AV332: Digital Communication Lab

Lab 4
Sampling and Pulse Code Modulation — Date: 7th and 9th August 2016

1 Sampling and Reconstruction

1.1 Task 1 (Compulsory)

Prelab assignment (5 marks)

1. Draw a block diagram representation of a system to sample a bandlimited signal $m(t)$ of two-sided bandwidth W. What should be the sampling frequency in order to prevent aliasing? If you are doing first order sample and hold what is the spectrum of the sampled signal?
2. Draw a block diagram representation of a system to recover the bandlimited signal $m(t)$ from its sampled representation.

In lab tasks (5 marks)

1. Implement the sampling and reconstruction systems that you have drawn in the first prelab assignment on the Emona board. Assume that $m(t)$ is a sinusoid of frequency $2kHz$ and your sampling rate is $8kHz$. Record the spectrum of the sampled waveform and compare with what you have obtained in the first prelab assignment. Record the recovered signal and compare with $m(t)$. Refer to the kit manual for details on the blocks that you need to implement these systems.
2. Suppose the frequency of the sinusoid $m(t)$ is increased to $6kHz$ and then $10kHz$. Record the spectrum of the sampled waveform and the recovered signal. Write down your observations as well as explanations for what you observe.

2 Pulse code modulation and demodulation

2.1 Task 1 (Compulsory)

Prelab assignment (5 marks)

1. Using the kit manual for the Emona board find out how to implement a PCM encoding and decoding system. Draw a block diagram representation of the system using blocks available on the Emona board.

In lab tasks (5 marks)

1. Record the PCM code that is put out by the Emona kit for 3 different values of input voltage (the input voltage can be a variable DC source). What is the "step size" of the quantizer within the PCM encoder?
2. Implement a system for PCM encoding of a signal $m(t)$ which is sinusoidal with frequency of $1kHz$. Record the output signal from the PCM encoder and the recovered signal. Compare the recovered signal with the input signal. Write down your explanations for possible differences between the input $m(t)$ and recovered signal.