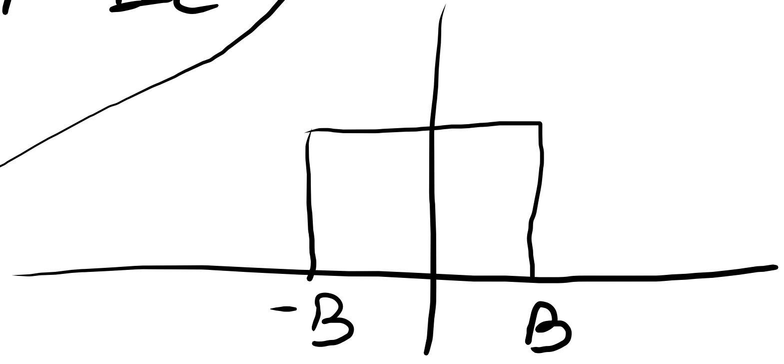
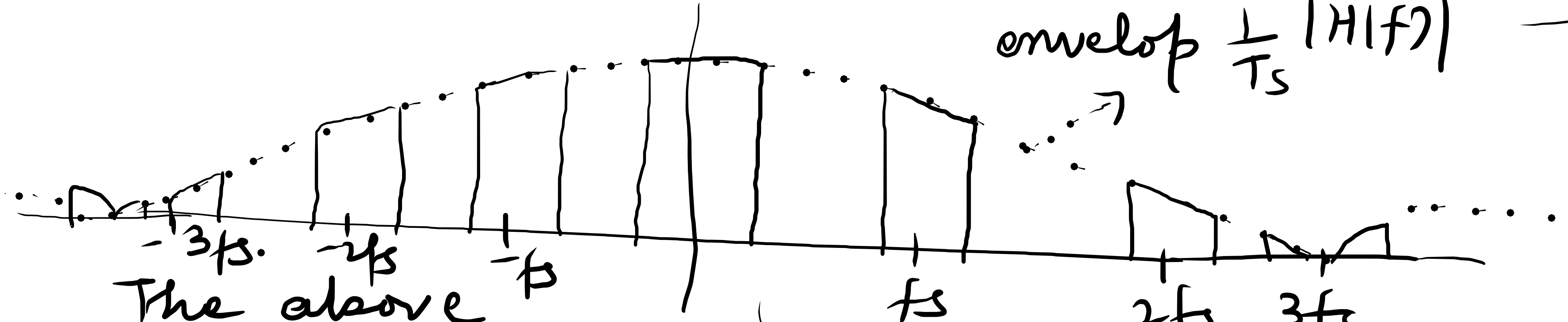
Lec-13, DC

Magnitude Spectrum of input analog WF be $\frac{\tau}{T_s}\left|\frac{\sin \pi\tau f}{\pi \tau f}\right|$



Instantaneous PAM | sampling



$$\left|\frac{H(f)}{T}\right|$$

The above case considers

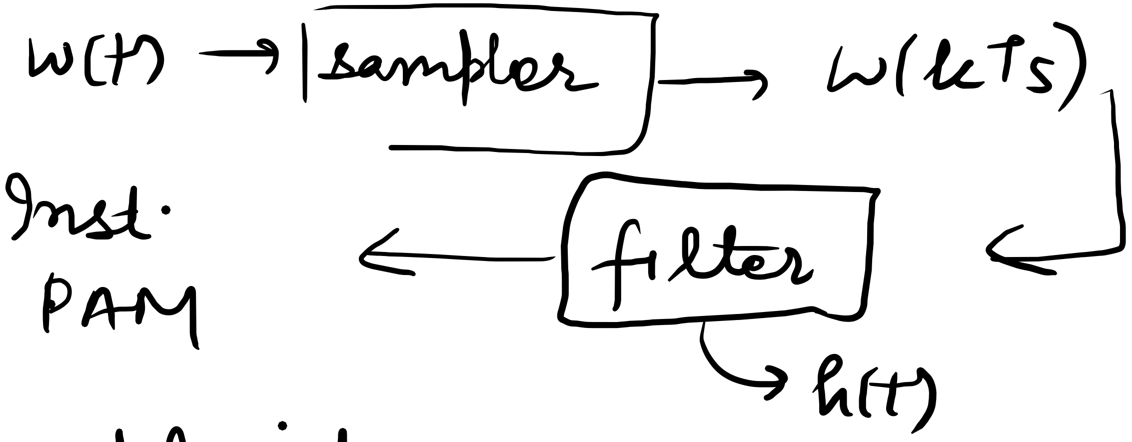
$$\tau / T_s = 1/3 \ \& \ f_s = 4B$$

$$|W_s(f)| = \frac{1}{T_s}|H(f)| \sum_{n=-\infty}^{\infty} |W(f-nf_s)|$$

→ Inst. PAM is also called as "Sample & hold"

