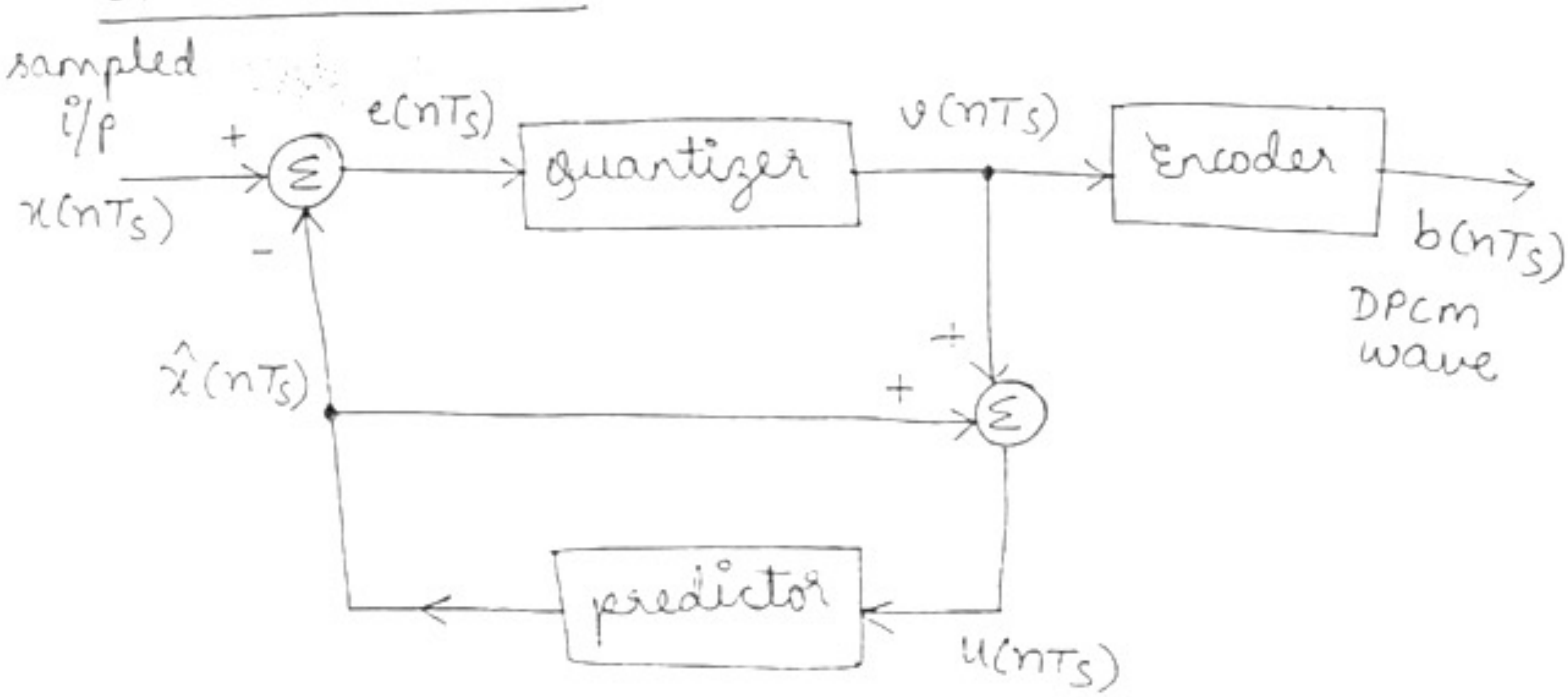
Differential Pulse code modulation (DPCM) -

when a voice or video signal is sampled at a rate slightly higher than the nyquist rate, the resulting sampled signal is found to exhibit a high correlation between adjacent samples. If we encode this highly correlated samples in a PCM system, it contains redundant information. If we can remove this redundancy, effeciency of coded signal can be increased.

If we know the past behaviour of a signal upto a certain point of time, it is possible to make some inference about its future values, such a process is commonly called as prediction.

DPCM tranemitter -



let $x(t)$ be a baseband signal sampled at a rate $f_S = 1/T_S$ to produce a sequence of samples denoted by $x(nT_S)$.

From fig ⇒

$$e(nT_s) = x(nT_s) - \hat{x}(nT_s) \quad \text{--- (1)}$$

$\hat{x}(nT_s)$ is o/p of prediction filter.
$e(nT_s)$ is prediction error.

The quantizer o/p is given by ⇒

$$v(nT_s) = e(nT_s) + q(nT_s) \quad \text{--- (2)}$$

$q(nT_s)$ is quantizing error.

$$\& \quad u(nT_s) = \hat{x}(nT_s) + v(nT_s) \quad \text{--- (3)}$$

put (2) in (3) ⇒

$$u(nT_s) = \hat{x}(nT_s) + e(nT_s) + q(nT_s) \quad \text{--- (4)}$$

put (1) in (4) ⇒

$$u(nT_s) = \cancel{\hat{x}(nT_s)} + x(nT_s) - \cancel{\hat{x}(nT_s)} + q(nT_s)$$

$$u(nT_s) = x(nT_s) + q(nT_s)$$

$$u(nT_s) = \text{quantized version of } x(nT_s)$$

Irrespective of prediction filter, the quantized sample $u(nT_s)$ at prediction filter i/p differs from sample $x(nT_s)$ of original msg signal $x(t)$ by a quantizing error $q(nT_s)$.

If the prediction is good, the average power of prediction error sequence $e(nT_s)$ will be smaller than that of msg sequence $x(nT_s)$.

DPCM receiver is as shown in the figure below, It consists of a decoder & a prediction filter. The quantized version of original i/p is reconstructed from the decoder o/p using the same prediction filter as used in transmitter.

DPCM receiver -