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Grupa 2133

Proiect SCIA

1. Tematica proiectului

Specificatii generale:

ETAJ 1:
Sursa semnal:4(current diferential)
Amplitudine minima(pt castig maxim PGA):2.00e-05
Amplitudine maxima(pt castig minim PGA):5.02e-05
Unitate masura(A diferential)
Tip etaj1:6(AI cu 2AO;Inversor,intrare I)
|Castig| etaj 1(liniar):10K

ETAJ 2:
Tip etaj 2:9(Trece banda;1 AO V-V, Delyiannis)
|H0|castig liniar in banda de trecere:1
Rintrare minim:2kΩ
Banda:5khz
Q=1.41

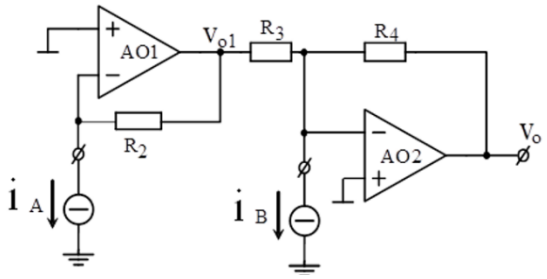
ETAJ 3:
Tip etaj 3:5(RF serie)
Castig minim[dB]:2
Rezolutie(pas minim[dB]):2
Nr. pasi:5
Castig maxim[dB]:20
Rintrare minim:-

ETAJ 4:
Tip etaj:6(redresor dubla alternanta FWR v6)
Castig(liniar):2

TIP AO:4(LT6234;+/-5V)

2. Dimensionarea etajului 1 / 2 / 3 / 4

ETAJUL 1:



$$I_2 = I_A$$

$$I_2 = \frac{V_{O1} - 0}{R_2}$$

$$I_3 = \frac{V_{O1} - 0}{R_3}$$

⇨ Daca $R_3 = R_2, I_2 = I_3 = I_A$

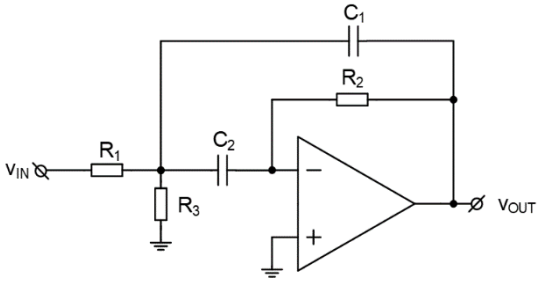
$I_3 + I_4 = I_B$ =>
$I_4 = I_B - I_3$,$I_3 = I_A$ => $V_{OUT} = R_4 * (I_B - I_A)$

$A_V = \frac{V_{OUT}}{V_{IN}}$=$R_4$ (castigul) =>$R_4 = 10k\Omega$
Aleg R_2=R_3=10kΩ
Aleg $I_A = 0.5A$
I_B=-0.5A

Amplitudine maxima(pt castig PGA maxim):5,02*e-05(A diferential)
Amplitudine minima(pt castig PGA minim):2*e-05(A diferential)

⇨ Offset=(5,02*e-05+2*e-05)/2=3.51*e-05=35.1uA
⇨ Amplitudinea(Av)=5,02*3e-05-3,51*e-05=15.1uA

ETAJUL 2:



Parametrii functiei de transfer:

$$H_0 = \frac{R_2}{R_1} \cdot \frac{C_2}{C_1 + C_2};$$

$$\omega_0 = \sqrt{\frac{R_1 + R_3}{R_1 R_2 R_3 C_1 C_2}};$$

$$Q = \sqrt{R_2 \frac{R_1 + R_3}{R_1 R_3}} \cdot \frac{\sqrt{C_1 C_2}}{C_1 + C_2}.$$

Aleg:

$$R = R_1 \parallel R_3;$$

$$R_2 = r \cdot R;$$

$$C_1 = C;$$

$$C_2 = \frac{C}{k};$$

$$H_0 = \frac{r \cdot R}{R_1} \cdot \frac{1}{k+1}; \omega_0 = \frac{1}{R \cdot C} \cdot \sqrt{\frac{k}{r}}; Q = \frac{\sqrt{r} \cdot \sqrt{k}}{k+1}.$$

$$a = Q \cdot \omega_0 \cdot R \cdot C;$$

$$k = \frac{a}{1-a}; r = \frac{k}{\omega_0^2 \cdot R^2 \cdot C^2}; R_1 = \frac{r \cdot R}{H_0} \cdot \frac{1}{k+1}; R_2 = r \cdot R; R_3 = \frac{R_1 \cdot R}{R_1 - R}$$

$|H_0| = 1$(castig liniar in banda de trecere)
$R_{in_{minim}} = 2k,$
$B_{-3dB} = 5khz$
Q=1.41

Fie k=0.16 si r=16
R=20kΩ
$R_2 = r * R = 16 * 20 = 320k\Omega$

$f_0 = 5khz$

$$2 * \pi * 5 * 10^3 = \frac{1}{RC} * \sqrt{\frac{k}{r}} => \pi * 10^4 = \frac{1}{20k * C} * \sqrt{\frac{0.16}{16}} = \frac{0.1}{20k * C} =>$$

$$C = \frac{1}{20k * \pi * 10^4 * 10} = 10^{-9} * \frac{1}{2 * \pi} \cong 0.16nF$$

$C_1 = C = 0.16nF$

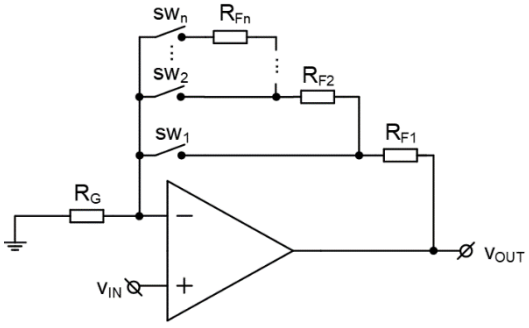
$$C_2 = \frac{C}{k} = \frac{0.16nF}{0.16} = 1nF$$

$$H_0 = \frac{R_2}{R_1} * \frac{1}{1+k}$$

$R_1 = \frac{R_2}{k+1} = \frac{320k}{1.16}$=275.86kΩ

$$R_3 = \frac{R_1 * R}{R_1 - R} = \frac{275.86k * 20k}{255.86k} = 21.56k\Omega$$

ETAJUL 3:



$A_{dB} = \{12dB; 14dB; 16dB; 18dB; 18dB; 20dB\}$,
$A_V = 10^{\frac{A_{dB}}{20}} => |A_V| = \{4\frac{V}{V}; 5\frac{V}{V}; 6.3\frac{V}{V}; 8\frac{V}{V}; 10\frac{V}{V}\}$

AO neinversor=>A_V=(1+$\frac{R_{ech}}{R_G}$)

Sw1=on(castig minim): $A_V = 4$

$R_{ech} = R_{F1}$, A_V=(1+$\frac{R_{ech}}{R_G}$)=>$R_{F1} = (A_V - 1)R_G$
Aleg $R_G = 100\Omega$

