CPE 4010: Sensors, Actuators and Integration

Laboratory Exercise 1 – Analog to Digital Conversion

Objective:

To provide the student with the opportunity to learn the basics of A/D (Analog to Digital Conversion). A freeware A/D simulator will be used to explore concepts such as sampling rate, resolution, and basic waveform analysis.

Following the procedures given, students are required to collect data for the report, enter all required data in the appropriate field within the accompanying Datasheet.

Required Equipment:

Personal Computer running windows.

Procedure:

1. Download the zip file from the D2L page where the Laboratory Exercise manual for Lab 1 is located and extract all files.
2. From the extracted folder, double-click the "adconversion" application to start it. The running program should look like the following.

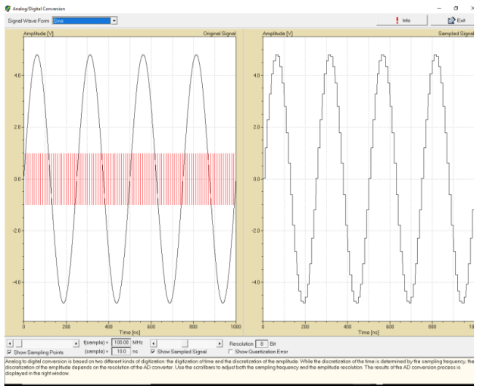

Fig. 1 adconversion simulation application initial screen

3. **Determine the period of the default sine wave shown in the left window and enter it into the associated field of the Datasheet.**
4. **Calculate the required Nyquist Frequency to properly sample the sine wave and enter it into the associated field of the Datasheet.**

5. Move the scroll bar on the bottom left, above “Show Sampling Points”, to adjust the sampling frequency. Set it to the value obtained in step 4.
6. Take a screenshot of the resulting sampled signal shown via the display window on the right and insert it into the associated section of your Datasheet.
7. Change the sampling rate to 37 MHz
8. Compare the newly sampled signal in comparison to the one obtained in step 6. Does the new sample represent the original signal better? Or is it worse? **Explain what is happening in your own words in the associated section of the Datasheet**.
9. Change the resolution to 1 Bit, while keeping the sampling rate at 37 MHz, using the scroll bar on the right. **Describe the sampled signal with 1 bit resolution in the associated section of the Datasheet**.
10. Set the Resolution bits back to 8.
11. Increase the sampling rate until the sampled signal looks like a smooth sinusoidal. **Record this frequency in the associated field of the Datasheet. How many times greater is this frequency in comparison to the Nyquist frequency obtained in step 4?**
12. Check the “Show quantization Error” checkbox. Change the resolution bits and observe the change in quantization error happening dependent on the sampling resolution. **From what was observed, describe what quantization error is in your own words in the associated field of the datasheet**.
13. **Write a short conclusion of what you have learned in this laboratory exercise in the “Conclusions” section of the datasheet**.