

ECE 321 - Homework #2

Temperature Sensors, Active Filters.

Temperature Sensors

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

$$R = 1000 \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$$

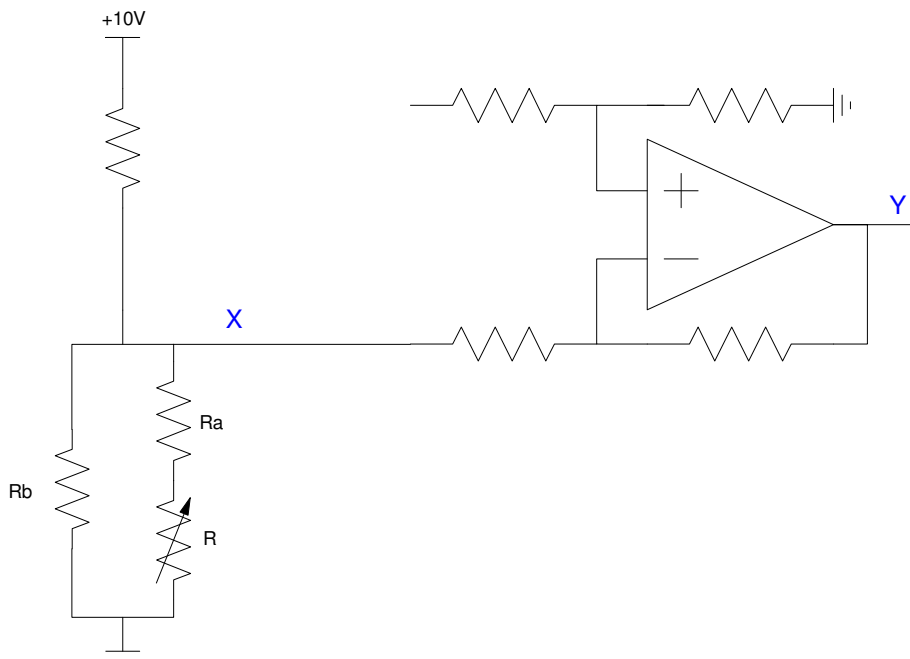
where T is the temperature in degrees C.

1) Design a linearizing circuit so that the resistance is approximately linear from 0C to +40C. Plot the resulting resistance vs. temperature relationship.

2) Using the linearizing circuit from problem 4, design a circuit which outputs

- 0V at 0C
- +5V at +40C
- Proportional in between.

Plot the resulting output voltage vs. temperature.



Active Filters

(Over)

Active Filters

3) Give an op-amp circuit to implement the following filter

$$Y = \left(\frac{200}{(s+2)(s+5)(s+10)} \right) X$$

4) Determine the gain vs. frequency for this circuit using CircuitLab.

5) Give an op-amp circuit to implement the following filter

$$Y = \left(\frac{500}{(s^2+2s+10)(s^2+2s+38)} \right) X$$

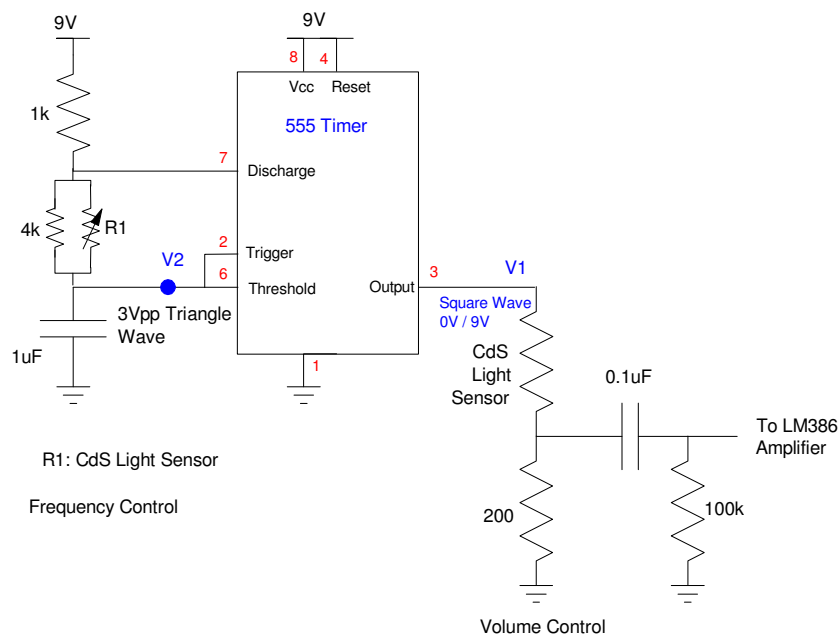
6) Determine the gain vs. frequency for this circuit using CircuitLab.

Electronic Theramin

A circuit which uses two light sensors (photo-resistors) to

- Adjust the frequency of a 555 timer and
- Adjust the volume of a 555 timer

is as follows:



7) Simulate this circuit in CircuitLab with

- R1 = R2 = 100k Ohms (dark)
- R1 = R2 = 1k (light)

8) Build this circuit on a breadboard

- Take measurements when R1 is under normal light levels and when dark

9) Demo - either in person or with a video