$R_{F1} = (4-1) * R_G = 3 * 100\Omega = 300\Omega$

Sw2=on: $A_V = 5$

$R_{ech} = R_{F1} + R_{F2}$

$R_{F1} + R_{F2} = (5-1)R_G = 4R_G$

$R_{F2} = 4R_G - R_{F1} =$

$= 400 - 300 =$

$= 100\Omega$

Sw3=on: $A_V = 6.3$

$R_{ech} = R_{F1} + R_{F2} + R_{F3}$

$R_{F1} + R_{F2} + R_{F3}$=$5.3R_G$

R_{F3}=$5R_G - R_{F2} - R_{F1}$=

=530-100-300=

=130Ω

Sw4=on: $A_V = 8$

$R_{ech} = R_{F1} + R_{F2} + R_{F3} + R_{F4}$

$R_{F1} + R_{F2} + R_{F3} + R_{F4} = 7R_G$

$R_{F4} = 8R_G - R_{F1} - R_{F2} - R_{F3} - R_{F4}$=

=700-300-100-130=

=170Ω

Sw5=on: $A_V = 10$

$R_{ech} = R_{F1} + R_{F2} + R_{F3} + R_{F4} + R_{F5}$

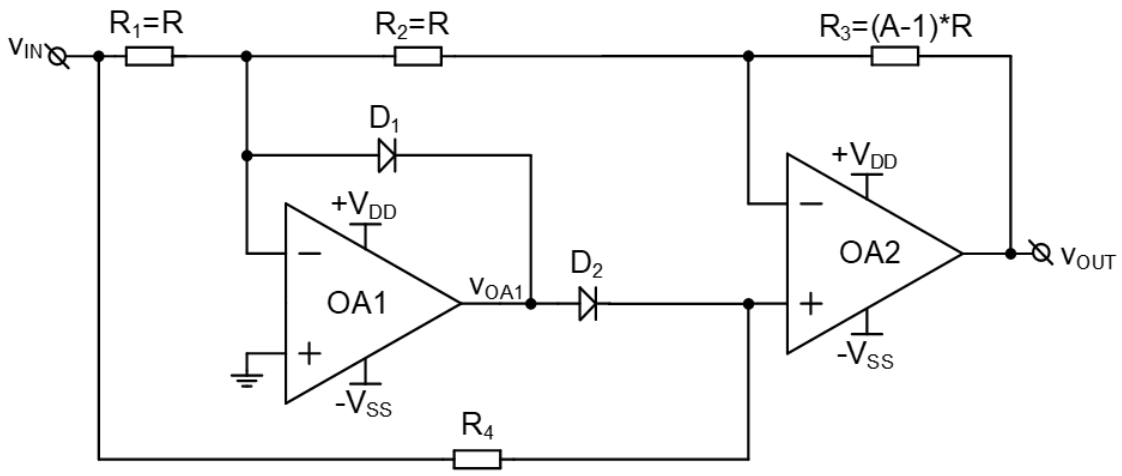
$R_{F1} + R_{F2} + R_{F3} + R_{F4} + R_{F5}$=$9R_G$

$R_{F5} = 9R_G - R_{F1} - R_{F2} - R_{F3} - R_{F4}$=

=900-300-100-130-170=

=200Ω

ETAJUL 4:



Presupunem D1,D2=OFF

I) $V_{IN} = -V_{SS}$

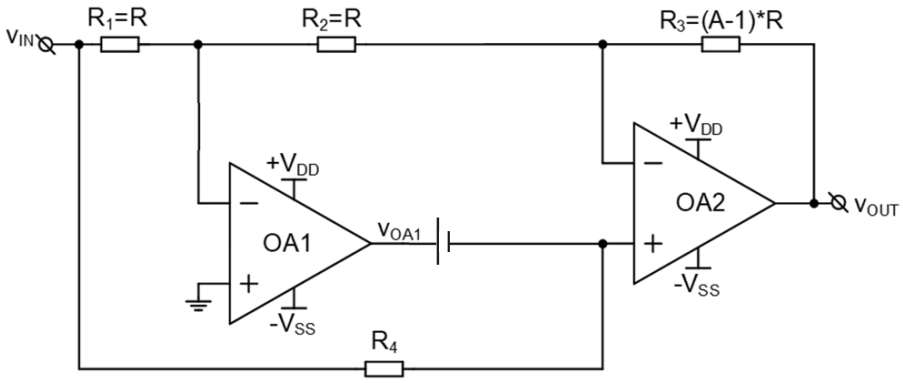
Pentru AO1:

$\left.\begin{matrix} V^+ = 0 \\ V^- = -V_{SS} \end{matrix}\right\} => V_{OA1} \nearrow V_{DD}$

$V_{OA} = a_\infty(V^+ - V^-)$=$\infty(0 + V_{SS}) > 0 => V_{OA1} \nearrow V_{DD}$

$V_{AK1} = -V_{SS} - V_{DD} < 0 \ => \ D1 = OFF$

$V_{AK2} = V_{DD} - (-V_{SS}) > 0 \ => \ D2 = ON$



OA1 in bucla de reactie negative deoarece $V_2^+ = V_2^-$ $\Rightarrow V_1^+ = V_1^- = 0$

$\Rightarrow I_{R1} = \frac{V_{IN}}{R_1}$

$I_{R1} = I_{R2} = I_{R3} = \frac{V_{IN}}{R_1}$

$V_{OUT} = 0 - I_{R1}(R_2 + R_3)$

$V_{OUT} = -\frac{V_{IN}}{R_1}(R_2 + R_3) = -(\frac{R_2 + R_3}{R_1})V_{IN}$

II) $V_{IN} = V_{DD}$

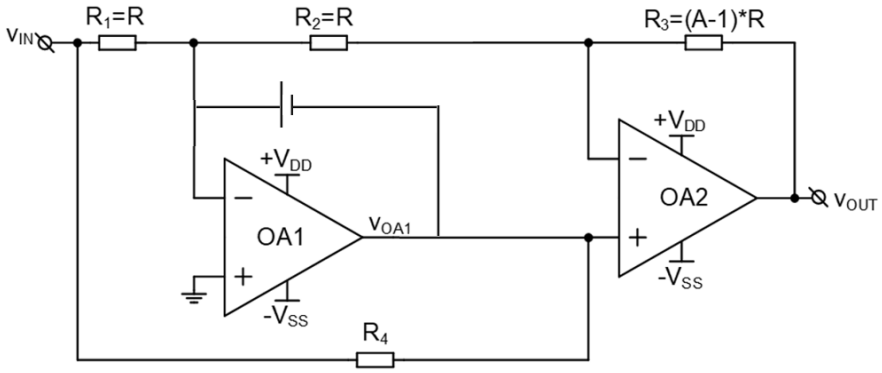
Pentru AO1:

$\left.\begin{matrix} V^+ = 0 \\ V^- = V_{DD} \end{matrix}\right\} \Rightarrow V_{OA1} \searrow -V_{SS}$

$V_{OA} = a_\infty(V^+ - V^-) = \infty(0 - V_{DD}) < 0 \Rightarrow V_{OA1} \searrow -V_{SS}$

$V_{AK1} = V_{DD} - (-V_{SS}) > 0 \Rightarrow D1 = ON$

$V_{AK2} = -V_{SS} - V_{DD} < 0 \Rightarrow D2 = OFF$



Exista Reactie Negativa prin D1:

$V_1^+ = V_1^-$ =>AO2 neinversor

$V_{OUT} = (1 + \frac{R_3}{R_2})V_{IN}$

CONDITIA REDRESOR BIALTERNANTA: $R_1 = R_2$

Concluzie:

$$V_{OUT} = \begin{cases} -\frac{R_3+R_2}{R_1}V_{IN}, V_{IN} < 0 \\ 1 + \frac{R_3}{R_2}V_{IN}, \quad V_{IN} > 0 \end{cases} \quad \Leftrightarrow \quad V_{OUT} = \begin{cases} -A * V_{IN}, V_{IN} < 0 \\ A * V_{IN}, \quad V_{IN} > 0 \end{cases}$$

$R_1 = R_2$ => A=$1 + \frac{R_3}{R_2}$

$|H_0|$=2(liniar)

$|H_0| = \frac{V_{OUT}}{V_{IN}} = A \quad => \quad 2 = 1 + \frac{R_3}{R_2} \Leftrightarrow 1 = \frac{R_3}{R_2} \quad => \quad R_2 = R_3$

