lab8_pulseoximeter

November 10, 2019

1 Lab 8: Pulse Oximeter

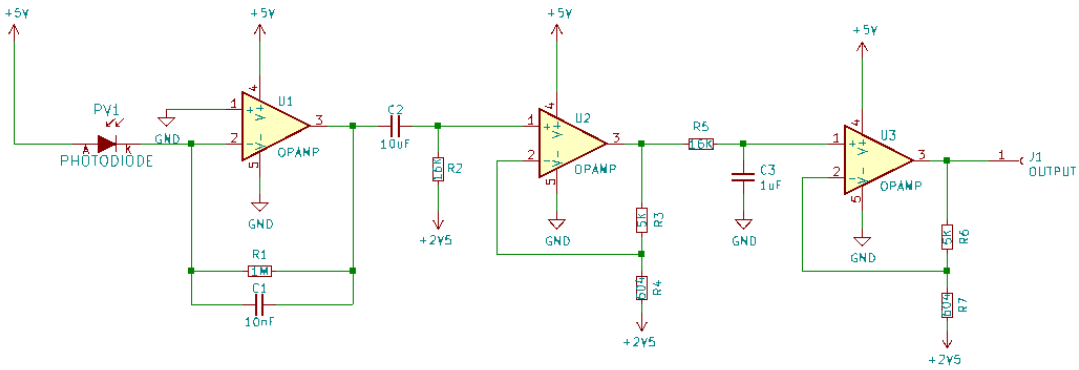
In this lab, a pulse oximeter was used to measuere my heart rate.

Your deliverables for this lab are: 1. Provide a short analysis of two different offsets that can be used for some op-amp circuits. 2. Your final circuit schematic, i.e. a copy of Figure 1 but with your final values selected. You can hand sketch it. Include the resistor values on the schematic. Include the actual cutoff frequencies and amplifier gains. You can sketch the circuit, but it should be neat enough that someone else in the class could build the circuit off your drawing. 3. Provide a short explanation/calculation that shows how you selected resistor/capacitor values. 4. A picture of your final circuit. It should be neat with clipped straight wires, low profile resistors, clean lines, and no loopy stuff. 5. One nice clean scope trace of your pulse with this circuit.

1.1 Prelab Concepts

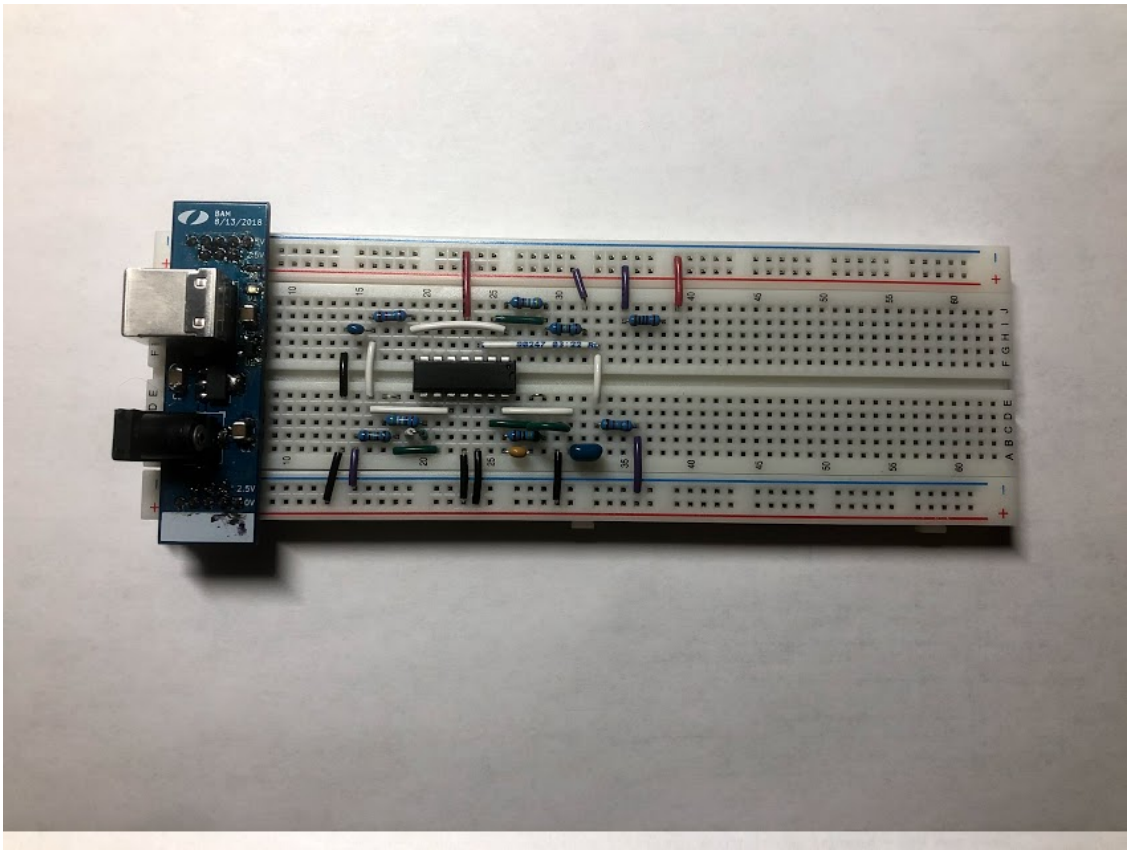
In this lab, the op-amps were all powered from 0-5V but the non-inverting terminals were all set to 2.5V. While this seems to imply a loss of resolution, it is actually necessary to pull the non-inverting terminals to 2.5V instead of 0V to preserve the full range of the op-amp's output. The output needs to be able to be driven as both a source and a sink, and thus needs to be able be driven below the reference voltage. By powering the op-amps from 0-5V and setting the reference to 2.5V, this allows current to flow both into the output pin of the op-amp and out of the output pin.

