

Project report

1.RLC Filter

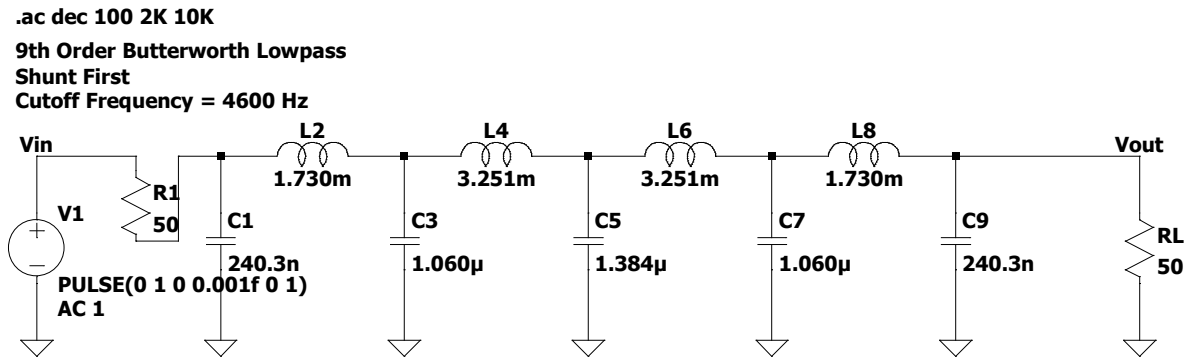


Figure 1. RLC passive filter [filter.asc]

Normalized Values		R	f	Denormalized Values	
c1	0.35	50 Ω	4600Hz	C1	242.19nF
l2	1			L2	1.73mH
c3	1.53			C3	1.059uF
l4	1.87			L4	3.235mH
c5	2			C5	1.384uF
l6	1.88			L6	3.235mH
c7	1.53			C7	1.059uF
l8	1			L8	1.73mH
c9	0.35			C9	242.19nF

Table 1. Normalized and denormalized values

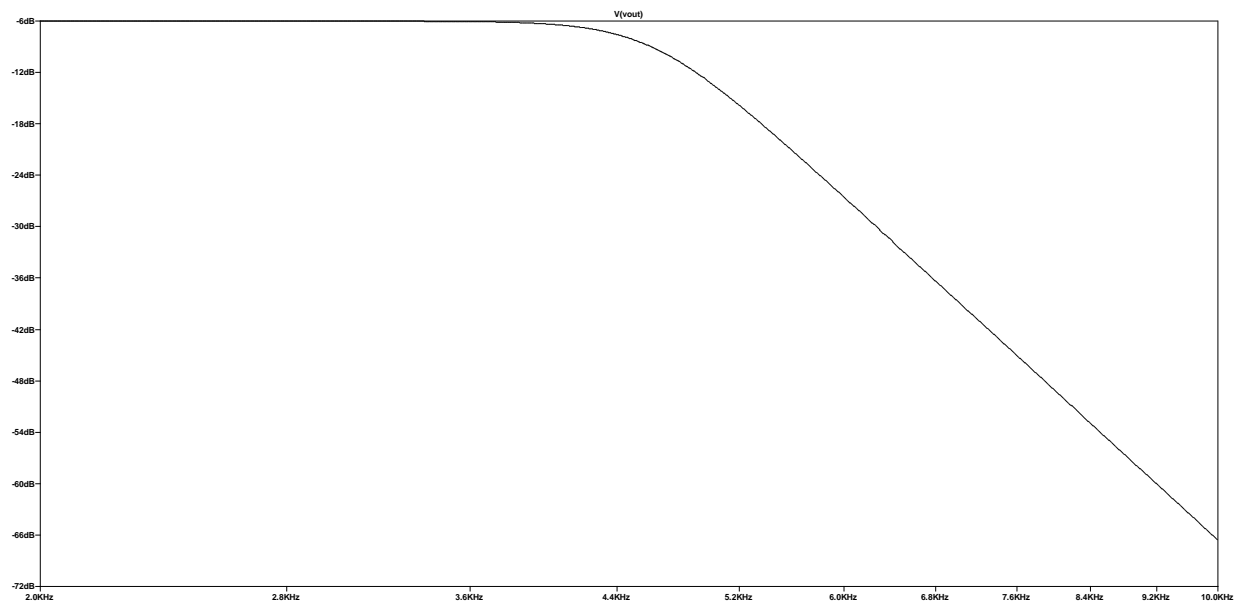


Figure 2. Module characteristic [filter.asc]

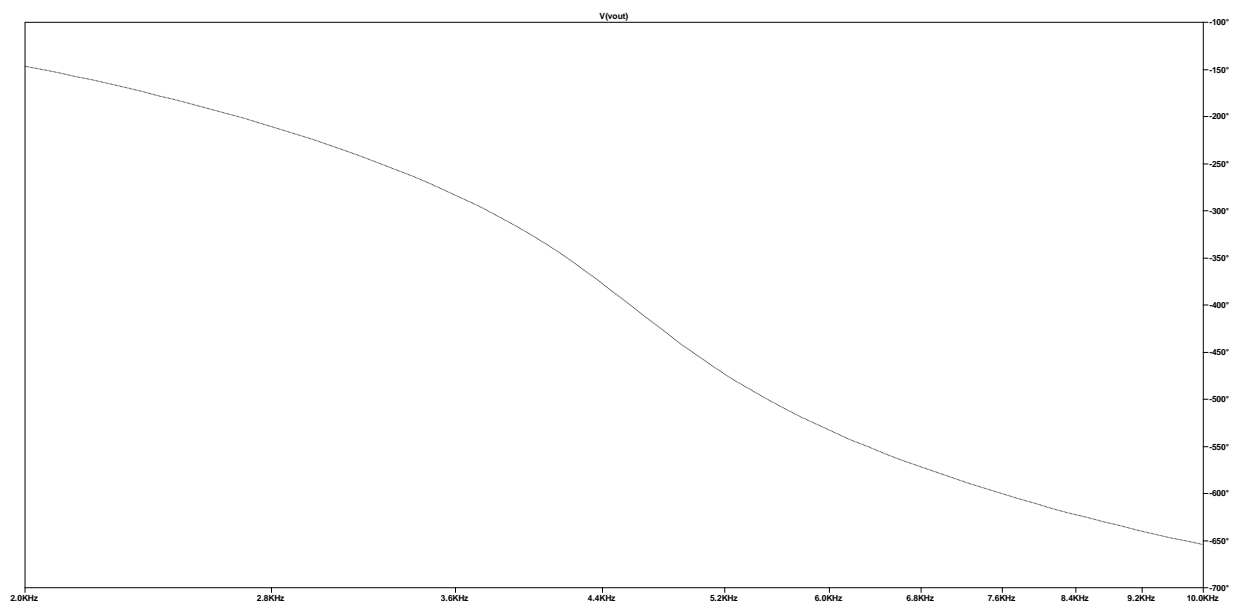


Figure 3. Phase characteristic [filter.asc]

