

Digital Scale

Objective

Develop a digital scale using the strain-gaged beam used in the strain lab. The scale should be suitable for loads up to **5lb**. Then use the digital scale to determine the weight of three items provided by the lab instructor. Your answer has to include not just the weight of the item but also an uncertainty interval. You are allowed **one** lab period to complete this task.

Goals

In order to get full credit you have to accomplish the following:

1. Write a Labview VI that shows the load on the scale (in lb).
2. Develop a calibration process for the scale.
3. Go through a statistical process to estimate the uncertainty of the measurement.
4. Determine the mass of each of the unknown weights plus an uncertainty interval.
5. Compare calibration factors for the digital scale using either the axial or transverse gages to measure the applied load. What is the ratio of the calibration factors for the two different gages?

Grading

This lab makes up 7% of the total grade. For full credit, at the end of the lab period, each team needs to demonstrate to the TA that all the goals have been met. Show documentation (such as your notes in the lab notebook) to support the calibration process and statistical process that you used to achieve goals 2) and 3)

Hints (READ THIS BEFORE YOU START)

DO NOT PUT THE UNKOWN WEIGHTS ON THE REFERENCE SCALE. THAT IS CHEATING AND YOUR TEAM WILL FORFEIT ALL POINTS FOR THIS LAB.

Setup:

- Setup the beam strain gages as you did in the strain lab. Use either the axial or transverse strain gages.

Building the Labview VI:

- If you don't remember, how to build a simple Labview VI, take a quick look at the temperature lab
- Setup an equation in the VI to convert from strain to applied load.
- Use statistics in the VI to obtain an average over several samples to get a better mean value.

Calibration:

- Calibration is end-to-end. This means that a known reference load is applied and the displayed output signal should match that value (within some tolerance).
- Use the reference scale in the lab as the calibration reference for the calibration loads.
- Use some of the weights used in the strain lab to setup a calibration process. Go through a regression using at least 3 cal weights.

Uncertainty:

- You can estimate the precision of your measurement by repeating it several times. Use this approach during calibration to estimate the precision. Consider different cal weights and increasing and decreasing loads. Apply the student-t factor to go from standard deviation to uncertainty.
- Do you have to consider bias with the end-to-end calibration?