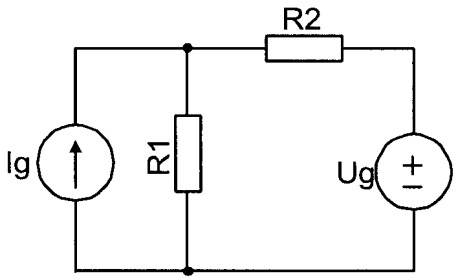
DIGITALNA TEHNIKA

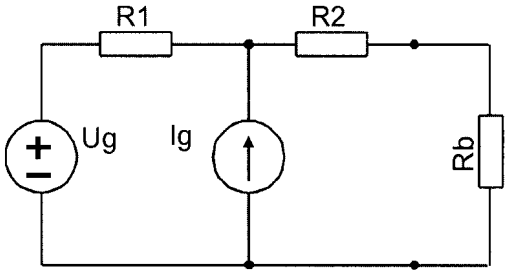
UNI

1.kolokvij 12. 12. 2005

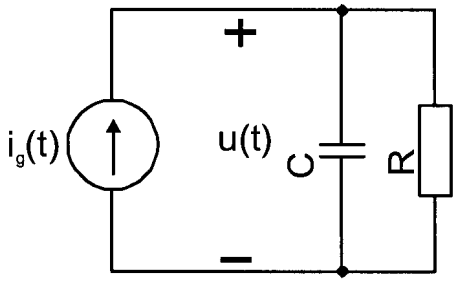
1. Izračunajte napetosti v vozliščih vezja.
   Upoštevajte: $Ug=5V$ $Ig=1A$ $R_1=1\Omega$ $R_2=2\Omega$



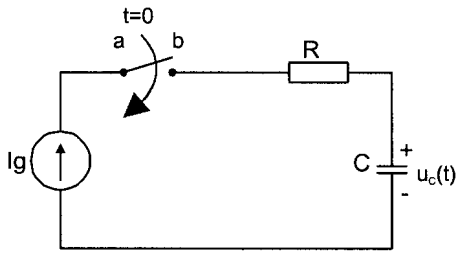
2. Določite velikost bremenskega upora Rb tako, da bo prenesena moč iz vezja na breme Rb maksimalna in izračunajte največjo moč na uporu.
   Ug=4V Ig=1A $R_1=2\Omega$ $R_2=3\Omega$



3. Izračunajte napetost $u(t)$, če vezje napajamo z generatorjem $i_g(t)= 4A\ sin(\omega t+60^o)$.
   Ostali elementi vezja so: $C=1F$ $R=1\Omega$ $\omega=1\ rd/s$



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 $u_C(0^+)=0V$!
   $C=1F$ $R=1\Omega$ $I_g=1A$



Čas pisanja je 60min. Vsaka naloga je vredna 10 točk. Na list z rešitvami se podpišite in napišite še vpisno

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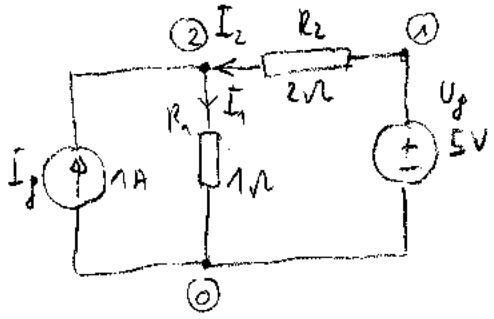


Vezje ima 3 vozlišča, 0 referenčno in

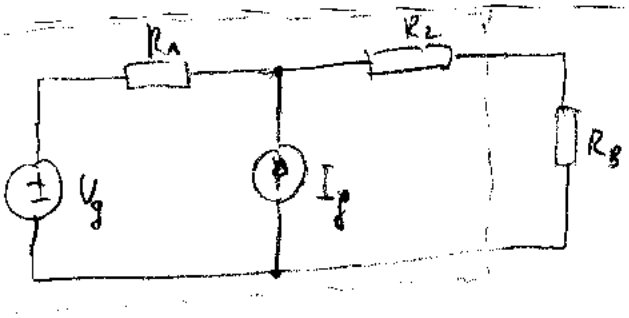
$U_1 = U_g = 5V$

KTT ②: $I_g + I_2 = I_1$

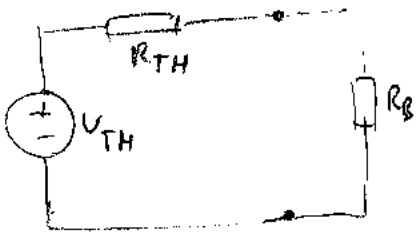
$$I_1 = \frac{U_2}{R_1} \qquad I_2 = \frac{U_1 - U_2}{R_2} = \frac{U_g - U_2}{R_2}$$

$$I_g + \frac{U_g - U_2}{R_2} = \frac{U_2}{R_1} \rightarrow \left[I_g + \frac{U_g}{R_2}\right] = U_2\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$$

$$\frac{1A + \frac{5V}{2\Omega}}{\frac{1}{1\Omega} + \frac{1}{2\Omega}} = U_2 = \underline{2.3V}$$

