PCM ENCODER

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***Abstract*—An introduction to Pulse Code Modulation (PCM) Encoder. To successfully transmit audio across a network, a network audio application must be able to convert the audio analog signals into digital signals. PCM encoding technique is used for this purpose.**

Keywords—Sampling, Quantization, Uniform Quantization, Quantization distortion, Non-uniform Quantization & Coding

I. Introduction

In this era of digitalization, communication through devices is an integral part of life. In order to communicate through these devices, major techniques are used. Pulse Code Modulation(PCM) encoding is one such technique that represents the continuous audio signals (voice, dog bark, violin music etc) into electrical signals which have discrete value at each sampling point. It serves as a standard form of digital audio for several digital audio applications.

II. OPERATION.

PCM encoder performs Sampling, Quantization and Encoding.

A. Sampling

Sampling reads the values of analog signal at discrete time intervals. This sampling frequency is twice the highest frequency of the input analog system. The obtained values are called samples. For a 4 KHz voice channel the sampling rate is 8000 Hz i.e signal is sampled 8k times per second.

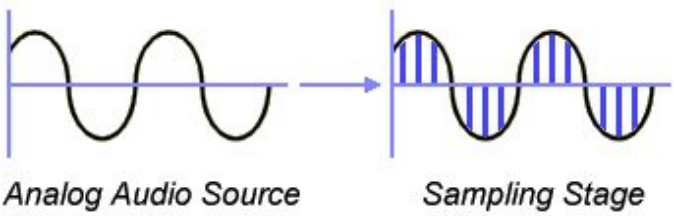

fig 1. Sampling Stage

B. Quantization

Quantization assigns discrete values from a range of possible values to each sample obtained. The signal is rounded up or down to the nearest available value. As a result stepped waveform is obtained which resembles the source signal. The basic type of quantization is called the Uniform Quantization. Here the vertical axis that represents the amplitude is divided into equal sized steps between +ve volt and -ve volt (eg, +3 volt and -3 volt). All the samples whose amplitude falls within a step takes the same step value. However, this method introduces an error called Quantization Distortion. This is because the real amplitude of a sample is replaced by an approximate value. The signal to noise ratio (S/N ratio) is good at higher level signals but bad at low level signals. Therefore Non-Uniform Quantization method is introduced. Here the steps are not of equal size. Small steps are used for small signal values and large steps for large signal values.

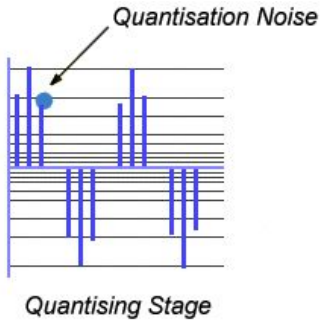

fig 2. Quantization Stage

C. Coding

Encoding represents the quantized values as a binary number in the range of 0 to n. The value of n has to be a power of two. If there are 8 quantization values then each sample is represented by 3 bits (2^3=8). The bit representations of all the samples are then concatenated together to form the digital representation of the signal.

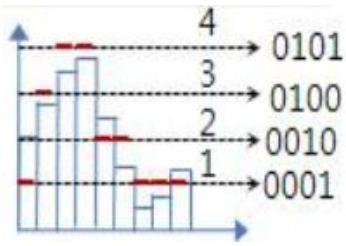

fig 3. Coding Stage

References

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