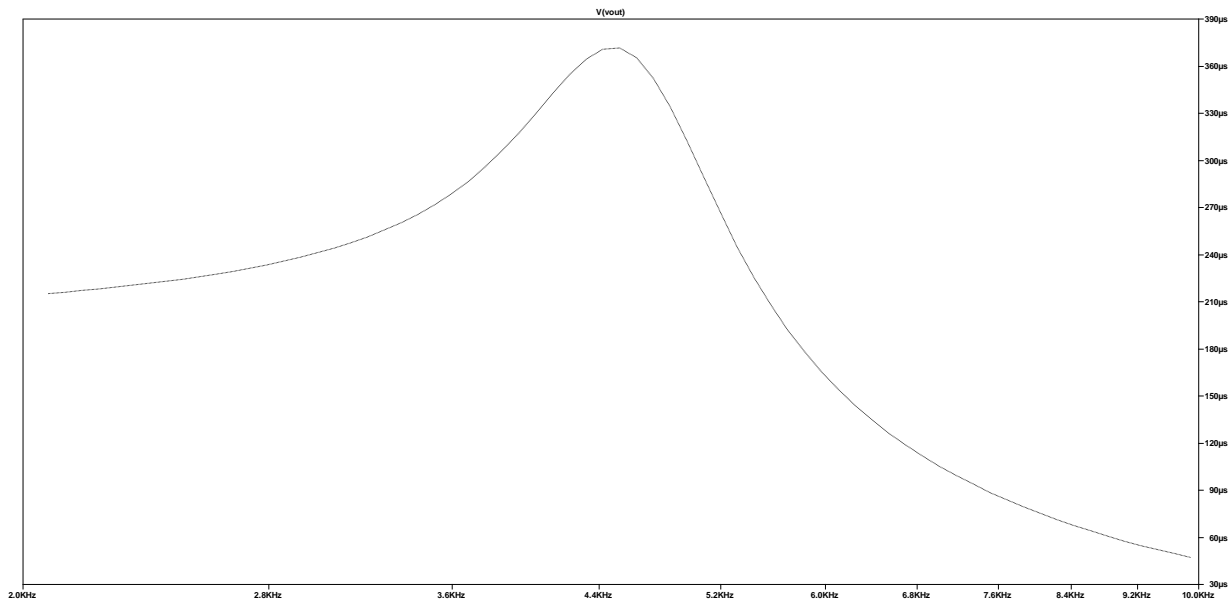


Figure 4. Group Delay [filter.asc]

Parameter	Goal	Measured
Frequency [Hz]	4600	4599

Table 2. Measured parameters

2. BJT transfer characteristic

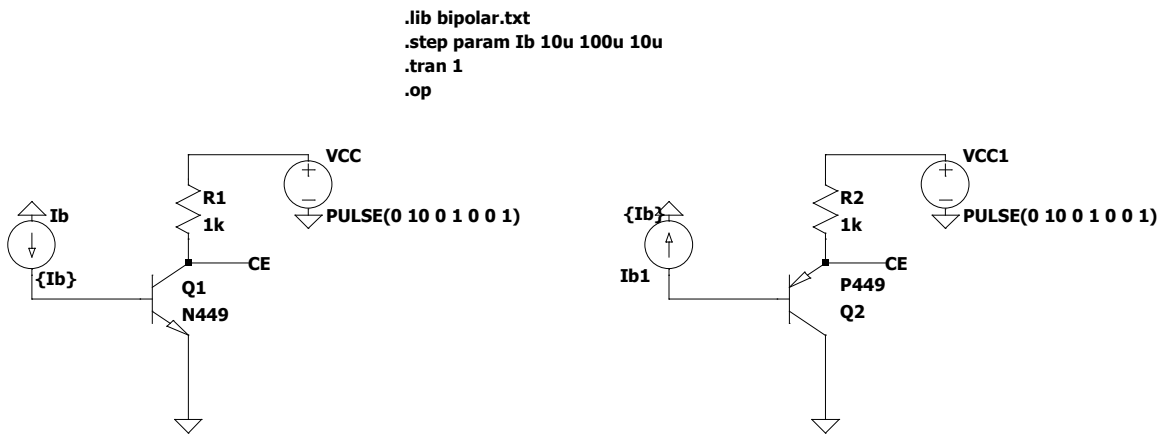


Figure 1. Circuit for the transfer characteristic of the BJT transistor [caracteristica_bjt.asc]

