

Lab 6 – Analog

Pre Lab-Questions:

1. What is hysteresis and how does it help prevent bad behavior on digital inputs?
 - It changes the voltage threshold to change to the other digital state. It prevents bad behavior because once it becomes digital high the threshold changes to digital low so that for it to change to a low signal it needs to be a very low value.
2. What is quantization?
 - The process of mapping a high-resolution signal to a manageable lower-resolution one.
3. What does Nyquist theory explain? What is the problem with sampling a signal too slowly?
 - It explains the relationship between how often you can sample an input signal and whether or not you will be able to tell what it is afterwards.
4. The maximum resolution of the ADC is 12-bits. How many quantization steps/values does this give us?
 - 4096 steps.
5. What are the steps to perform an ADC calibration?
 - 1. Verify `aden = 0` and `dmaen = 0`
 2. Set `adCal = 1`
 3. Wait until `adcal = 0`
 4. read calibration factor from 6:0 of `adc_dr`
6. What's the difference between right and left-aligned data in the DAC registers?
 - The left aligned puts it in bits 15:4 and right aligned puts it in bits 11:0. Right is usually used to read low to high values and left is used for only reading high values.
7. What DAC register would you use to write 8-bit right-aligned data? (use the peripheral reference manual)
 - DAC_DHR8Rx for 8-bit right alignment.
8. Name something you found confusing or unclear in the lab manual. If everything was clear, simply answer that you didn't have any issues.
 - I found it a little confusing/unclear exactly when you would want to use a left or right aligned data for the DAC register.

Post Lab Questions:

1. Consider a system where the DAC is updated every 4us (250 kHz) with a value from a 200-element wave table containing a single cycle of a waveform. What would be the frequency of the output waves?

-The frequency would be 1250 Hz It is $1/(4\mu s * 200)$.

2. Consider that the ADC in 12-bit mode divides the input voltage range (0-3V) into 4096 steps (where 0V is 0, and 3V is 4095).

- What is the voltage/measurement resolution (how much does the voltage change per bit) of the ADC?

-The voltage/measurement resolution is 0.00073 volts per bit

- What would be the ADC output value (nearest integer) if the input voltage was 1.75V?

- The ADC output value would be about 2389