MW 2411 Lab #4
Generating Sine Waves with Timer and DAC
Summer 2022

1 Overview

In this lab, you will use the Digital-to-Analog Converter (DAC) and the timer on the Flex-UI/dsPIC33F board to generate a sine wave. You must write a program that does all of the following.

1. Use preprocessor defines (`#define`) to define values for the sine waves frequency, sample rate, minimal voltage of the signal and maximal voltage of the signal. Additionally use a macro to convert the interrupt frequency to the number of timer ticks.

2. Use timer 3 to generate an interrupt.

3. Within the timer interrupt use the defined values to calculate the sine waves current value and perform the DAC conversion.

4. Toggle LED 1 at every timer interrupt.

2 Procedure

1. You can find an MPLAB X IDE project with template code on the Moodle course page.

2. Use your knowledge from the previous labs to configure the DAC and timer 3.

3. Update `lab04.c` and `dac.c` such that it fulfills the requirements specified above.

4. Make sure to use the defined macro to set the appropriate timer compare value (`PR3`) based on the interrupt frequency.

5. The output voltage can be calculated with a sine function:
   $V_{\text{out}} = V_{\text{amplitude}} \cdot sin(\omega_{\text{signal}} \cdot t) + V_{\text{offset}}$, with $\omega_{\text{signal}} = 2\pi \cdot f_{\text{signal}}$.

Due date of code submission can be found on the Moodle submission page for this lab. Only one member of the group must upload the code (all .c and .h files that your project uses compressed in one zip file). At the start of Lab 5, each lab group will be asked to demonstrate and explain their Lab 4 code to the lab instructor.
You will also be asked to change the frequency, sample rate and voltages in your code and show the generated sine wave using the oscilloscope.

3 Questions to Ponder

The following questions are provided for your lab group to think about. No written response is required.

1. Is there any other way to generate this and other waveforms from a microcontroller?

2. Is there limit for the sample rate and the signal frequency? And how are they linked?

3. How could you speed up the sine wave generation for a static frequency?