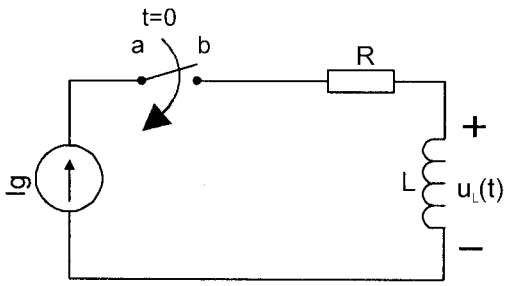
DIGITALNA TEHNIKA

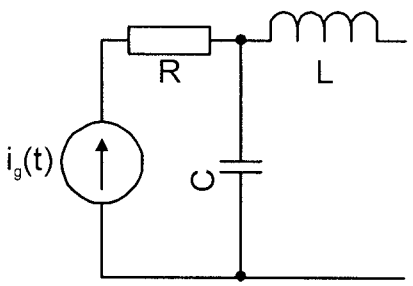
1.kolokvij

20. 4. 2009

1. V trenutku $t=0$ sklenemo stikalo. Določite potek napetosti na induktivnosti L $u_L(t)$ z uporabo Laplaceove transformacije. Začetni tok $i(t)$ skozi induktivnost je $i(0^+)=0A$!
Upoštevajte: $L=1mH$ $R=1k\Omega$ $I_g=5mA$



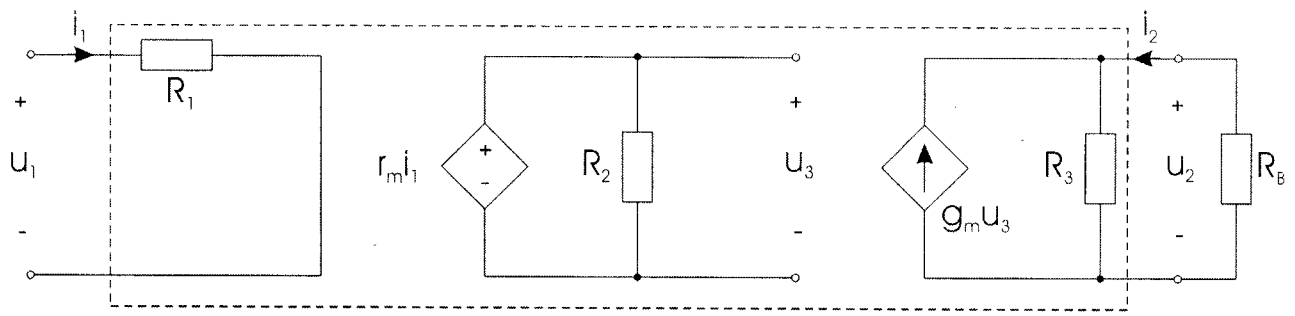
2. Izračunajte parametre Nortonovega nadomestnega vezja za narisani neidealni generator.
Upoštevajte: $I_g=5mA\ cos(2000t-30°)$ $R=100\Omega$ $L=20mH$ $C=10\mu F$



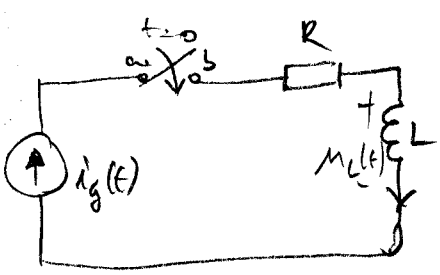
3. Z uporabo operacijskih ojačevalnikov realizirajte funkcijo:

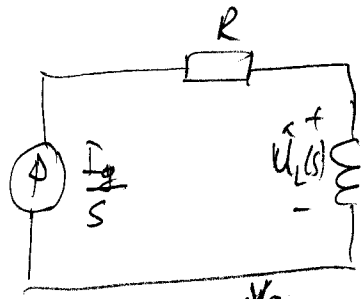
$$u_z = 5u_x - 5\,u_y - 5V$$

4. Izračunajte prevodnostne parametre (g-parametre) in napetostno ojačenje A_u dvostopenjskega vezja na spodnji sliki. Upoštevajte:
$R_1=2k\Omega$ $R_2=1k\Omega$ $R_3=3k\Omega$ $r_m=3k\Omega$ $g_m=4ms$ $R_B=1k\Omega$



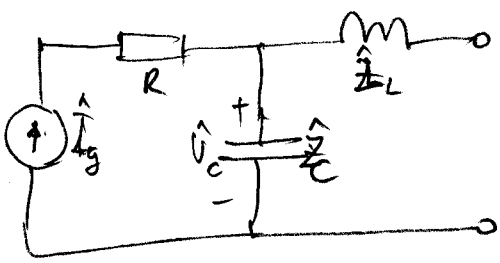
Čas pisanja je 60min. Vsaka naloga je vredna 10 točk. Na list z rešitvami se podpišite in napišite še vpisno številko ter kateri predmet pišete. Rezultati bodo objavljeni na https://estudent.fri.uni-lj.si

