ECE 321 - Homework #2

Audio Sensors, Strain Gages, Calibration and Noise. Due Monday, November 18th

Audio Sensors:

1) Assume the voltage from the headphone jack of your cell phone is a 100mVpp audio signal. Design a circuit to amplify this signal to 10Vpp.

2) Design a circuit which will mix two audio signals (each 100mVpp) and output a 10Vpp signal

- A = 100mVpp
- B = 100mVpp
- Y = 100(A + B)

Strain Gages

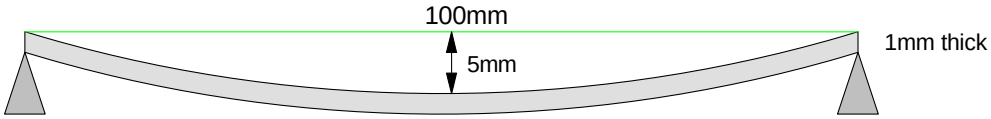
3) Assume a strain sensor has a strain - resistance relationship of

$$R = 120(1 + 2.14\varepsilon)$$

Design a circuit which outputs

- 0V for a force of 0N (0lb), and
- 10V for a force of 100N (22.4lb)

Assume a force of 100N causes the beam to deflect 5mm



Calibration

4) Determine an approximation for

$$y = \sin(x)$$

for 0 < X < 1 as

$$y \approx a + bx + cx^2 + dx^3$$

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Problem 5) Specify the requirements for an amplifier circuit. Some suggestions are:

Audio Mixer: Mix two signals together

- $y = aA + bB$
- $0 < a < 10$
- $0 < b < 10$

Temperature Sensor: Output -10V to +10V as the voltage goes from -10C to +10C

Sound on a Light Beam: Output a 5Vpp sine wave when a light sensor is hit with a time-varying light source

Cell Phone Function Generator: Amplify the output of a cell phone to -10V to +10V, turning your cell phone into a function generator.

Electronic Candle: Amplify the output of a D/A chip connected to a microcontroller to output-10V to +10V. This allows your microcontroller to output random voltages, simulating the flicker of a candle.

Other

Problem 6) Design a circuit to meet these requirements.

Problem 7) Build your circuit in lab and verify it operates correctly. Check the endpoints and one or two points inbeweeen.

Problem 8) Demo. Demonstrate your amplifier

Note: Save your circuit. You'll use it again in the following homework sets