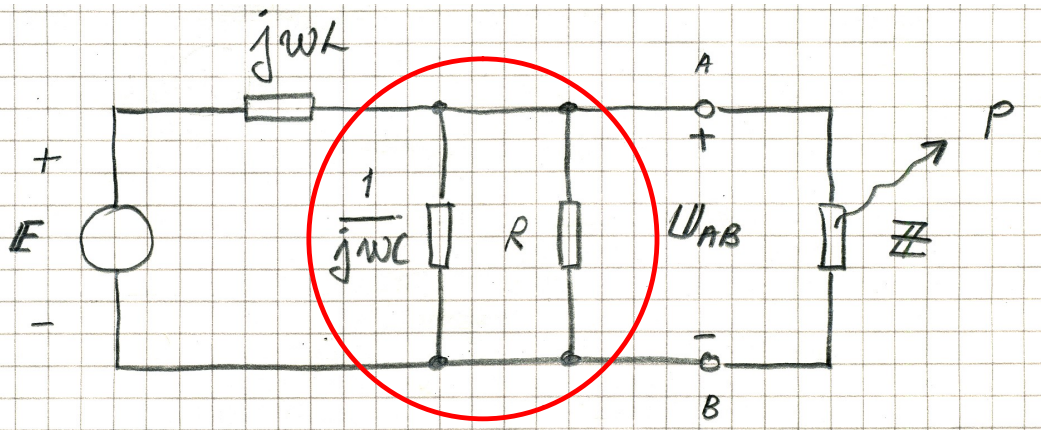
Effektanpassning – Lösning till Ex 3.



$$e(t) = 10\sqrt{2}\sin(1000t + 90°)\ \text{V}$$

$L = 500\ \text{mH}$, $C = 1{,}0\ \mu\text{F}$, $R = 1{,}0\ \text{k}\Omega$

FÖR VILKET $\underline{Z}$ BLIR $P = P_{MAX}$?

HUR STOR ÄR P_{MAX}?

LÖSNING: NOLLSTÄLL $\underline{E}$. BESTÄM $\underline{Z}_i$ MELLAN A OCH B. ⇒

$$\frac{1}{\underline{Z}_i} = \frac{1}{j\omega L} + j\omega C + \frac{1}{R} =$$

$$= \frac{1}{R} + j\left(\omega C - \frac{1}{\omega L}\right) =$$

$$= 0{,}001 + j(0{,}001 - 0{,}002) =$$

$$= 0{,}001\sqrt{2}\, e^{-j45°}\ \Omega^{-1} \Rightarrow$$

$$\underline{Z}_i = \frac{1000}{\sqrt{2}} \cdot e^{+j45^\circ} = 500 + j500$$

$P = P_{MAX}$ ОМ $\underline{Z} = \underline{Z}_i^* = 500 - j500$

$$\underline{E}_i = U_{ABO} = \underline{E} \cdot \frac{\underline{Z}_p}{j\omega L + \underline{Z}_p} =$$

$$= \left/ \underline{Z}_p = \frac{\frac{1}{j\omega C} \cdot R}{\frac{1}{j\omega C} + R} = \frac{R}{1 + j\omega CR} \right/ =$$

$$= \underline{E} \cdot \frac{\frac{R}{1+j\omega CR}}{j\omega L + \frac{R}{1+j\omega CR}} =$$

$$= \underline{E} \cdot \frac{R}{j\omega L(1+j\omega CR) + R} = \text{"ОЧЕВИДНО"}^* \ldots\ldots$$

$$= \underbrace{20 \cdot e^{+j45^\circ}}_{\hat{E}_i} \ V$$

$$E_i = \frac{\hat{E}_i}{\sqrt{2}} = \frac{20}{\sqrt{2}} \ V$$

$$P_{MAX} = \frac{E_i^2}{4R_i} = \ldots = 0{,}1 \ W$$

* Förslag på beräkningsgång vid ”övning” …

$$\underline{E}_i = \underline{E} \cdot \frac{R}{j\omega L(1+j\omega CR)+R}$$

$$\underline{E}_i = 10\sqrt{2}\cdot e^{j90^\circ} \cdot \frac{1000}{j1000\cdot 0{,}500\left(1+j1000\cdot 10^{-6}\cdot 1000\right)+1000} =$$

$$= 10\sqrt{2}\cdot e^{j90^\circ} \cdot \frac{1000}{j500-500+1000} =$$

$$= \frac{10\sqrt{2}\, e^{j90^\circ}\cdot 1000}{\sqrt{500^2+500^2}\, e^{j\arctan\frac{500}{500}}} =$$

$$= 20\, e^{j45^\circ} \quad V$$

$$\left(A+jB = \sqrt{A^2+B^2}\, e^{j\arctan\frac{B}{A}} \right)$$