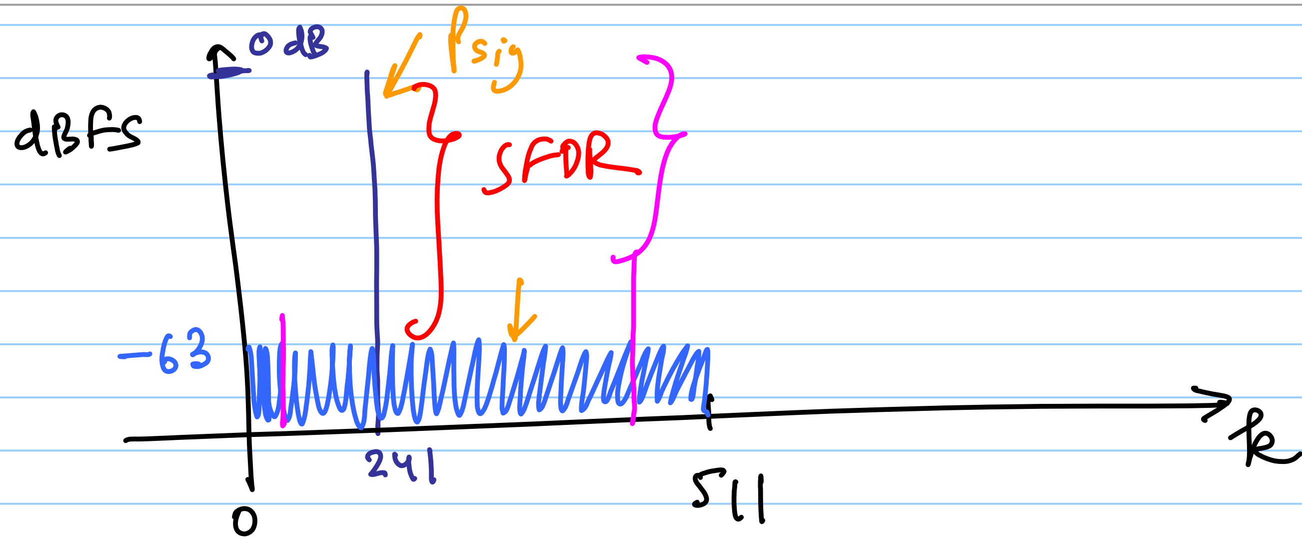
ECE 615 - Lecture 23

Note Title 4/5/2016



512 bins

SQNR
ENOB = ?

