Assignment 9

1 Design Exercises

Feel free to use Multisim to test and confirm your derivations. However, Multisim by itself does not prove anything! We need to see derivations.

NOTE Make sure that your circuits do not demand output OpAmp currents larger then the maximum output current of LM 741 (25 mA, see in the data sheet the output short circuit current parameter). On a paper it does not matter, but in the real life your timing and hysteresis will be off.

1.1 (6 points)

Design a comparator based on an bi-polar OpAmp (the one which can swing either to negative or positive power supply rail) that will switch when the input signal crosses +2.5 V with no hysteresis. Assume that positive and negative rails are connected to +15 V and -15 V.

1.2 (7 points)

Modify the design of your comparator with a positive feedback network to add a total hysteresis of approximately 0.2 V.

1.3 (7 points)

Design a relaxation oscillator with 10 Hz frequency. Use resistor and capacitor values in the same range as those found in the electronics lab. Note: modify the previous design keeping the hysteresis the same.

2 Lab 9: Comparators and oscillators

Always start with a circuit diagram and only then build it in hardware.

Your notebooks must be complete, understandable, and address all activities, design exercises, observations, and questions noted in the laboratory's procedures. Remember to use your notebook as a laboratory journal and record your data, design calculations, notes and scratch work. *Make sure to write a conclusion for each exercise and each week.*

Task 0

Demand

- a regimental tutorial about light emitting diodes (LED), all we need to know the conditions at which they light up.

Task 1 (10 points) Comparator

Use LM741 to build the trigger from DE 1. Confirm that it works according to the specification.

Task 2 (15 points) Comparator with a hysteresis: Schmitt trigger

Build the circuit to satisfy DE 2. Confirm that it works according to the specification.

Task 3 (15 points) Relaxation oscillator

Build the circuit to satisfy DE 3. Confirm that it works according to the specification. Check the square and the "triangular" signal outputs.

Task 4 (10 points) Blinker

Connect an LED to the square output of your relaxation oscillator and observe the blinking LED.

Does the act of the LED connection change the period of the oscillator? Is time when LED is ON different from the OFF time? Can you explain why this is happening and fix the problem?