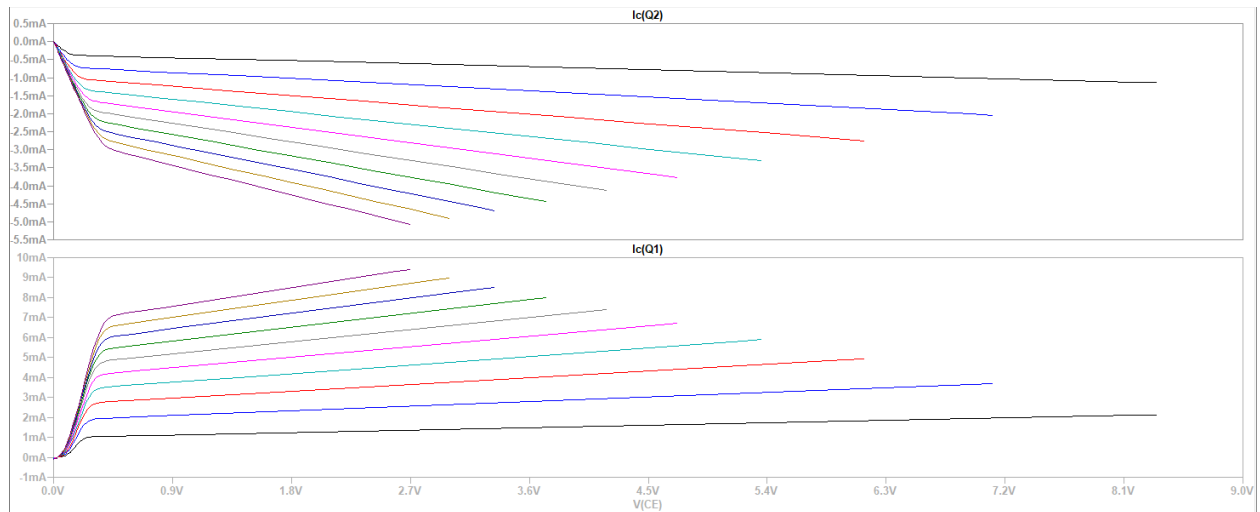


Figure 2. Transfer characteristic [caracteristica_bjt.asc]

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--- Bipolar Transistors ---
Name:      q2      q1
Model:     p449    n449
Ib:        -1.00e-05  1.00e-05
Ic:         2.04e-06 -9.77e-06
Vbe:       -7.22e-01  6.30e-01
Vbc:       -7.21e-01  6.29e-01
Vce:       -9.05e-04  9.05e-04
BetaDC:    -2.04e-01 -9.77e-01
Gm:         1.68e-04  6.83e-06
Rpi:       9.13e+03  6.72e+05
Rx:         6.48e+01  7.96e+01
Ro:         2.28e+02  6.25e+03
Cbe:        6.41e-13  2.92e-13
Cbc:        4.59e-12  1.02e-13
Cjs:        1.23e-13  1.23e-13
BetaAC:     1.54e+00  4.59e+00
Cbx:        5.95e-13  5.55e-13
Ft:         3.49e+06  1.12e+06

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Figure 3. SPICE Error Log with BJT parameters [caracteristica_bjt.asc]

Ib [μ A]	Ic_min [mA]	Ic_max [mA]
20	1.1	2.1
30	1.98	3.69
40	2.89	4.9
50	3.66	5.89
60	4.37	6.7
70	5.67	7.98
80	6.28	8.5
90	6.83	8.96
100	7.36	9.4

Table 1. Minimum and maximum current values

3. Active circuit synthesis

$$A := C_{inv} \cdot G = \begin{bmatrix} 0.057 & 2.857 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.654 & 0 & 0.654 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -0.535 & 0 & 0.535 & 0 & 0 & 0 \\ 0 & 0 & 0 & -0.5 & 0 & 0.5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.532 & 0 & 0.532 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -0.654 & 0 & 0.654 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -2.857 & 0.057 \end{bmatrix}$$

$$b := C_{inv} \cdot W = \begin{bmatrix} 0.057 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$c := [0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1] \quad d := 0$$

