Chapter 2: Data and Audio Coding

2.1. Pulse Code modulation (PCM)

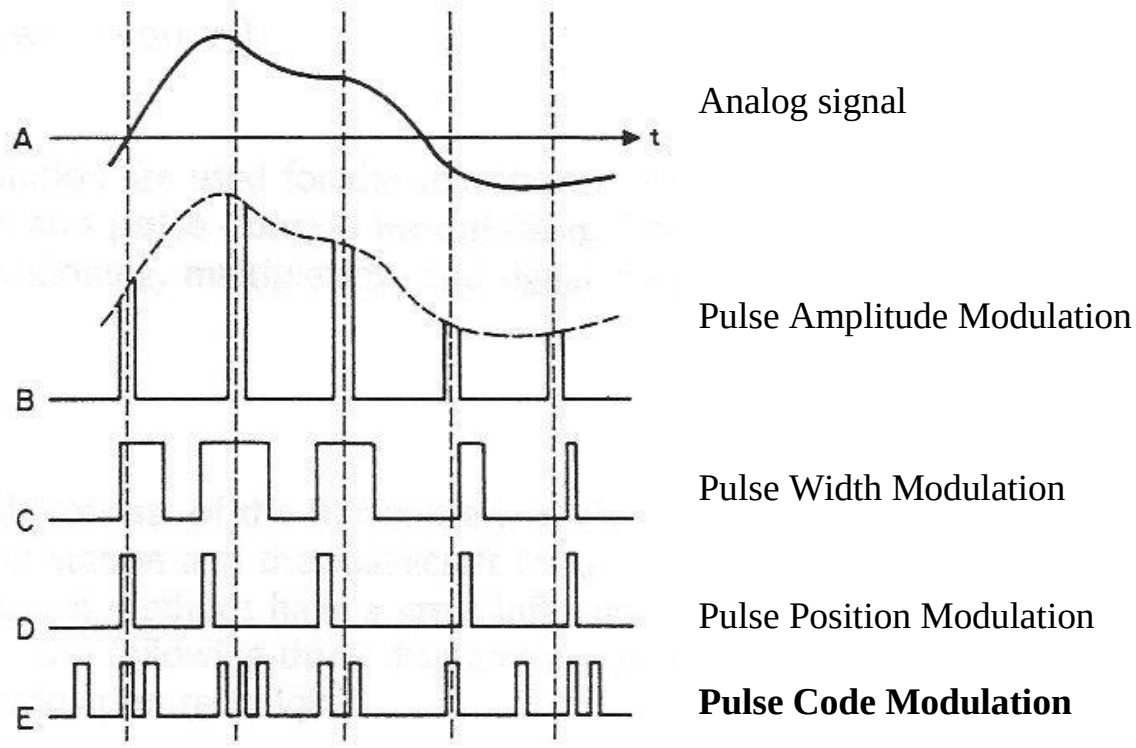

Fig. 2.1. Types of Pulse Modulation

*** Advantages of Digital Over Analog For Communications:**

1.Digital is more robust than analog to noise and interference

2.Digital is more viable to using regenerative repeaters

3.Digital hardware more flexible by using microprocessors and VLSI

4.Can be coded to yield extremely low error rates with error correction

5.Easier to multiplex several digital signals than analog signals

6.Digital is more efficient in trading off SNR for bandwidth

7.Digital signals are easily encrypted for security purposes

8.Digital signal storage is easier, cheaper and more efficient

9.Reproduction of digital data is more reliable without deterioration

10.Cost is coming down in digital systems faster than in analog systems and DSP algorithms are growing in power and flexibility

- Pulse code modulation (PCM) is produced by analog-to-digital conversion process. Quantized PAM
- As in the case of other pulse modulation techniques, the rate at which samples are taken and encoded must conform to the Nyquist sampling rate.
- The sampling rate must be greater than, twice the highest frequency in the analog signal,

