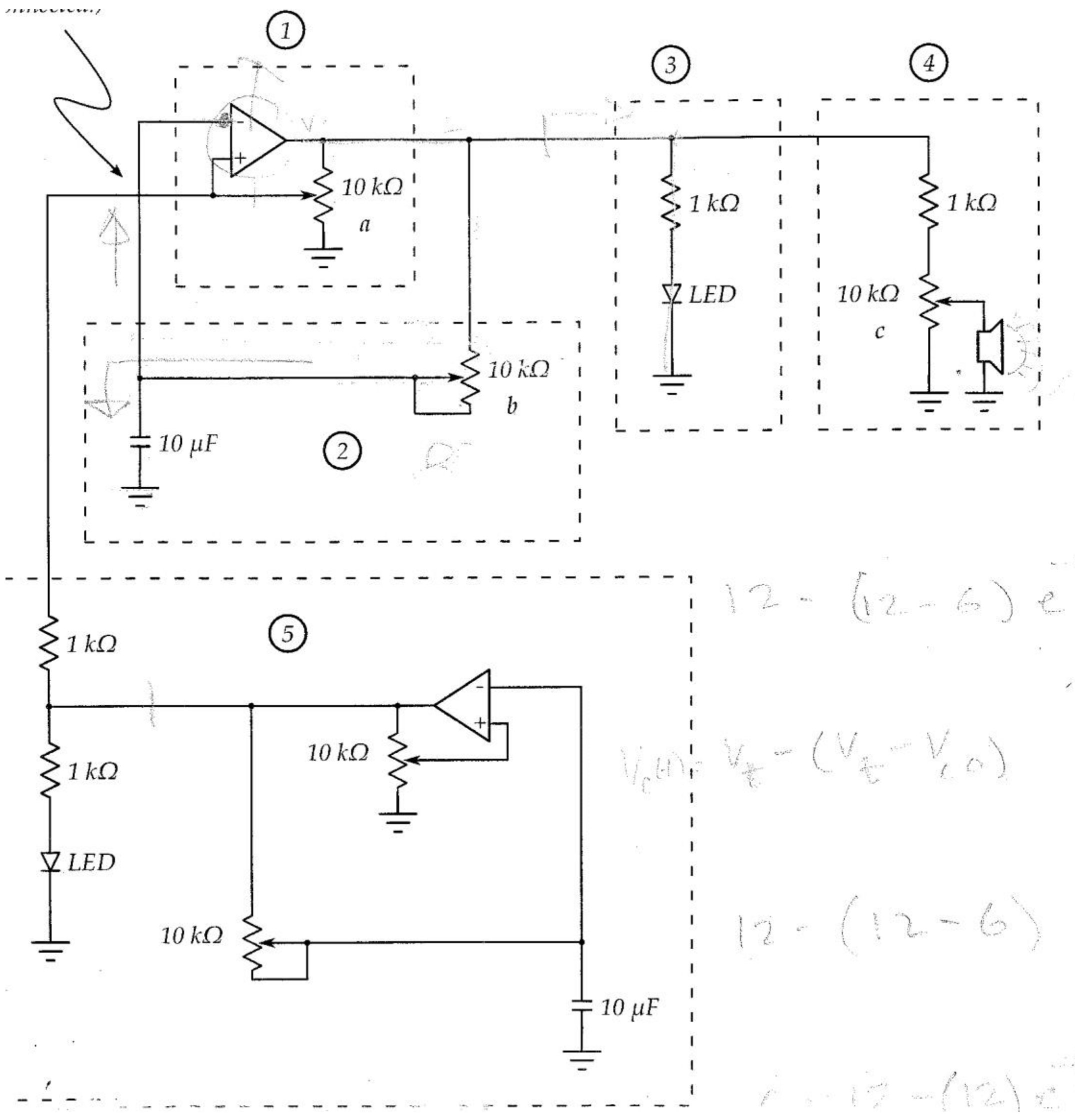
Lab 3

This lab really was focused on debugging!



1.

The equation $V_c(t) = V_t - (V_t - V_{co})e^{-t/RC}$ is used to determine the frequency (when both potentiometers are centered) as such:

$V_t = V_{out}$ max = 12V

$V_{co} = V_{in}$ at t = 0 = 0V

V_c (t) = V_{in} max = 6V

$6 = 12 - (12 - 0)\ e^{-t/RC} = 12 - (12)\ e^{-t/RC}$

$-6 = -12 * e^{-t/RC}$

$.5 = e^{-t/RC}$

$t = -\ln(.5)*R*C$

but what's R*C????!!!