Aleg R_1=R_3=R_3=R_4=10kΩ

1. Caracterizarea etajului 1 / 2 / 3 / 4. Verificarea si caracterizarea interfetei analogice

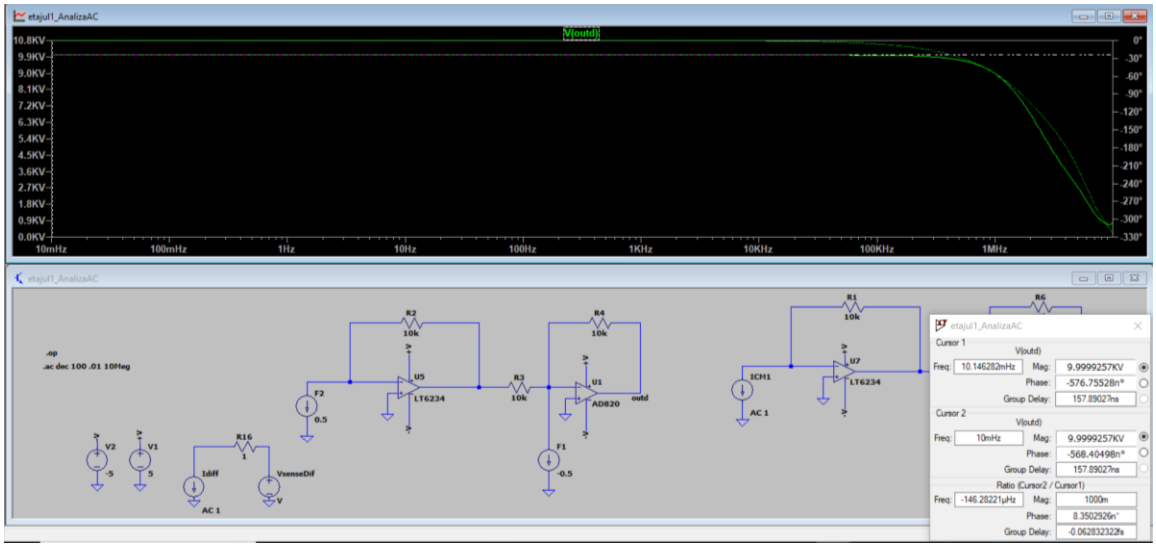
Etajul 1:

- Parametrii DCOP :
- **Starting Gmin stepping**
- **Gmin = 10**
- **Gmin = 1.07374**
- **Gmin = 0.115292**
- **Gmin = 0.0123794**
- **Gmin = 0.00132923**
- **Gmin = 0.000142725**
- **Gmin = 1.5325e-05**
- **Gmin = 1.6455e-06**
- **Gmin = 1.76685e-07**
- **Gmin = 1.89714e-08**
- **vernier = 0.5**
- **vernier = 0.25**
- **vernier = 0.125**
- **Gmin = 1.49241e-08**
- **vernier = 0.166667**
- **vernier = 0.222222**
- **Gmin = 1.00912e-08**
- **vernier = 0.296296**
- **Gmin = 5.38725e-09**
- **vernier = 0.395061**
- **vernier = 0.526748**
- **Gmin = 1.96664e-09**
- **vernier = 0.702331**
- **vernier = 0.936441**
- **Gmin = 4.16555e-10**
- **vernier = 1**
- **Gmin = 4.76818e-11**
- **Gmin = 5.11979e-12**
- **Gmin = 5.49733e-13**
- **Gmin = 0**
- **Gmin stepping succeeded in finding the operating point.**
-
- **N-Period=1**
- **Fourier components of V(out)**
- **DC component:0.350998**
-

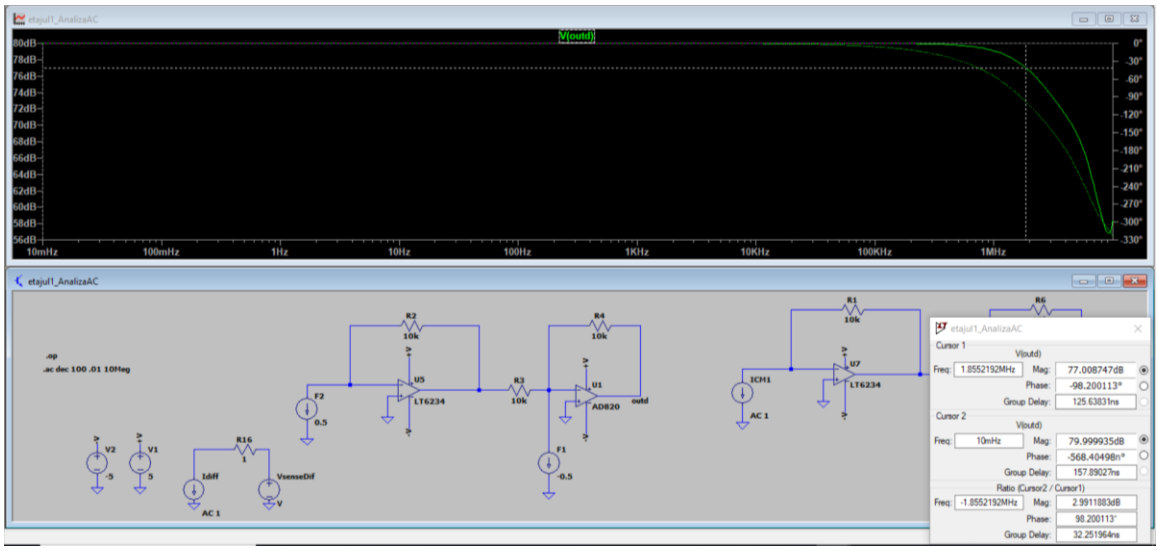
Harmonic Number	Frequency [Hz]	Fourier Normalized Component Phase [deg]	Normalized Component
1	1.000e+3 90.00°	1.510e-1 0.00°	1.000e+0
2	2.000e+3 16.92°	1.839e-9 -73.08°	1.218e-8

```
        3         3.000e+3           1.934e-9           1.281e-8
                    24.55°            -65.46°
        4         4.000e+3           2.062e-9           1.366e-8
                    31.27°            -58.73°
        5         5.000e+3           2.216e-9           1.468e-8
                    37.12°            -52.88°
        6         6.000e+3           2.391e-9           1.584e-8
                    42.15°            -47.86°
        7         7.000e+3           2.582e-9           1.711e-8
                    46.44°            -43.57°
        8         8.000e+3           2.786e-9           1.845e-8
                    50.10°            -39.91°
        9         9.000e+3           2.999e-9           1.987e-8
                    53.22°            -36.78°
       10         1.000e+4           3.221e-9           2.134e-8
                    55.91°            -34.09°
   Partial Harmonic Distortion: 0.000005%
   Total Harmonic Distortion:   0.000000%



   Date: Wed Jan 17 21:40:28 2024
   Total elapsed time: 0.233 seconds.

   tnom = 27
   temp = 27
   method = modified trap
   totiter = 2984
   traniter = 2120
   tranpoints = 1061
   accept = 1058
rejected = 3
matrix size = 25
fillins = 31
solver = Normal
Avg thread counts: 2.9/4.8/4.8/2.9
Matrix Compiler1: 2.90 KB object code size  2.6/1.6/[1.0]
Matrix Compiler2: 3.01 KB object code size  0.6/0.7/[0.3]
```

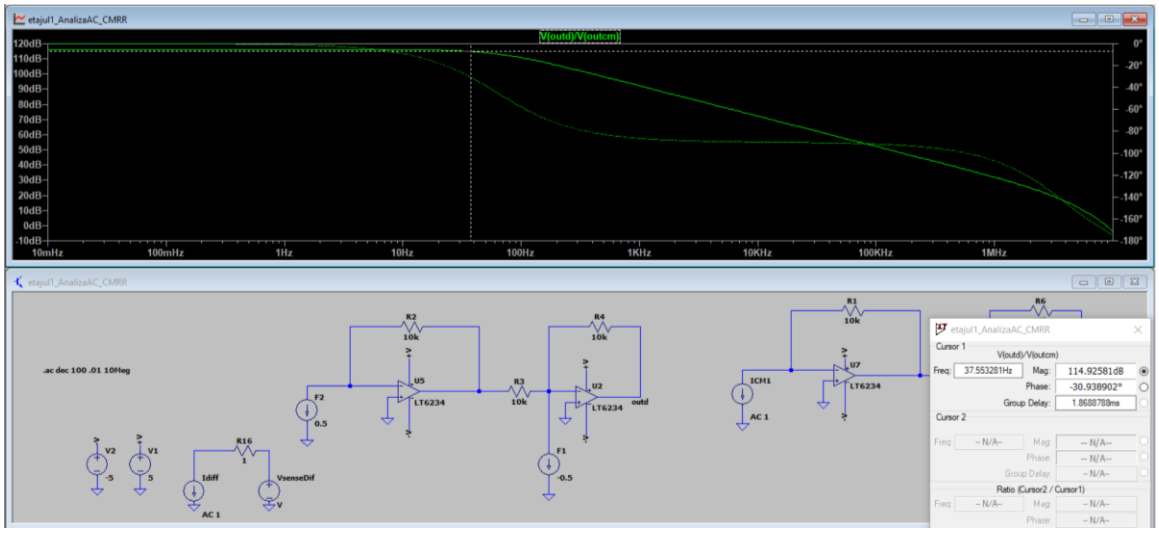
- Parametrii semnal mic:



