

Ask for TA/SA help:

The inverting op amp circuit I built wasn't behaving as expected, so I asked a TA/SA for help, and we figured out that I had mistakenly tied an offset voltage to ground. I think it was Tom? I've looked at every lab but I don't think I've seen them since?

Help another student or ask for help from another student:

Joe was having trouble with their M1K board was able to borrow an M2K, but needed some help learning how to use it. I had just learned how to use the analog discovery 1 and 2, which uses the same pinout and very similar software, so I helped guide them through the first few experimental circuits.

Portfolio:

Yeah I need to do my portfolio still, and I know it's required, but come on, you're not gonna make me work alone because of this little thing? I'll have it done asap

Add new info to ECSE skills doc:

[Power and measure the output of a working operational amplifier](#)

 Real Analog - Circuits1 Labs: Ch5 Vid1: Operation Amplifiers (Yuzhe)

<https://www.youtube.com/watch?v=UxvgZCRKooQ> if you're using an op37 or similar, this was a good explanation for why pins 1 and 5 (V offset) should usually be left floating

Instructions are provided in Parts B and C1:

https://sites.ecse.rpi.edu/~ssawyer/CircuitsSpring2023_all/Labs/Unit1/Lab01.pdf

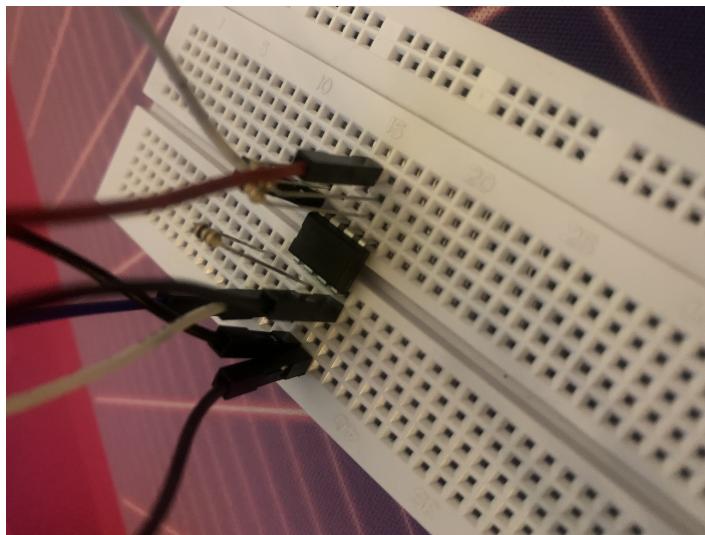
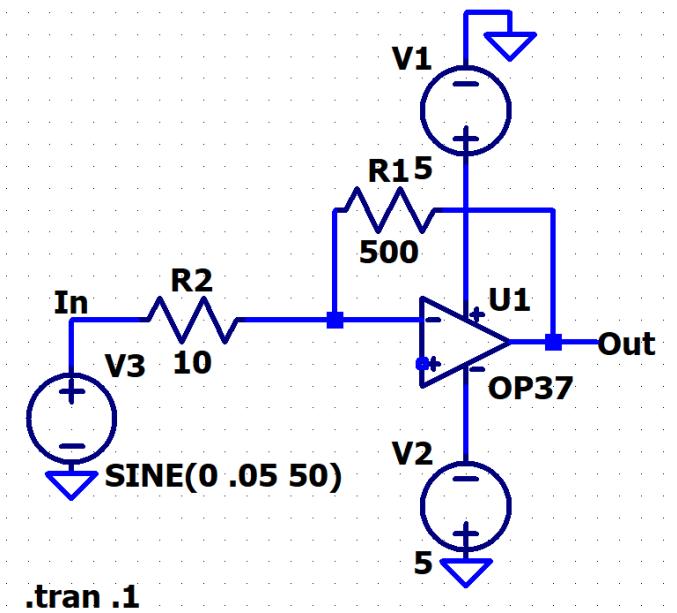
<https://www.labcenter.com/blog/sim-opamps/>

- Link providing background information on simple op-amp circuits and the projected oscilloscope readings if done correctly. Shows signals next to circuit diagrams!

Max level: compare calculated, simulated, and experimental results:

Inverting amplifier with gain of 50

Apology in advance: It's late at night and I'm bored so I went a little overboard with the analysis
lol



The first plot (blue, @(x)) is calculated by the 50hz frequency and the resistor values in my inverting amplifier

$$\text{Gain} = R_f / R_i = 500\text{ohm} / 10\text{ohm} = 50, \text{Amplitude} = \text{gain} * \text{input} = 50 * 0.05\text{V} = 2.5\text{V}$$

The second plot (orange, TIME) is experimental data from waveforms with the opamp circuit from my experimental proof of skills (which had a time offset applied to be in phase with the others)

