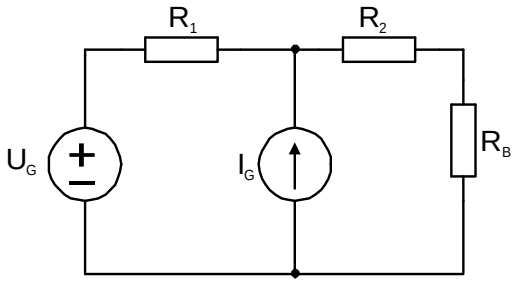
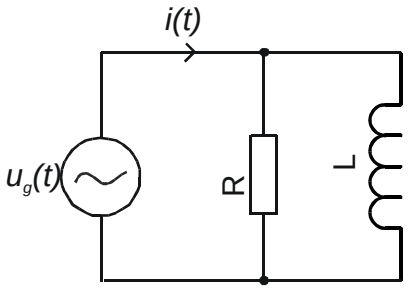
DIGITALNA TEHNIKA

1. kolokvij 22.04 2010

1. Določite velikost bremenskega upora R_B tako da bo prenesena moč iz generatorja na breme maksimalna. Uporabite Theveninovo nadomestno vezje in izrek o maksimalni preneseni moči. Upoštevajte: $U_G=5V$ $I_g=5A$ $R_1=2\Omega$ $R_2=3\Omega$

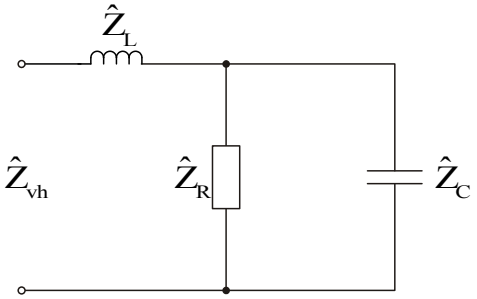


2. Vezje na sliki je vzbujano z izmenično napetostjo $u_g(t)=5V\ cos(100t+30°)$. Določite potek toka $i(t)$. Upoštevajte: $L= 300mH,$ $R= 250\Omega$



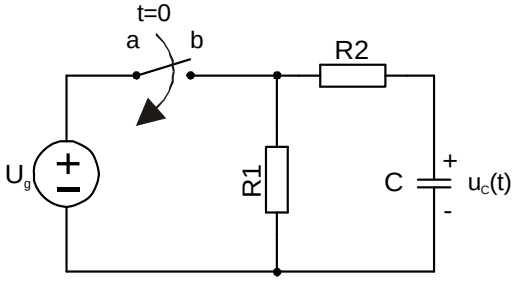
3. Izračunajte serijsko resonančno frekvenco narisanega vezja, pri kateri je impedanca narisanega vezja čisto ohmska.

$L=4H$ $R=5k\Omega$ $C=0.25\mu F$



4. V trenutku $t=0$ sklenemo stikalo. Izračunajte napetost $u_C(t)$ na kondenzatorju C z uporabo Laplaceove transformacije. Začetna napetost $u_C(t)$ na kondenzatorju je $\mathbf{u_C(0^+)=1V}$!

$C=1F$ $R_1=1\Omega$ $R_2=1\Omega$ $U_g=1V$



Čas pisanja je 60min. Vsaka naloga je vredna 10 točk. Na list z rešitvami se podpišite in napišite še vpisno številko ter kateri predmet pišete. Rezultati bodo objavljeni na https://estudent.fri.uni-lj.si

(2) $\hat{Z}_L = j\omega L = j \cdot 100 \cdot 0{,}3 = j30\,\Omega$

$\hat{Z}_R = R = 250\,\Omega$

$\hat{Z}_{sk} = \hat{Z}_L \parallel R = \dfrac{\quad}{j30+250} = 29{,}78\,e^{\quad}$

$u_g(t) = 5V\cos(\omega t + 30°) \rightarrow \hat{U}_g = 5\,e^{j30°}\,V$

$$\hat{I}(j\omega) = \frac{\hat{U}_g}{\hat{Z}_{sk}} = \frac{5\,e^{j30°}}{29{,}78\,e^{j83{,}15°}} = 0{,}167\,e^{-j53{,}15°}\,A \rightarrow i(t) = 0{,}167\cos(100t - 53{,}15°)\,A$$

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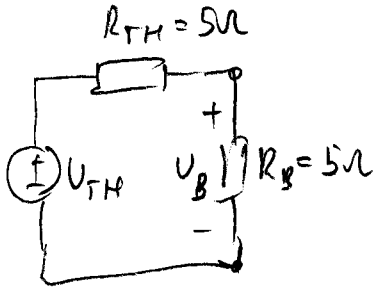
(1) $R_B = R_{TH} \rightarrow R_{TH} = R_1 + R_2 = 5\,\Omega$