$\rightarrow x_{dB} = 10 \log_{10}(x)$

$x = 10^{\left(\frac{x_{dB}}{10}\right)}$

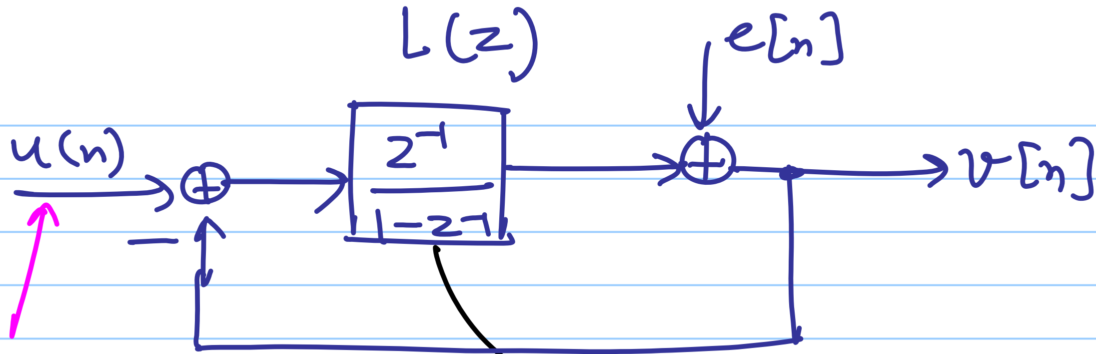
$P_{sig} = 1$

$P_{noise} = 511 \times 10^{(-63/10)}$

$SQNR = \frac{P_{sig}}{P_{noise}} \Rightarrow 36\,dB$

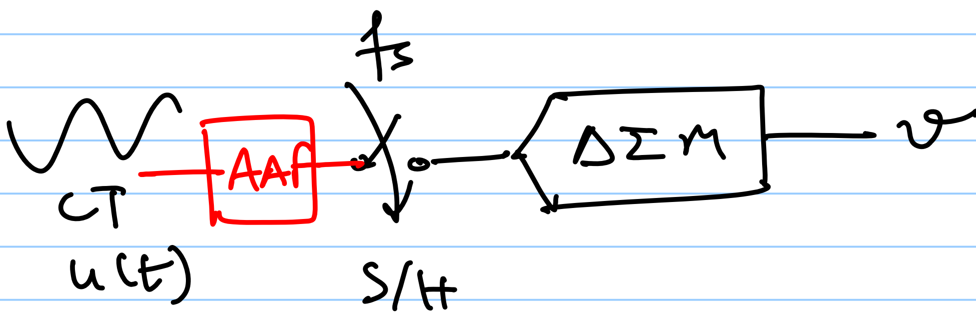
$\Rightarrow 5.7$ bits

1st order ΔΣ modulator



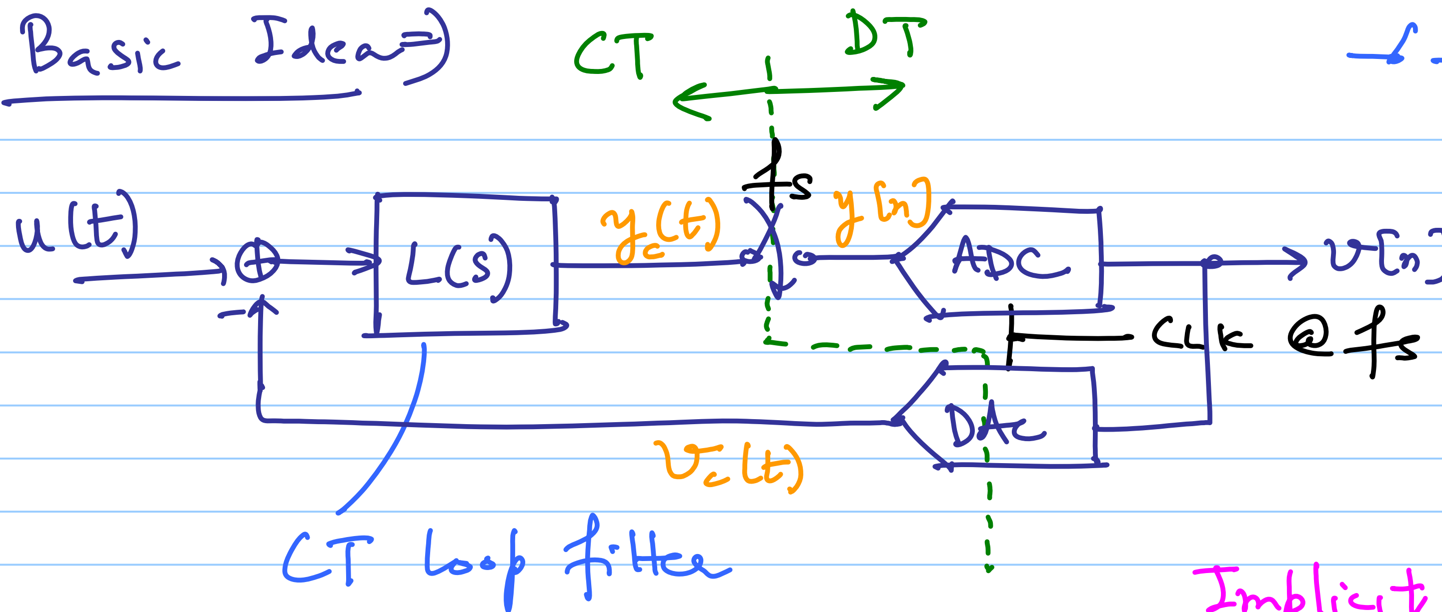
DT signal (already sampled)

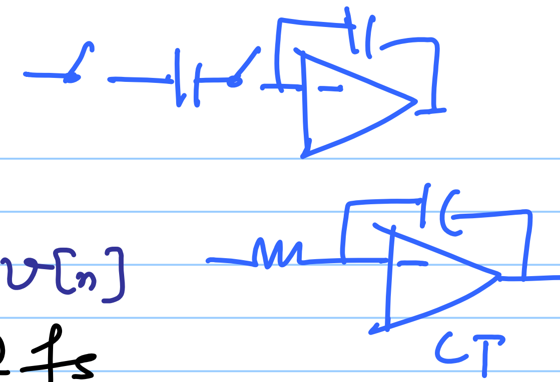
Discrete-time accumulator
Switched-capacitor circuits



Need additional AAF
↳ oversampling relaxes the requirements on the AAF

Basic Idea ⇒





Implicit AAF !

