

1)

$$U_{ui} = 2V$$

$$f_{ui} = 200 \text{ kHz}$$

$$R_{on} = 150 \Omega$$

$$C_D = 10 \text{ pF}$$

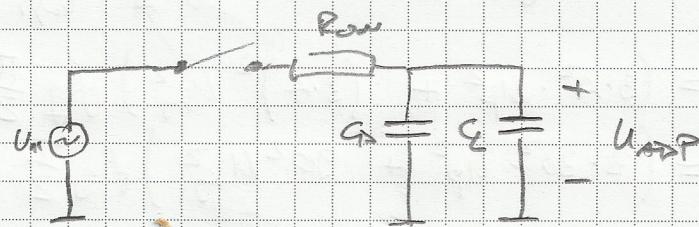
$$C_L = 15 \text{ pF}$$

$$t_{sett} = 50 \mu\text{s}$$

$$t_{akv} = 1 \mu\text{s}$$

$$C = C_D + C_L$$

a) $\gamma = ?$



$$U_{ADP} = U_{ui} \cdot \frac{\frac{1}{j\omega C}}{R_{on} + \frac{1}{j\omega C}} = \frac{1}{j\omega C R_{on} + 1}$$

$$\gamma = -\arctg \omega C R_{on} = \left| \arctg \omega = 2\pi f_{ui} \right| = -0,27^\circ$$

b) $U_{ui} \cdot e^{-\frac{t}{R_{on} C}} = LSTB$

$$2 \cdot e^{-\frac{t}{R_{on} C}} = \frac{10}{210} \quad | \ln$$

$$-\frac{t}{R_{on} C} = \ln \frac{10}{210} \rightarrow t = 35,55 \mu\text{s}$$

c) $t_{sett} + t_{akv} + t_{ADP} < \frac{1}{2f_{ui}}$

$$[2f_{ui} = f_S]$$

$$t_{ADP} < 1 \mu\text{s}$$

d) 2 kann da

$$t_{sett} + t_{akv} + t_{ADP} + t_{sett} + t_{akv} + t_{ADP} < \frac{1}{f_S}$$

$$[f_S = 200 \text{ kHz}]$$

$$U_g = 1 \text{ mV} \quad R_g = 1 \text{ k}\Omega$$

$$f_g = 30 \text{ kHz}$$

$$M_p^2 = 4 \cdot 10^{-16} \text{ V}^2/\text{Hz}$$

$$a) SNR_A, SNR_B = ?$$

Pojacalo A: ($A=30$)

$$U_{g,et}^2 = 4kT R_g = 1,64 \text{ n} \cdot 10^{-17}$$

stav je jedan ulazni signal
koji se pojmove go

$$\begin{aligned} U_{m,1/2}^2 &= (3 \cdot A^2 \cdot M_p^2 + (3 \cdot A)^2 U_{g,et}^2) f_g \frac{\pi}{2} \\ &= (3 \cdot 30^2 \cdot M_p^2 + 90^2 U_{g,et}^2) f_g \frac{\pi}{2} \end{aligned}$$

$$U_{m,1/2}^2 = 5,717 \cdot 10^{-8} \text{ V}^2$$

$$U_{m,SR} = 2,4 \cdot 10^{-4} \text{ Vef}$$

$$SNR_A = 20 \log \frac{U_{g,et}}{U_{m,SR}} = 20 \log \frac{1 \text{ mV} \cdot \frac{1}{\sqrt{2}}}{2,4 \cdot 10^{-4} \text{ V}} = 9,385 \text{ dB}$$

b) Pojacalo B: ($A=20$)

$$\begin{aligned} U_{m,1/2}^2 &= A^2 (M_p^2 + M_p^2) f_g \frac{\pi}{2} \\ &= 1,59 \cdot 10^{-7} \text{ V}^2 \end{aligned}$$

$$U_{m,SR} = 4 \cdot 10^{-4} \text{ Vef}$$

$$SNR_B = 20 \log \frac{1 \text{ mV} \cdot \frac{1}{\sqrt{2}}}{4 \cdot 10^{-4} \text{ V}} = 9,93 \text{ dB}$$

$$c) F_A = ? , F_B = ?$$

$$F = 1 + \frac{M_p^2}{6kTB_g}$$

$$F_A = 1 + \frac{3 U_p^2}{6kTB_g} = 74$$

$$F_B = 1 + \frac{M_p^2}{6kTB_g} = 25,33$$

d) Iz faktora sume se vidi da pojачalo B manje narušava snr izvora (zato što pojачalo B ima samo jedan izvor sume pojачala, dok pojачalo A ima 3 izvora sume pojачala)

