* Experiment No. 6 *

Aim : To perform DPCM Modulation and Demodulation using Matlab Simulink.

Apparatus : Matlab Simulink.

Theory :

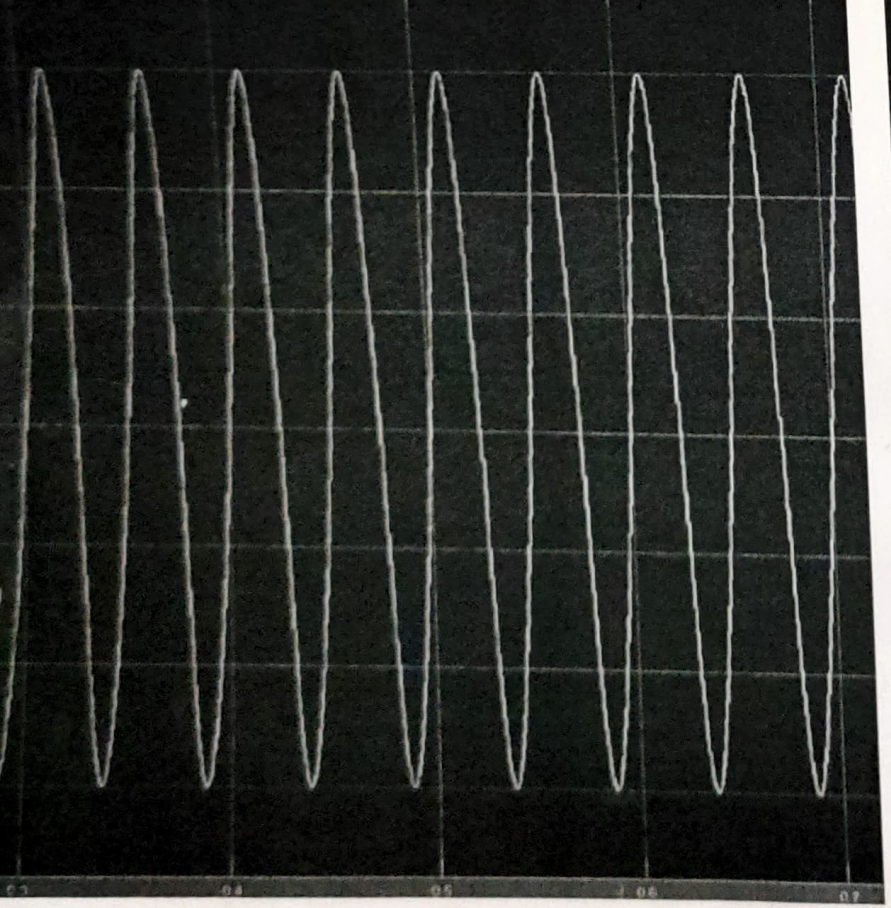
. Differential pulse code Modulation is a singal encoder that uses the baseline of PCM but adds some functionalities based on the prediction of the samples of signal. The input can be analog signal or Digital signal.

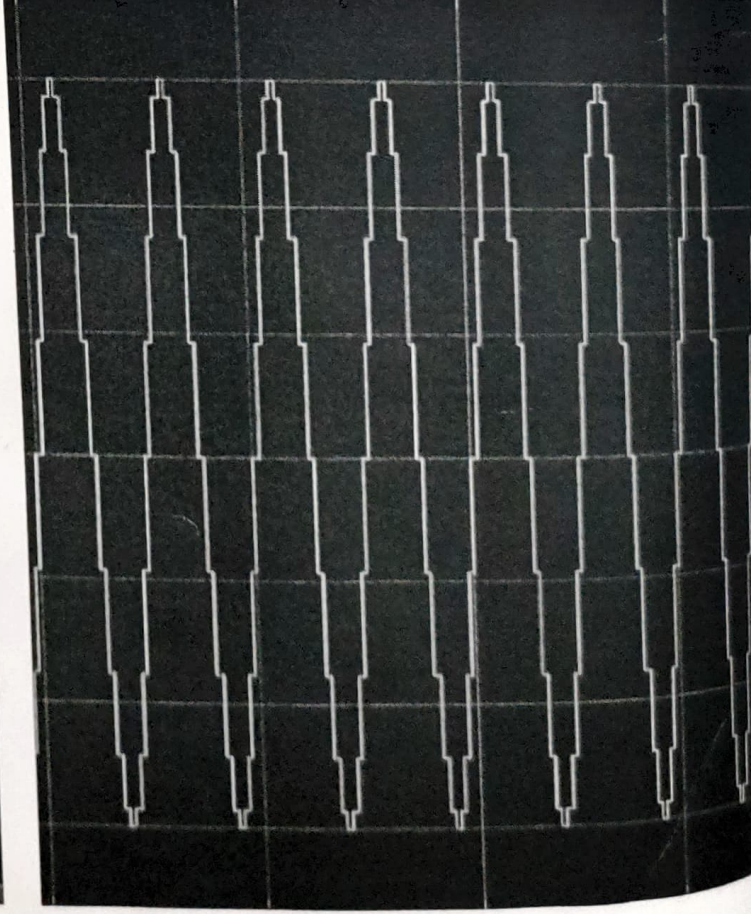
The DPCM Techniques encodes the signal to form a digital value.