$$f_s > 2f_A(\max)$$

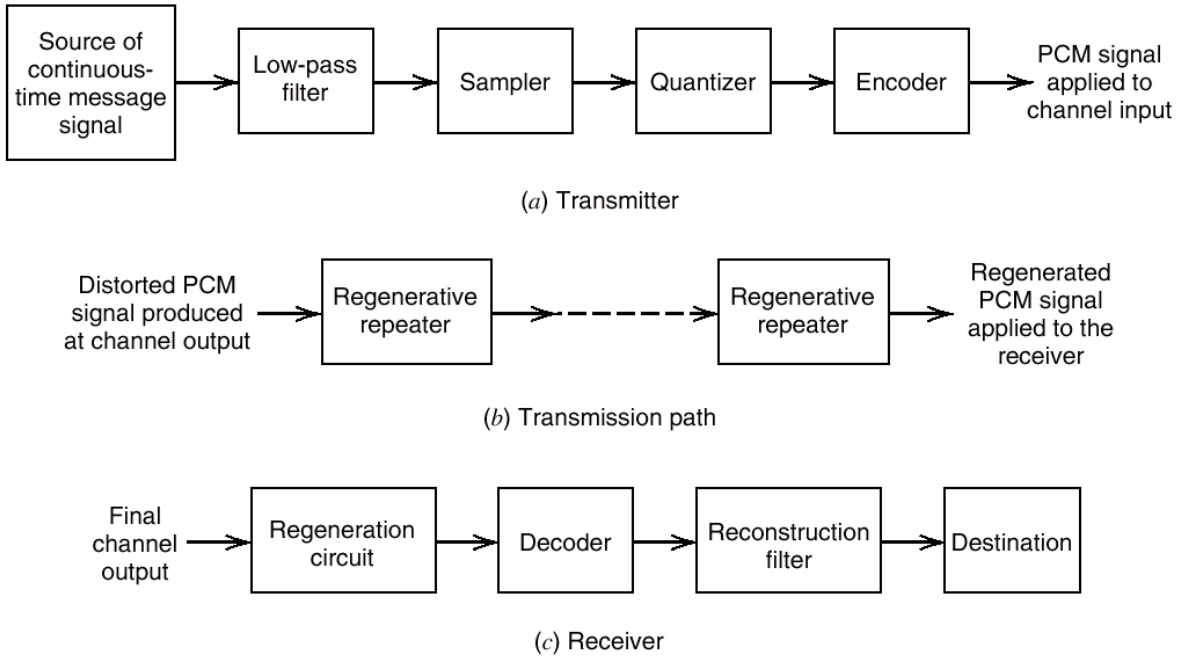

Fig. 2.2. Pulse Code Modulation Transmission and Receiving Systems

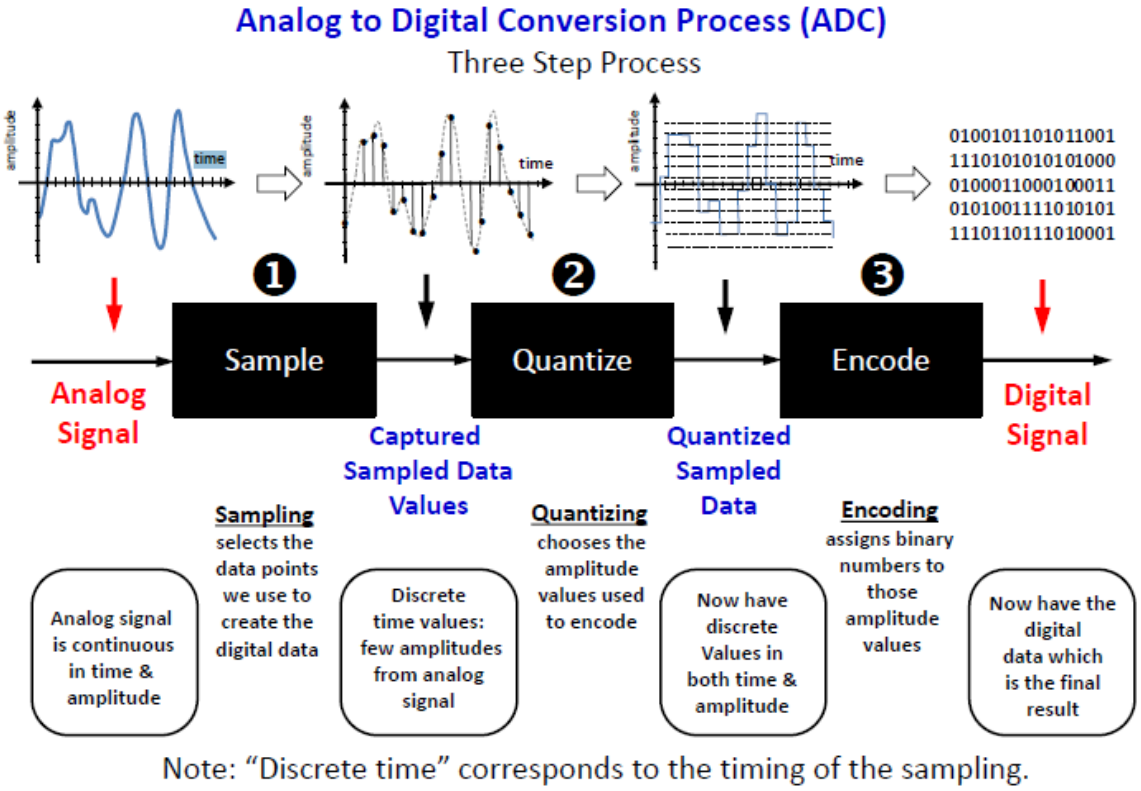

Fig. 2.3. Analog to Digital Conversion System

PCM is used to digitally represent sampled analog signals. It is the standard form of digital audio in computers, CDs, digital telephony and other digital audio applications. The amplitude of the analog signal is sampled at uniform intervals and each sample is quantized to its nearest value within a predetermined range of digital levels.

