ISIM Lab 3- Strain Gauge

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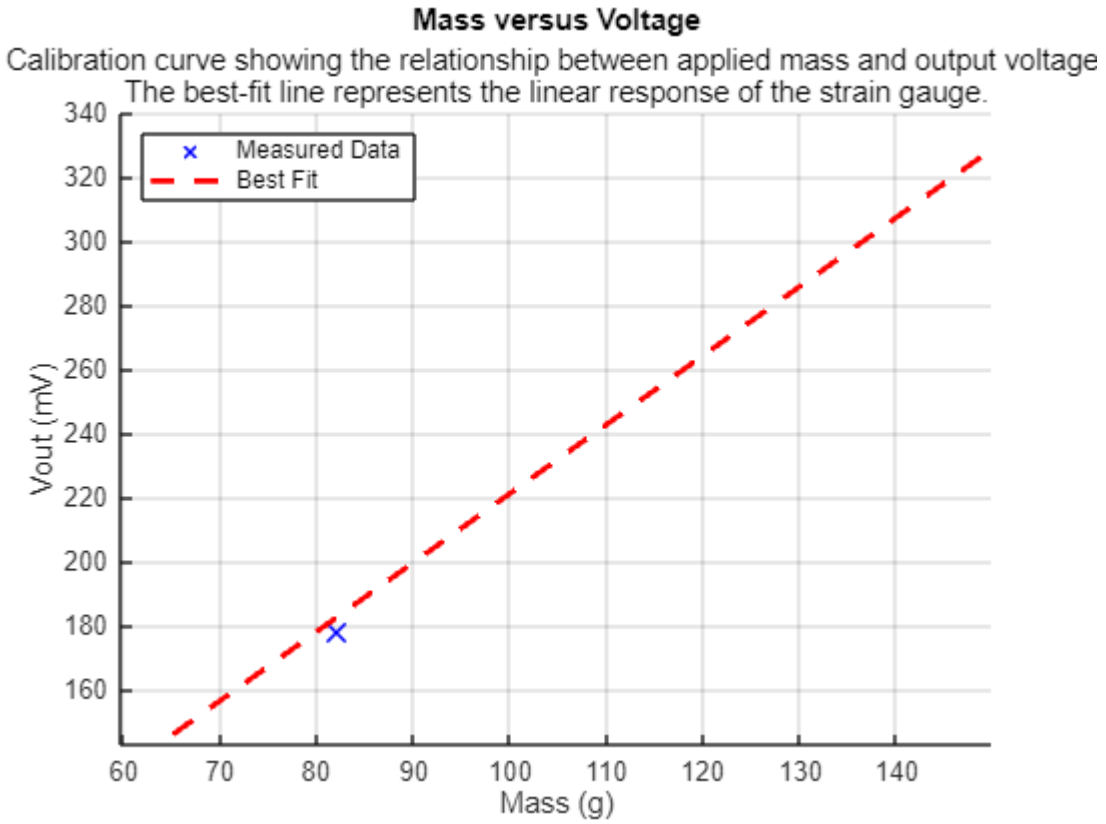
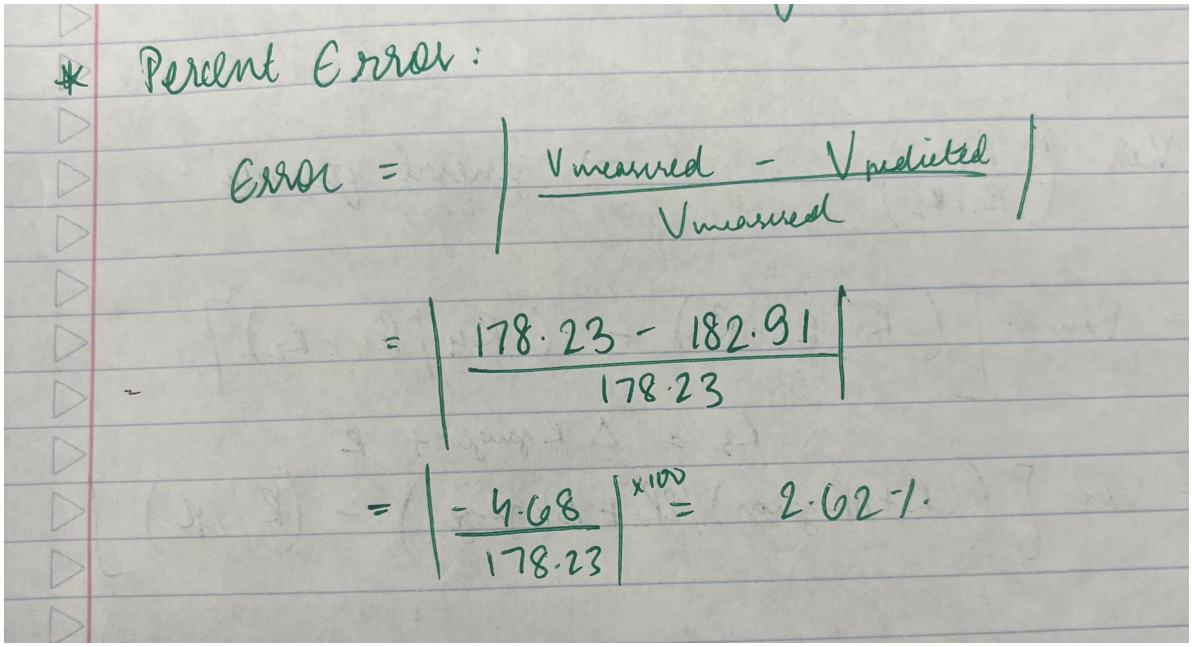
Calibration Plot:

```
mass = [0, 40.6, 82.2, 157.1];
Vout = [1.32, 102.44, 178.23, 344.32];
p = polyfit(mass, Vout, 1);
best_fit = polyval(p, mass);

figure;
scatter(mass, Vout, 'bx', 'LineWidth', 1, 'SizeData', 100);
hold on;
plot(mass, best_fit, 'r--', 'LineWidth', 2);
xlabel('Mass (g)');
ylabel('Vout (mV)');
title('Mass versus Voltage');
subtitle({'Calibration curve showing the relationship between applied mass and
output voltage.', 'The best-fit line represents the linear response of the strain
gauge.'})
grid on;
legend('Measured Data', 'Best Fit', 'Location', 'northwest');
hold off;
```



Percent Error:



Analysis:

* Analysis:

$$V_{out} = V_{in}\left(\frac{R_1}{R_1+R_2}\right) \longrightarrow \text{general formula}$$

$$\therefore V_{out} = V_{in}\cdot\left[\left(R_3/R_3+R_1\right) - \left(R_4/R_4+R_2\right)\right]$$

$$R_3 = \Delta R_{gauge} + R$$

$$V_{out} = V_{in}\left[\left((R+\Delta R_{gauge})/2R + \Delta R_{gauge}\right) - \left(R/2R\right)\right]$$

$$V_{out} = V_{in}\left[\frac{\Delta R_{gauge}}{2R}\right]$$

amplifies x2 (as shown by Oscope).

$$\therefore V_{out} = V_{in}\left(\frac{\Delta R_{gauge}}{4R}\right)$$

$$\therefore \Delta R_{gauge} = 1.92$$

Mass:

* Mass to get a change of 20mV on output voltage:

reciprocal of slope (from line of best fit)
$= 1/2.1539 = 0.4643$

$20(0.4643) = 9.29$ grams