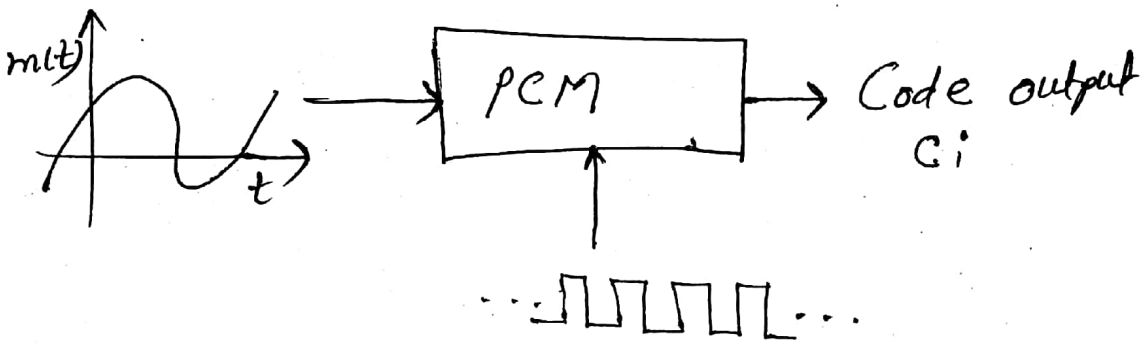
Lecture Notes on PCM

PCM
- Pulse
- Code
- Modulation

it is a type of Modulation in which the output code changes in accordance with the amplitude variation of Modulating signal m(t)



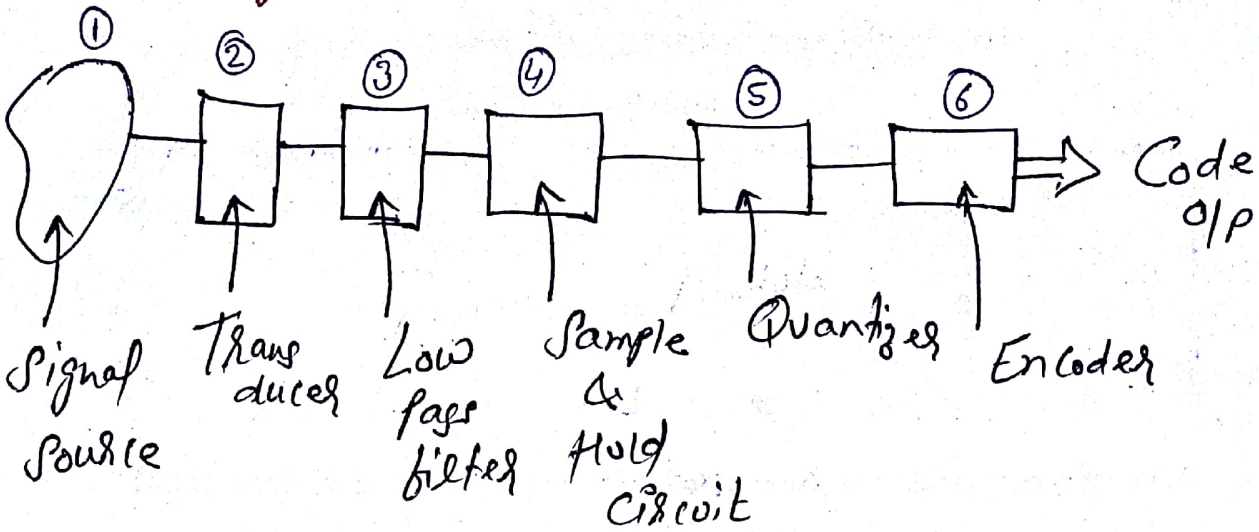
As shown in the figure the output code Ci changes in accordance with the changes in the amplitude variation of signal.

Hence PCM is a type of Coded modulation.

The Code output changes with respect to the pulse given

PCM is a technique to Convert the Analog signal to digital signal.

Block Diagram of PCM:



1. It generates the information in physical form so from here, the signal emanates, for example, human being generates the sound in the form of pressure variation in air molecules due to sound.

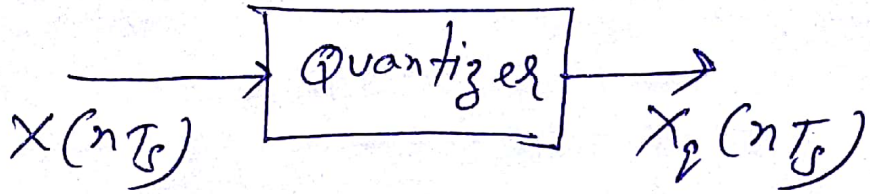
(2). This Converts the physical signal in the electrical form

(3). Low pass filter, filter the low frequency Component in the output & blocks the high frequency noise.

