Lab 2
Data Acquisition

The purpose of this lab is to get more familiar with the DSK board and to understand the operation of the Codec. By the end of the lab you will be able to input and output signals through the Codec chip as well as see the effects of aliasing.

1 Introduction

The TMS320C6713DSK board includes a C6713 floating-point digital signal processor and a 16 to 32 bit stereo codec, AIC23, which contains a coder (ADC) that converts analog waveforms to 16-bit signed integer sequences, and a decoder (DAC) that reconstructs an analog signal from a sequence of 16-bit signed integer samples. Using the codec you will be able to input and output signals; therefore it is important to understand its operation and limitations.

Communication with the AIC23 is carried over two multichannel buffered serial ports (MCBSPs): the MCBSP0 is used as unidirectional channel to send a 16-bit control word to the AIC23, the MCBSP1 is used as bidirectional channel to send and receive audio data.

2 Prelab

Given the following continuous time signal

$$x_1(t) = A\cos(2\pi F_0 t)$$

Assuming a sampling rate of F_{s1}

1. Sketch the Fourier Transform of $x_1(t)$
2. What is the constraint on F_{s1} to avoid aliasing?
3. Compute the discrete-time signal $x_1(n)$
4. If you were to output the signal $x_2(t)$ which consists of every other sample of $x_1(n)$ through the codec, what would be the equivalent sampling rate F_{s2}?
5. Assume $F_{s1} = 48$ KHz and an ideal reconstruction filter with bandwidth of 24 KHz

(a) If you output every other sample, what is the frequency content of $x_2(t)$ if $F_0 = 11$ KHz after the reconstruction filter?

(b) If you output every other sample, what is the frequency content of $x_2(t)$ if $F_0 = 12$ KHz after the reconstruction filter?

3 Lab

1. Start a new project.
2. Write a program that will allow you to read/write from and to the codec.
3. What is the maximum input voltage to the codec? confirm value with TA before proceeding.
4. Set the sampling frequency to 96kHz.
5. Set the function generator to output a sinusoidal signal with amplitude 500mV and frequency 1kHz. Connect the function generator to the board.
6. Connect an oscilloscope to the output of the board.
7. Record and plot the magnitude of the output signal as you vary the frequency from 1kHz to 96kHz. Explain what you are recording.
8. Change the sampling frequency to 8kHz. Vary the frequency and record your observations. Comment on your results.
9. Using a sampling rate of 48kHz and the function generator at 12kHz, confirm your prelab result when you output every other sample.
10. Using a sampling rate of 48kHz and the function generator at 11kHz, sketch the output signal when you output every other sample. Does it match your prelab? Explain how.