SEMINAR 6

Contents:

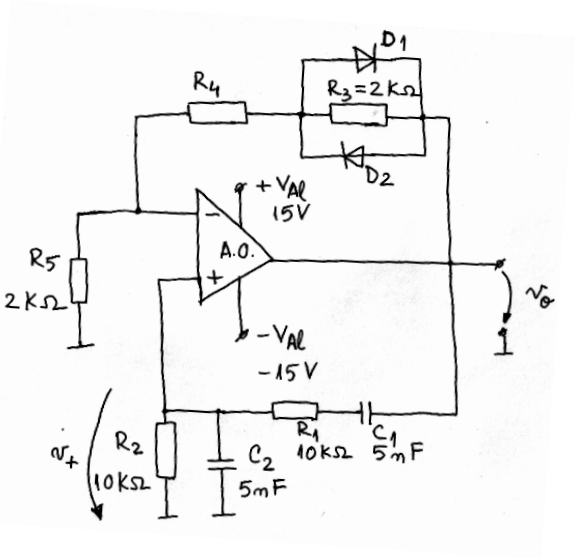
- Sinusoidal oscillators
- Nonsinusoidal Oscillators

1.

a) How do the $v_o(t)$ and $v_+(t)$ signals look like, qualitative, in permanent regime? Compute the frequency of the $v_o(t)$ output signal.

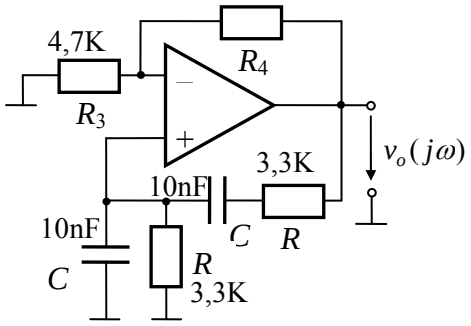
b) Size R_4 such that the circuit will sustain the oscillations in steady-state regime. Consider that in conduction, the equivalent resistances of D_1 and D_2 diodes are $r_{D1}=r_{D2}=0{,}5K\Omega$. Verify the chosen value for the condition of starting-up the oscillation in transient regime.

c) How does the $v_o(t)$ signal shape modifies in permanent regime if the D_2 diode connection is omitted in the circuit?



2.

a) What is the application of the circuit? What are the expression and value of the oscillation frequency?
b) What should be the value of the R_4 resistor to accomplish the oscillation criterion?
c) Assume a value of 6V for the output voltage. What does the output voltage and the voltages at the inverting and noniverting input look like?
d) Complete the circuit in order to obtain the automatic control of the amplitude.



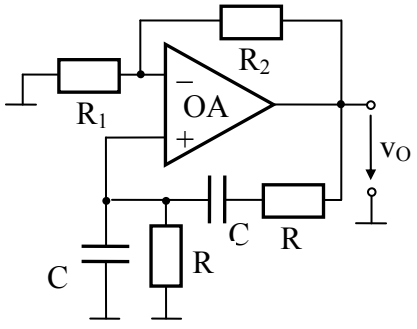
3.

For this circuit $R_2=5.6K\Omega$ and C=10nF.

a) Assume that the Barkhausen condition is fulfilled. What are the values of resistances R to obtain oscillation on $f_0=3.18KHz$.

b) Deduce the value of R_1 to fulfill the oscillation (Barkhausen) condition.

c) Using diodes modify the circuit to assure an automatic gain control. Assuming $r_d=2K\Omega$ of the conducting diode in the moment when the Barkhausen condition is satisfied, size all the resistors in circuit. The start-up condition should also be satisfied.



4.

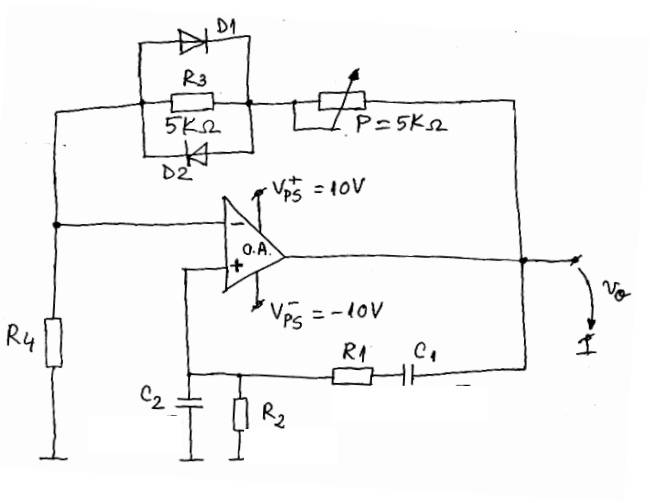
For the position of the cursor of P in the middle, the diodes operate at $r_{D1,on}= r_{D2,on}=0.5K\Omega$. Consider $R_1=R_2=15k\Omega$ and $C_1=C_2=10nF$. Approximate $R_3>> r_{D1,on}, r_{D2,on}$.

a) What is the expression and the value of the frequency of the sinewave $v_o(t)$?

b) What are the expression and the value of r (positive feedback transmittance) at the frequency of oscillation? Find a suitable value of R_4 to fulfill the Barkhausen condition in steady state assuming the cursor of P is in the middle.

c) What is the condition on the product $a \cdot r$ to start-up the oscillation? Verify that, for the value of R_4 chosen at (b), the oscillation start-up can be achieved.

d) Assume the diodes D_1 and D_2 are not connected in the circuit. In this case, how would $v_o(t)$ look like (in steady state) for a value of $R_4=1K\Omega$?



5.

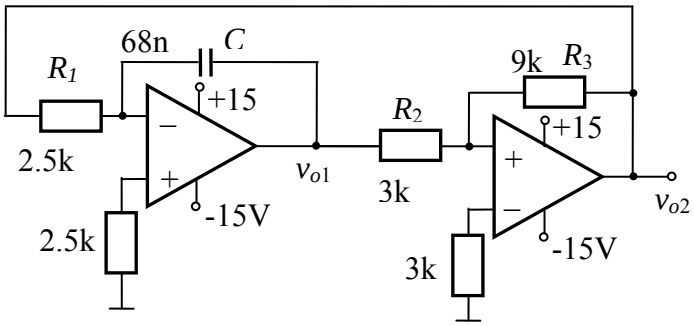
The op ams are rail-to-rail type.

a) Draw qualitatively the signals $v_{01}(t)$ and $v_{02}(t)$.

b) What are the expressions and minimum and maximum values for $v_{01}(t)$ and $v_{02}(t)$?

c) What is the expression and value of the period of the v_{01} signal?

d) Propose a solution for frequency adjustment.



6.

a) Considering v_2 the input voltage, find the values of the threshold voltages for the comparator circuit with OA1.

b) Plot $v_1(t)$ and $v_2(t)$?

c) What is the expression and value of the oscillation frequency?