Introduction to Sensors, Measurement and Instrumentation

Lab 7: Pulse Oximeter

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Circuit Diagram

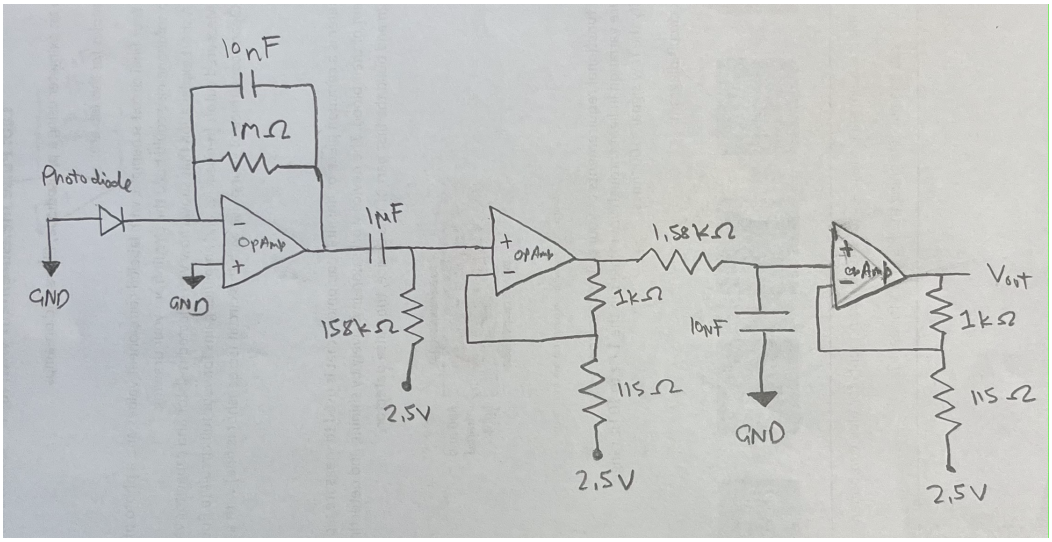

Figure 1: The circuit diagram demonstrates a pulse oximeter circuit that utilizes a photodiode, Op-Amps, and RC filters.

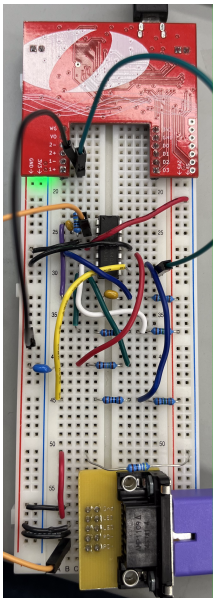

Figure 2: O-scope photo of the Pulse Oximeter circuit.

Resistors and Capacitors Explanation

Using the equation, $f = \frac{1}{2\pi RC}$, we input the desired cut-off frequencies f which are 1 Hz and 10 Hz, respectively.

Picking the value of capacitors $C = 1\mu F$ for f = 1 Hz and $C = 10\mu F$ for f = 10 Hz, we obtained the values of resistors $R = 158k\Omega$ and $R = 1.58k\Omega$ respectively.

For choosing the value of resistors for obtaining an amplifier gain of ~ 10, we use the equation, $Gain = \frac{R_1 + R_2}{R_2}$, where $R_1 >> R_2$.

Using this, we can obtain the values of $R_1 = 1k\Omega$ and $R_2 = 115\Omega$.

Cut-off Freqs, Gain, Bode Plot

The circuit utilizes one high-pass RC filter and one low-pass RC filter.

The cut-off frequencies obtained from the filters are:

- High-pass = 0.15915 Hz
- Low-pass = 10.073 Hz

The amplifier gain of the circuit is ~ 100 in total because of using two amplifiers with a gain of ~ 10 each.