1.2 Hardware Setup



The circuit consists of 3 op-amps. The first one is set to be used to convert the current source of the light sensor to a voltage source. A small 10nF bypass capacitor is added to filter out the high frequency noise generated by the lights in the room. Next, a first order high pass filter is added

with cutoff frequency 1Hz. This is added before any of the amplifications to ensure that the voltage is always in range. After this, the signal is amplified, filtered, and amplified again, to give the final output signal that is read by the Analog Discovery.

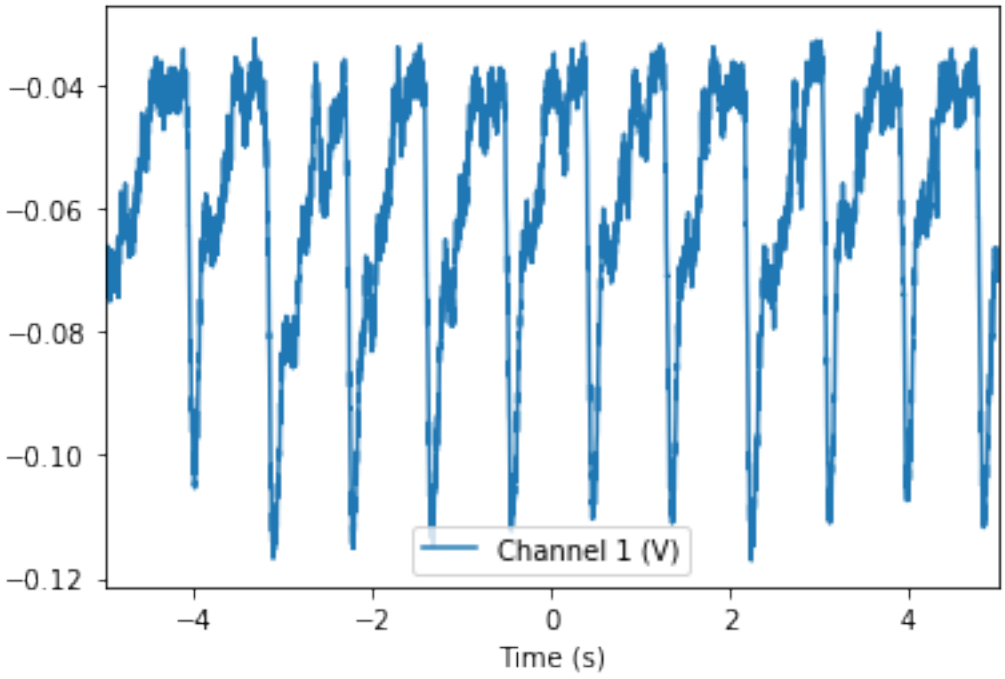


1.3 Results

[3]:
```
import pandas as pd
%matplotlib inline
```

[6]:
```
data = pd.read_csv('pulse.csv')
data.plot(x='Time (s)', y='Channel 1 (V)')
```

[6]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f5bd85e0dd0>
```


−0.04
−0.06
−0.08
−0.10
−0.12
−4
−2
0
2
4
Time (s)
Channel 1 (V)