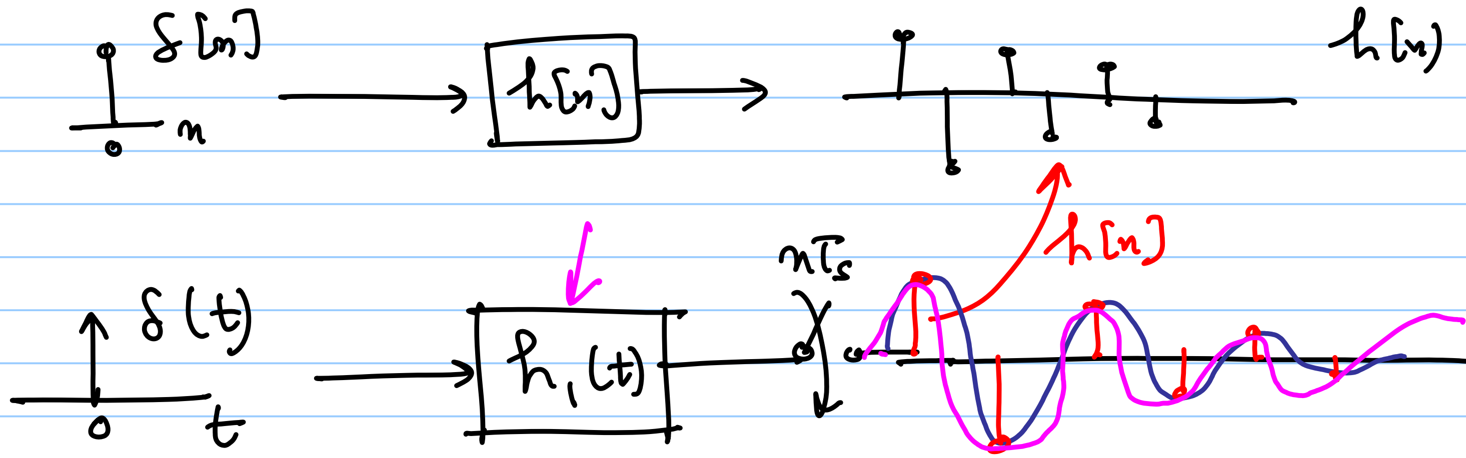
Continuous-time ΔΣ Modulator

↳ loop filter is a CT filter

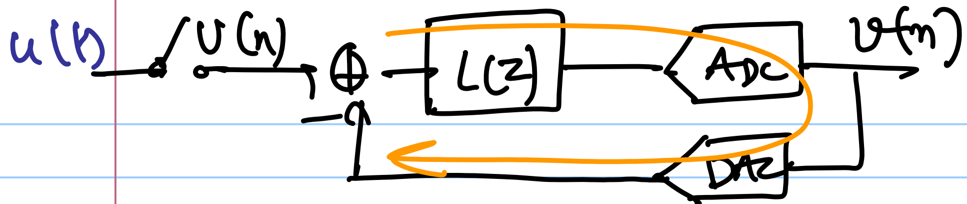
NTF(z) or ~~NTF(s)~~

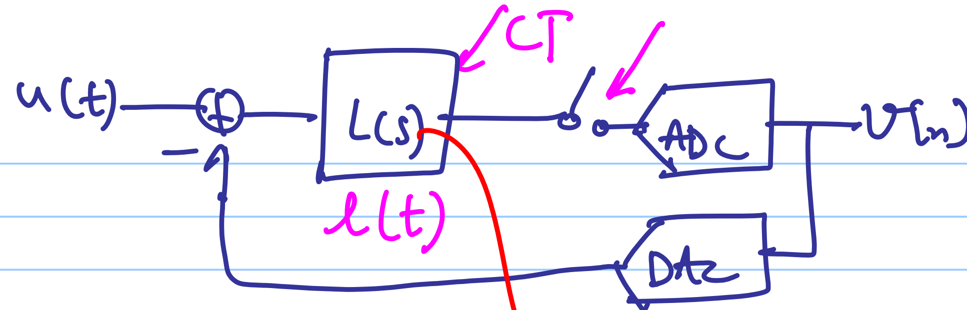
✓ Overall, the system is still a DT system!

