→ Disadvantages of PAM :-

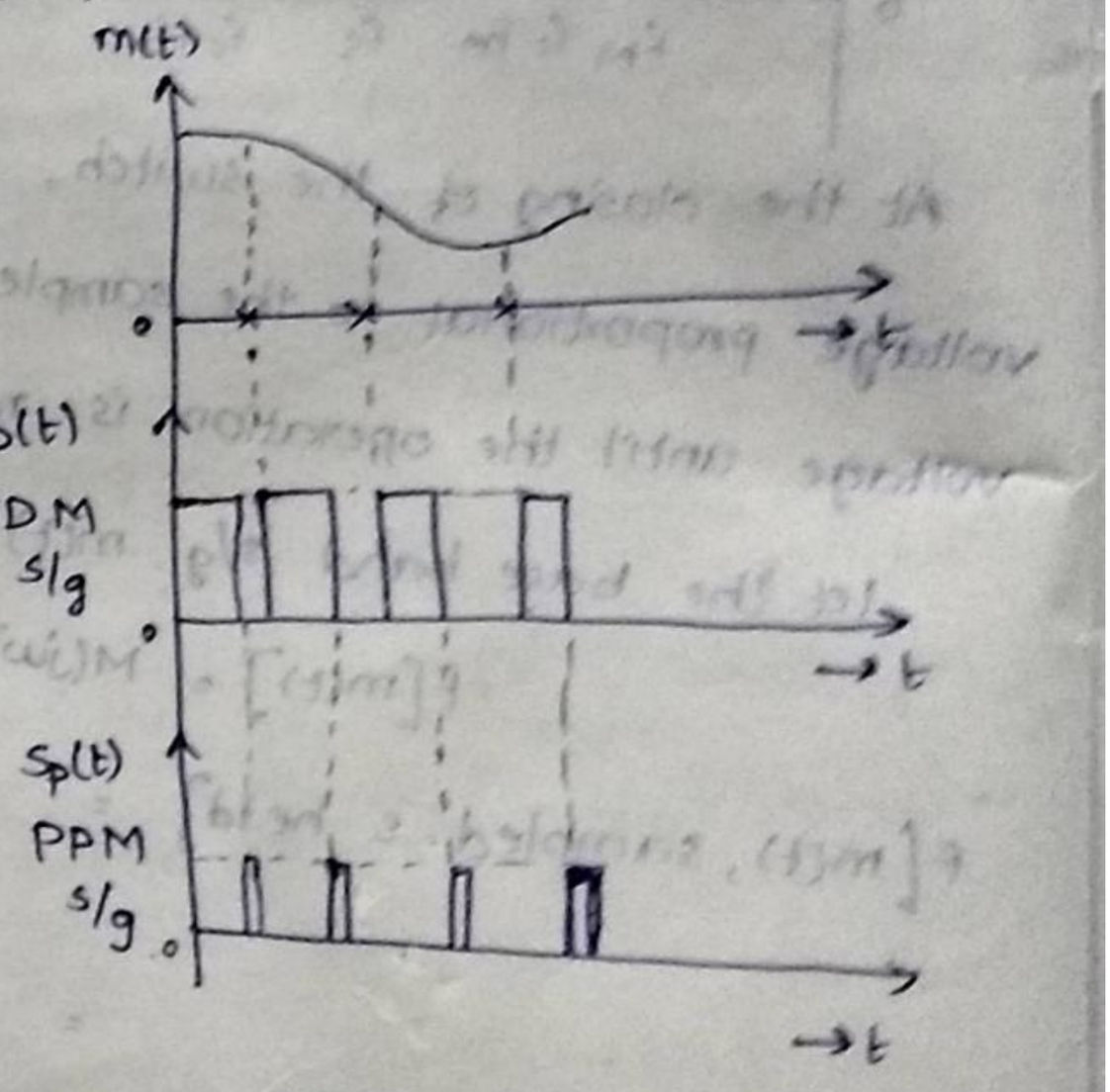
1) The BW needed for Txion of PAM s/g is very very large compared to the max. freq content.