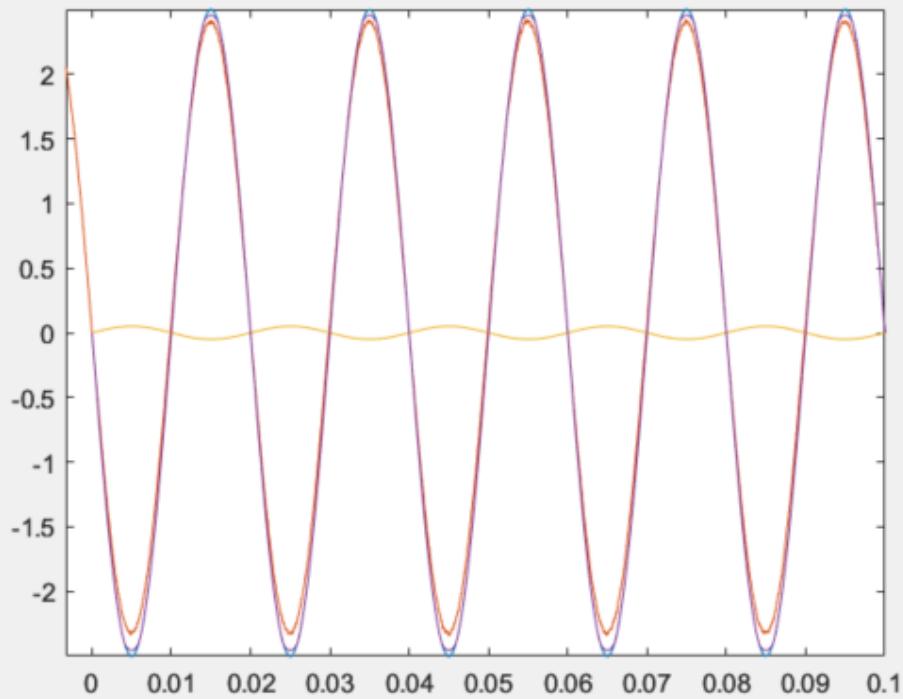
The third and fourth plots (time) are my simulation data from LTspice (also from the my experimental proof of skills). The third plot (yellow, Vn-003) is input voltage and the fourth (purple, Vout) is output voltage.

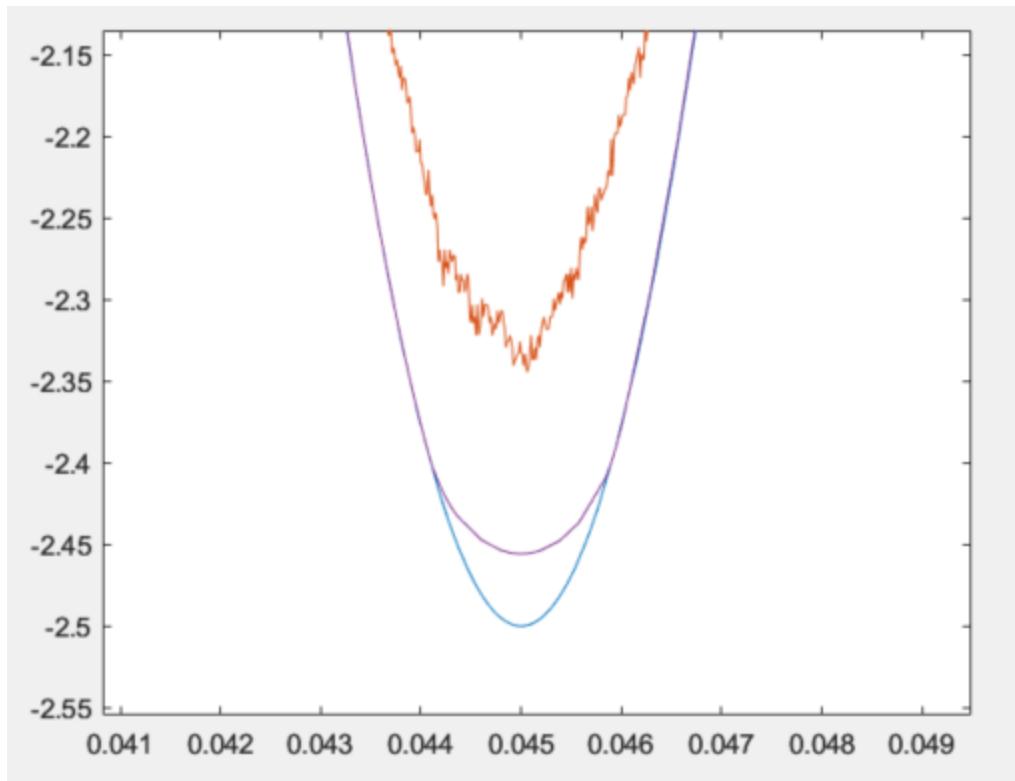
```
fplot(@(x) 0-2.5*sin(100*pi*x+0),[0,.1])
hold on
plot(TIME,Channel1V)
plot(time,Vn003)
plot(time,Vout)
```

Name	Value
Channel1V	8192x1 double
time	636x1 double
TIME	8192x1 double
Vn003	636x1 double
Vout	636x1 double

Figure 1

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There is a slight deviation in amplitude and offset between my experimental, simulated, and calculated date

Value	Calculated	Simulated	Experimental
max(V)	2.5	2.455758	2.42530912447753
min(V)	-2.5	-2.455756	-2.34436491638639
Output offset (average)(V)	0	0.006597876055757 86	0.0736192211426854
Input offset (average/50)(V)	0	0.0001319575211151 57	0.001472384422853 71
Amplitude ((max-min)/2)(V)	2.5	2.455757	2.38483702043196

LTspice was actually surprisingly far from calculated, I assume the amplitude is simply because of limited samples (only 636) not fully capturing the peaks and troughs, and the offset is because (again surprisingly), the time steps aren't consistent, varying between 30ns and .4ms.

Experimental data showed an amplitude of 2.38, 4.8% off from calculated data, but when considering that the resistors are both $\pm 5\%$, we can calculate that we could reasonably (albeit unlikely) get an amplitude as low as $2.5 \cdot .95 / 1.05 = 2.26$. Our results could be achieved if the resistors were off by 2.35756%, giving us a gain of 47.6967404086.

Experimental data also showed an output offset of 73.6192211426854mV. Dividing this by our gain of 47.6967404086, we get an input offset of 1.54348537263mV, which is 15 times the rated max of .1mV for the OP37G, but well within expected values for most opamps, meaning there are either other issues in this test, or my two OP37G's are counterfeits, which I wouldn't rule out considering how different their label is compared to everything else in the kit. I'll test this with a much more reliable method soon to find out.