Consider the DT impulse response, h[n]



* Can use a CT impulse response $h_1(t)$ such that the sampled response is h[n]
  - ↳ many CT responses '$h_1(t)$' are possible
    - ↳ impulse invariant transformation





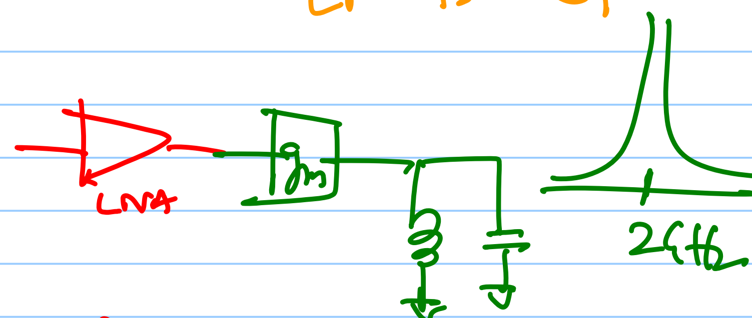
$$NTF(z) = \frac{1}{1+L(z)}$$

NTF(z) ??

DT system

LF is CT

CT-ΔΣM
- lower power dissipation
- research activity
- > GHz clock rates

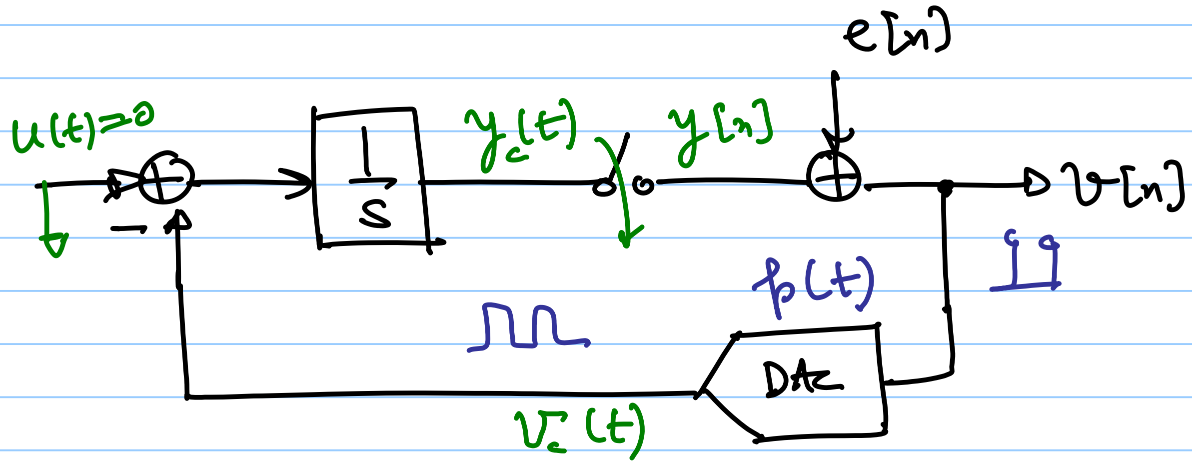


RF to Digital Converter

1^{st}-order CT ΔΣM :

