

# ECE 376 - Homework #8

## Timer2 Interrupts

### Measuring Time to 0.1ms with Timer2 Interrupts

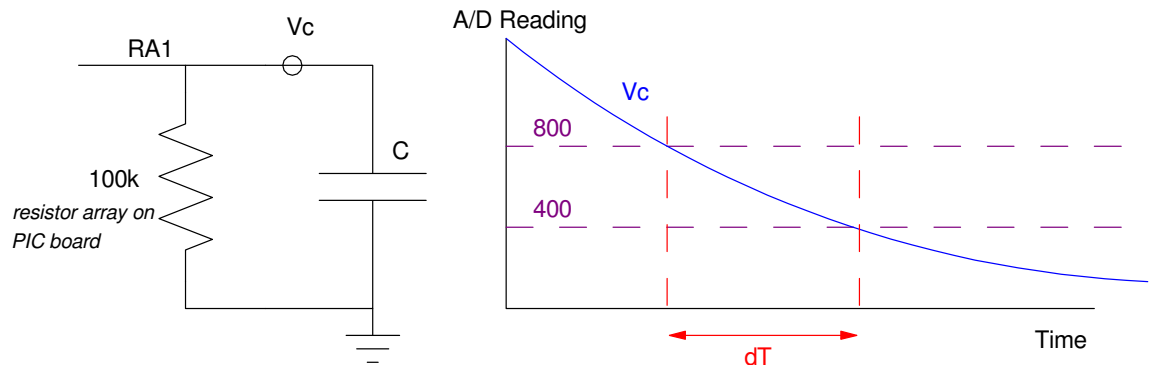
One way to measure capacitance is to measure the RC time constant.

- Charge up a capacitor to +5V (connect +5V to pin RA1)
- Remove the 5V signal from RA1
- Measure the time when the voltage drops to 1000 A/D reading
- Measure the time when the voltage drops below 500 A/D reading

C is then

$$400 = 800 \cdot \exp\left(\frac{-t}{RC}\right)$$

$$dT = RC \cdot \ln(2) \quad \text{seconds}$$



1) Write a C program which

- Measures time to 0.1ms using Timer2 interrupts
- Measures a capacitor connected between RA1 and ground ( $R = 100k$ ), and
- Displays the value of C.

2) Measure the value of two (or more) 10.0uF capacitors using the correct polarity (different values are OK). From this data, determine the 90% confidence interval for a given 10uF capacitor

3) Measure the value of two (or more) 10.0uF capacitors using incorrect polarity. From this data, determine the 90% confidence interval for a given 10uF capacitor when used with the incorrect polarity.

## Generating Frequencies with Timer2

- 4) Write a program which outputs the music note F3 (174.61 Hz) using Timer2 interrupts
  - Verify the frequency of the square wave you generate
  - (Pano Tuner app on you cell phone works well for this)

## Fun with Timer2

Problem 5-9) Build an embedded system which uses

- Timer2 interrupts,
- The LCD display, and
- Collects data you can analyze using statistics

Some suggestions are

- Vertical Leap: Measure how high you can jump with your air-time measured to 1ms
- Reflex Time: Turn on a light from 3,000ms to 10,000ms after you press RB0. Measure the time it takes you to press RB0 after the light turns on. Measure time to 1ms using Timer2 interrupts.
- Roulette Wheel: Use Timer2 interrupts to drive the stepper motor to simulate a Roulette wheel. Stop on a numbers 1..8 (0 / 25 / 50 / ... / 150 / 175 steps) at random at a rate of 10ms/step. Use Timer2 interrupts to drive the stepper motor in the background.
- Random Number Generator: Count really fast using Timer2 interrupts. The time you press a button determines the random number generated.
- Other...

5) Requirements: Explain what the inputs are / what the outputs are / and how they relate. Also explain how Timer2 interrupts will be used in your embedded system.

6) C-Code and flow chart.

7) Data. Your raw data (at least two data points)

8) Statistical Analysis: Analyze your data to determine

- The 90% confidence interval, or
- Who in your group can jump the highest (with what probability level), or
- Something else (your pick - just use some statistics to analyze your data)

9) Demo (in person during Zoom office hours or in a video)