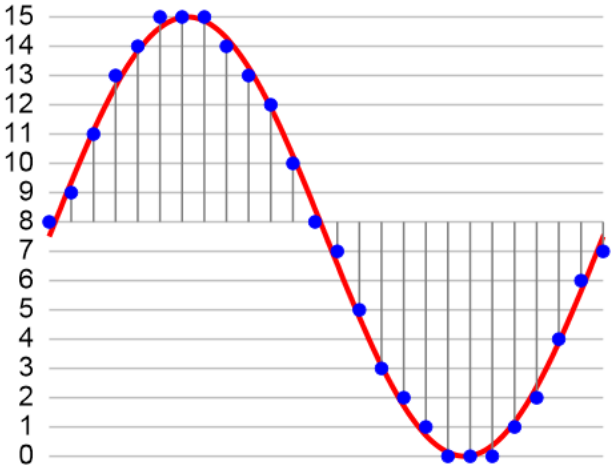

Fig. 2.4. DAC

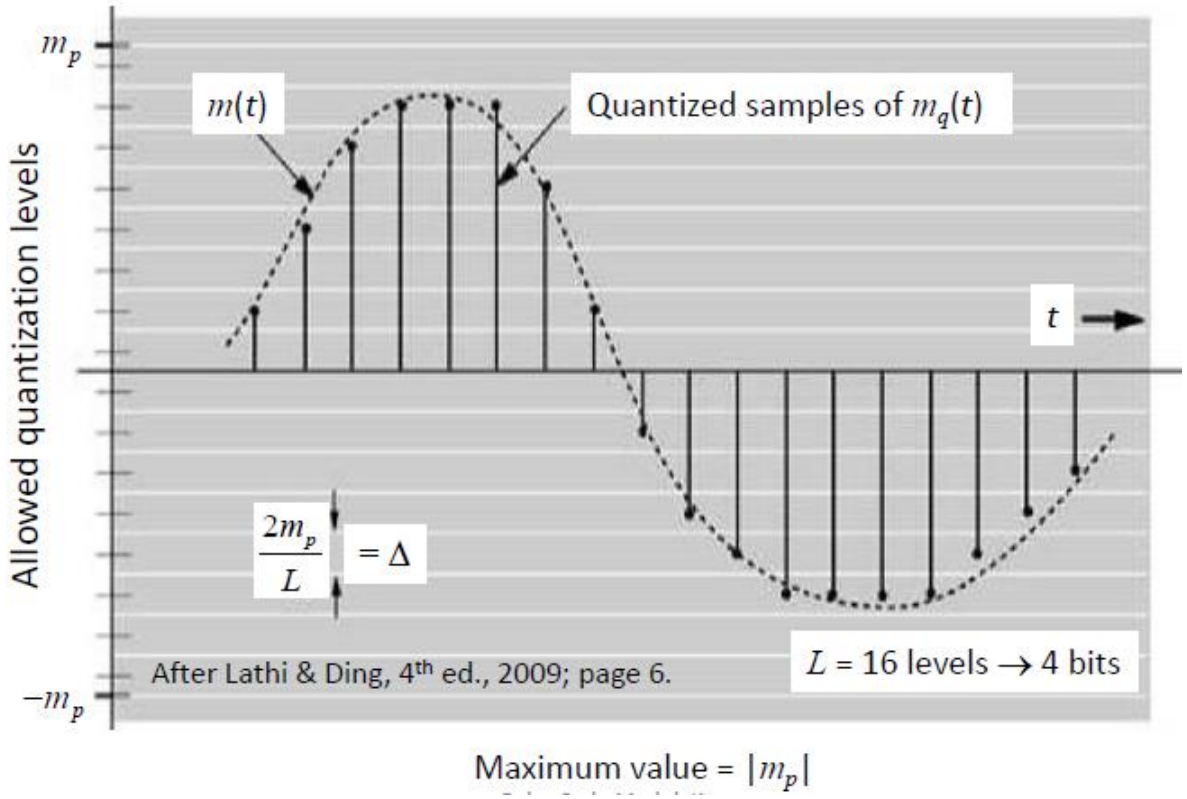

Fig. 2.5. Quantization