Sampling rate Normalized to 1 Hz

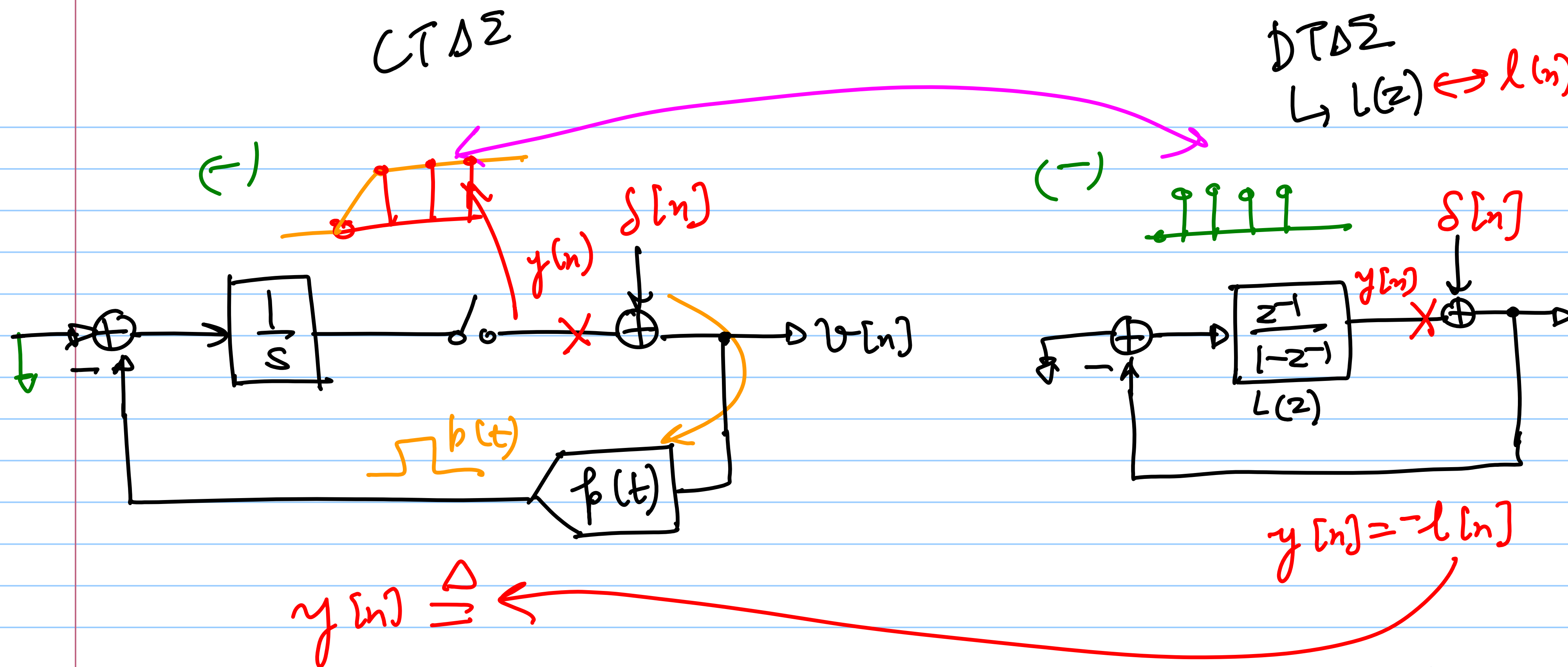
$f_s = 1\,Hz$



DAC is converting a DT Signal to a CT signal

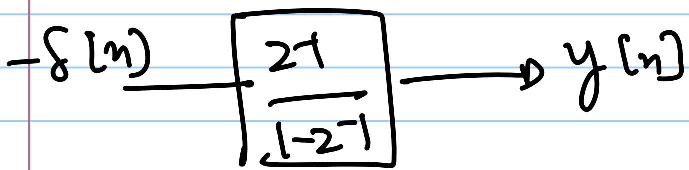
↳ need to account for the DAC pulse shape, p(t)

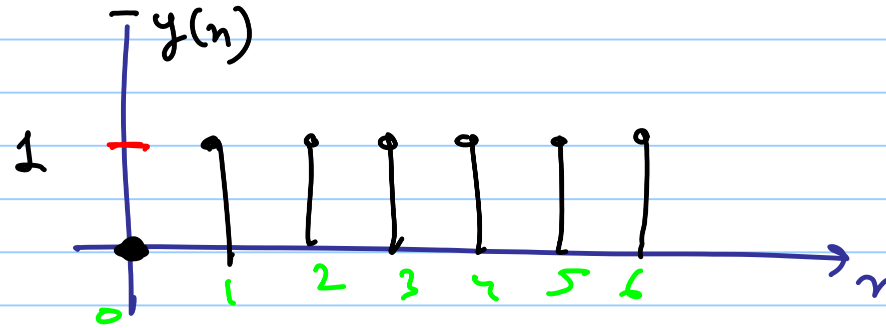
↳ The NTF should be Same as the DT NTF, NTF(z)



