

1. why we use ADC and DAC

Ans. most of the signals which we find around us are analog in nature for ex - temperature, pressure, sound or velocity. all signals are analog in nature.



By using transducer, analog signal is converted to electrical signal. these signals remain analog in nature. now these analog signal are very susceptible to the noise, particularly whenever they are used in the communication.

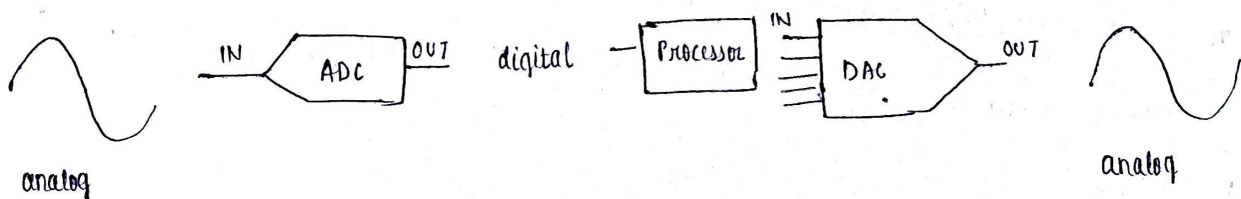
analog signal

- difficult to process in analog domain
- difficult to store in analog domain

digital signal

- less susceptible to noise
- easy to process in digital domain
- easy to store in digital domain

So, that's why analog signals are converted so that they can easily processed and stored.



using DAC, we can retrieve the signal. these conversions are not lossless. during conversion, some information of analog signal will be lost.

② Quantization : it is the process of assigning a sampled signal a value from the discrete set of values.

Resolution is defined in the no. of bits, bit refers to the number of bits in which the quantized signal is going to get encoded. the minimum change in the i/p signal which can be detected by ADC. if the resolution is

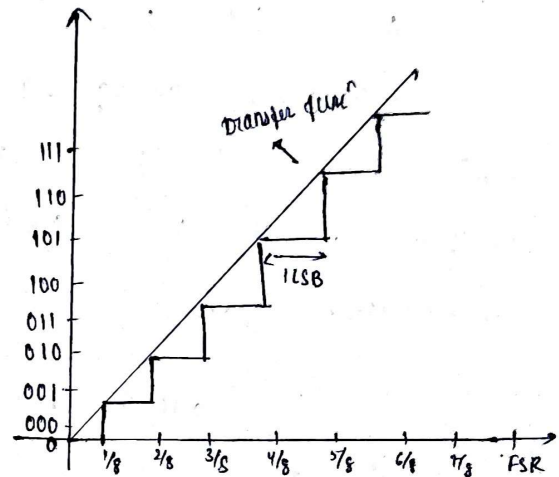
$n$  bits, then in a binary number system, total no. of discrete levels which can be defined is equal to  $2$  to the power  $n$ . That means the input signal will get quantized into  $2$  to the power  $n$  levels.

$$\text{Resolution} = \frac{\text{full scale range (FSR)}}{2^n}$$

$$\frac{V_{\max} - V_{\min}}{2^n}$$

quantization error =  $1\text{LSB}$

this error can be reduced by increasing the no. of bits. By shifting to left, we can reduce error.



3. what is sampling
- Ans. Analog signal is sampled at a particular rate. the more sample we take, the more accurate we can represent the analog.
- acc. to nyquist sampling theorem, the sampling rate should be least,  $2$  times the max frequency of o/p signal.
- for sine wave with max frequency of  $f_{\max}$ , the min. sampling rate should be  $2f_{\max}$  and if sampling rate is less than  $2f_{\max}$ , the aliasing effect is seen in reconstructed waveform. so, to avoid, the sampling should be  $2$  times maximum