2) The amplitude of PAM pulses varies according to base band s/g. ∴ Interference of noise is max for PAM s/g & this noise cannot be removed very easily.

3) Since the amp. of PAM s/g varies, this also varies the peak power required by the Txer with modulating s/g.

→ Pulse Time Modulation :- (PTM)

In PAM, the base band s/g modulates the amplitude of sampling s/g, but in PTM one of the time characteristics (such as width, position) of the sampling s/g is varied according to the s/g amplitude at that instant.



PTM is of 2 types :-

→ 1) PWM / PDM / PLM

→ 2) PPM

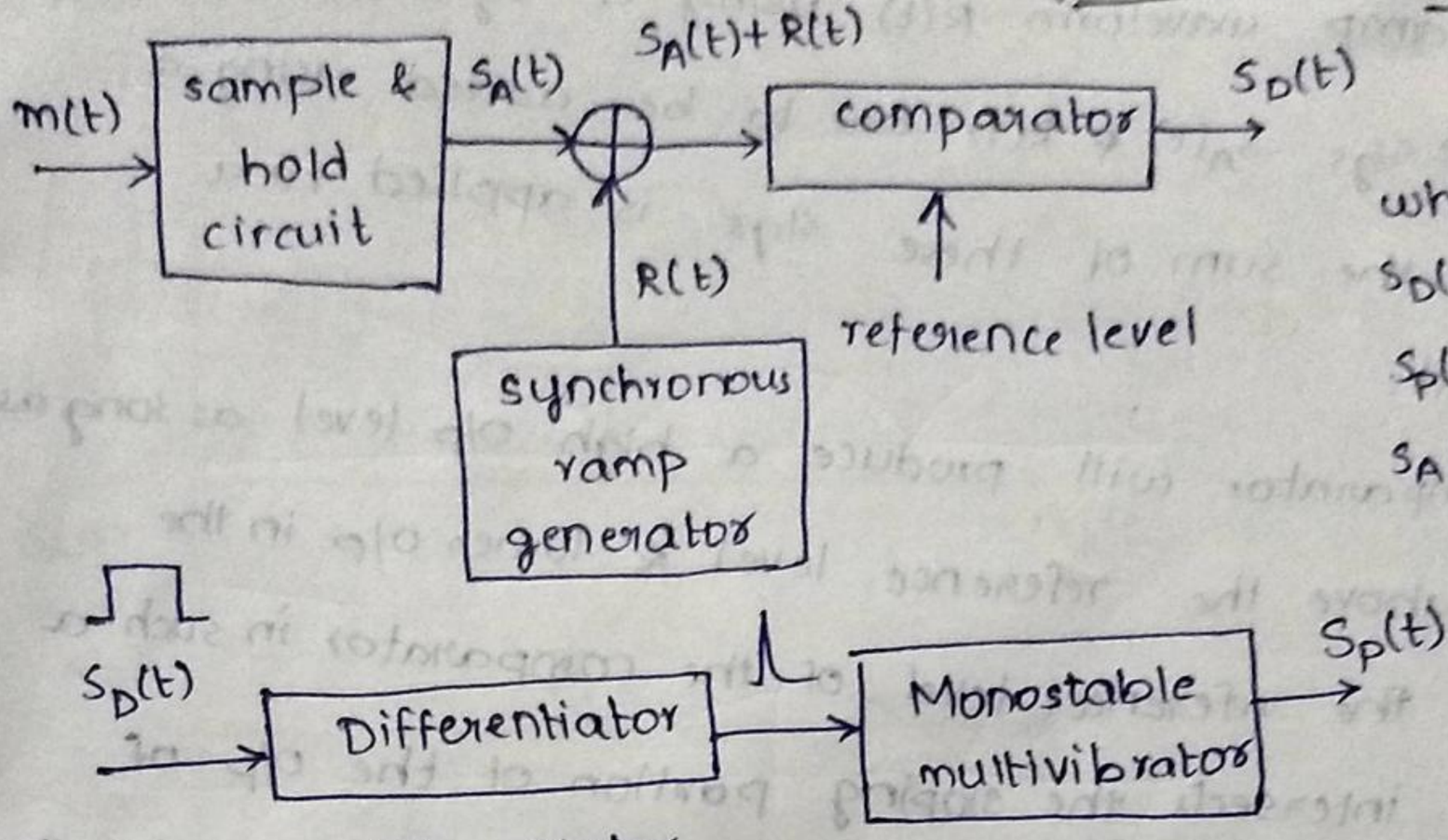
PWM : Pulse width modulation

PDM : Pulse Duration Modulation

PLM : Pulse length Modulation

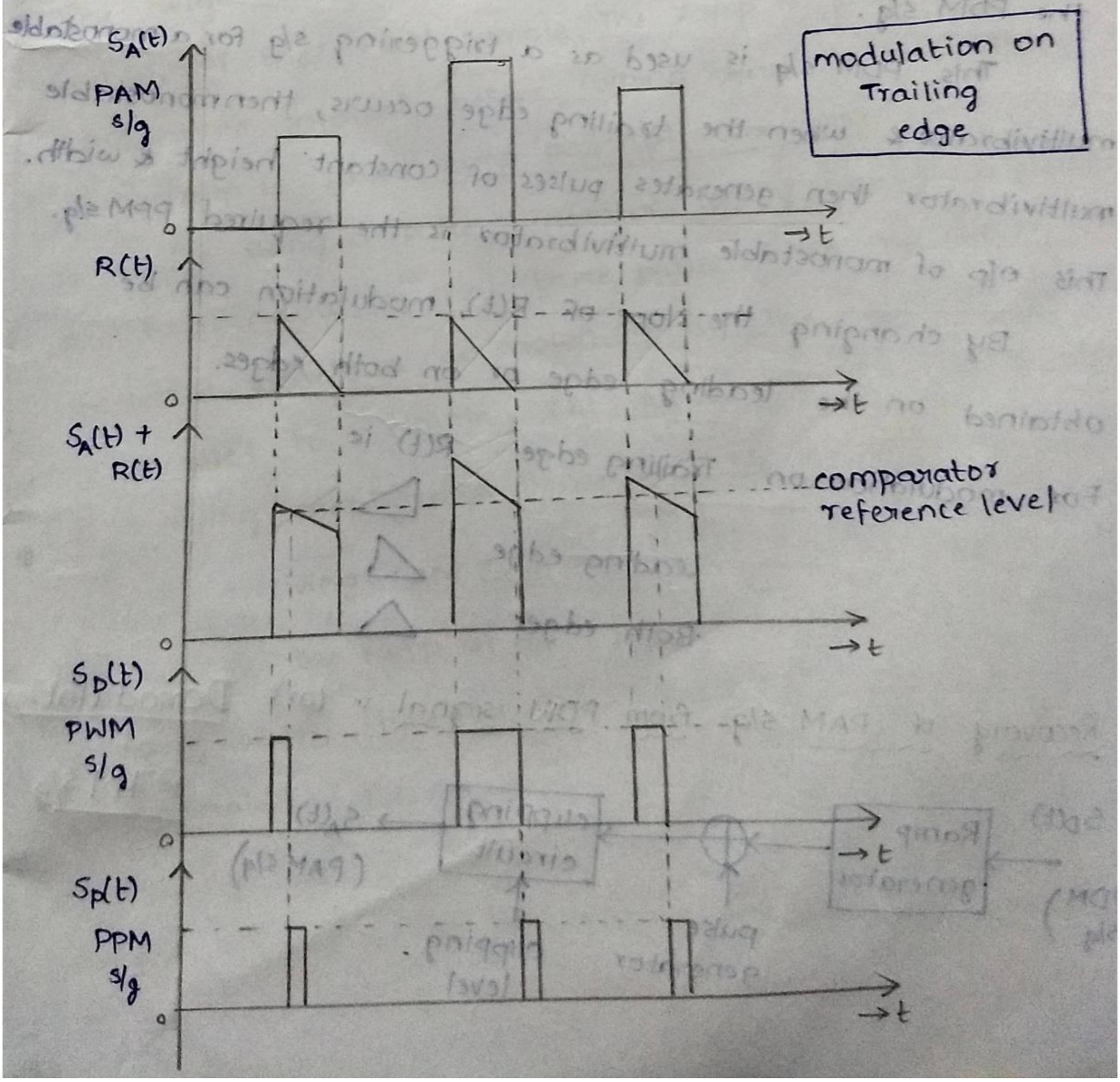
In PDM system, the duration of sampled pulse is proportional to sample value of base band s/g amplitude, whereas PPM system generates pulses of constant amplitude & width whose position is varied according to the base band amplitude at each sampling point.