R*C is the time constant, and is simply resistance times capacitance.

So R*C = $5000\Omega * 10^{-5}$F = .05

back to our other equation, we now have

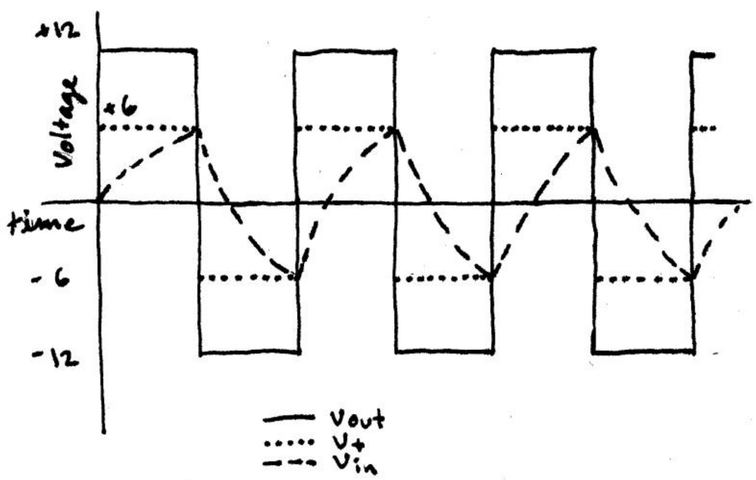
t = -ln(.5)*.05 = .034657

t is the time for one period, so

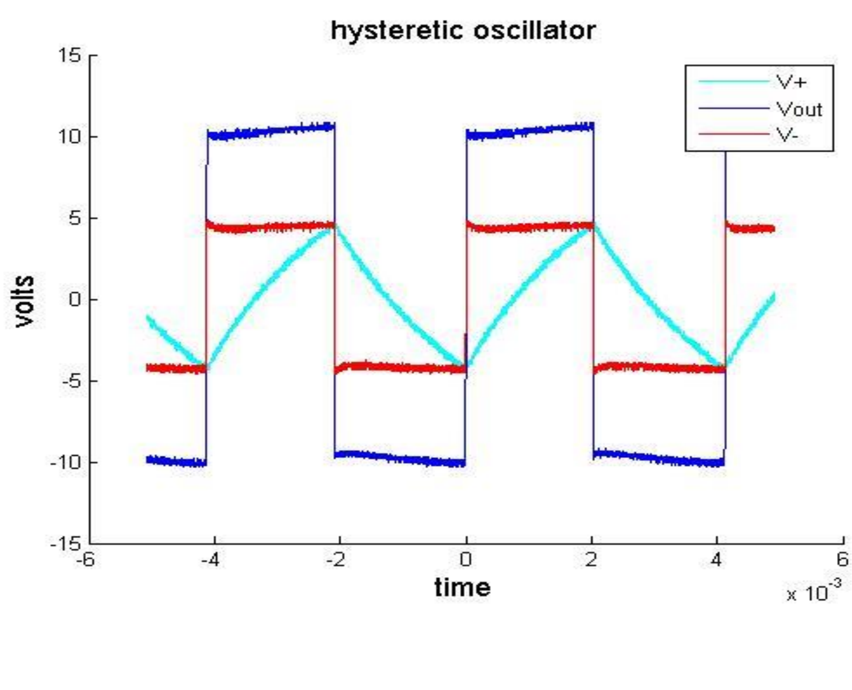
f = 1/t = 28.85Hz

Hurray!

Here's what the theoretical graph looks like:



Now subsystems 1 and 2, which form a Hysteretic Oscillator, were built and data was collected. The following graph from matlab shows the shark pattern:



Unfortunately you can see that I messed up the legend a bit. V_+ and V_- should be swapped. As for the experimental frequency, you can see that V_+ is not quite at 6V (oops), so the experimental frequency won't be perfect. But here goes.

t = .004 seconds

f = 1/.004 = 250Hz

That's nowhere near 28Hz

2.

The speaker was awesome. It made cool noises. I wish the speaker were part of our lab. Oh well!

With the second oscillator in place, the frequency of the first oscillator can be affected by turning the second oscillator's potentiometers, as seen below: