ECE 321 - Homework #2

Tmperature and Strain Sensors. Due Wednesday, April 15th

Please make the subject "ECE 321 HW#2" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

Temperature Sensors

1) Assume you are using a thermistor where the temperature - resistance relationship is

$$R = 1000\ \exp\left(\frac{3905}{T} - \frac{3905}{298}\right)\ \Omega$$

where T is the temperature in degrees Kelvin.

1) Design a linearizing circuit so that the resistance is approximately linear from 0C to +30C. Plot the resulting resitance vs. temperature relationship.

2) Using the linearizing circuit from part 1, design a circuit which outputs

- -10V at 0C
- +10V at +30C
- Proportional in between.

Plot the resulting output voltage vs. temperature.

Audio Sensors and Envelope Detectors:

3) Design a circuit which conerts a 1Vpp, 20-20kHz audio signal to a DC signal

Input: Cell Phone

- 1Vpp capable of driving 1mA
- 20-20kHz

Output: 0 - 10VDC capable of driving 1kOhms (i.e. 10mA @ 10V)

Relationship:

- 1Vpp input produces 10VDC output
- Ripple = 0.5Vpp @ 1kHz

4) Check your design in CircuitLab using a 0.5Vp, 1kHz sine wave for the input.

Strain Sensors

5) Assume a metal beam deflects 5mm when 200lb is placed on the beam. Design a circuit which outouts

- 0V at 0lb
- 10V at 200lb

Assume

- Length of beam = 5cm
- Thickness of beam = 0.5mm
- Strain Gage relationship is

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