CMPE-460 Laboratory Exercise 3

Characterization of OPB745

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Contents

Abstract

The purpose of this exercise was to develop an understanding behind the functionality and various functional parameters of the OPB745 photo-transducer. In order to test its ability to perform as an opto-isolator, a tube with an adjustable reflective surface was created, and the OPB745 was placed inside in order to isolate any external light source. With the following implemented, the Opto-Isolator functioned accordingly yielding the expected results.

Design Methodology

The first step in this lab exercise was to build the enclosure for the opto-isolator. Figure 1 shows the logical diagram for the enclosure.

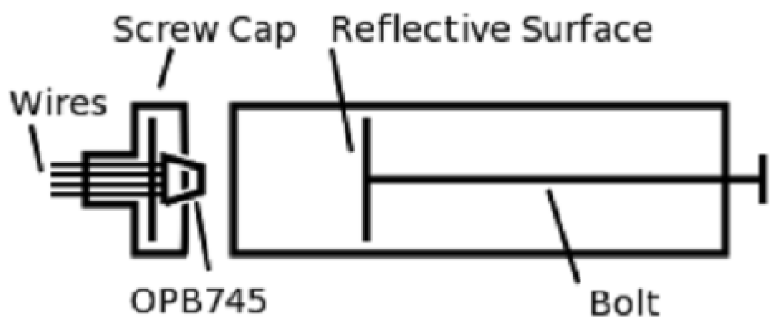

Figure 1: Opto-Isolotor enclosure diagram

Two black ABS plastic tubes were used to create this enclosure. One with roughly a one inch outer diameter with an end cap to hold the OPB754 sensor. The second tube, with a slightly smaller diameter, was used to hold the reflective surface at a variable distance from the sensor as well as block out any interfering light from outside the tube. A metric ruler was also attached to the inner tube to allow the distance from the sensor to the reflective surface to be measured.

Once the enclosure was assembled the next step was to calculate the necessary resistors for the two different circuits used to analyze the voltage vs. distance and frequency characteristics of the OPB745 sensor. Figures 2 and 3 show the two circuits.

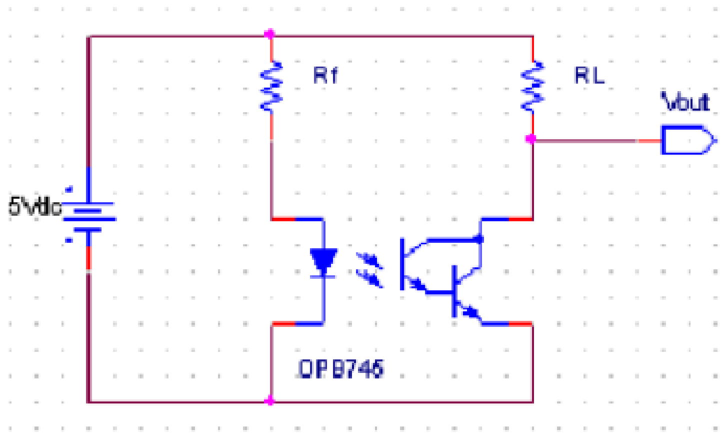

Figure 2: Voltage vs. Distance circuit

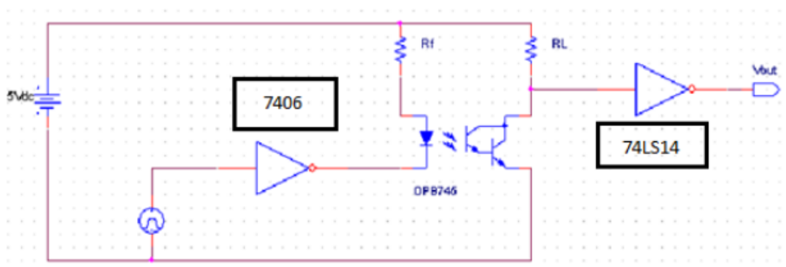

Figure 3: Frequency response circuit

Each circuit will be analyzed twice with two different load resistor values of 10kΩ and 20kΩ. Equations 1 - 4 show the derivation for the R_f resistor for the circuit in Figure 2. The values for V_f were obtained from the respective datasheets.

$$I_f = \frac{V_{dc} - V_f}{R_f} \tag{1}$$

$$R_f = \frac{V_{dc} - V_f}{I_f} \tag{2}$$

$$R_f = \frac{5\text{V} - 1.7\text{V}}{40\text{mA}} \tag{3}$$

$$R_f = 82.5\Omega \tag{4}$$

The same process was used for deteminging the R_f resistor for the circuit in Figure 3 and is shown in Equations 5 - 7.

$$R_f = \frac{V_{dc} - (V_{f,inverter} - V_{f,diode})}{I_f} \tag{5}$$

$$R_f = \frac{5 - (1.7\text{V} - 0.8\text{V})}{40\text{mA}} \tag{6}$$

$$R_f = 65\Omega \tag{7}$$

These circuits were then built using a breadboard, jumper wires and various resistors to get as close as possible to the calculated values above. The circuit in Figure 2 was analyzed by using a multimeter to measure the voltage at V_{out} while the distance between the reflective surface and the sensor is varried. The circuit in Figure 3 was analyzed by using an oscilloscope at V_{out} and a waveform generator at the input of the diode. The output was then measured while the frequency of the input waveform was varried.

Results & Analysis

Table 1 shows the measurements taken from the multimeter as the distance from the OPB745 sensor and the reflective surface was varried.

Table 1: Voltage vs. Distance measurements

	$R_{l,1}$ - 10kΩ		$R_{l,2}$ - 20kΩ	
Distance (mm)	V_{out} (V)	I_{R_l} (mA)	V_{out} (V)	I_{R_l} (mA)
0	4.934	0.4934	4.859	0.24295
1	0.866	0.0866	0.781	0.03905
2	0.723	0.0723	0.679	0.03395
3	0.701	0.0701	0.653	0.03265
4	0.703	0.0703	0.651	0.03255
5	0.717	0.0717	0.662	0.0331
6	0.736	0.0736	0.681	0.03405
7	0.757	0.0757	0.707	0.03535
8	0.782	0.0782	0.729	0.03645
9	0.808	0.0808	0.729	0.03645
10	0.844	0.0844	0.772	0.0386
11	0.985	0.0985	0.791	0.03955
12	2.107	0.2107	0.809	0.04045
13	2.800	0.2800	0.838	0.0419
14	3.097	0.3097	0.885	0.04425
15	3.300	0.3300	1.137	0.05685
20	3.582	0.3582	1.613	0.08065
25	3.627	0.3627	1.985	0.09925
30	3.848	0.3848	2.246	0.1123
35	4.243	0.4243	3.255	0.16275
40	4.508	0.4508	3.971	0.19855
45	4.637	0.4637	4.287	0.2139
50	4.695	0.4695	4.421	0.22105

The data in Table 1 was graphed using Excel and produced Figures 4 and 5. These figures show data produced by the circuit with both the 10kΩ and 20kΩ load resistors. From inspection the voltage at the 0mm mark reads close to that of the source, 5V. As the distance initially increases, the voltage drops close to 0 and as the distance continues to grow, the voltage begins to return to the source value of 5V. This is due to the operating range of the device.

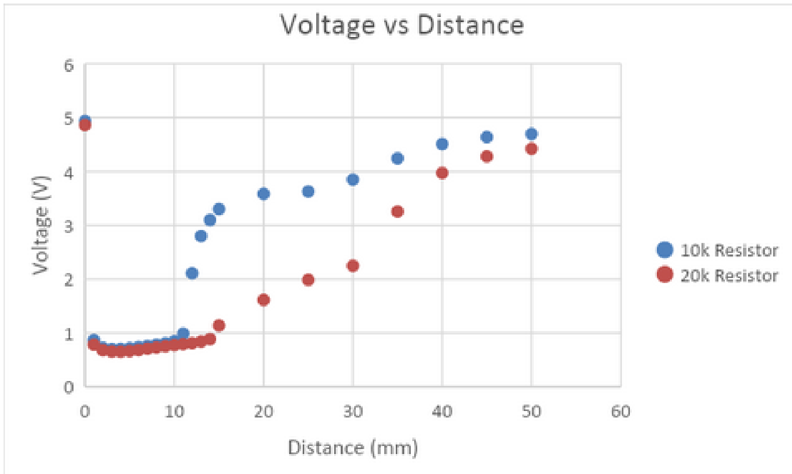

Figure 4: Voltage vs. Distance of OPB745

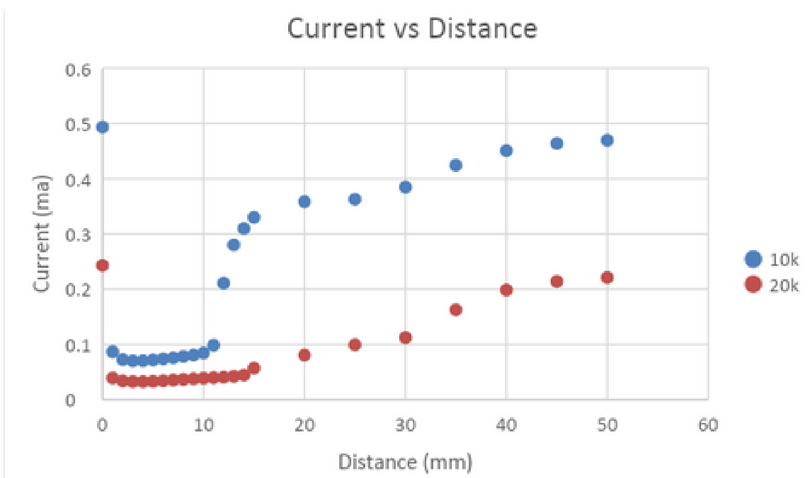

Figure 5: Current vs. Distance of OPB745

Results and Analysis go here. Follow lab report guidelines. Remember to introduce Figures (**??**) through (**??** before they appear in the document. Make sure that your figure labels are below the figure itself and that they have a title.
A pair of exemplary segmentations are illustrated in Figures (**??**) and (**??**), corresponding to the CPU and GPU implementations respectively. Note that the images are identical.
Graphs are very helpful if you're trying to show a trend to the reader. Figures (**??**), (**??**), and (**??**) plot the CPU and GPU execution times of the segmentation of the images of

different sizes, with 24, 100, and 400 superpixels respectively. Note that not only does the GPU consistently provide a speedup ¿1, but that the speedup improves with an increasing image size. Moreover, speedup also improves with an increased superpixel size.
Results and Analysis are also pretty tedious :)

Conclusions

Conclusions go here. Follow lab report guidelines.