Pre-lab and Post lab Questions

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181EC155

LAB 7 (PCM)

Pre Lab

1)What is meant by uniform and non-uniform quantization?

A: The type of quantization in which the quantization levels are uniformly spaced is termed as a Uniform Quantization. The type of quantization in which the quantization levels are unequal and mostly the relation between them is logarithmic, is termed as a Non-uniform Quantization.

2)What are the quantization standards followed in different parts of the world?

A: In the United States, Canada, and Japan, a u - law type of compression characteristic is used. In the United States, Canada, and Japan, the standard value for u is 255. In Europe and the rest of the world (ROW), another compression law, the *A-law* characteristic is used. The case of uniform quantization corresponds to *A* = 1.

3)What is the role of a CODEC in association with PCM and being used in computers?

A: In the mid-20th century, a codec was a device that coded analog signals into digital form using pulse-code modulation (PCM). Later, the name was also applied to software for converting between digital signal formats, including compander functions.

An audio codec converts analog audio signals into digital signals for transmission or encodes them for storage. A receiving device converts the digital signals back to analog form using an audio decoder for playback. An example of this is the codecs used in the sound cards of personal computers. A video codec accomplishes the same task for video signals.

Post Lab

1)State A-law and μ-law in non-linear PCM.

A: ***A- Law***

An A-law algorithm is a standard companding algorithm, used in 8-bit PCM digital communications systems to optimize, i.e. modify, the dynamic range of an analog signal for digitizing.

The equation for A-law encoding is as follows,

$$F(x) = \operatorname{sgn}(x) \begin{cases} \frac{A|x|}{1+\ln(A)}, & |x| < \frac{1}{A} \\ \frac{1+\ln(A|x|)}{1+\ln(A)}, & \frac{1}{A} \leq |x| \leq 1, \end{cases}$$

where *A* is the compression parameter. In Europe, A=87.6

A-law expansion is given by the inverse function,

$$F^{-1}(y) = \operatorname{sgn}(y) \begin{cases} \frac{|y|(1+\ln(A))}{A}, & |y| < \frac{1}{1+\ln(A)} \\ \frac{\exp(|y|(1+\ln(A))-1)}{A}, & \frac{1}{1+\ln(A)} \le |y| < 1. \end{cases}$$

μ-law

The **μ-law algorithm** is a companding algorithm, primarily used in 8-bit PCM digital telecommunication systems in North America and Japan
The μ-law algorithm may be described in an analog form and in a quantized digital form.

For a given input x, the equation for μ-law encoding is:

$$F(x) = \operatorname{sgn}(x) \frac{\ln(1+\mu|x|)}{\ln(1+\mu)} \quad -1 \le x \le 1$$

where $\mu = 255$ in the North American and Japanese standards and $\operatorname{sgn}(x)$ is the sign function. It is important to note that the range of this function is −1 to 1.

μ-law expansion is then given by the inverse equation

$$F^{-1}(y) = \operatorname{sgn}(y)(1/\mu)((1+\mu)^{|y|} - 1) \quad -1 \le y \le 1$$

2)What are the advantages and disadvantages of mid-rise and mid-tread quantization schemes?

A: Mid-tread quantizers have a zero-valued reconstruction level (corresponding to a *tread* of a stairway), while mid-riser quantizers have a zero-valued classification threshold (corresponding to a *riser* of a stairway). Mid-tread quantization involves rounding. Mid-riser quantization involves truncation. mid-riser uniform quantizers do not have a zero output value – their minimum output magnitude is half the step size. In contrast, mid-tread quantizers do have a zero output level. For some applications, having a zero output signal representation may be a necessity.

In general, a mid-riser or mid-tread quantizer may not actually be a *uniform* quantizer – i.e., the size of the quantizer's classification intervals may not all be the same, or the spacing between its possible output values may not all be the same.

3). What are the ways PCM systems can be improvised?

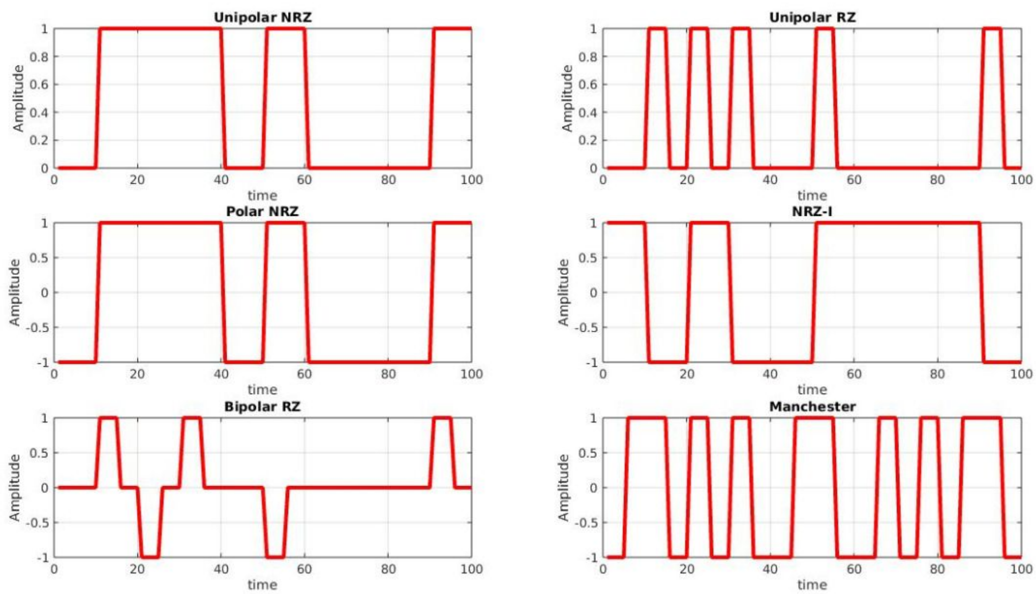
A:mid-riser uniform quantizers do not have a zero output value – their minimum output magnitude is half the step size. In contrast, mid-tread quantizers do have a zero output level. For some applications, having a zero output signal representation may be a necessity. In general, a mid-riser or mid-tread quantizer may not actually be a uniform quantizer – i.e., the size of the quantizer's classification intervals may not all be the same, or the spacing between its possible output values may not all be the same. The distinguishing characteristic of a mid-riser quantizer is that it has a classification threshold value that is exactly zero, and the distinguishing characteristic of a mid-tread quantizer is that is it has a reconstruction value that is exactly zero.

Lab 8 (Line Coding)

Pre-lab

1)Given the binary sequence b = [1; 0; 1; 0; 1; 1]; sketch the waveforms representing the sequence b using the following line codes: a. unipolar NRZ; b. polar NRZ; c. unipolar RZ; d. bipolar RZ; e. Manchester. Assume unit pulse amplitude and use binary data rate Rb = 1 kbps

A:



PTO

2)Determine and sketch the power spectral density (PSD) functions corresponding to the above line codes. Use Rb = 1 kbps: Let f1 > 0 be the location of the first spectral null in the PSD function. If the transmission bandwidth BT of line code is determined by f1, determine BT for the line codes in question 1 as a function of Rb:

A: