EECS 100/43
Lab 7 Strain Gauge

1. Objective

In this lab, you will build an op-amp amplifier circuit for a strain gauge.

2. Equipment

a. Breadboard
b. Wire cutters
c. Wires
d. Oscilloscope
e. Function Generator
f. Power supply
g. LMC6482 op-amp
h. Strain gauge bridge on your lab bench
i. Various connectors for the power supply, function generator and oscilloscope
j. Resistors (you will pick their values depending on your strain gauge)

3. Theory

a. System Block Diagram

In this lab you will design a strain gauge system that you can interface to digital systems (like microcontrollers). Figure 1 shows the expected block diagram of your strain gauge system.

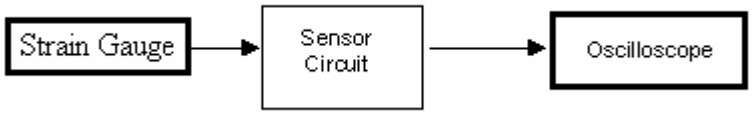

Figure 1. Strain Gauge block diagram

YOU NEED TO READ THIS LAB AHEAD OF TIME SO THAT YOU CAN COME PREPARED IN LAB. IF YOU DON'T YOU WILL NOT BE ABLE TO FINISH THE LAB IN 3 HOURS!

Let us examine the blocks in figure 1 (excluding the scope).

b. Strain Gauge

A nice description of strain gauges is in **Chapter 5** of your book. Thus, **READ**:

1. p. 155 in your book (**Practical Perspective**).

2. pp. 165 – 166 in your book (**Section 5.6: The Difference Amplifier Circuit**)

We will not be using the 4-pair strain gauge model in your book. Rather (for simplicity) we will be using only one strain gauge and build a Wheatstone bridge network out of discrete resistors. The Wheatstone bridge is also described in your book. Hence, **READ pp. 71 – 72** (**Section 3.6: Measuring Resistance – The Wheatstone Bridge**) in your book.

When you deflect the strain gauge, the resistance of the strain gauge changes by a very small amount (around 0.5% to 1%). First, you need to convert the resistance measurement into a voltage output and then amplify this voltage. This is the purpose of your Sensor Interface block in figure 1.

c. Sensor Circuit

Figure 2 below shows a MultiSim screen shot of your sensor circuit. It contains two amplifiers: a difference amplifier followed by a non-inverting amplifier for additional gain.

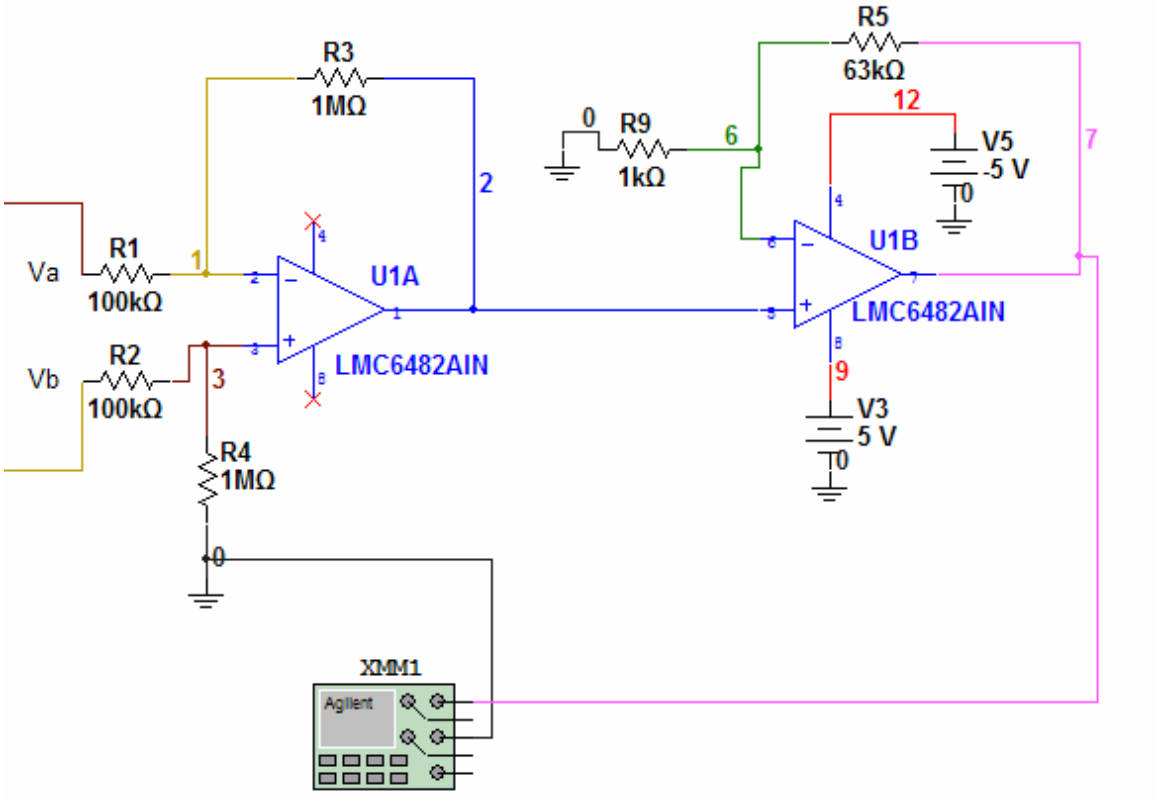

Figure 2. The sensor interface circuit

Figure 3 shows a screen shot of the completed system in MultiSim. I also assumed a theoretical "rest" resistance of the strain gauge to be 119.4 ohms. The actual resistance in lab will vary depending on your strain gauge. Now, answer your prelab questions.

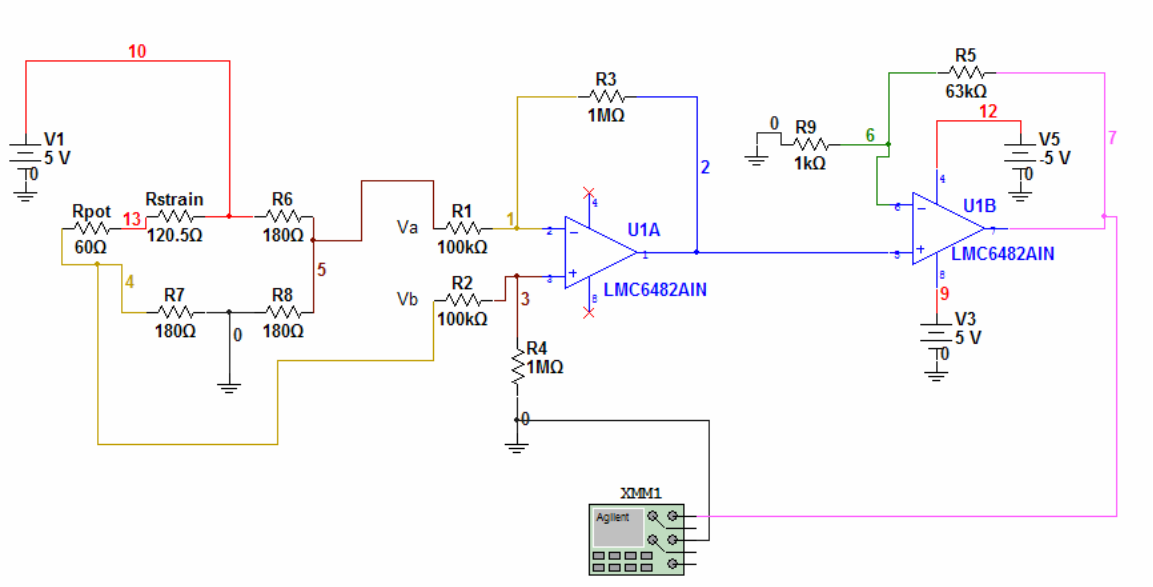

Figure 3. The completed Strain Gauge interface. Rstrain is the resistance of the strain gauge. For the simulation above, I have assumed the strain gauge is at rest.

4. REVISION HISTORY

Date/Author	Revision Comments
Summer 2007/Bharathwaj Muthuswamy	Typed up source documentation, organized lab report, typed up solutions.
Summer 2008/Bharathwaj Muthuswamy, Ronnie Bajwa	Modified original lab for use as a stand-alone lab. Incorporated Ronnie's idea to use potentiometer to adjust zero offset.