Class / home assignment :- Product detection of Inst. PAM from pg 133, Haykin's TB

At some places, we have mentioned that Inst. PAM is sampled signal passed through a filter.

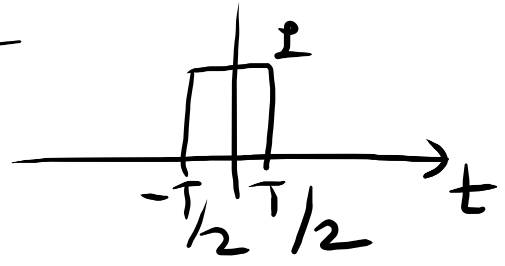


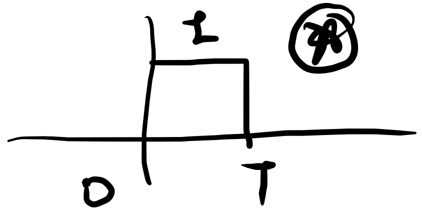
(flat-top Inst. PAM)

Sim. Haykin's presentation of Inst. PAM takes ⊛ as the filter.

a delay is imposed

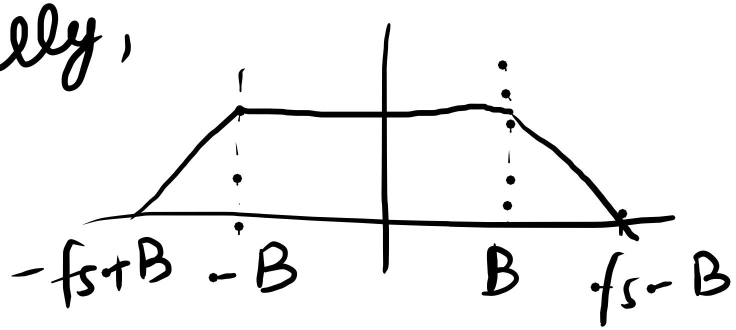
delay it by $T/2$





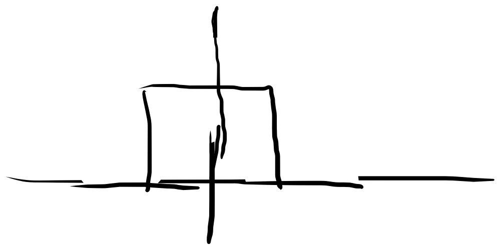
→ Natural Sampling, a typical LP filter would look like

Ideally,

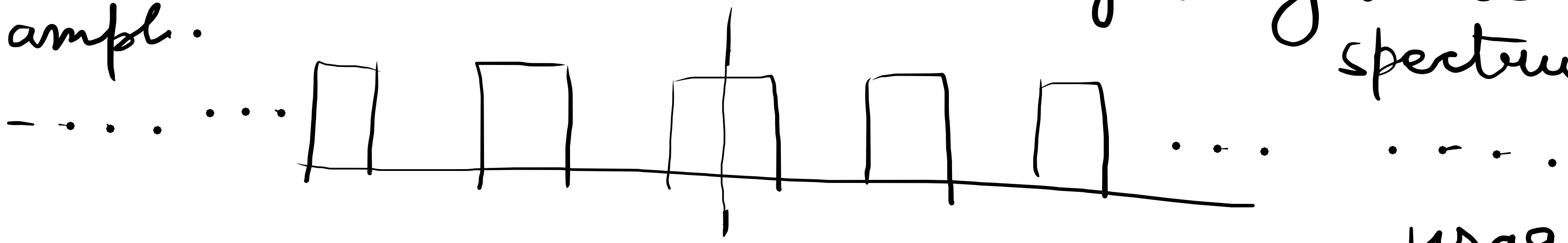


Ideal filter of BW $> B$ & $< f_s - B$ should work but since steep fall is diff. to realize, the used filter can die down slowly b/w B & $f_s - B$

One benefit of either form of PAM.