→ Generation of PDM & PPM signals from PAM samples :-
or (Modulation of PTM s/gs)



Differentiator
or
High pass filter

fig :- Block diagram for hardware to generate PTM s/gs.



Generate PAM samples $S_A(t)$ using sample & hold ckt. Generate the ramp waveform R(t) using a synchronous ramp generator. These s/gs $S_A(t)$ & R(t) are to be added using a adder ckt & the sum of these s/gs is applied to a comparator ckt.

A comparator will produce a high o/p level as long as the i/p s/g is above the reference level & lower o/p in the other case. Fix the reference level of the comparator in such a way that it intersects the sloping portion of the o/p of adder ckt. The 1st crossing of the reference level generates the leading edge & the 2nd crossing generates the trailing edge of the PDM s/g.

This PDM s/g is used as a triggering s/g for a monostable multivibrator & when the trailing edge occurs, the monostable multivibrator then generates pulses of constant height & width. This o/p of monostable multivibrator is the required PPM s/g.

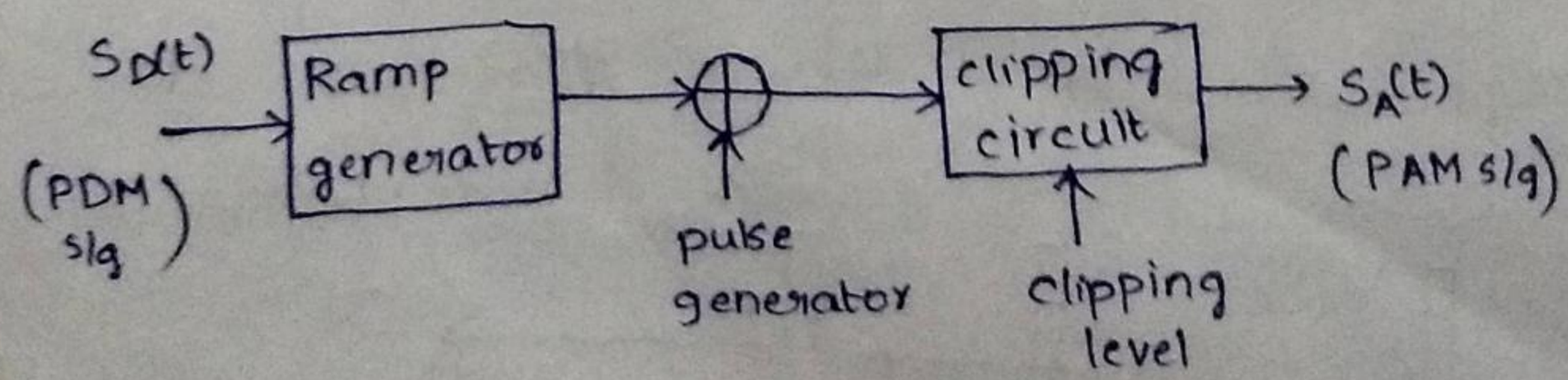
By changing the slope of R(t), modulation can be obtained on the leading edge or on both edges.

