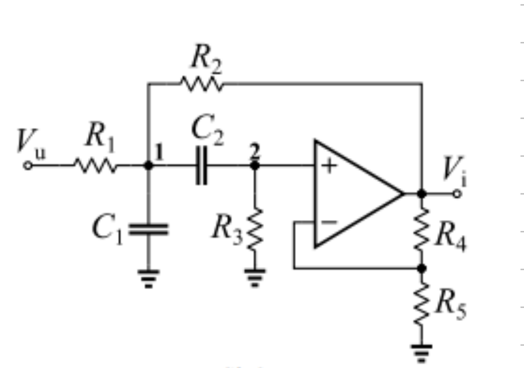
Септембар 2022, 3. задатак



Sl. 3

$$H(s) = K \frac{s \cdot \frac{RC}{2}}{s^2 \frac{R^2C^2}{2} + s(4-K)\cdot\frac{RC}{2} + 1}$$

$$K = 1 + \frac{R_4}{R_5}$$

б) $f_0 = ?$

општи израз за пропусник опсега учестаности

$$H(S) = \frac{A_0 \cdot \frac{S}{Q\cdot\omega_0}}{\frac{S^2}{\omega_0^2} + \frac{S}{Q\cdot\omega_0} + 1} \Rightarrow \boxed{\frac{1}{\omega_0^2} = \frac{R^2C^2}{2}} \Rightarrow \boxed{f_0 = \frac{1}{2\pi}\cdot\frac{\sqrt{2}}{RC}}$$

$$\omega_0^2 = \frac{2}{R^2C^2} \Rightarrow \omega_0 = \frac{\sqrt{2}}{RC}$$

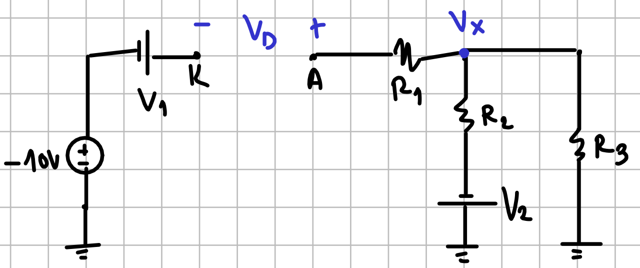
в) $H(j\omega_0) = 3$

$$H(j\omega_0) = K\frac{j\omega_0\cdot\frac{RC}{2}}{-\omega_0^2\cdot\frac{R^2C^2}{2} + j\omega_0(4-K)\cdot\frac{RC}{2} + 1} = K\frac{j\frac{\sqrt{2}}{\cancel{RC}}\cdot\frac{\cancel{RC}}{2}}{\cancel{-1} + j\frac{\sqrt{2}}{\cancel{RC}}(4-K)\cdot\frac{\cancel{RC}}{2}\cancel{+1}} = \frac{K\cdot\cancel{j}\frac{\cancel{\sqrt{2}}}{\cancel{2}}}{\frac{\cancel{j}\cancel{\sqrt{2}}(4-K)}{\cancel{2}}} = \frac{K}{4-K} = 3$$

$$K = 3(4-K) = 12 - 3K \Rightarrow 4K = 12 \Rightarrow K = 3 \Rightarrow 1 + \frac{R_4}{R_5} = 3 \Rightarrow \boxed{\frac{R_4}{R_5} = 2}$$

Септембар 2022. 1. задатак

Претпоставка: D – OFF за $V_u = -10V$



$$V_D = V_A - V_K$$

$$V_A = V_x = \frac{-R_3}{R_2 + R_3} \cdot V_2 = -1.5V$$

$$V_K = V_u + V_1 = -10V + 2V = -8V$$

$$V_D = -1.5V - (-8V) = 6.5V > 0.7V = V_{D0}$$

Погрешна претпоставка, ако диода не води, онда мора да важи:

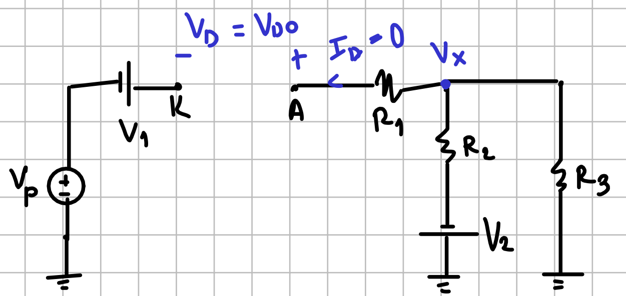
$$V_D < V_{D0}$$

Пошто имамо само једну диоду, имамо само две могућности: диода или води или не, тако да у овом случају диода сигурно води.

