DIGITALNA TEHNIKA

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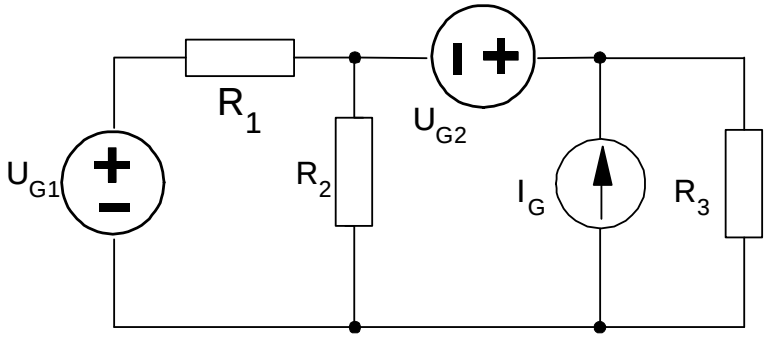
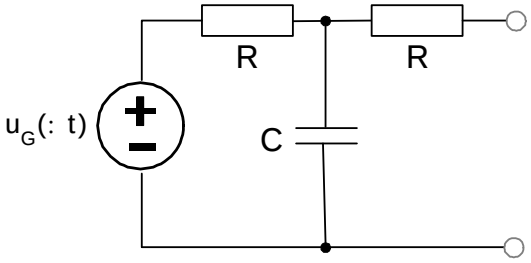
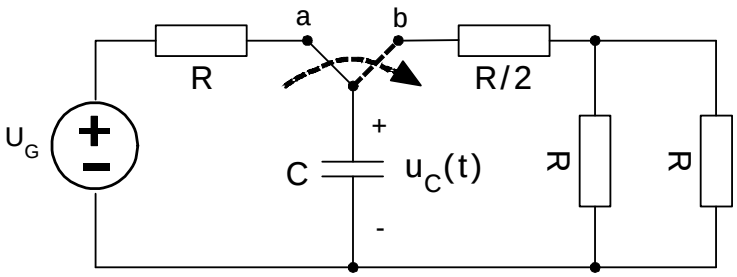
1. Z vozliščno metodo izračunajte napetosti v vseh vozliščih vezja za podane vrednosti elementov.
   $R_1=1k\Omega$ $R_2=2k\Omega$ $R_3=3k\Omega$ $I_G=5mA$ $U_{G1}=4V$ $U_{G2}=5V$



2. Izračunajte parametre Nortonovega nadomestnega vezja za narisani neidealni generator.
   Upoštevajte: $u_G(\omega t) = 5V \sin(1000t+60°)$ $R=1k\Omega$ $C=1\mu F$



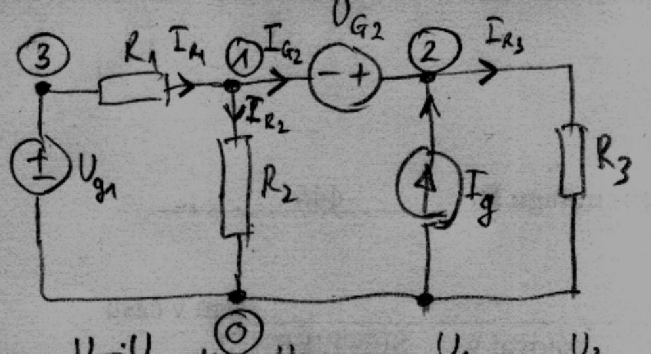
3. Stikalo je bilo dolgo časa pred preklopom v položaju a. Ob času t=0 preklopimo stikalo v položaj b. Določite časovni potek napetosti na kondenzatorju $u_C(t)$ za čas t>0. Ostali podatki elementov v vezju so: $R=10k\Omega$ $C=100\mu F$ $U_G=10V$



4. Z uporabo operacijskih ojačevalnikov realizirajte funkcijo:

$$u_z = 3u_x + 5u_y$$

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 v sistemu e-študent.

① 

$U_3 = U_{g1} = \underline{4V}$

$U_2 - U_1 = U_{G2} = 5V$

KTZ ①: $I_{R_1} = I_{G2} + I_{R_2}$

KTZ ②: $I_{R_3} = I_{G2} + I_G$

$\ominus \rightarrow I_{R_1} - I_{R_3} = I_{R_2} - I_G$

$I_{R_1} = \frac{U_3 - U_1}{R_1} = \frac{U_{g1} - U_1}{R_1}$; $I_{R_2} = \frac{U_1}{R_2}$; $I_{R_3} = \frac{U_2}{R_3}$

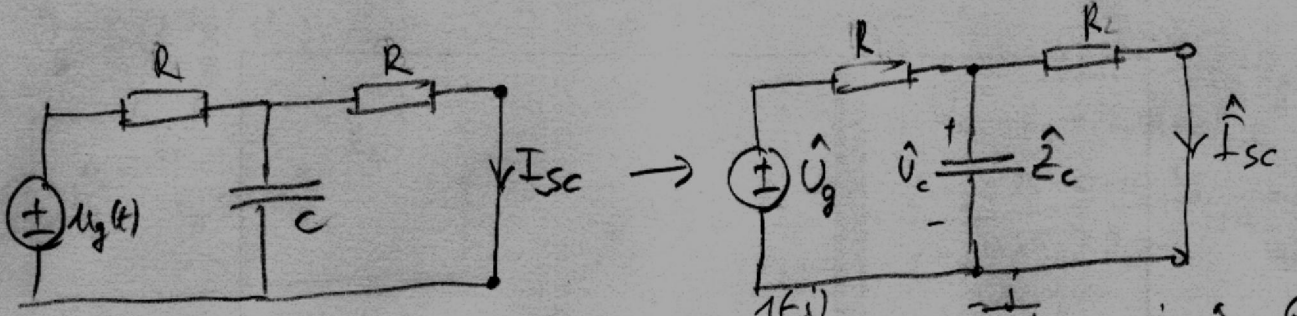
$$\frac{U_{g1}}{R_1} - \frac{U_{g2}}{R_3} + I_G = \left[\frac{1}{R_2} + \frac{1}{R_1} + \frac{1}{R_3}\right] U_1$$

