

EE230: Lab 9 (Offline)

Instrumentation Amplifier on Load Cell Sensor

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1 Selection of Values of Resistors

1.1 Gain of Instrumentation Amplifier in Part 1

$$A_v = \frac{R_4}{R_3} \left(1 + \frac{2R_2}{R_1} \right) \quad (1)$$

For a value of $A_v = 300$, the values of Resistors chosen were such that $\frac{R_2}{R_1} = 7$ and $\frac{R_4}{R_3} = 20$. For R_1 (the gain resistor) a 1k potentiometer was used. For R_2, R_3, R_4 two resistors each were needed which I refer to here as R_2, R_3, R_4 and R'_2, R'_3, R'_4 . They were chosen as follows

Resistor	Experimental Value ($k\Omega$)
R_2	5.56
R'_2	5.66
R_3	0.26
R'_3	0.27
R_4	5.69
R'_4	5.54

The potentiometer was adjusted such that the output waveform seen on the DSO was approximately 300 times amplified.

2 Readings and Observations

2.1 Part 1 - Instrumentation amplifier made using TL-084

2.1.1 Readings Taken

Weight (g)	Measured Voltage (V)
0	1.144
1	1.143
2	1.14
3	1.138
5	1.132
6	1.129
7	1.125
8	1.123
10	1.12
15	1.108
20	1.095
25	1.085
30	1.072
35	1.06
50	1.035
100	0.898
150	0.79

2.1.2 Plots Obtained

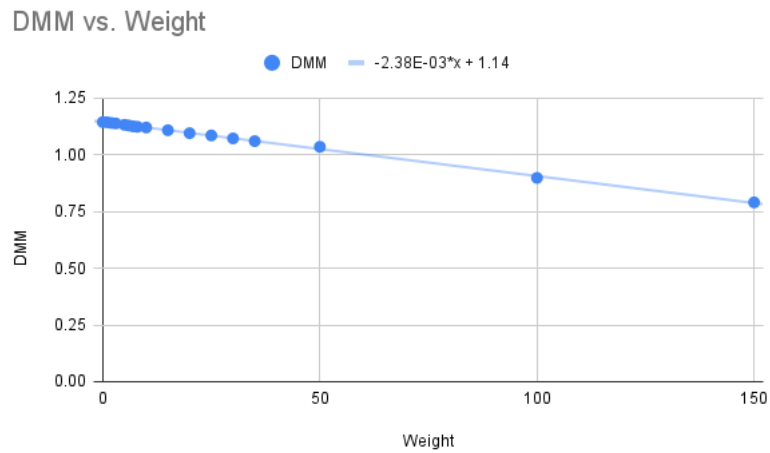


Fig 1: Plot for Part 1

2.1.3 Calculation of Sensitivity

The best fit minimum error equation of a line was fit to the points. The slope was obtained as -2.38 mV/g which can be seen above the plot

2.2 Part 1 - Attempt at Doubling the Sensitivity

2.2.1 Readings Taken

Weight (g)	Measured Voltage (V)
0	2.28
10	2.24
15	2.22
20	2.19
25	2.17
30	2.14
35	2.12
50	2.07
70	1.97
100	1.8
150	1.59

2.2.2 Plots Obtained

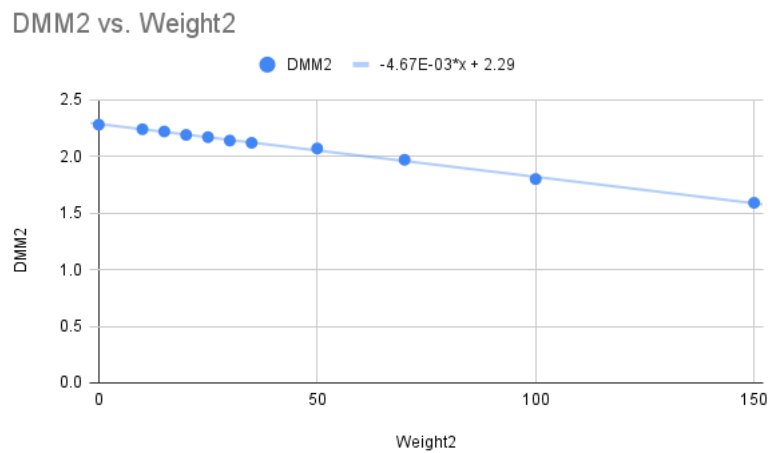


Fig 1: Plot for Part 1 - Doubled Sensitivity

2.2.3 Calculation of Sensitivity

The best fit minimum error equation of a line was fit to the points. The slope was obtained as -4.67 mV/g which can be seen above the plot. The sensitivity is nearly double the previous case.

2.3 Part 3 - Instrumentation Amplifier INA128

2.3.1 Readings Taken

Weight (g)	Measured Voltage (V)
0	0.003
5	-0.004
10	-0.012
15	-0.019
20	-0.028
25	-0.036
30	-0.044
35	-0.052
50	-0.076
60	-0.09
70	-0.107
80	-0.123
100	-0.154
120	-0.186
150	-0.236
170	-0.268

2.3.2 Plots Obtained

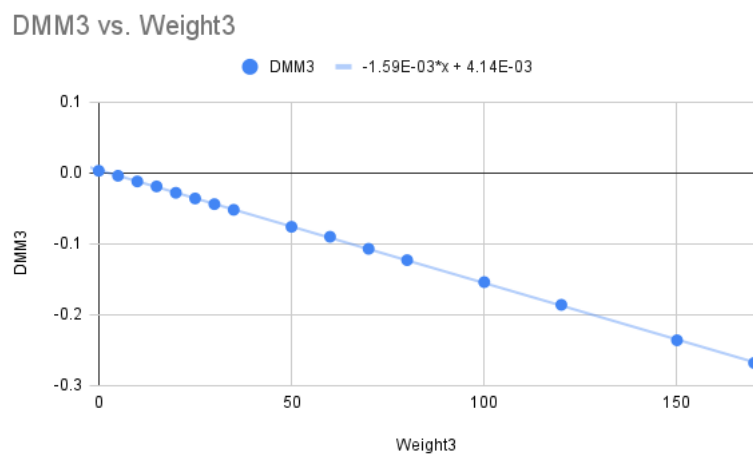


Fig 1: Plot for Part 3

2.3.3 Calculation of Sensitivity

The best fit minimum error equation of a line was fit to the points. The slope was obtained as -1.59 mV/g which can be seen above the plot

2.4 Part 3 - Attempt at Doubling the Sensitivity

2.4.1 Readings Taken

Weight (g)	Measured Voltage (V)
0	0.006
5	-0.008
10	-0.023
15	-0.039
20	-0.056
25	-0.072
30	-0.088
35	-0.103
50	-0.152
60	-0.183
70	-0.216
80	-0.247
100	-0.313
120	-0.377
150	-0.473
170	-0.538

2.4.2 Plots Obtained

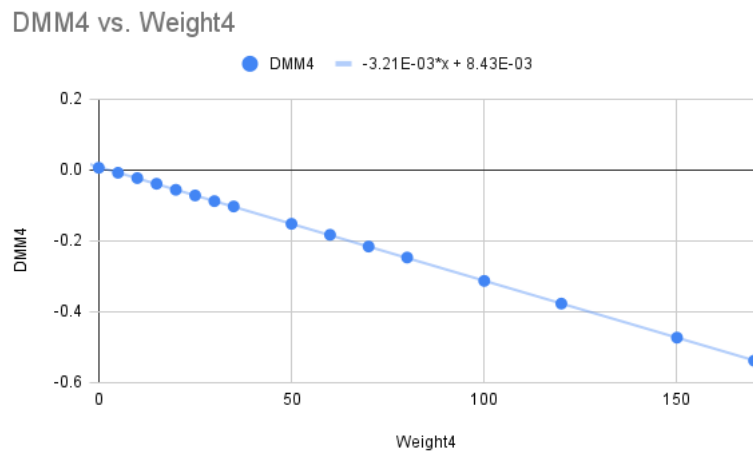


Fig 1: Plot for Part 3 - Doubled Sensitivity

2.4.3 Calculation of Sensitivity

The best fit minimum error equation of a line was fit to the points. The slope was obtained as -3.21 mV/g which can be seen above the plot. The sensitivity is nearly double the previous case.