$U_{TH} = U_G + R_1 \cdot I_G = 15V \rightarrow$



$U_B = \dfrac{U_{TH}}{2} = 7.5$

$P_B = \dfrac{U_B^2}{R_B} = \underline{\underline{11{,}25W}}$

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(3)

$$j\omega L + \frac{R \cdot \frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} = j\omega L + \frac{R \cdot \cancel{\frac{1}{j\omega C}}}{\cancel{\frac{1}{j\omega C}}(1 + j\omega RC)}$$

$$j\omega L + \frac{R}{1 + j\omega RC} = j\omega L + R \cdot \frac{(1 - j\omega RC)}{1 + \omega^2 R^2 C^2}$$

$$\hat{Z}_{vh} = \frac{R}{1 + \omega^2 R^2 C^2} + j\left[\omega L - R\,\frac{\omega RC}{1 + (\omega RC)^2}\right]$$

$\cancel{\omega} L(1 + (\omega RC)^2) = R^2 \cancel{\omega} C \rightarrow \omega = 0$ ni resonancha

$L + \omega^2 (RC)^2 L - R^2 C = 0$

$$\omega = \frac{R^2 C - L}{(RC)^2 \cdot L} = 3{,}6 \cdot 10^5 \rightarrow \omega = 600\,rd/s \rightarrow f = \frac{\omega}{2\pi} = 95.5\,Hz$$

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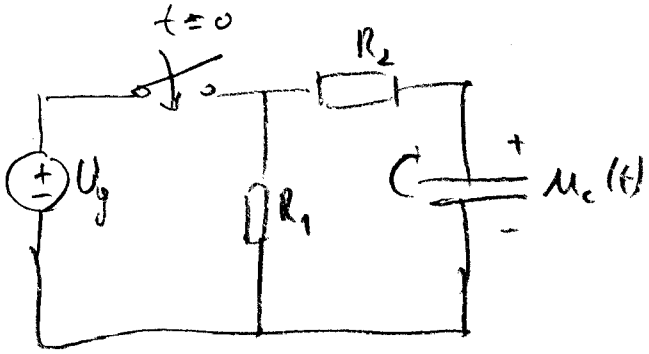
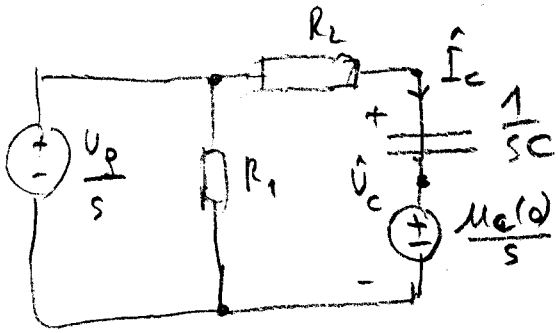


$$i_c = C \cdot \frac{du_c}{dt}$$

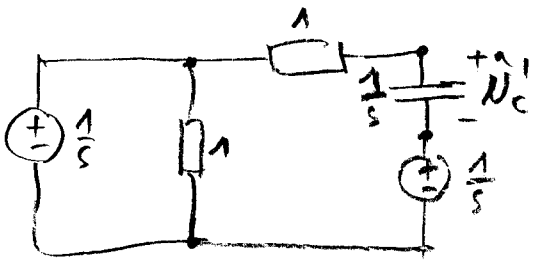
$$\hat{I}_c = C \cdot [s \cdot \hat{U}_c - u_c(0)]$$

$$\hat{I}_c = sC\hat{U}_c - u_c(0) \cdot C$$

$$\frac{\hat{I}_c}{sC} + \frac{u_c(0)}{s} = \hat{U}_c$$



Napetost na $\frac{1}{sC}$ je enaka 0 V, ker je $\frac{u_c(0)}{s} = \frac{U_g}{s}$ (KNZ):



$$\hat{U}_c' = 0\,V = \frac{U_g}{s} - \frac{u_c(0)}{s}$$

$$\hat{U}_c = \hat{U}_c' + \frac{u_c(0)}{s} = \frac{1}{s} = \mathcal{L}[u_c(t)]$$

$$\left.\begin{aligned} u_c(t) &= \underline{\underline{1 \cdot 1(t)}} \\ u_c(0) &= 1\,V \end{aligned}\right\} \; u_c(t) = \underline{\underline{1\,V}}$$