Digital Communication Laboratory

Laboratory report submitted for the partial fulfillment
of the requirements for the degree of

Bachelor of Technology
in
Electronic and Communication Engineering

by

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Contents

Chapter *1*

Experiment - 2

1.1 Aim

1) To implement Pulse Code Modulation (PCM) and Demodulation on MATLAB Simulink platform.
2) To implement Delta Modulation (DM) and Demodulation on MATLAB Simulink platform.

1.2 Hardware and Software Used

1. Desktop/Laptop
2. MATLAB

1.3 Theory

1.3.1 Pulse Code Modulation

Pulse code modulation is basically the conversion of an analog signal to digital signal. A signal in its Analog form can take on infinite number of values however it can attain only limited values in its digital form. An analog signal can be converted to digital signal by means of sampling and quantization, which is rounding off the sampled value to one of its closest number called quantization Levels.

The stream of pulses and non-pulse streams of 1's and 0's are not easily affected by interference and noise. Even in the presence of noise, the presence or absence of a pulse can be easily determined. Since PCM is digital, a more general reason would be that digital signals are easy to process by cheap standard techniques. This makes it easier to implement complicated communication systems such as telephone networks. The practical implementation of PCM makes use of other processes. The processes are carried out in the order in which they appear below:

* Filtering
* Sampling
* Quantizing
* Encoding

The filtering stage removes frequencies above the highest signal frequency. These frequencies if not removed, may cause problems when the signal is going through the stage of sampling. Generally, while modulating a signal for PCM a simple A/D converter can be used.

1.3.2 Delta Modulation

Delta Modulation

The type of modulation, where the sampling rate is much higher and in which the stepsize after quanti-zation is of a smaller value , such a modulation is termed as Delta modulation.

1.3.3 Features of Delta Modulation

Following are some of the features of delta modulation. An over-sampled input is taken to make full use of the signal correlation.

1. The quantization design is simple.
2. The input sequence is much higher than the Nyquist rate.
3. The quality is moderate.
4. The design of the modulator and the demodulator is simple.
5. The stair-case approximation of output waveform.
6. The step-size is very small, i.e., delta.
7. The bit rate can be decided by the user.
8. This involves simpler implementation.

1.4 Delta Modulation

Delta Modulation is a simplified form of DPCM technique, also viewed as 1-bit DPCM scheme. As the sampling interval is reduced, the signal correlation will be higher.

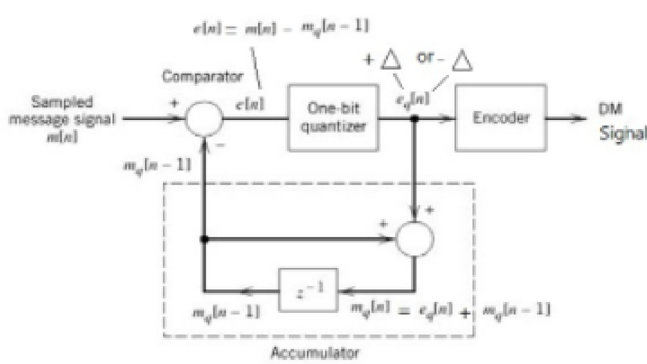

Figure 1.1 Delta Modulation Block Diagram

The predictor circuit in DPCM is replaced by a simple delay circuit in DM. Using these notations, now we shall try to figure out the process of delta modulation.

Reconstruction or approximation for next time sample.

1.4.1 Delta Demodulator

The delta demodulator comprises of a low pass filter, a summer, and a delay circuit. The predictor circuit is eliminated here and hence no assumed input is given to the demodulator. Following is the diagram for delta demodulator.