$U_1 = \underline{4V} \rightarrow U_2 = U_{G2} + U_1 = \underline{9V}$

$\frac{U_{g1} - U_1}{R_1} - \frac{U_2}{R_3} = \frac{U_1}{R_2} - I_G$ in $U_2 - U_1 = U_{G2}$

$\frac{U_{g1} - U_1}{R_1} - \frac{U_{G2} + U_1}{R_3} = \frac{U_1}{R_2} - I_G$

② $u_g = 5V \sin(1000t + 60°) = 5V \cos(1000t - 30°) \rightarrow \hat{U}_g = 5e^{-j30°} V$



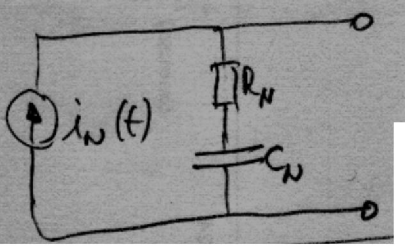
$$\hat{I}_{SC} = \frac{\hat{U}_c}{R} \rightarrow \hat{U}_c = \hat{U}_g \frac{R \| \hat{Z}_c}{R + (R \| \hat{Z}_c)} = \hat{U}_g \frac{\frac{1(-j)}{1-j}}{1 + \frac{-j}{1-j}} = \hat{U}_g \frac{\frac{-j}{1-j}}{\frac{1-j-j}{1-j}} = \frac{-j}{1-2j} \hat{U}_g = \frac{e^{-j90°}}{\sqrt{5}e^{-j63,4°}} 5e^{-}$$

$$\hat{Z}_c = \frac{1}{j\omega C} = \frac{1}{j \cdot 10^3 \cdot 10^{-6}} = -j1k\Omega \rightarrow R \| \hat{Z}_c = \frac{R \cdot \hat{Z}_c}{R + \hat{Z}_c} = \frac{1 \cdot (-j)}{1 + (-j)} k\Omega = \frac{e^{-j90°}}{\sqrt{2}e^{-j45°}} = \frac{1}{\sqrt{2}}$$

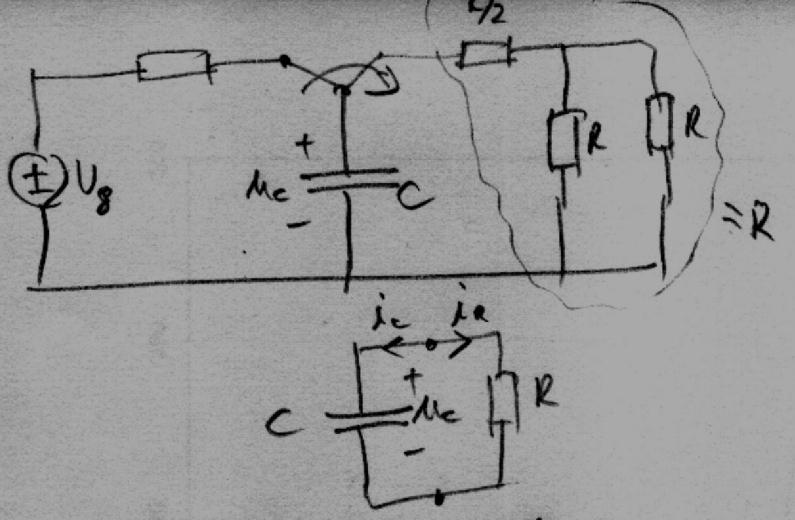
$$\hat{I}_{SC} = \frac{5 \cdot e^{-j120°}}{\sqrt{5}\, e^{-j63,4°}} mA = \sqrt{5}\, e^{-j56,57°} mA \rightarrow i_N(t) = \sqrt{5} \cos(1000t - 56,57°)\, mA$$

$$\hat{Z}_N = R \| \hat{Z}_c + R = \frac{1}{\sqrt{2}} e^{-j45°} k\Omega + 1k\Omega = \frac{(-j) + 1 - j}{1 - j} = \frac{1 - 2j}{1 - j} = (1,5 - j0,5) k\Omega = 1,58 e^{-}$$

$$\hat{Z}_N = \underbrace{1.5k\Omega}_{R_N} - \underbrace{j0.5k\Omega}_{\frac{1}{j\omega C_N}} \rightarrow \frac{1}{\omega C_N} = 0.5$$



(3)



$u_c(0^-) = U_g$

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

$i_R = \frac{u_c}{R}$

$i_c + i_R = 0$

$C \cdot \frac{du_c}{dt} = -\frac{u_c}{R}$

$\frac{du_c}{u_c} = -\frac{1}{RC} dt \;/ \int_0^t$

$\int_{u_c(0^-)}^{u_c(t)} \frac{du_c}{u_c} = -\frac{1}{RC} \int_0^t dt$

$u_c(t) = u_c(0^-) \cdot e^{-\frac{t}{\tau}}; \; t \geq 0$

$\tau = RC$

(4)

$u_z = -(-3u_x - 5u_y) = -(-(3u_x + 5u_y))$

