

EE230- Analog lab (Labwork-4)

Spring Semester: Year 2021-22

January 30, 2022

Instructions:

- Write your netlists and show the simulation results of each question to the evaluating TA during the lab session on Feb 3, 2022.
 - No Additional time will be given.
 - You can refer: NGSPICE tutorial, model files uploaded on the course moodle / MS Teams channel and your written netlists of previous experiments / homeworks.
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1. (a) Write the netlist for the Schmitt trigger circuit shown in the figure [1]. Use dual supply of $\pm 15V$ for the Op-amp 741 and zener diodes of $4.7V$.
(b) Apply a sinusoidal input ($6V_{peak}, 1kHz$) and observe $V_o(t)$ for $V_a = 0V(GND)$. Also, plot V_o v/s V_i .
(c) Compare the threshold voltages V_{TH} and V_{TL} with the values you expect theoretically.
(d) Now, repeat the steps (b) and (c) for $V_a = 3V$ and $-3V$.

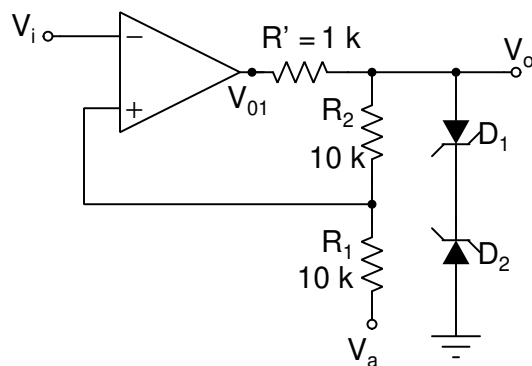


Figure 1: Schmitt Trigger

2. A circuit in Figure [2] is an Astable multivibrator using operational amplifier. Write the netlist for the circuit. Use dual supply of $\pm 15V$ for the Op-amp 741 and zener diodes of $4.7V$.

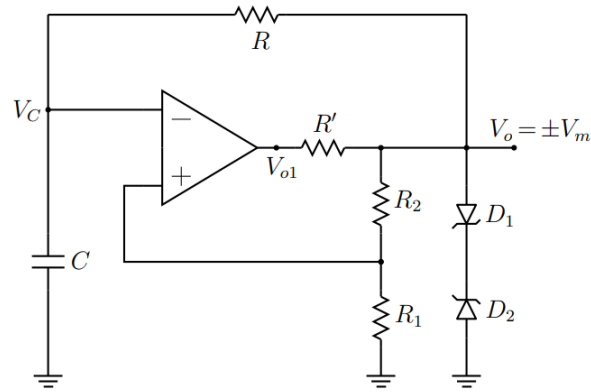


Figure 2: Astable Multivibrator

- Write the netlist for the circuit in Figure [2] without resistor R' and zener diodes D_1 and D_2 .
 - Simulate the circuit for the values of $C = 0.01\mu F$, $R = 50k\Omega$, $R_1 = 30k\Omega$, $R_2 = 35k\Omega$. Perform transient analysis for $10ms$.
 - Plot the Voltages at V_c and V_o on the same plot.
 - Observe the voltage at V_o .
 - What is the frequency of the waveform obtained at V_o ?
 - Now, repeat the steps (b) and (c) adding resistor R' with the value of $1k\Omega$ and zener diodes D_1 and D_2 .
 - Observe the voltages at V_{o1} and V_o . What are the voltage levels at both the points? Is it different? If yes, why?
 - What is the frequency of the waveform obtained at V_o ? Is there any change in the frequency? Comment.
3. A circuit in Figure [3] is a Monostable multivibrator using operational amplifier. Write the netlist for the circuit. Use dual supply of $\pm 15V$ for the Op-amp 741 and zener diodes of $4.7V$.
- Calculate the output pulse width for the monostable circuit shown in the figure [3], when the push button is closed and released.
 - Now, apply a pulse across the capacitor (select suitable time) which will momentarily short the capacitor 'C'. **This should work like 'Make' and 'Break' contact of the push button across the capacitor 'C'.**

- (c) Capture the output pulse at V_o in the plot. Compare the duration of the output pulse width with your calculation.
- (d) Observe voltage at inverting terminal (V_-) and output voltage (V_o) simultaneously in the plot.

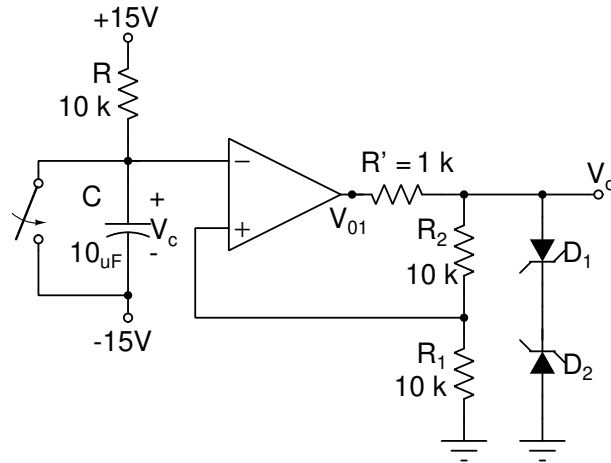


Figure 3: Monostable multivibrator