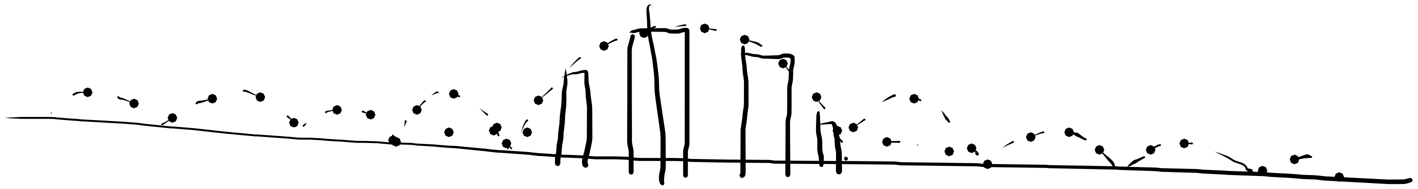


Ideal sampl. $\longrightarrow$

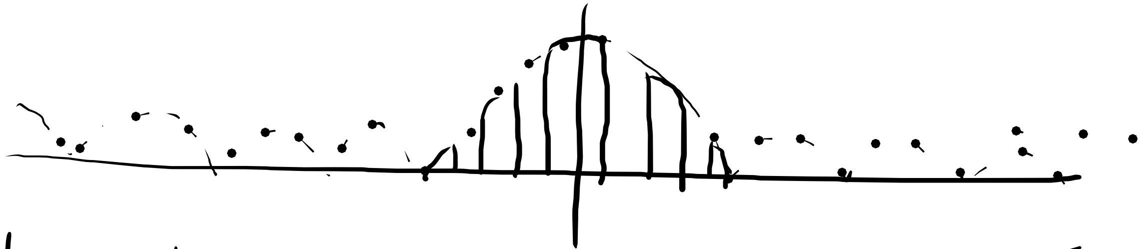


Very-very wide spectrum usage.

NS $\longrightarrow$



flattop Inst Sam. $\longrightarrow$



Recovery of PAM (Inst.) :- Low pass filter the signal (sampled) - but there is high freq. loss in the recovered analog WF due to the filtering effect $H(f)$. How, this loss can be reduced by $\downarrow \tau$ (How?) or using an equalizer with TF of $1/H(f)$

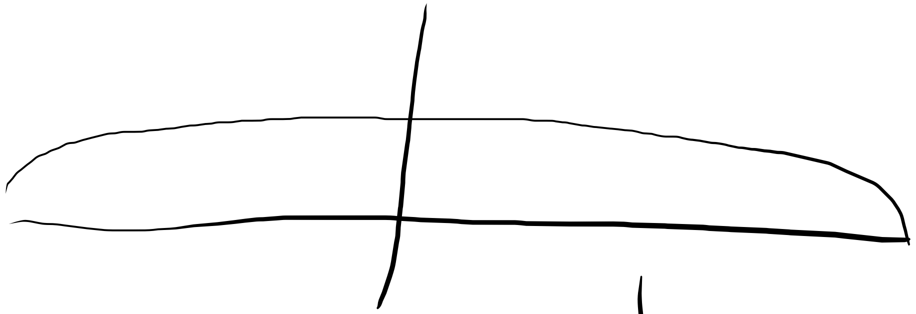
Sampled (Inst. PAM) → $\boxed{\text{LPF}}$ → $\boxed{1/H(f)}$ →

↳ subject to this is finite / exists

Pulse width τ is called aperture since τ/T_s determines the gain of the recovered analog signal

→ limitations of PAM :- (both NS & IS)

↳ If we Tx PAM signal over a wire / any channel requires a very wide freq. response because of narrow pulse width (how?)



→ BW reqd. is much larger than that of the original analog signal

→ Noise perf. is not better than direct analog sig. Tx.

PAM is used as the first building block of the PCM system.
Also, PAM helps in efficient multiplexing of diff. signals.

—— × —— × —— × —— × ——

Quantization process:— PAM gives us signal at discrete time but the amplitudes do not belong to a finite set

4 bit length
can rep. $2^4 = 16$

→ The existence of a finite no. of discrete amplitude levels is a basic condition of PCM → pulse-code-modul^n