Figure 1. A, b, c, d matrixes

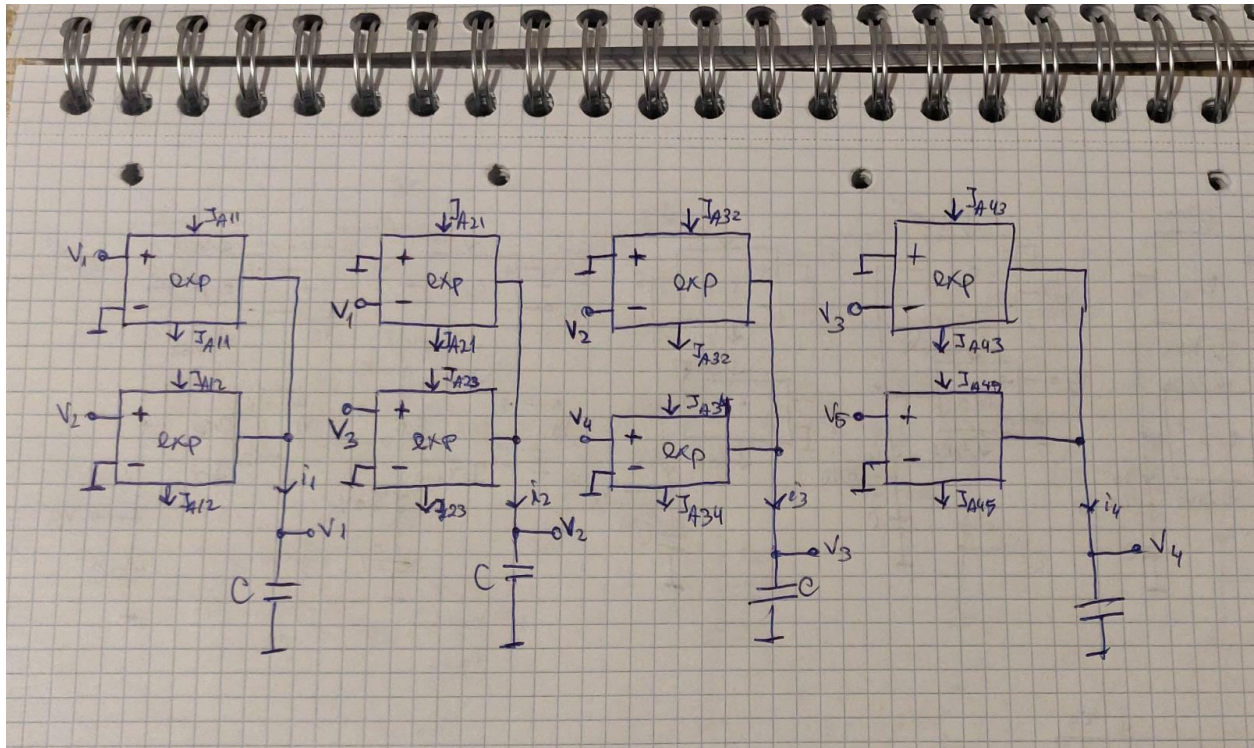


Figure 2. Nonlinear circuit

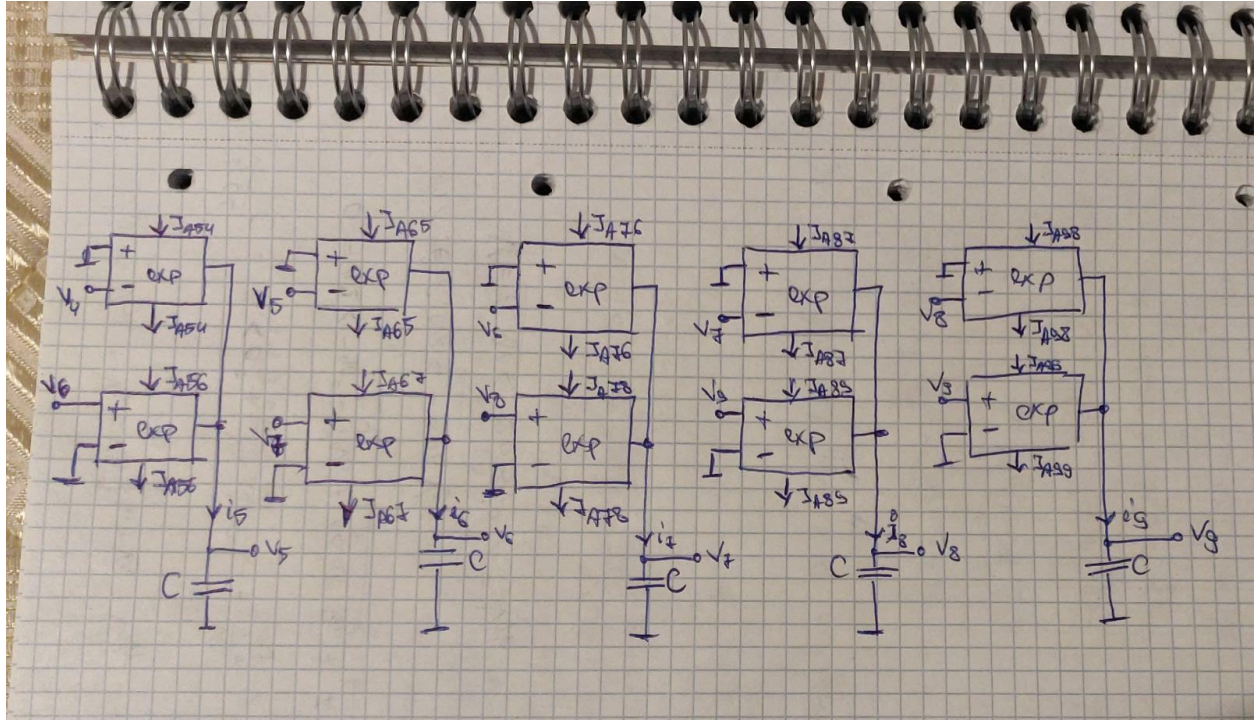


Figure 2. Nonlinear circuit

Parameter	Value
I_{A11}	85.881 nA
I_{A12}	4.294 μ A
I_{A21}	1.503 μ A
I_{A23}	1.503 μ A
I_{A32}	982.32 nA
I_{A34}	982.32 nA
I_{A43}	803.771 nA
I_{A45}	803.771 nA
I_{A54}	751.469 nA
I_{A56}	751.469 nA
I_{A65}	799.413 nA
I_{A67}	799.413 nA
I_{A76}	982.32 nA
