Analog Pulse Modulation Methods

In analog modulation system, some parameters of sinusoidal carrier is varied according to the instantaneous value of the modulating signal.
In pulse modulation method, the carriex is no longer a continuous signal but consists of pulse train. So in modulation process, some parameters of pulse are varies according to the instantaneous value of modulating signal.

On the basis of parameter variation, following types of pulse modulation system are there:-

1) Pulse Amplitude Modulation (PAM)
2) Pulse Width Modulation (PNM)
3) Pulse Position Modulation (PPM)

All the above pulse modulation methods are called analog Pulse modulation methods because the modulating signal is analog in nature in PAM, PWM & PPM.

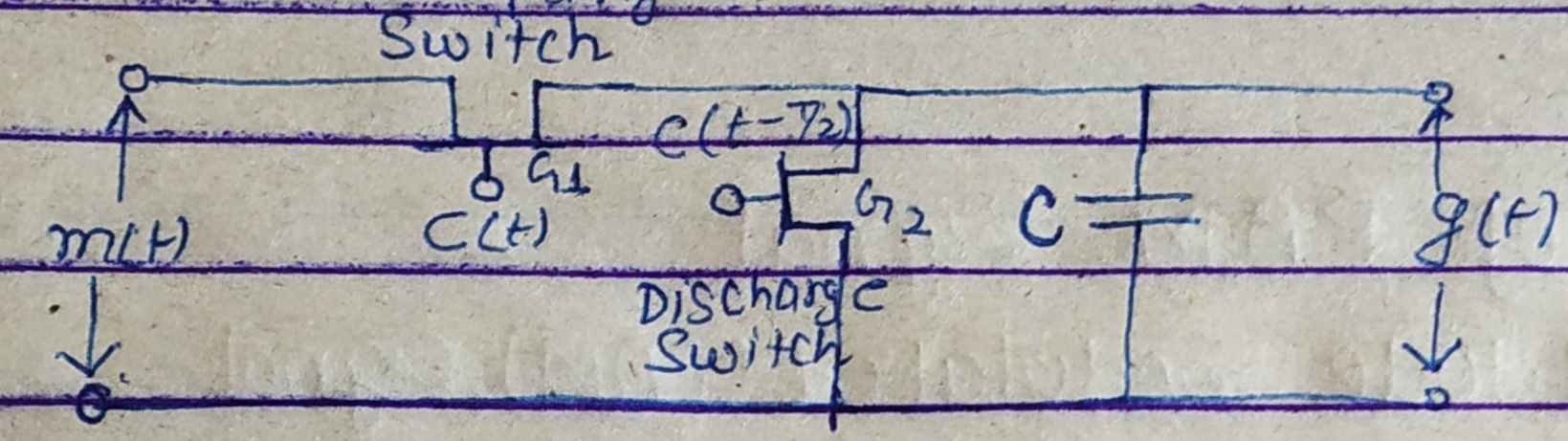
According to the Sampling theorem, if a modulating signal is bandlimited to fm Hz i.e the maximum freqency component in signal is fm Hz, then

the sampling frequency must be at least 2fm Hz. hence the frequency of the carrier pulse train must also be alteast 2fm Hz.

Pulse Amplitude Modulation (PAM)

Pulse amplitude modulation may be defined as that type of modulation in which the amplitude of regularly spared rectangular pulse vary according to instantaneous value of the modulating or message signal.

In order to generate Pulse amplitude modulated Signal, a Sample and hold Circuit is used. It produces flat top Sampled PAM. The circuit is given below



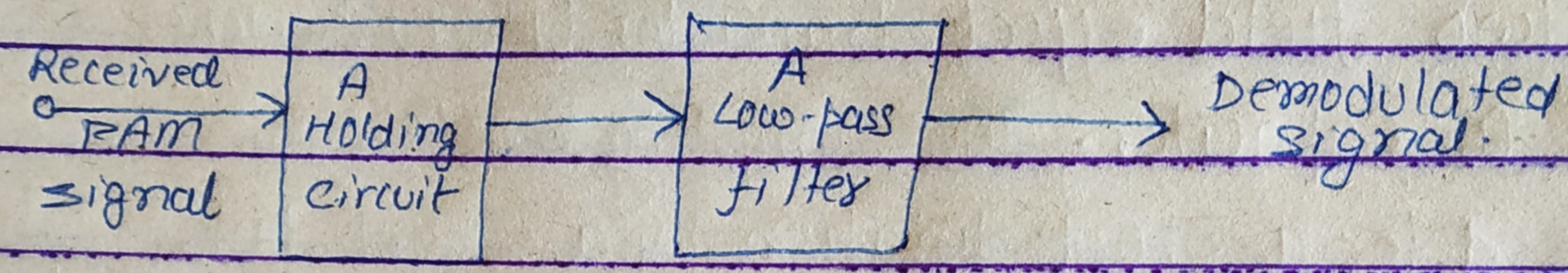
The Sample and hold (S/H) circuit consist of two field effect transistor (FET) Switches and a Capacitor. The Sampling switch is closed for a short duration by a short pulse applied to the gate of G1 of the transistor. When positive pulse is applied to gate of G1, the transistor G1 conducts and Capacitor C quickly charged upto a voltage equal to the instantaneous sampled value of message signal $m(t)$.

