**Experiment 0**

**Tian Ye**

**Lab 8**

**October 10th, 2017**

**Megan Wu**

**Abstract**

Experiment 0 centers about recording an output voltage that is proportional to the force applied to the sensor by masses that are hung on its hook. The objective of said experiment is to use linear regression to find a line that most accurately reflects the data collected.

However, there is associated uncertainty with the value of the data points collected, specifically the voltage, as we can assume that the sensor used has neither perfect accuracy nor calibration. As the recorded data will inherently have some scatter, there are many different lines with slightly different slopes and intercepts that can be considered to accurately reflect the data.

Thus, the data analysis tool of Microsoft Excel will be used to calculate the uncertainties inherent in the slope and intercept values of the linear fit line.

**Data Analysis**

Before being able to perform linear regression, we first had to obtain data using various masses and their correlating voltages. As the masses are given values, there is no uncertainty regarding their measurements. The uncertainty rather instead exists in the values obtained for voltage. Below is a table illustrating the masses and the corresponding voltages reflected in the force sensor:

|  |  |  |
| --- | --- | --- |
| **Mass of Weight** | **Force of Weight** | **Measured Voltage of Force Sensor** |
| 50 grams | 0.49 N | -0.08 volts |
| 100 grams | 0.98 N | -0.16 volts |
| 200 grams | 1.96 N | -0.31 volts |
| 250 grams | 2.45 N | -0.39 volts |
| 300 grams | 2.94 N | -0.46 volts |

***Table 1: Mass of Weights with the Corresponding Voltages Displayed by Force Sensor*.** *The sensor was zeroed after every test; the 250 gram and 300 gram masses were obtained by combining the 200 gram mass with a 50 gram and 100 gram mass, respectively. Force was obtained via multiplying the mass of each weight by the gravitational constant 9.8 m/s2.*

It is important to note that the values for the table are not completely accurate as the instrument used for measuring voltage is accurate only to a certain extent; consequently, there exists uncertainty for the values of the measured voltage.

When the points in the data table are plotted on a scatterplot with the x-axis representing force in newton and the y-axis representing the measured voltage, the following plot is created:

***Figure 1: Voltage (V) displayed on Force Sensor plotted against Force (N).*** *The data points follow a relatively linear progression. The data points were collected from left to right with: 50 gram mass, 100 gram mass, 200 gram mass, 200 + 50 gram mass, 200 + 100 gram mass.*