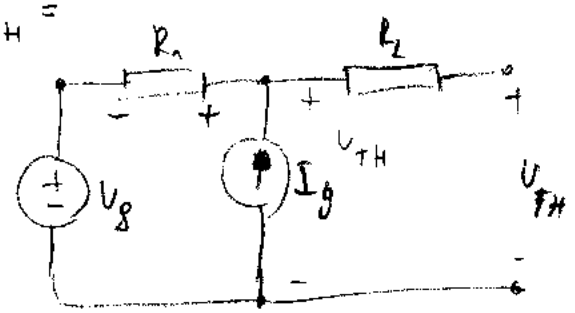


Za vezje poiščemo Theveninov ekvivalent:



$R_{TH} = R_1 + R_2 \rightarrow R_B = R_{TH} = 5\Omega$

$U_{TH} =$



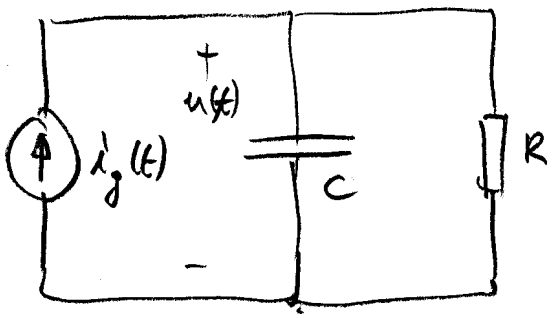
$U_{R_2} = 0$ (odprte sponke)

$U_{TH} = U_g + I_g R_1 =$

$U_{TH} = 4V + 1A \cdot 2\Omega = 6V$

$$P_{BMAX} = \left(\frac{U_{TH}}{2}\right)^2 / R_B = 3^2/5\Omega = \underline{0.5W}$$

Kazalci



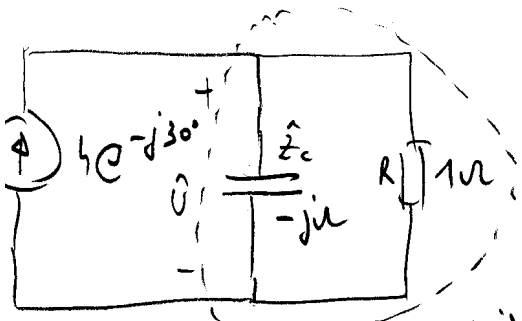
$$i_g(t) = 4\sin(\omega t + 60°)\,A$$

$$i_p(t) = 4\cos(\omega t - 90° + 60°)\,A$$
$$= 4\cos(\omega t - 30°)\,A$$

$$\hat{I}_g = 4e^{-j30°}\,A$$

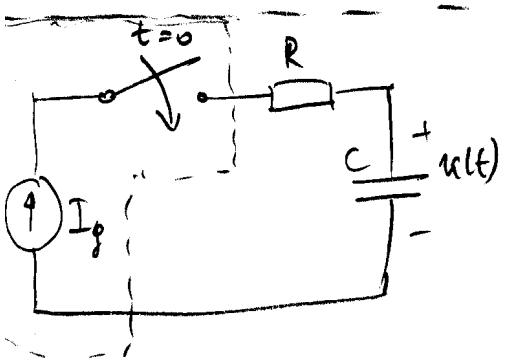
$R \to R = 1\,\Omega$

$$C \to \frac{1}{j\omega C} = \hat{Z}_c = \frac{1}{j\cdot 1\cdot 1} = -j$$



$$\hat{Z} = R_1 \| \hat{Z}_c = \frac{1\Omega\cdot(-j)\Omega}{1\Omega + (-j)\Omega} = \frac{-j}{1-j} = \frac{e^{-j90°}}{\sqrt{2}\cdot e^{-j45°}} = \frac{1}{\sqrt{2}}e^{-j45°}$$

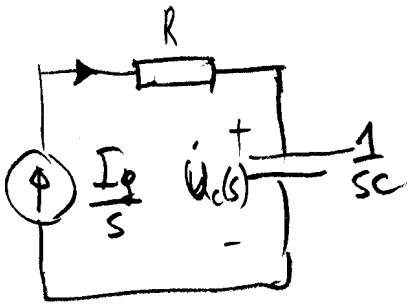
$$\hat{U} = \hat{I}_g\cdot\hat{Z} = 4\cdot e^{-j30°}\cdot\frac{1}{\sqrt{2}}e^{-j45°} = \frac{4}{\sqrt{2}}e^{-j75°} \to u(t) = \frac{4}{\sqrt{2}}\cos(t - 75°)$$



Transform vzbujanja:

$$\mathcal{L}\left[I_g\cdot 1(t)\right] = \frac{I_g}{s}$$

Transform vezja $R \to R$ $Z_c(s) = \frac{1}{sC}$



$$U_c(s) = \frac{1}{sC}\cdot\frac{I_g}{s} = \frac{I_g}{C}\cdot\frac{1}{s^2}$$

$$U_c(s) = \frac{1A}{1F}\cdot\frac{1}{s^2} = \frac{1}{s^2}$$

$$u_c(t) = \mathcal{L}^{-1}\left[U_c(s)\right] = t\cdot 1(t)$$