

ECE 321 - Homework #2

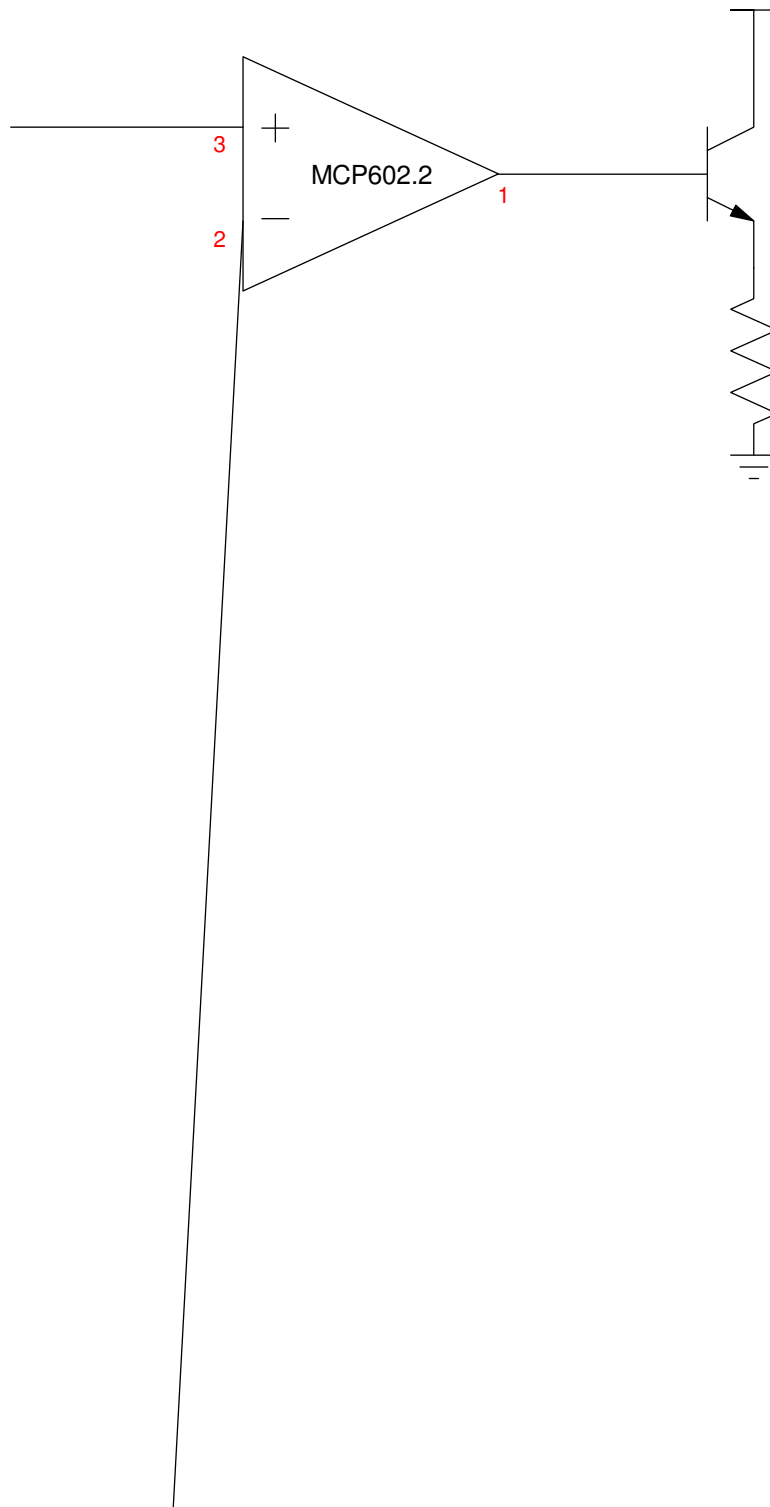
Push-Pull Amplifiers & Temperature Sensors. Due Monday, April 12th

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

Push-Pull Amplifiers

1) Assume you only have access to a +5V power supply. Design a push-amplifier to drive an 8-Ohm speaker

- Input: 0..5V analog signal, capable of 22mA
- Output: 8 Ohm speaker
- Relationship: $Y = X$