Now, the Sampling Switch is Opened and Capacitor 'C' holds the charge. The discharge switch (G2) is closed now by providing positive pulse. Due to this, the Capacitor C discharges to Zero volts. The discharge switch

is then opened and thus Capacitor has no voltage.
Hence, the output of the sample and hold circuit consists of a sequence of Flat top Samples.

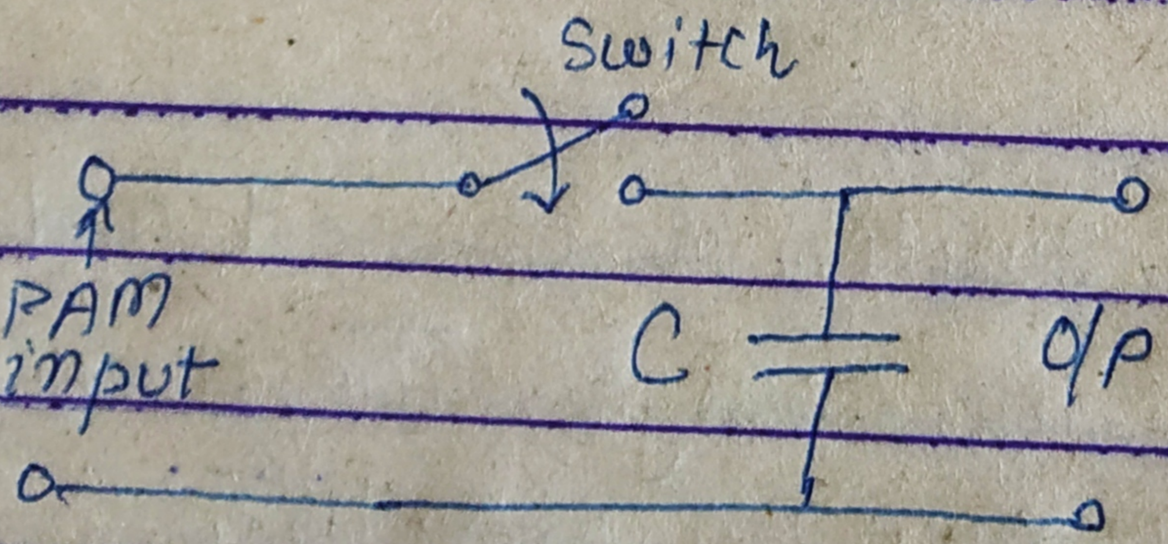
Demodulation of PAM Signal

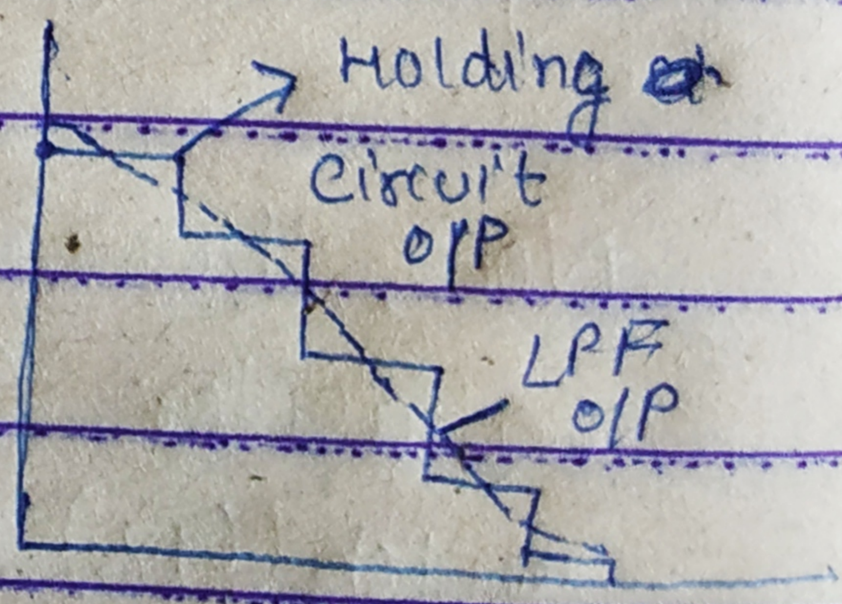
For pulse amplitude modulated (PAM) signal the demodulation is done using a holding circuit.



Block diagram of PAM demodulator

The received PAM signal is allowed to pass through a holding circuit and a low pass filter. The holding circuit can be given as





Here the switch 'S' closes after the arrival of the pulse and it is opened at the end of the pulse. In this way, the capacitor C is charged to the pulse amplitude value and it holds this value during the interval between the two pulses.

After this the holding circuit output is smoothened in low Pass filter.

Drawbacks of Pulse Amplitude Modulated (PAM) signal

1) The bandwidth required for the transmission of a PAM signal is very large in comparision to the maximum frequency present in the modulating signal.

2) Since the amplitude of the PAM pulse varies in accordance with the modulating signal therefore the interference of noise is maximum in a PAM signal.

3) Since the amplitude of the PAM signal varies, therefore, this also varies the peak power required by the transmitter with modulating signal.