Налажење граничног напона V_p:

За $V_u = V_p$ важи:

$V_D = 0.7V$ $I_D = 0A$



$$V_A - V_K = V_{D0}$$

$$V_A = V_x = -1.5V$$

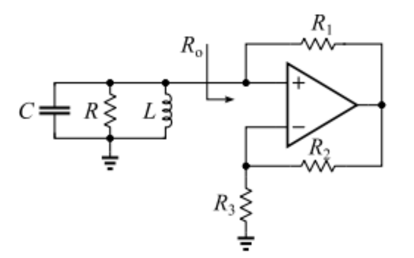
$$V_K = V_p + V_1 = V_A + V_{D0}$$

$$V_p = V_A + V_{D0} - V_1 = -1.5V + 0.7V - 2V = -2.8V$$

$-10V \leq V_u \leq V_p \rightarrow$ диода води

$V_p \leq V_u \leq 10V \rightarrow$ диода не води

Задатак 4. Јун 2- 2022.



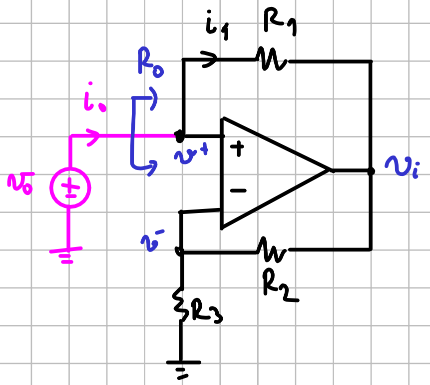
Sl. 4

а) одредити R_0

б) фреквенцију осциловања f_0

в) вредност R_1 тако да буде испуњен услов осциловања

а)



$$R_0 = \frac{v_0}{i_0} \qquad v^+ = v_0$$

$$v^+ = v^- = \frac{R_3}{R_2 + R_3} \cdot v_i \Rightarrow v_i = \frac{R_2 + R_3}{R_3} \cdot v^+ = \frac{R_2 + R_3}{R_3} v_0$$

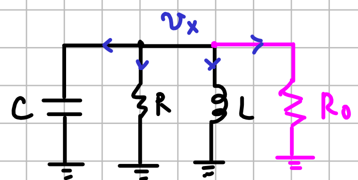
$$i_1 = i_0$$

$$i_1 = \frac{v^+ - v_i}{R_1}$$

$$\Rightarrow i_0 = \frac{v_0 - \frac{R_2 + R_3}{R_2} \cdot v_0}{R_1} = \frac{\left(1 - \frac{R_2 + R_3}{R_2}\right)}{R_1} \cdot v_0$$

$$i_0 = \frac{-\frac{R_3}{R_2}}{R_1} \cdot v_0 = -\frac{R_3}{R_1 \cdot R_2} v_0 \Rightarrow \boxed{R_0 = \frac{v_0}{i_0} = -\frac{R_1 \cdot R_2}{R_3}}$$

б)



$$X: \; sC \cdot v_x + \frac{v_x}{R} + \frac{v_x}{sL} + \frac{v_x}{R_0} = 0$$

$$\left(sC + \frac{1}{R} + \frac{1}{sL} + \frac{1}{R_0}\right) \cdot v_x = 0$$

$$\Rightarrow \Delta(s) = sC + \frac{1}{R} + \frac{1}{sL} + \frac{1}{R_0}$$

$$s \rightarrow j\omega_0$$

$$\Delta(j\omega_0) = j\omega_0 C + \frac{1}{R} + \frac{1}{j\omega_0 L} + \frac{1}{R_0} = \frac{1}{R} + \frac{1}{R_0} + j\left(\omega_0 C - \frac{1}{\omega_0 L}\right)$$

$$\frac{1}{j\omega_0 L} \rightarrow -j\frac{1}{\omega_0 L}$$

$$Im\{\Delta(j\omega)\} = \omega_0 C - \frac{1}{\omega_0 L} = 0 \quad / \cdot \omega_0 L$$

$$\omega_0^2 LC - 1 = 0$$

$$\omega_0^2 = \frac{1}{LC} \Rightarrow \omega_0 = \frac{1}{\sqrt{LC}} \Rightarrow \boxed{f_0 = \frac{1}{2\pi\sqrt{LC}}}$$

δ) $Re\left\{\Delta(j\omega_0)\right\} = \frac{1}{R} + \frac{1}{R_0} = 0 \Rightarrow R = -R_0 = \frac{R_1 \cdot R_2}{R_3}$

$$\boxed{R_1 = \frac{R \cdot R_3}{R_2}}$$