① 

→ 

$$\hat{U}_L(s) = \frac{I_g}{s}\cdot\hat{Z}_L(s) = \frac{I_g}{s}\cdot sL = I_g\cdot L = 5mA\cdot 1m\frac{Vs}{A} = 5\mu Vs \rightarrow u_L(t) = 5\mu V\cdot\sigma(t)$$

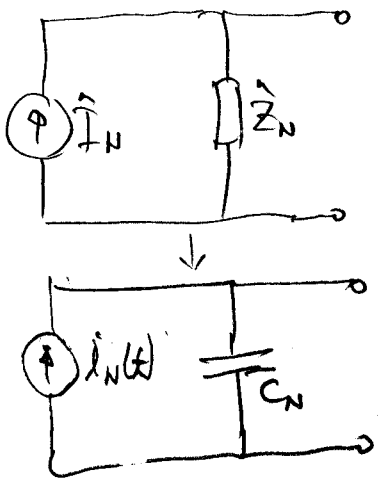
---

② 

$$\hat{I}_g = 5mA\,e^{-j30°}$$

$$\hat{Z}_C = \frac{1}{j\omega C} = \frac{1}{j2000\cdot 10\cdot 10^{-6}} = -j50\,\Omega$$

$$\hat{Z}_L = j\omega L = j2000\cdot 20\cdot 10^{-3} = j40\,\Omega$$



$$\hat{Z}_{TH} = \hat{Z}_N = \hat{Z}_L + \hat{Z}_C = j40 - j50 = -j10\,\Omega \Rightarrow \frac{1}{j\omega C} \Rightarrow \underline{C_N = 50\mu F}$$

$$\hat{U}_{TH} = \hat{U}_C = \hat{I}_g\cdot\hat{Z}_C = 5mA\cdot e^{-j30°}\cdot 50\cdot e^{-j90°} = 250mV\,e^{-j120°}$$

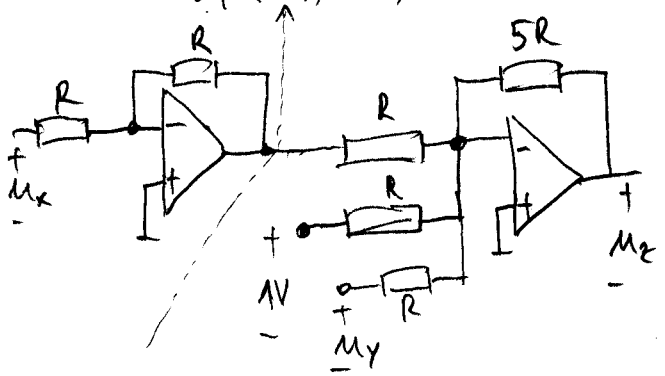
$$\hat{I}_N = \frac{\hat{U}_{TH}}{\hat{Z}_N} = \frac{250mV\,e^{-j120°}}{10\,e^{-j90°}} = 25mA\,e^{-j30°}$$

$$\underline{i_N(t) = 25mA\cos(2000t - 30°)}$$

---

③ $u_2 = -(-5u_x) - 5u_y - 5V$

$= 5(-(-u_x) - u_y - 1V)$



---

④ $i_1 = g_{11}u_1 + g_{12}u_2$

$i_2 = g_{21}u_1 + g_{22}u_2$

$\underline{g_{11} = \frac{1}{R_1} = 0{,}5mS}$; $\underline{g_{12} = 0mS}$

$g_m u_3 + i_2 = \frac{u_2}{R_3}$; $u_3 = r_m\cdot i_1 = r_m\cdot\frac{u_1}{R_1}$

$g_m\cdot r_m\cdot\frac{u_1}{R_1} + i_2 = \frac{u_2}{R_3} \rightarrow i_2 = -\frac{g_m\cdot r_m}{R_1}\cdot u_1 + \frac{1}{R_3}u_2$

$g_{21} = -\frac{g_m r_m}{R_1}$ $\underline{g_{22} = \frac{1}{R_3} = 0{,}33mS}$

$g_{21} = -\frac{4mS\cdot 3k\Omega}{2k\Omega}$

$\underline{g_{21} = -6mS}$

$$A_u = -\frac{g_{21}}{g_{22} + G_B} = -\frac{-6mS}{0{,}33mS + 1mS}$$

$$\boxed{A_u = 4{,}5}$$