I_{A78}	982.32 nA
I_{A87}	1.503 μ A
I_{A89}	1.503 μ A
I_{A98}	4.294 μ A
I_{A99}	85.881 nA
I_{C9}	85.904 nA
I_L	85.904 nA
I_E	85.904 nA
C	1 nF

Table 1. Polarization currents and the capacitor

4. Polarization circuit

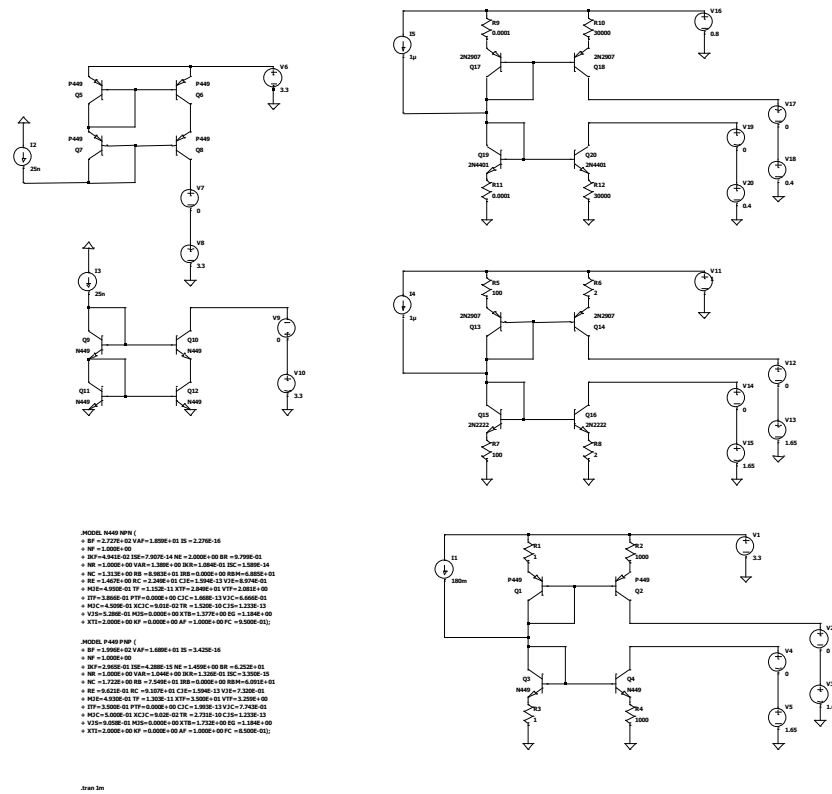


Figure 1. BJT Current mirrors [polarizare.asc]

5. ELIN circuit

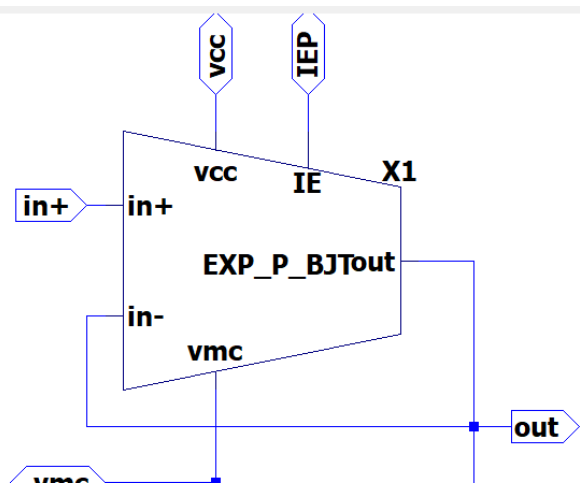


Figure 1. Exponential cell P_BJT [metoda_sinteza_state_space.asc]