Castig:10kV(liniar)

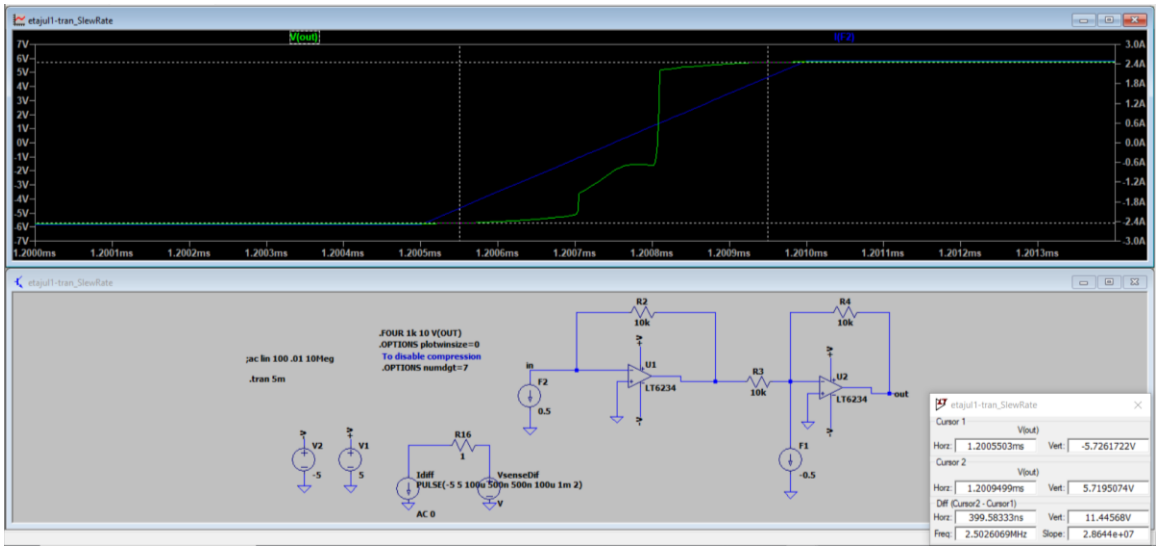


Banda la -3dB:1.85Mhz



CMRR(factorul de rejectie al modului comun):114.92dB

- Parametrii semnal mare:



SR:28.64V/us

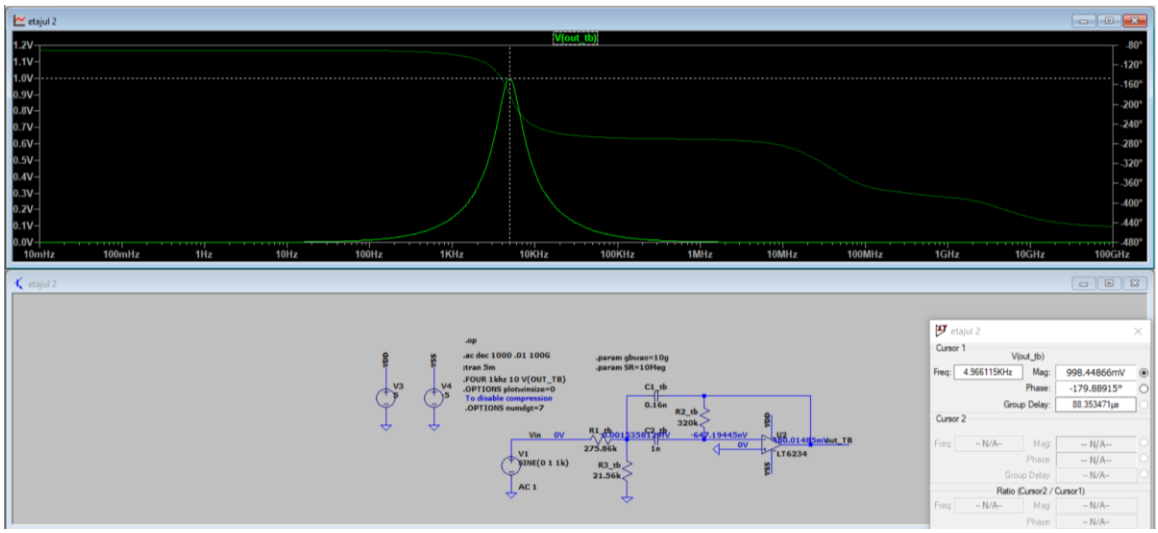
Etajul 2:

- Parametrii DCOP:

```
-   Circuit: *
    C:\Users\danci\OneDrive\Desktop\Proiect_SCIA\etajul2\etajul 2.asc
-
-   Direct Newton iteration failed to find .op point.  (Use ".option
    noopiter" to skip.)
-   Starting Gmin stepping
-   Gmin = 10
-   Gmin = 1.07374
-   Gmin = 0.115292
-   Gmin = 0.0123794
-   Gmin = 0.00132923
-   Gmin = 0.000142725
-   Gmin = 1.5325e-05
-   Gmin = 1.6455e-06
-   Gmin = 1.76685e-07
-   Gmin = 1.89714e-08
-   vernier = 0.5
-   vernier = 0.25
-   vernier = 0.125
-   Gmin = 1.49241e-08
-   vernier = 0.166667
-   vernier = 0.222222
-   Gmin = 1.00912e-08
-   vernier = 0.296296
-   Gmin = 5.38725e-09
-   vernier = 0.395061
-   vernier = 0.526748
-   Gmin = 1.96664e-09
-   vernier = 0.702331
-   vernier = 0.936441
-   Gmin = 4.16555e-10
-   vernier = 1
-   Gmin = 4.76818e-11
-   Gmin = 5.11979e-12
-   Gmin = 5.49733e-13
-   Gmin = 0
-   Gmin stepping succeeded in finding the operating point.
-
-   N-Period=1
-   Fourier components of V(out_tb)
-   DC component:0.480015
-
-   Harmonic      Frequency           Fourier            Normalized
                   Phase             Normalized
-    Number         [Hz]             Component           Component
                  [degree]           Phase [deg]
-       1          1.000e+3           1.501e-1           1.000e+0
                   -171.35°             0.00°
```

```
-       2          2.000e+3            2.371e-7            1.579e-6
                    178.46°             349.81°
-       3          3.000e+3            2.361e-7            1.573e-6
                    177.69°             349.04°
-       4          4.000e+3            2.346e-7            1.563e-6
                    176.92°             348.27°
-       5          5.000e+3            2.328e-7            1.550e-6
                    176.14°             347.49°
-       6          6.000e+3            2.305e-7            1.535e-6
                    175.36°             346.71°
-       7          7.000e+3            2.278e-7            1.517e-6
                    174.57°             345.92°
-       8          8.000e+3            2.247e-7            1.496e-6
                    173.78°             345.13°
-       9          9.000e+3            2.211e-7            1.473e-6
                    172.98°             344.32°
-      10          1.000e+4            2.172e-7            1.447e-6
                    172.16°             343.51°
-   Partial Harmonic Distortion: 0.000458%
-   Total Harmonic Distortion:   0.006198%
-
-
-
-   Date: Wed Jan 17 22:31:34 2024
-   Total elapsed time: 0.273 seconds.
-
-   tnom = 27
-   temp = 27
-   method = modified trap
-   totiter = 2942
-   traniter = 2092
-   tranpoints = 1047
-   accept = 1046
-   rejected = 1
-   matrix size = 16
-   fillins = 11
-   solver = Normal
-   Avg thread counts: 2.9/4.8/4.8/2.9
-   Matrix Compiler1: 1.21 KB object code size  1.4/0.7/[0.7]
-   Matrix Compiler2: 1.66 KB object code size  0.5/0.6/[0.3]
```