→ The Differential pulse code modulation works on the principle of prediction

→ The prediction may not be exact but very close to actual value.

→ This technique is efficient for lossless compression and implementation of lossless medical image - compression





* Procedure :

1) Open simulink from the MATLAB software
2) Create a blank model
3) Add the following blocks.
   i) pulse generator (T= 1/400)
   ii) Sine wave (A=3, f = 2pi x20)
   iii) Sample & hold
   iv) Quantizer
   v) Delay
   vi) Add
   vii) Uniform encoder
   ix) Analog filter design
   x) Scope.
4) Do connections as shown.
5) Connections.
6) Set stop timer =1
7) Run
8) Check the graphs.

* Observations :

fig 2 → Output of Sine wave
fig 3 → Output of sample & hold
fig 4 → Output of error signal
fig 5 → Output of DPCM modulated signal after quantizer and uniform encoder
fig 6 → Output of DPCM demodulated signal along with initial sine wave

Conclusion :

1) Error is reduced
2) No. of bits required is low.
3) Error signal is calculated using the present signal along with previous signal in the prediction filter block.

Result : We have successfully completed the DPCM modulation and demodulation. Got the graphs on simulink.

14/03/23

* Experiment No. 7.

Aim : To perform Delta Modulation and demodulation using MATLAB and understanding threshold, slope overload and granular distortion.

Software Used : MATLAB

Theory :

① Delta Modulation is a form of pulse modulation where a sample value is represented as a single bit. It is also called as 1-bit DPCM.

② This scheme sends only the difference between pulses. if the pulse at time t_{n+1} is higher in amplitude value than the pulse at time t_n, then a single bit say '1' is used to indicate positive value.

③ It is similar as of differential PCM

④ The encoding, decoding and quantifying process is extremely simple.

⑤ It works for small changes in amplitude. other resulting in large sense.

⑥ It leads in increase in quantifying noise.

* Observation :

① fig (i), shows for normal threshold condition $\Delta = 0.2$

② fig (ii), shows for slope overload noise $\Delta = 0.05$

③ fig (iii), shows for granular noise, $\Delta = 0.1$

Conclusion :

DM modulation transmits 1 bit per sample and output of DM adds some noise and it can be eliminated by using Adaptive Delta Modulation.

Result :

Hence, we have successfully performed delta modulation using MATLAB and understood the types of noises present in this system.

Path
11/04/23

Experiment No. 8.

Aim : To perform modulation and demodulation of QPSK using MATLAB.

Apparatus : MATLAB

Theory :

QPSK is Quandrature phase shift keying

Phase of the carrier takes on one of form equally spaced values such as $\frac{\pi}{4}$, $\frac{3\pi}{4}$, $\frac{5\pi}{4}$, $\frac{7\pi}{4}$

$$S_i(t) = \sqrt{\frac{2E_b}{T_b}} \cos\left[2\pi f_c t + (2i-1)\frac{\pi}{4}\right]$$

$\hookrightarrow 0 \leq t \leq T_b$

$= 0$

$E_b \rightarrow$ Energy transmitted per symbol.

$T_b \rightarrow$ bit duration.

Thus, the gray encoded ~~bit~~ set of dibits :

10, 00, 01, 11

$$S_i(t) = \sqrt{\frac{2E_b}{T_b}} \cos\left[(2i-1)\frac{\pi}{4}\right] \cos(2\pi f_c t) - \sqrt{\frac{2E_b}{T_b}} \sin\left[(2i-1)\frac{\pi}{4}\right] \sin(2\pi f_c t).$$

There are two orthonormal basis functions.

$$\phi_1(t) = \sqrt{\frac{2}{T_b}} \cos 2\pi f_c t,$$

$$\phi_2 = \sqrt{\frac{2}{T_b}} \sin(2\pi f_c t).$$

Avg probability of error $P_e = Q\sqrt{\frac{2E_b}{N_0}}$

The binary wave is demultiplexed into two separate binary waves consisting of odd and even numbered i/p bits denoted by $b_1(t)$ & $b_2(t)$

Procedure :

1. Open MATLAB software
2. Write the code and set phase difference of $\frac{\pi}{2}$ b/w i/p signals.
3. Run the program and observe graphs
4. set phase difference of $\frac{\pi}{4}$
5. Run the program and observe the graph

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Observation :

i) fig (i) shows optimized output when phase difference is $\frac{\pi}{2}$

ii) fig (ii) shows when phase diff is $\frac{\pi}{4}$

iii) fig (ii) shows output when phase diff is same.

Conclusion : QPSK modulation transmits 2 bits per symbol as command to BPSK and has bandwidth efficiency twice as that of BPSK. Hence, it is also called as DSB&C.

Result : Hence, we have successfully performed modulation and demodulation of QPSK signal using MATLAB.

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