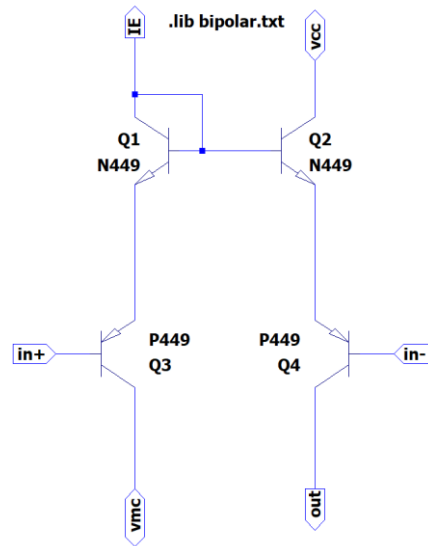


Figure 2. Circuit for P_BJT exponential cell [metoda_sinteza_state_space.asc]

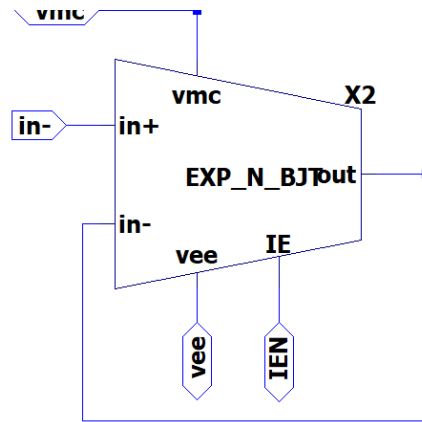


Figure 3. Exponential cell N_BJT [metoda_sinteza_state_space.asc]

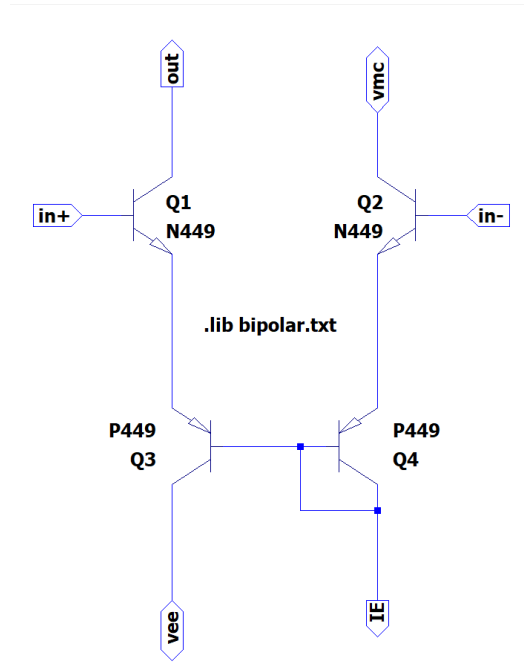


Figure 4. Circuit for N_BJT exponential cell [metoda_sinteza_state_space.asc]

Parameter	Current source	Value
I _{A11}	I1, I3	85.881 nA
I _{A12}	I2, I4	4.294 μ A
I _{A21}	I7, I8	1.503 μ A
I _{A23}	I11, I12	1.503 μ A
I _{A32}	I13, I14	982.32 nA
I _{A34}	I15, I16	982.32 nA
I _{A43}	I5, I6	803.771 nA
I _{A45}	I9, I10	803.771 nA
I _{A54}	I17, I18	751.469 nA
I _{A56}	I25, I26	751.469 nA
I _{A65}	I27, I28	799.413 nA
I _{A67}	I29, I30	799.413 nA
I _{A76}	I31, I32	982.32 nA
I _{A78}	I33, I34	982.32 nA
I _{A87}	I35, I36	1.503 μ A
I _{A89}	I37, I38	1.503 μ A
I _{A98}	I39, I40	4.294 μ A
I _{A99}	I41, I42	85.881 nA
I _{C9}	-	85.904 nA
I _L	-	85.904 nA
I _E	-	85.904 nA
C1->C8	-	1 nF

Table 1. Current sources and capacitors.