3.

$$U_{FS} = \pm 10V$$

$$U_{ref} = 5V \pm 0,005\% \cdot 5V$$

$$\text{LOAD REG} = 50 \mu V/\text{mA}$$

$$\text{LINE REG} = 300 \mu V/V$$

$$\Delta U_{LOAD} = 500 \mu V$$

$$\underline{\Delta I_{LOAD} = 4 \text{ mA}}$$

$$n = 3$$

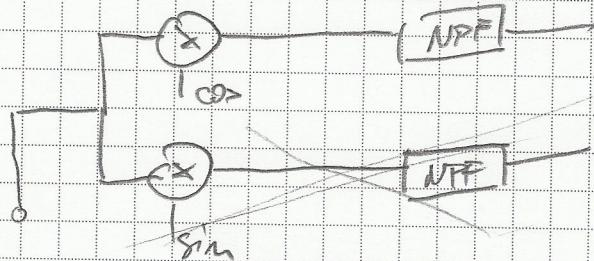
$$\Delta U = \frac{5V \cdot 0,005}{100} + 300 \frac{\mu V}{V} \cdot 500 \mu V + 50 \mu V/\text{mA} \cdot 4 \text{ mA} = 0,16 \mu V$$

$$\Delta U > \frac{15V}{2} = \frac{20V}{2,2m}$$

$$2^m > \frac{10V}{0,16 \mu V}$$

$$\boxed{n = 15 \text{ bita}}$$

4.



Komponente su u fazi s ref. izvorom pa se dojavljuje skremnjava.

MIKSER: 10 kHz

$$\text{kompl 1: } \underbrace{0,5V \text{ i } 0,6\text{Hz}}_{A_{21}} \text{ te } \underbrace{0,5V \text{ i } 2,26\text{Hz}}_{A_{31}}$$

$$\text{kompl 2: } \underbrace{0,5V \text{ i } 0,56\text{Hz}}_{A_{22}} \text{ te } \underbrace{0,5V \text{ i } 10,56\text{Hz}}_{A_{32}}$$

$$\text{kompl 3: } \underbrace{0,5V \text{ i } 1\text{kHz}}_{A_{12}} \text{ te } \underbrace{0,5V \text{ i } 9,1\text{kHz}}_{A_{11}}$$

$$\text{OVO DOLAZI NA NPF S H} = \frac{1}{\sqrt{1 + \left(\frac{f}{10\text{Hz}}\right)^2}}$$

- a) Načinu veličinostima komponenta 2 je komponenta 1 je čisti DC i u komponenti 3 je prijedstavljen od komponente 2

b) veličinosti:

$$r = A \cdot H(0,5\text{kHz}) = \frac{0,5}{\sqrt{1 + \frac{(0,5\text{kHz})^2}{(10\text{Hz})^2}}} = 1\text{mV}$$

c) THD = ?

$$\text{THD} = \frac{\sqrt{A_{21}^2 + A_{22}^2 + A_{32}^2 + A_{23}^2 + A_{12}^2}}{A_{11}} = \frac{1,1953 \cdot 10^{-3}}{0,5} = 2,19 \cdot 10^{-3}$$

$$A_{21} = 0,5V \cdot \frac{1}{\sqrt{1 + \frac{(0,5\text{kHz})^2}{(10\text{Hz})^2}}} = 1\text{mV}$$

$$A_{22} = 0,5V \cdot \frac{1}{\sqrt{1 + \frac{(2,26\text{Hz})^2}{(10\text{Hz})^2}}} = 0,2649\text{mV}$$

$$A_{32} = 0,5\text{mV}$$

$$A_{23} = 0,2381\text{mV}$$

$$A_{12} = 0,125\text{mV}$$