Parametrii semnal mic:



|H0|(Castig liniar in banda de trecere):1
Banda:5kHz

```
   10                 1.000e+4              2.172
Partial Harmonic Distortion: 0.000458%
Total Harmonic Distortion:   0.006198%
```

(THD<1%)

ETAJUL 3:

- Parametrii DCOP (pentru primul switch=on; castig minim)

- **Circuit: ***
  C:\Users\danci\OneDrive\Desktop\Proiect_SCIA\etajul3\etajul 3.asc
-
- **Direct Newton iteration failed to find .op point. (Use ".option noopiter" to skip.)**
- **Starting Gmin stepping**
- **Gmin = 10**
- **Gmin = 1.07374**
- **Gmin = 0.115292**
- **Gmin = 0.0123794**
- **Gmin = 0.00132923**
- **Gmin = 0.000142725**
- **Gmin = 1.5325e-05**
- **Gmin = 1.6455e-06**
- **Gmin = 1.76685e-07**
- **Gmin = 1.89714e-08**
- **Gmin = 2.03704e-09**
- **Gmin = 2.18725e-10**

- Gmin = 2.34854e-11
- Gmin = 2.52173e-12
- Gmin = 2.70769e-13
- Gmin = 0
- Gmin stepping succeeded in finding the operating point.
-
- N-Period=1
- Fourier components of V(out)
- DC component:0.00045156
-

Harmonic Number	Frequency [Hz]	Fourier Normalized Phase [degree]	Normalized Component	Normalized Component Phase [deg]
1	1.000e+3	8.001e-1	1.000e+0	90.00°
2	2.000e+3	2.638e-6	3.297e-6	179.70°
3	3.000e+3	3.961e-7	4.951e-7	97.39°
4	4.000e+3	1.296e-7	1.620e-7	167.54°
5	5.000e+3	1.340e-7	1.675e-7	177.22°
6	6.000e+3	1.292e-7	1.615e-7	161.32°
7	7.000e+3	1.285e-7	1.607e-7	156.89°
8	8.000e+3	1.279e-7	1.598e-7	154.83°
9	9.000e+3	1.271e-7	1.588e-7	151.65°
10	1.000e+4	1.263e-7	1.578e-7	148.13°

- Partial Harmonic Distortion: 0.000336%
- Total Harmonic Distortion: 0.013323%
-
-
-
- Date: Wed Jan 17 22:55:54 2024
- Total elapsed time: 0.503 seconds.
-
- tnom = 27
- temp = 27
- method = modified trap
- totiter = 2608
- traniter = 2116
- tranpoints = 1059
- accept = 1055
- rejected = 4
- matrix size = 60
- fillins = 45
- solver = Normal

- **Avg thread counts: 2.9/4.8/4.8/2.9**
- **Matrix Compiler1: 5.67 KB object code size 3.3/1.8/[1.0]**
- **Matrix Compiler2: 6.42 KB object code size 1.6/1.7/[0.9]**

- Parametrii DCOP (pentru ultimul switch=on; castig maxim)

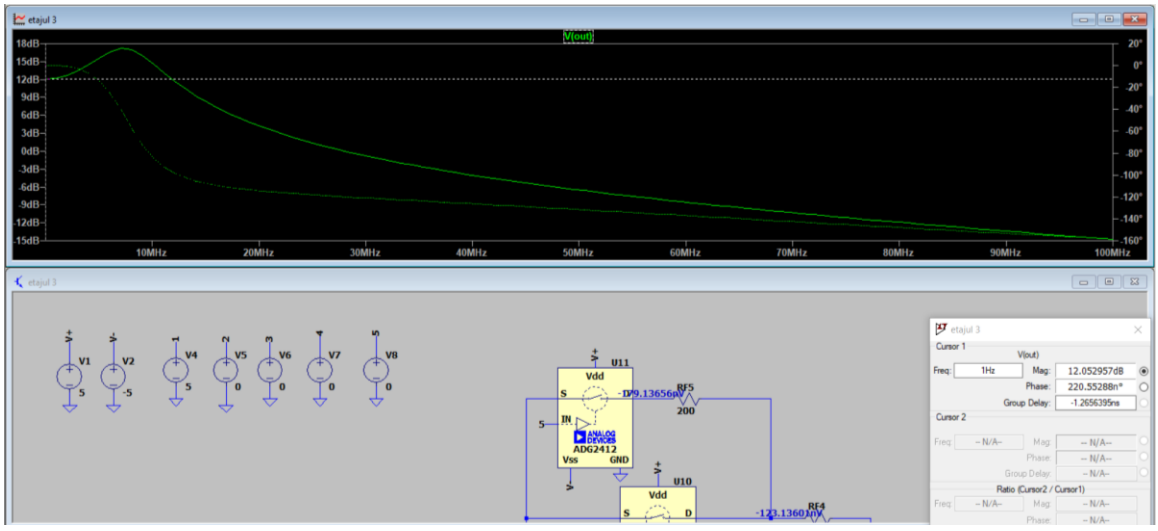
- **Circuit: ***
  C:\Users\danci\OneDrive\Desktop\Proiect_SCIA\etajul3\etajul 3.asc
-
- **Direct Newton iteration failed to find .op point. (Use ".option noopiter" to skip.)**
- **Starting Gmin stepping**
- **Gmin = 10**
- **Gmin = 1.07374**
- **Gmin = 0.115292**
- **Gmin = 0.0123794**
- **Gmin = 0.00132923**
- **Gmin = 0.000142725**
- **Gmin = 1.5325e-05**
- **Gmin = 1.6455e-06**
- **Gmin = 1.76685e-07**
- **Gmin = 1.89714e-08**
- **Gmin = 2.03704e-09**
- **Gmin = 2.18725e-10**
- **Gmin = 2.34854e-11**
- **Gmin = 2.52173e-12**
- **Gmin = 2.70769e-13**
- **Gmin = 0**
- **Gmin stepping succeeded in finding the operating point.**
-
- **N-Period=1**
- **Fourier components of V(out)**
- **DC component:0.00134897**
-

Harmonic Number	Frequency [Hz]	Fourier Normalized Component	Normalized Component Phase [deg]
1	1.000e+3	1.999e+0	1.000e+0
	90.00°	0.00°	
2	2.000e+3	2.536e-6	1.269e-6
	179.45°	89.45°	
3	3.000e+3	1.056e-6	5.286e-7
	81.09°	-8.92°	
4	4.000e+3	5.972e-8	2.988e-8
	121.61°	31.60°	
5	5.000e+3	5.407e-8	2.705e-8
	-172.42°	-262.42°	
6	6.000e+3	8.227e-8	4.117e-8
	112.75°	22.75°	
7	7.000e+3	9.912e-8	4.960e-8
	107.20°	17.20°	