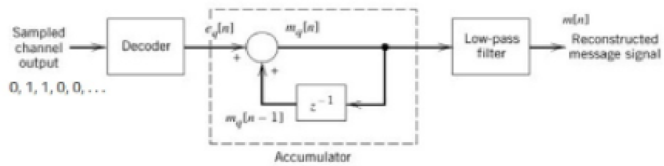

Figure 1.2 Delta Demodulator Block Diagram

A binary sequence will be given as an input to the demodulator. The stair-case approximated output is given to the LPF. Low pass filter is used for many reasons, but the prominent reason is noise elimination for out-of-band signals. The step-size error that may occur at the transmitter is called granular noise, which is eliminated here. If there is no noise present, then the modulator output equals the demodulator input.

1.5 MATLAB Simulink Block Diagram

1.5.0.1 PCM Modulation and Demodulation

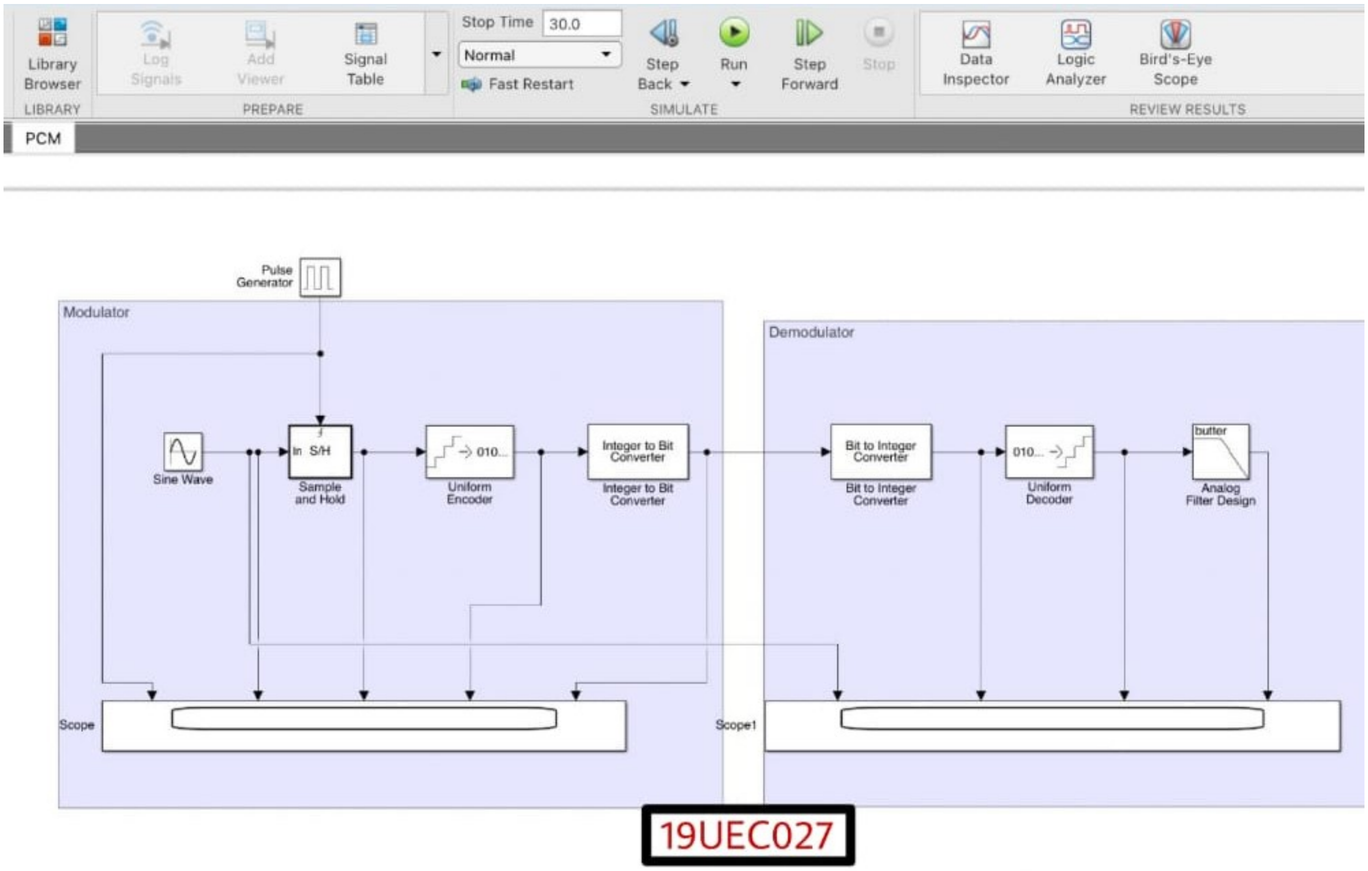

Figure 1.3 PCM Block Diagram

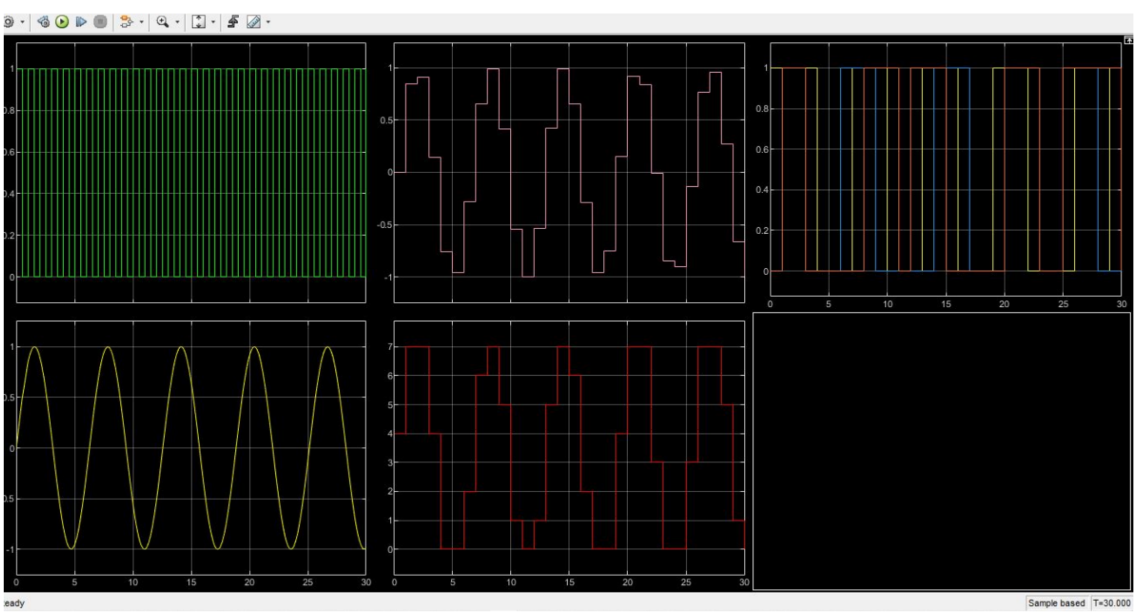

Figure 1.4 Modular Output

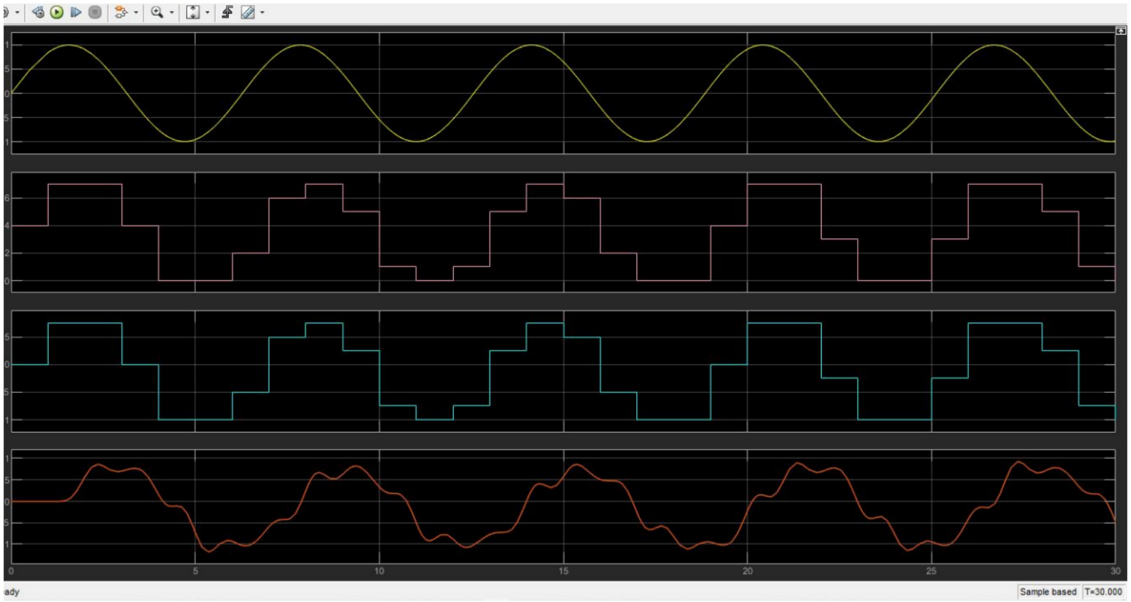