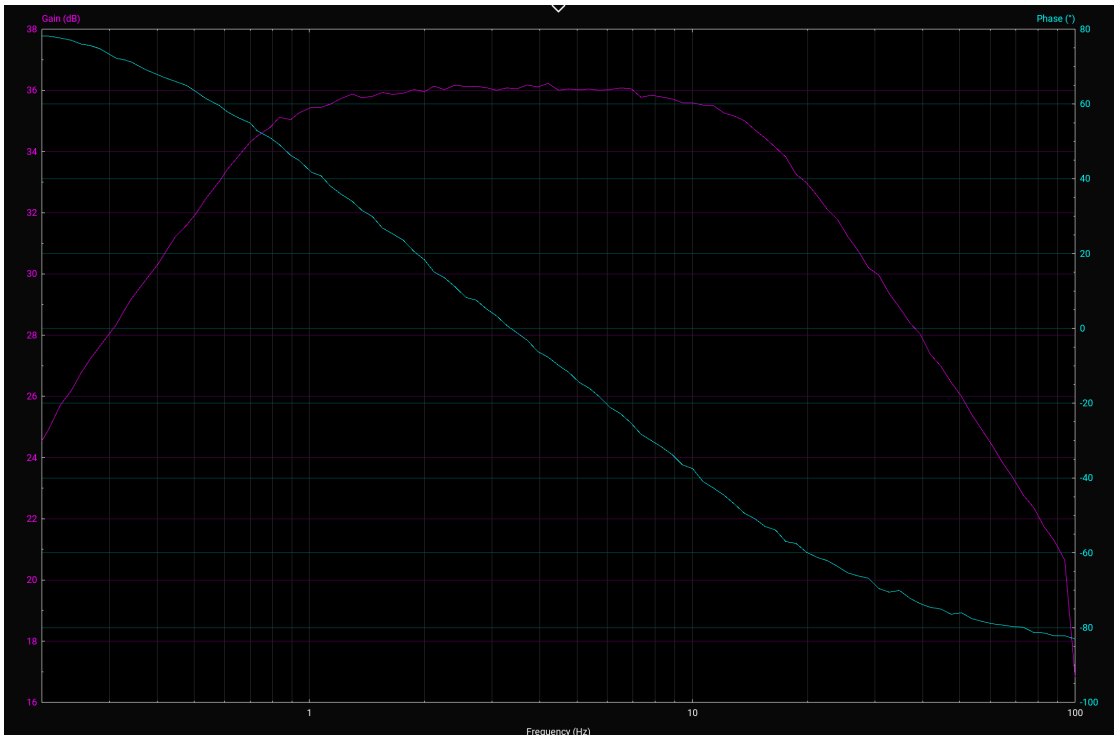

Figure 3: The Bode plot (Gain(dB) vs Frequency (Hz)) for the Pulse Oximeter Circuit to observe the cut-off frequencies.

Pulse Output

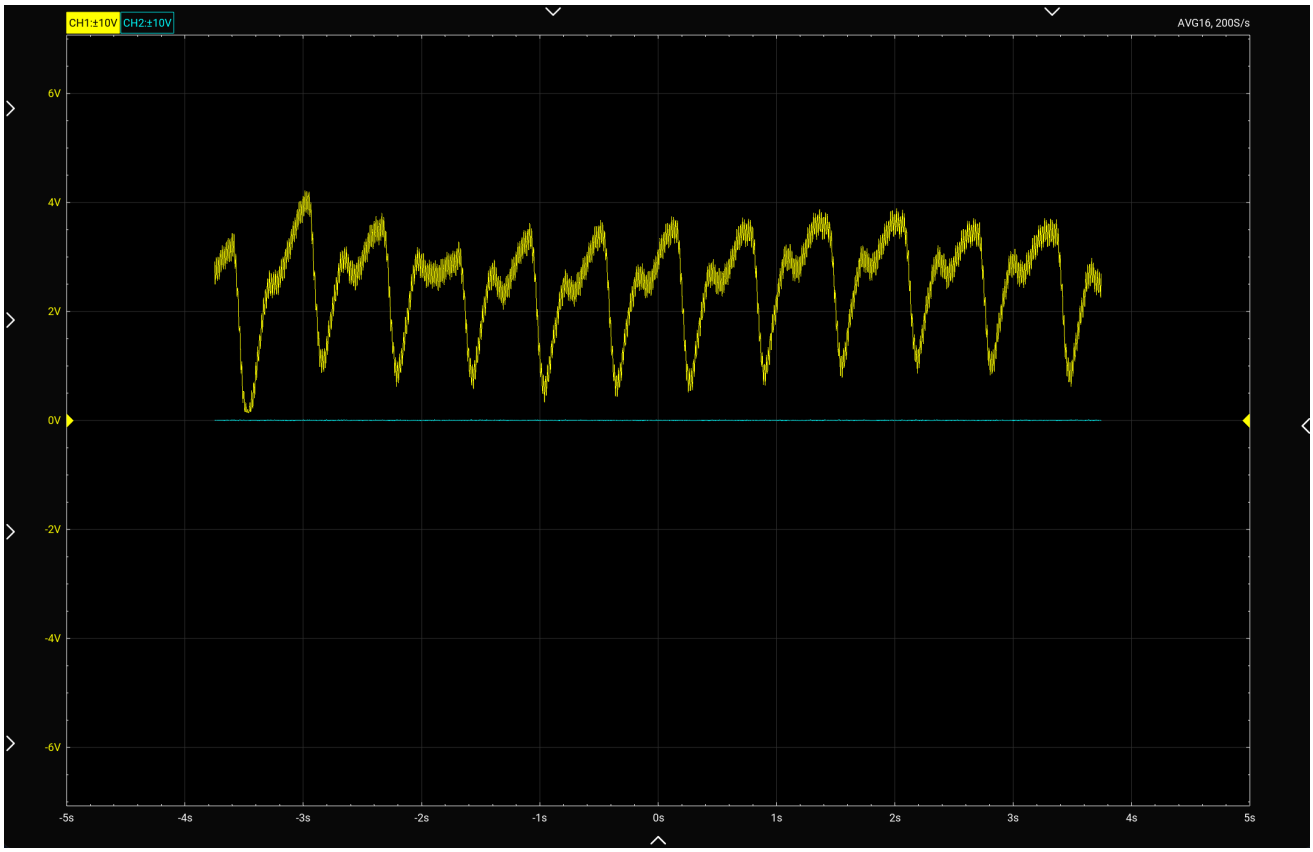

Figure 4: Pulse Oximeter output: The scope trace of the Pulse Oximeter circuit output which utilizes a photodiode, RC filters, and Op-Amps. The cut-off frequencies in the circuit are 0.15915 Hz and 10.073 Hz.