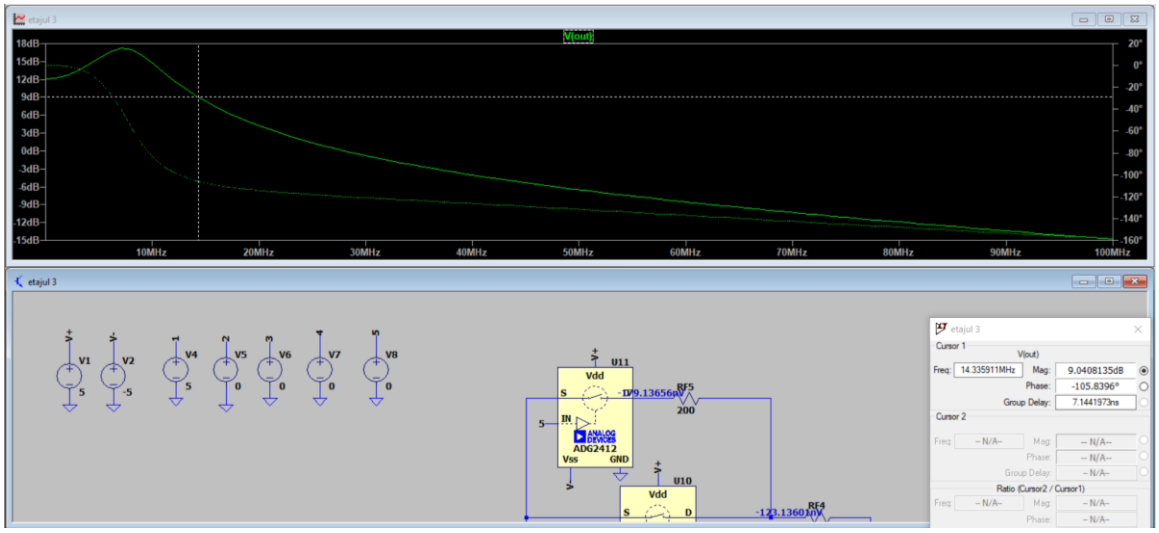
```
-       8          8.000e+3            1.060e-7            5.302e-8
                     107.71°              17.71°
-       9          9.000e+3            1.174e-7            5.874e-8
                     106.22°              16.22°
-      10          1.000e+4            1.299e-7            6.499e-8
                     104.55°              14.55°
-   Partial Harmonic Distortion: 0.000138%
-   Total Harmonic Distortion:   0.011595%
-
-
-
-   Date: Wed Jan 17 22:57:40 2024
-   Total elapsed time: 0.388 seconds.
-
-   tnom = 27
-   temp = 27
-   method = modified trap
-   totiter = 2631
-   traniter = 2148
-   tranpoints = 1075
-   accept = 1065
-   rejected = 10
-   matrix size = 60
-   fillins = 45
-   solver = Normal
-   Avg thread counts: 2.9/4.7/4.7/2.9
-   Matrix Compiler1: 5.67 KB object code size  2.9/1.5/[1.0]
-   Matrix Compiler2: 6.42 KB object code size  1.5/1.5/[0.9]
```

Parametrii semnal mic:

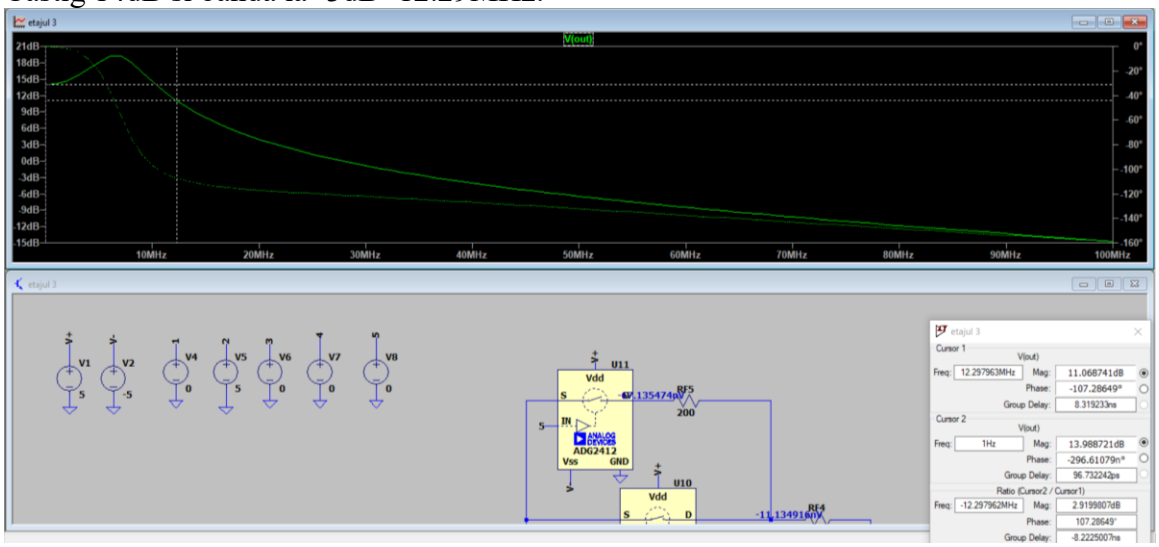
Castig minim(12dB):



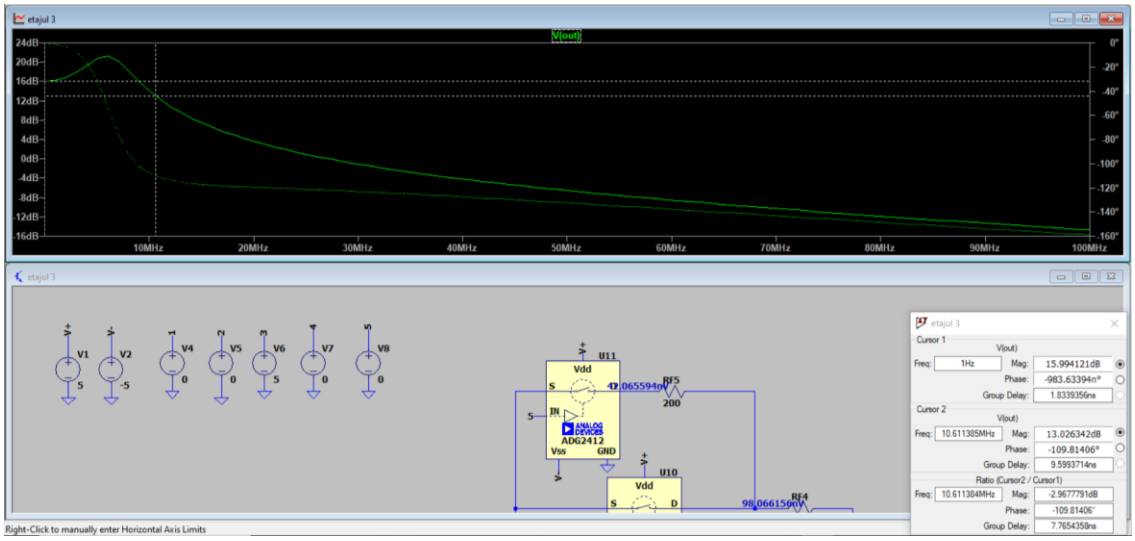
Banda la -3dB:14.33MHz:



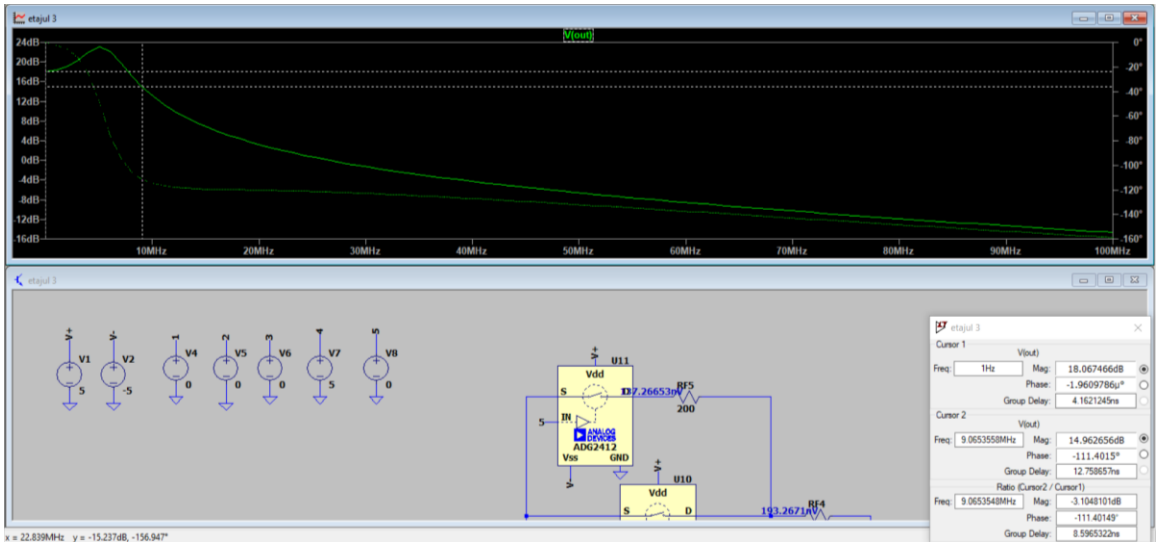
Castig 14dB si banda la -3dB=12.29MHz:



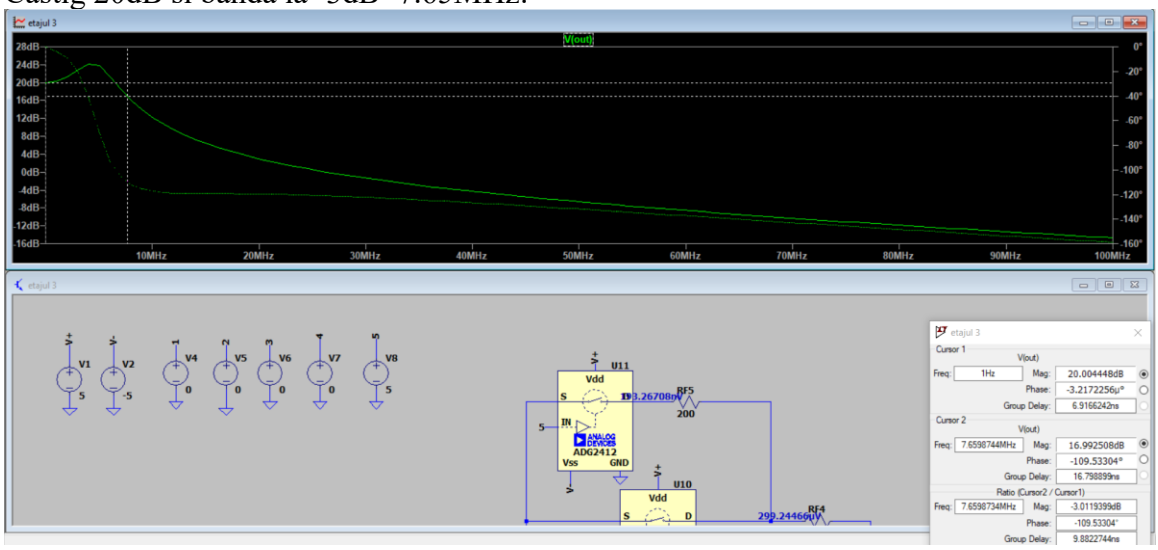
Castig 16dB si banda la -3dB=10.61MHz:



Castig 18dB si banda la -3dB=9.065MHz:



Castig 20dB si banda la -3dB=7.65MHz:



Etajul 4:

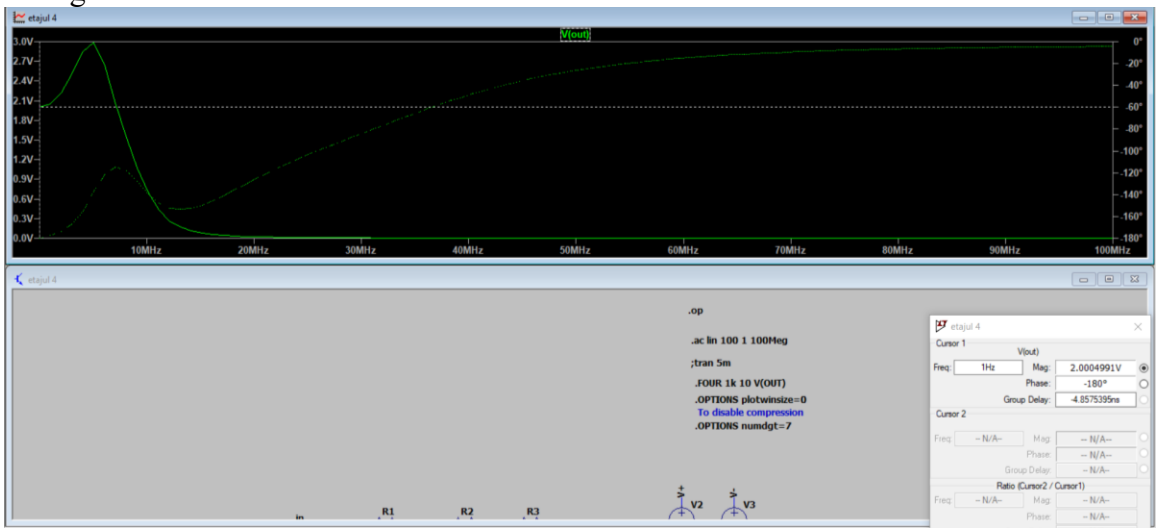
Parametrii DCOP:

```
Circuit: * C:\Users\danci\OneDrive\Desktop\Proiect_SCIA\etajul4\etajul
4.asc

Direct Newton iteration failed to find .op point.  (Use ".option
noopiter" to skip.)
Starting Gmin stepping
Gmin = 10
Gmin = 1.07374
Gmin = 0.115292
Gmin = 0.0123794
Gmin = 0.00132923
Gmin = 0.000142725
Gmin = 1.5325e-05
Gmin = 1.6455e-06
Gmin = 1.76685e-07
Gmin = 1.89714e-08
vernier = 0.5
vernier = 0.25
vernier = 0.125
vernier = 0.0625
vernier = 0.03125
vernier = 0.015625
vernier = 0.0078125
vernier = 0.00390625
vernier = 0.00195312
Gmin = 1.89714e-08
vernier = 0.000976562
vernier = 0.000488281
Gmin = 0
Gmin stepping failed
```

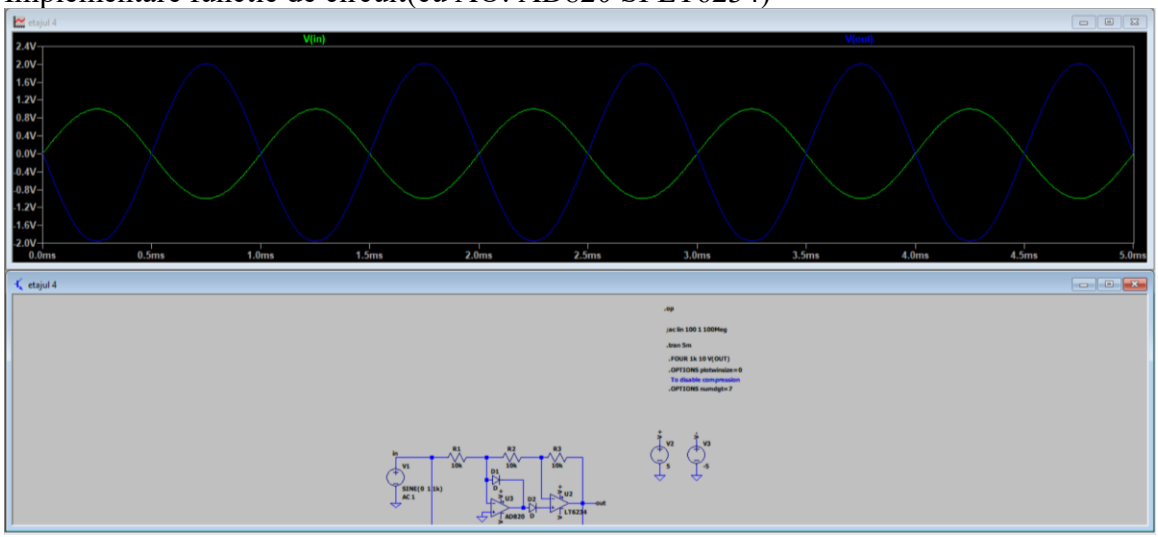
```
Starting source stepping with srcstepmethod=0
Source Step = 3.0303%
Source Step = 24.4318%
vernier = 0.015625
Source Step = 24.2661%
Starting source stepping with srcstepmethod=1
Source Step = 3.0303%
Source Step = 33.3333%
Source Step = 63.6364%
Source Step = 93.9394%
Source Step = 100%
Source Step = 99.1894%
Source Step = 99.6629%
Source Step = 99.9973%
Source Step = 100%
Source stepping failed

Pseudo Transient succeeded in finding the operating point at 325.549
ms.
N-Period=1
Fourier components of V(out)
DC component:0.0180656

Harmonic            Frequency           Fourier           Normalized
                     Phase              Normalized
 Number               [Hz]              Component          Component
                     [degree]           Phase [deg]
    1                1.000e+3           1.994e+0          1.000e+0
                      -89.96°              0.00°
    2                2.000e+3           5.724e-3          2.871e-3
                     -179.91°             -89.95°
    3                3.000e+3           5.250e-3          2.633e-3
                      -89.87°              0.10°
    4                4.000e+3           4.646e-3          2.330e-3
                        0.18°             90.14°
    5                5.000e+3           3.962e-3          1.987e-3
                       90.22°            180.18°
    6                6.000e+3           3.249e-3          1.629e-3
                     -179.73°             -89.77°
    7                7.000e+3           2.554e-3          1.281e-3
                      -89.69°              0.27°
    8                8.000e+3           1.917e-3          9.614e-4
                        0.35°             90.31°
    9                9.000e+3           1.363e-3          6.838e-4
                       90.39°            180.36°
   10                1.000e+4           9.087e-4          4.558e-4
                     -179.56°             -89.60°
Partial Harmonic Distortion: 0.551785%
Total Harmonic Distortion:   0.552760%



Date: Thu Jan 18 00:06:08 2024
Total elapsed time: 0.951 seconds.

tnom = 27
```

```
temp = 27
method = modified trap
totiter = 14970
traniter = 2254
tranpoints = 1128
accept = 1103
rejected = 35
matrix size = 24
fillins = 62
solver = Normal
Avg thread counts: 2.8/4.6/4.6/2.8
Matrix Compiler1: 4.77 KB object code size  1.2/0.6/[0.6]
Matrix Compiler2: 3.68 KB object code size  1.0/1.0/[0.5]
```