Figure 1.5 Demodular Output

1.5.0.2 Delta Modulation and Demodulation

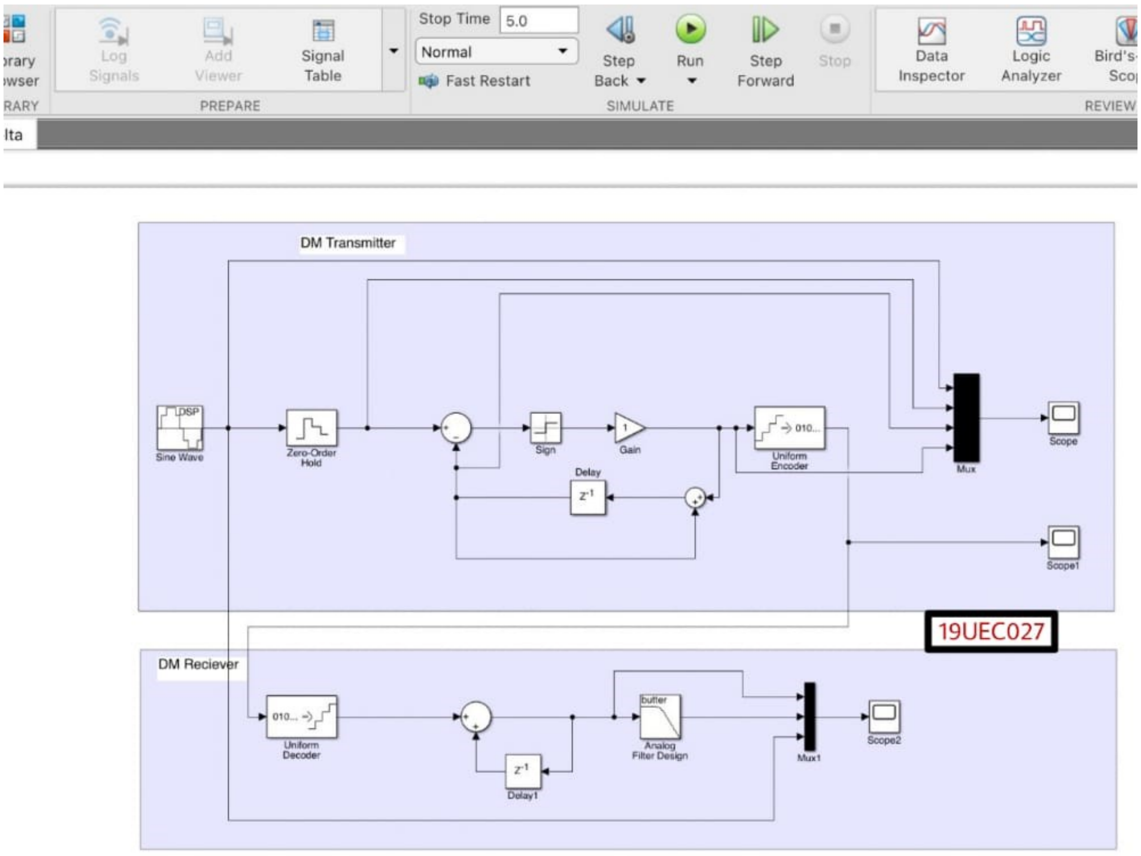

Figure 1.6 Delta Block Diagram

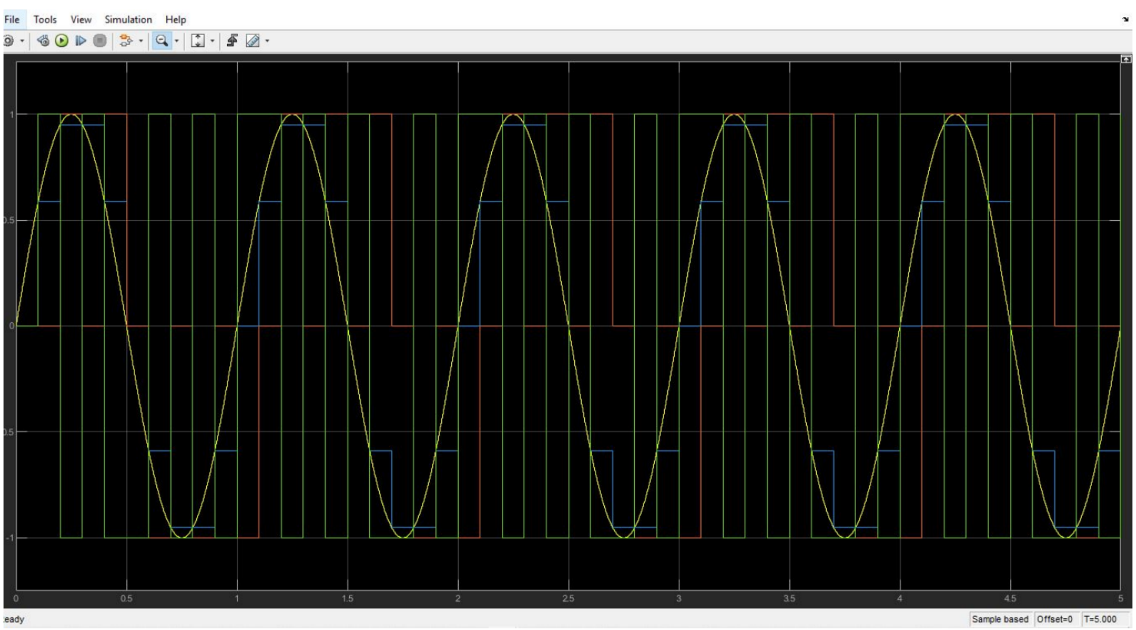

Figure 1.7

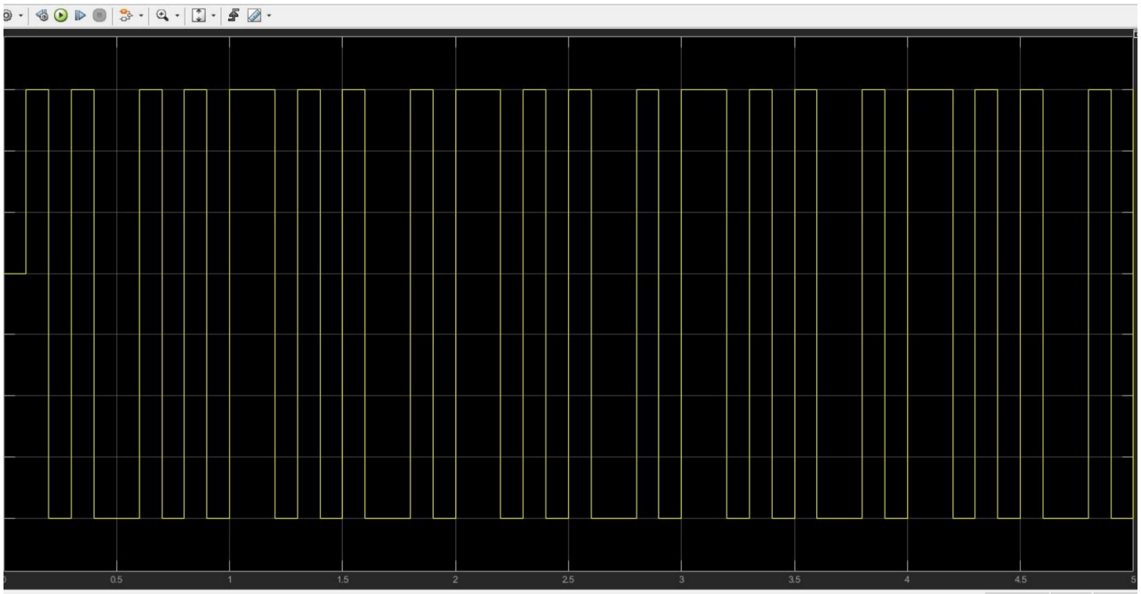

