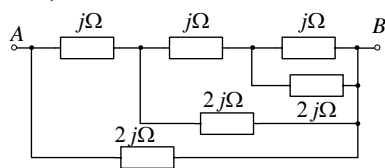


Osnovi elektronike - Odsek za SI

Prvi kolokvijum 04.11.2007. - rešenja

1. a) Na osnovu modifikovane šeme vidi se da je ekvivalentna impedansa jednaka



$$Z_{AB} = [(((1 \parallel 2) + 1) \parallel 2) + 1] \parallel 2] j\Omega = 0.977 j\Omega$$

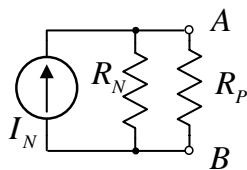
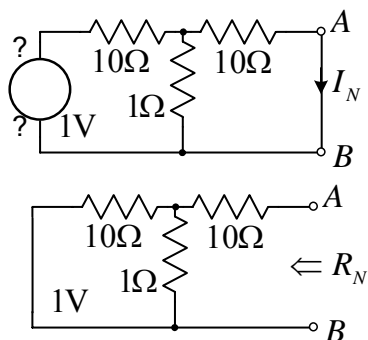
b) Dovoljan je jedan kalem

$$Z_{AB} = 0.977 j\Omega = j\omega L \Rightarrow L = \frac{0.977}{2\pi \cdot 10^3} = 155 \mu\text{H}$$

2.

$$A = \Delta q \cdot \int_{P_1}^{P_2} \vec{E} \cdot \vec{dl} = \Delta q \cdot E \cdot r = -10^{-9} \cdot 1 \cdot 10^{-3} = -10^{-12} \text{ J}$$

3.



$$I_N = \frac{1\text{V}}{10\Omega + 1\Omega \parallel 10\Omega} \cdot \frac{1\Omega}{1\Omega + 10\Omega} = \frac{1\text{V}}{120\Omega} = 8.33\text{mA}$$

$$R_N = 10\Omega + 1\Omega \parallel 10\Omega = 10.9\Omega$$

$$V_P = I_N (R_N \parallel R_P) = I_N \frac{R_N R_P}{R_N + R_P} = 8.33\text{mA} \cdot \frac{100 \cdot 10.9}{110.9} = 82\text{mV}$$

$$P = \frac{V_P^2}{R_P} = 67 \mu\text{W}$$

4. Na osnovu metode potencijala čvorova za čvorove označene kao na slici dobija se da važi:

$$\frac{V_1}{1000} + 0.04 + \frac{V_1 - V_2}{1000} = 0$$

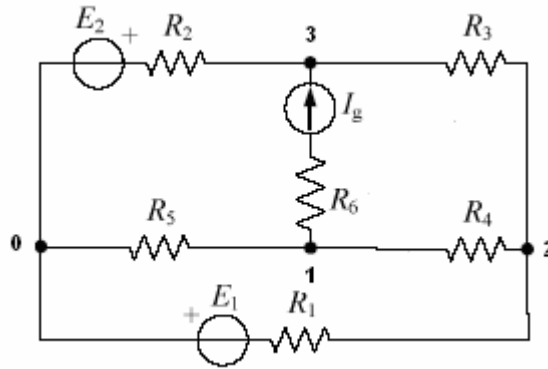
$$\frac{V_2 - V_1}{1000} + \frac{V_2 + 10}{500} + \frac{V_2 - V_3}{500} = 0$$

$$\frac{V_3 - 10}{500} - 0.04 + \frac{V_3 - V_2}{500} = 0, \text{ odakle se dobija}$$

$$V_1 = -\frac{150}{7}V,$$

$$V_2 = -\frac{20}{7}V,$$

$$V_3 = \frac{95}{7}V$$



$$R_1 = R_2 = R_3 = 500\Omega, R_6 = 2k\Omega, E_1 = E_2 = 10V, I_g = 40mA, R_4 = R_5 = 1k\Omega.$$

$$V_{R1} = V_2 + 10 = \frac{50}{7}V, P_{R1} = \frac{5}{49}W \approx 0.1W$$

$$V_{R2} = V_3 - 10 = \frac{25}{7}V, P_{R2} = \frac{5}{196}W \approx 0.026W$$

$$V_{R3} = V_3 - V_2 = \frac{115}{7}V, P_{R3} = 0.54W$$

$$V_{R4} = V_2 - V_1 = \frac{130}{7}V, P_{R4} = 0.34W$$

$$V_{I_g} = V_3 + R_6 I_g - V_1 = 115V, P_{I_g} = 4.6W$$

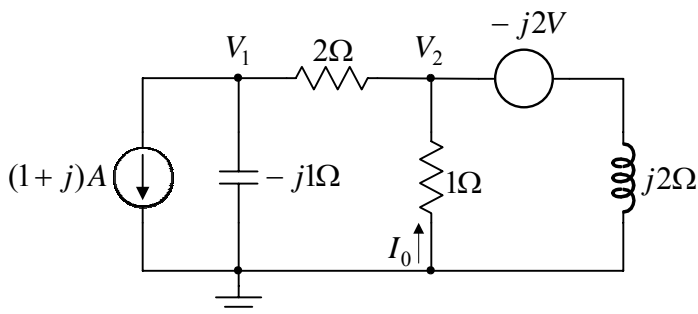
5. $v(t) = 2\sqrt{2}V \cdot \sin(2\pi ft) = 2\sqrt{2}V \cdot \cos(2\pi ft - 90^\circ) \Rightarrow \underline{V} = 2 \cdot e^{-j90^\circ} V = -j2V$

$$i(t) = 2A \cdot \cos(2\pi ft + 45^\circ) \Rightarrow \underline{I} = \sqrt{2} \cdot e^{j45^\circ} A = (1 + j)A$$

$$\underline{Z}_L = j2\pi fL = j2\Omega$$

$$\underline{Z}_C = -\frac{j}{2\pi fC} = -j1\Omega$$

Ukoliko se čvorovi u kolu označe na način kao što je to prikazano na slici:



sistem jednačina po metodi potencijala čvorova ima sledeći izgled:

$$\left(\frac{1}{-j} + \frac{1}{2}\right) \cdot \underline{V}_1 - \frac{1}{2} \cdot \underline{V}_2 = -1 - j$$

$$-\frac{1}{2} \cdot \underline{V}_1 + \left(\frac{1}{2} + \frac{1}{1} + \frac{1}{2j}\right) \cdot \underline{V}_2 = -\frac{-2j}{2j}$$

Rešenje ovog sistema je: $\underline{V}_1 = \left(-\frac{44}{41} + j\frac{14}{41}\right)V$ i $\underline{V}_2 = \left(\frac{10}{41} + j\frac{8}{41}\right)V$.

Dalje sledi: $\underline{I}_0 = -\frac{\underline{V}_2}{1\Omega} = \left(-\frac{10}{41} - j\frac{8}{41}\right)A = 0,312 \cdot e^{j218,66^\circ} A$,

ili u vremenskom domenu: $i_0(t) = 0,44A \cdot \cos(2\pi ft + 218,66^\circ)$.