(4). **Sample & Hold circuit:** This circuit do the function of sampling & Holding the sampled part for the time duration of Converting it into digital form.

(5) Quantizer :

This part Converts the analog sampled value into a discrete sampled value



the Quantizer introduces some quantization error (e_q)

$$e_q = -\left(X(nT_s) - X_q(nT_s)\right)$$

$$= \text{Measured value} - \text{True value}$$

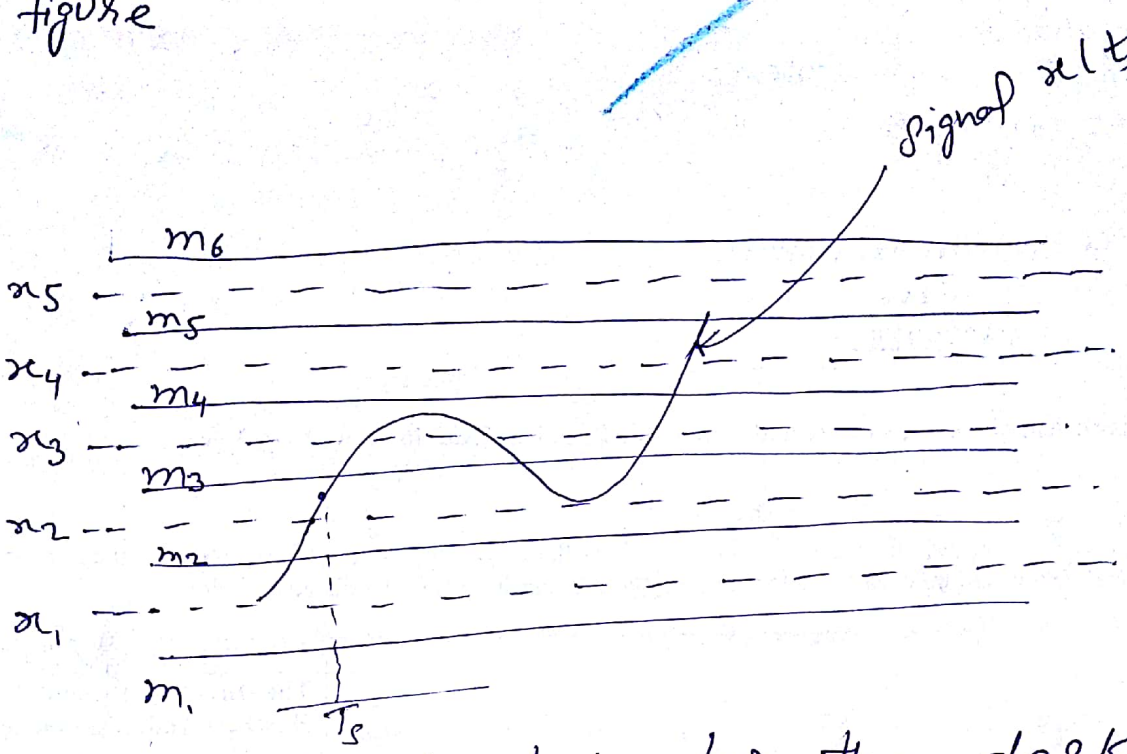
$$= X_q(nT_s) - X(nT_s)$$

The quantized value of the output is defined as

$$X_q(nT_s) = m_i \quad \text{if } x_{i-1} \leq X(nT_s) < x_i$$

Where m_i is the i^{th} level of the Quantization process

The quantization process is as shown in the figure



level m_i is denoted for the dark lines & Comparing steps x_i is denoted for dotted lines

Suppose at any instant the signal $x(t)$ is sampled at $t = T_s$

then as per observation

$$x_2 < X(T_s) < x_3$$

$\therefore$ $x_q(T_s) = m_3$ (As per definition)

Hence the voltage level of m_3 is assigned to $x_q(T_s)$

The voltage values assigned to each level is Pre-defined integer values and these values are easy to Convert in digital Code of binary Pattern.

Disadvantage of PCM:

one of the main disadvantage of PCM is that, there is a transmission of fixed no of bits irrespective of the amplitude Variation in the message Signal.
So PCM does not utilize the given bandwidth efficiently.

Hence Differential PCM is used to avoid such problem where the amplitude variation is Compared then on the basis of amplitude difference the output is encoded.