CSE4355/5355/6351 Electromechanical Systems and Sensors
Fall 2023, Lab 7 (Strain Gauge Measurements)

This lab is due on November 15, 2023.

1. Using the circuit shown in class, connect the HX711 device DATA and PD_CLK lines to the controller. Connect 350ohm fixed value resistors from E+ to A+, E+ to A-, and E- to A+.
The intended use of the 4 banana jacks on the strain gauge block is:
- RED: Excitation + (E+)
- BLACK: Excitation – (E-)
- GREEN: Signal + (A+)
- YELLOW: Signal - (A-)

Connect the E- to the BLACK banana jack and A- to the YELLOW banana jack on the strain gauge block.

2. Solder 30 AWG bare wires to the strain gauge while it is on a glass plate.

3. Glue the strain gauge to the aluminum beam.

4. Clip the wires to the BLACK and YELLOW banana jack toothless alligator clips.

5. Configure the clock line as a GPO and the data line as a GPI.

6. Write code to read out the value of the voltage across the A+ and A- in the Whetstone bridge repeatedly using these steps:
- Wait for the DATA input to go high indicating the data is ready to be read
- Output 24 clocks reading in the data bits from Msb to Lsb order as follows:
  - Pull PD_CLK high for less than 50 µs in length
    (if you exceed 60 µs, the HX711 will go to sleep)
  - Read the DATA line and store the bit in a variable
  - Pull PD_CLK low for no less than 200 ns
  - Repeat until all 24 clocks are sent
- Output a 25^{th} clock to indicate that you want to sample the A channel with 128 gain
- Display the value to the UART window

7. Using the weight from the stepper lab and other items in the lab, empirically derive the equation for converting the 24-bit A/D result to a force in N and mass in g. Add a display of this force and mass to the loop in step 6.

8. Now press on the end of the beam (trying to shorten the beam). What force is detected? What additional strain gauges could be added to eliminate this error?

9. Document the results in a brief 2-4 page document (with pictures and data), along with your code, and email to the TA for the course.