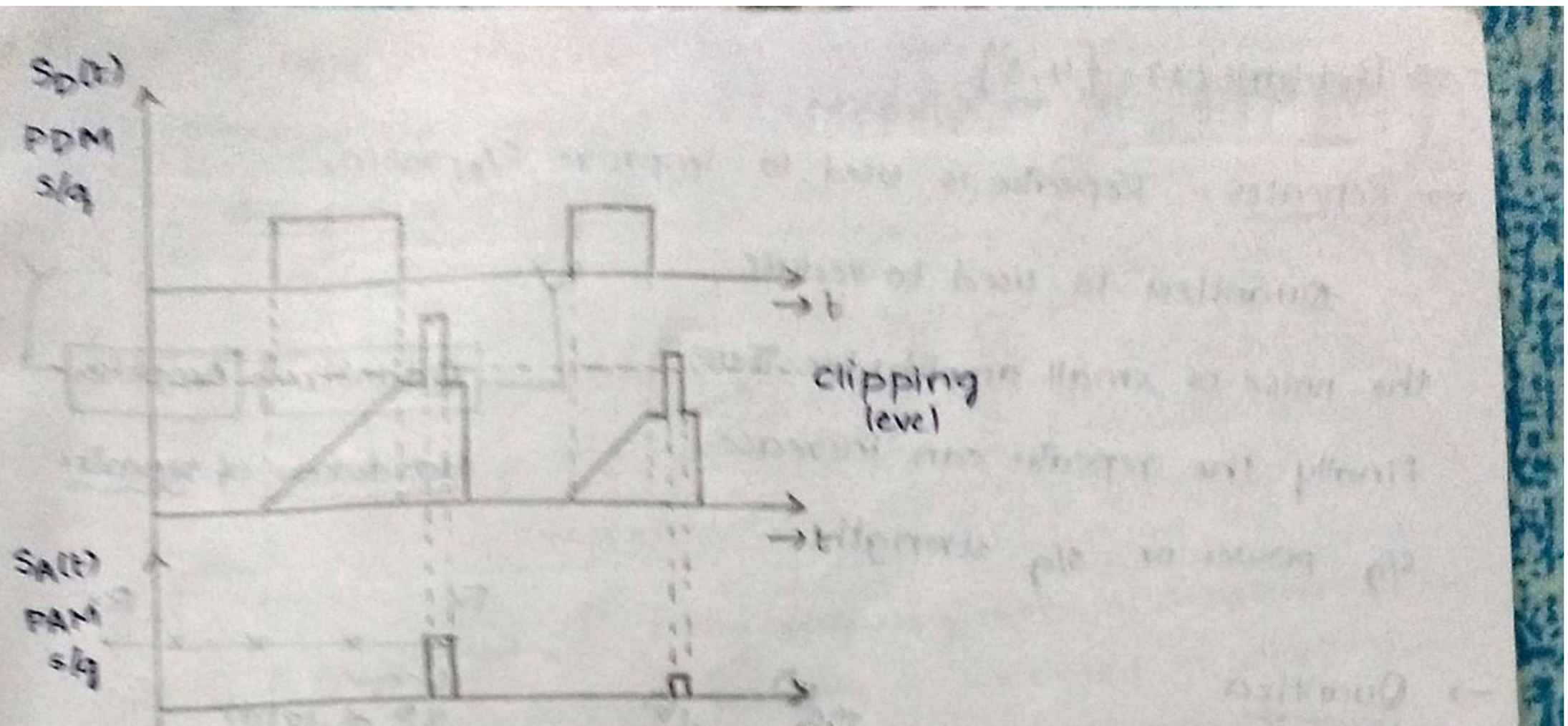
For modulation on Trailing edge R(t) is

Leading edge

Both edges

→ Recovery of PAM s/g from PDM signal :- (or) Demodulation of PTM s/g





The leading edge of PDM s/g initiates a ramp generator & the rise of the ramp is terminated at the trailing edge. The height attained by the ramp is proportional to the width of the PDM sample. The ramp is sustained for a fixed time interval before coming back to zero. This waveform is called ramp pedestal waveform.

By using a pulse generator, locally generated pulses are to be added, so that these pulses sit on the top of the pedestal waveform as shown in fig. The resultant waveform is applied to a clipping ckt, whose o/p consists of pulses of varying amplitudes. Hence this s/g is called PAM sample s/g's

For receiving PAM from PPM, initiate the ramp at the beginning of the time slot & terminate at the occurence of leading edge of the PPM sample. The remaining procedure is same as that of PDM sample.