Cow Bell: Time Response

Don't Fear the Reaper: Frequency Content. Cowbell 604Hz

Temperature Sensors

Assume you are using a thermistor where the tempera

Plotting the voltage vs. temperature

$$R_a = 100$$

$$R_b = 820.0471$$

$$T = [10:0.1:30]';$$

$$R = 1000 * \exp(3905 ./ (T+273) - 3905/298);$$

$$Z = (R + R_a) * R_b ./ (R + R_a + R_b);$$

$$V_x = Z ./ (Z + 2000) * 5;$$

$$V_y = 19.715 * (1.139 - V_x);$$

$$\text{plot}(T, V_x, 'b', T, V_y, 'r')$$

$$\text{xlabel}('Temperature (C)');$$

$$\text{ylabel}('Volts');$$

Voltage at Vx (blue) and Vy (red)

6) Using the linearizing circuit from problem 4, design a 555 timer which outputs 500Hz at +10C

- Determine the frequency it outputs from 0C to +40C

At 10C, $R = 2002$ Ohms, $Z = 589.9731$ Ohms

For 500Hz

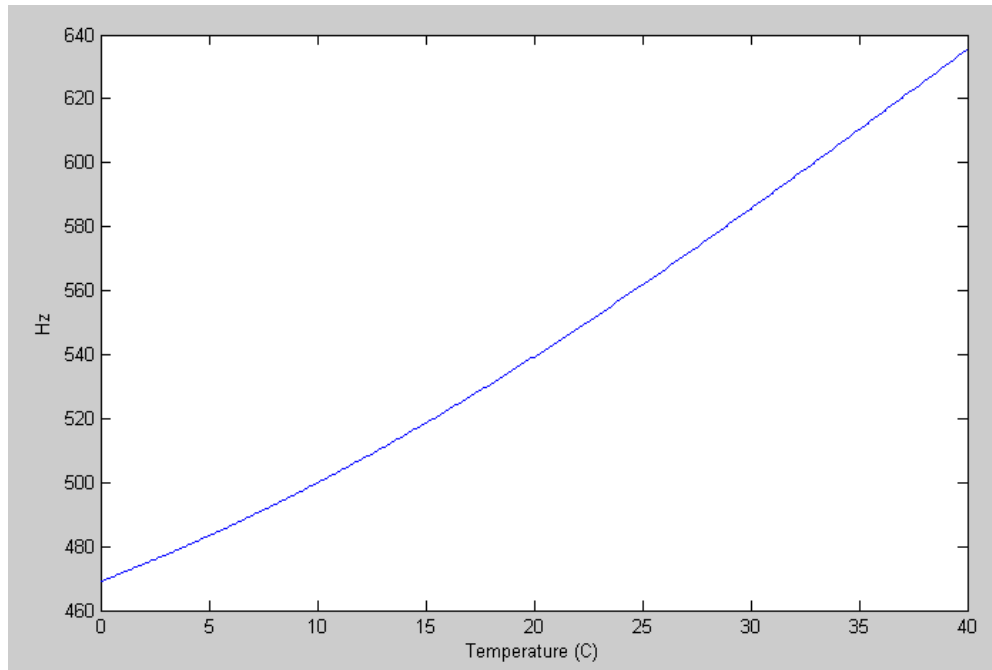
$$2ms = (R_1 + 2R_2) \cdot C \cdot \ln(2)$$

Let

- $R_1 = 1k$
- $R_2 = Z = 589.9731$ Ohms
- $C = 1.324\mu F$

555 timer with a linearizing circuit for the thermistor (Rx)


```
>> T = [0:0.1:40]';
>> R = 1000 * exp(3905 ./ (T+273) - 3905/298);
>> Ra = 100;
>> Rb = 820.0471;
>> Z = (R + Ra)*Rb ./ (R + Ra + Rb);
>> R1 = 1000;
>> C = 1.324e-6;
>> Period = (R1 + 2*Z)*C*log(2);
>> Hz = 1 ./ Period;
>> plot(T,Hz);
>> xlabel('Temperature (C)');
>> ylabel('Hz')
```



Frequency vs. Temperature for the 555 timer with a linearizing circuit