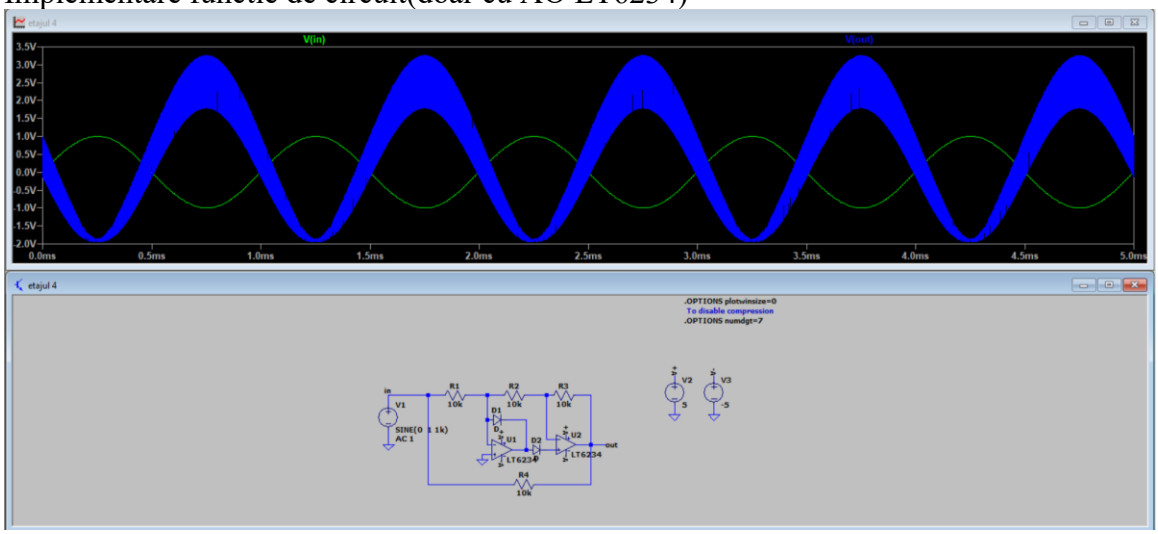
Castigul liniar:2



Implementare functie de circuit(cu AO: AD820 SI LT6234)



Implementare functie de circuit(doar cu AO LT6234)



2. Concluzii

Compararea rezultatelor obtinute cu cerintele impuse:
Cerinte impuse:

Etaj 1						Etaj 2					Etaj 3						Etaj 4		AO
Sursa semnal	amplitudine minima (pt castig maxim PGA)	amplitudine maxima (pt castig minim PGA)	unitate masura	Tip Etaj 1	|Castig| etaj 1 (liniar)	tip Etaj 2	|H0| castig liniar in banda de trecere	Rintrare minim	Banda	Q	tip Etaj 3	castig minim [dB]	rezolutie (pas minim) [dB]	nr pasi	castig maxim [dB]	Rintrare minim	tip Etaj 4	|Castig| etaj 4 (liniar)	Tip AO
4	2.00E-05	5.02E-05	A (differential)	6	10000	9	1	2.00E+03	5.00E+03	1.41	5	12	2	5	20		6	2	4

Rezultate obtinute:

Etaj 1:
Castig(liniar):9.99Kv
Banda etaj1:1.85MHz

Etaj 2:
Castig (liniar) in banda de trecere: 998.44mV
Banda:4.966kHz

Etajul 3:

Castig=12dB(cerinte):12dB masurat
Banda:14.33MHz

Castig=14dB(cerinte):14dB masurat
Banda: 12.29MHz:

Castig=16dB(cerinte):15.99dB masurat
Banda:10.61MHz:

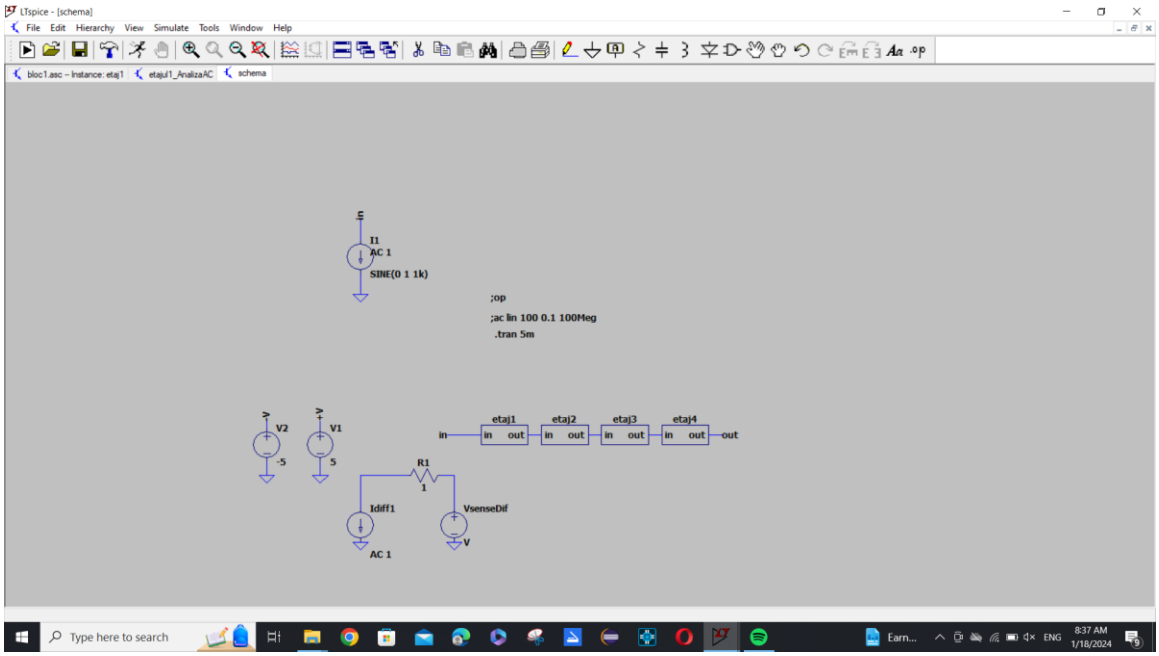
Castig=18dB(cerinte):18.06dB masurat
Banda:9.065MHz

Castig=20dB(cerinte):20dB masurat
Banda:7.65MHz

Etaj 4:

Castig liniar=2(cerinte):2 masurat

Schema Bloc


LTspice - [schema]
File Edit Hierarchy View Simulate Tools Window Help
bloc1.asc – Instance: etaj1
etajul1_AnalizaAC
schema
I1
AC 1
SINE(0 1 1k)
;op
;ac lin 100 0.1 100Meg
.tran 5m
V2
-5
V1
5
R1
1
Idiff1
AC 1
VsenseDif
V
etaj1
etaj2
etaj3
etaj4
in
out
Type here to search
ENG
8:37 AM
1/18/2024