Figure 1.8

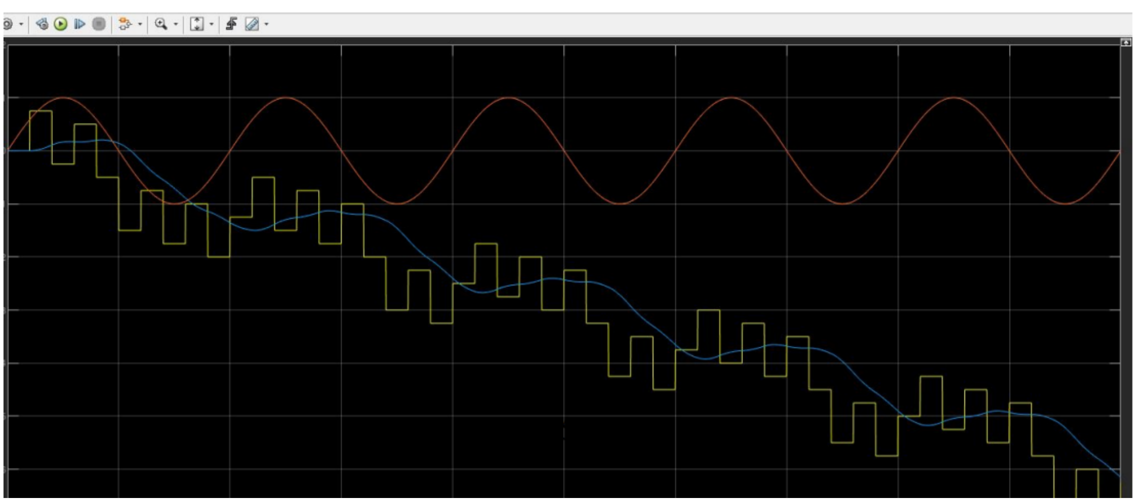

Figure 1.9

1.6 Analysis and Conclusions

Implemented Pulse Code Modulation (PCM) and Demodulation on MATLAB Simulink and also implemented Delta Modulation (DM) and Demodulation on MATLAB Simulink.