If $l[n]$ or $L(z)$ is same for the CT & DT loops, their $NTF = \frac{1}{1+L(z)}$ is also the same

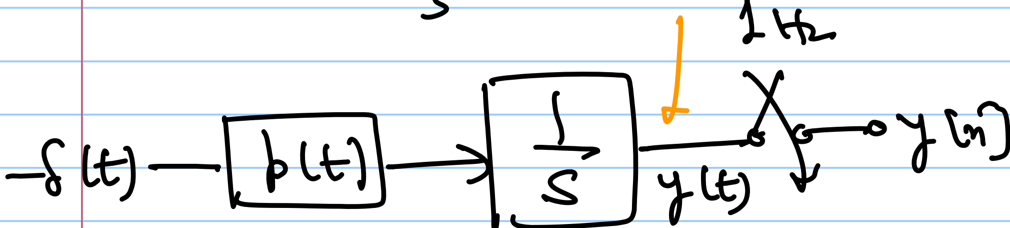
DT impulse response

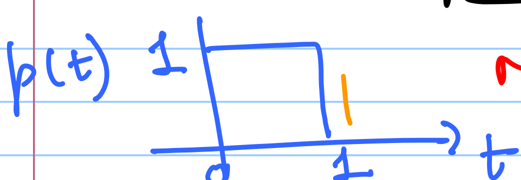




1, 0, 0, 0, ...

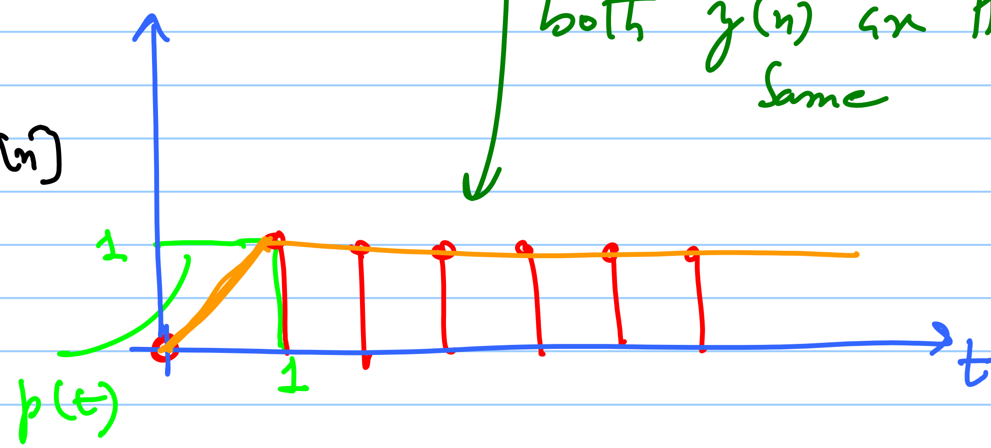
$L(s) = \frac{1}{s}$

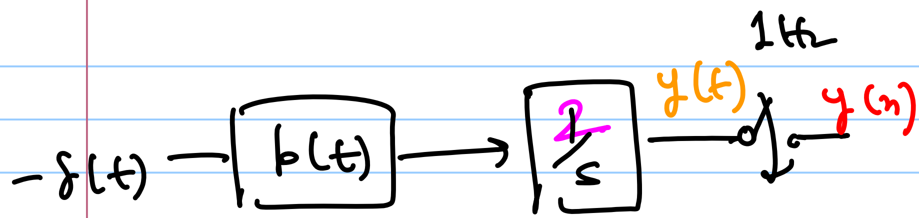


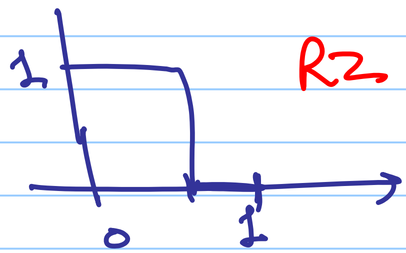


NRZ

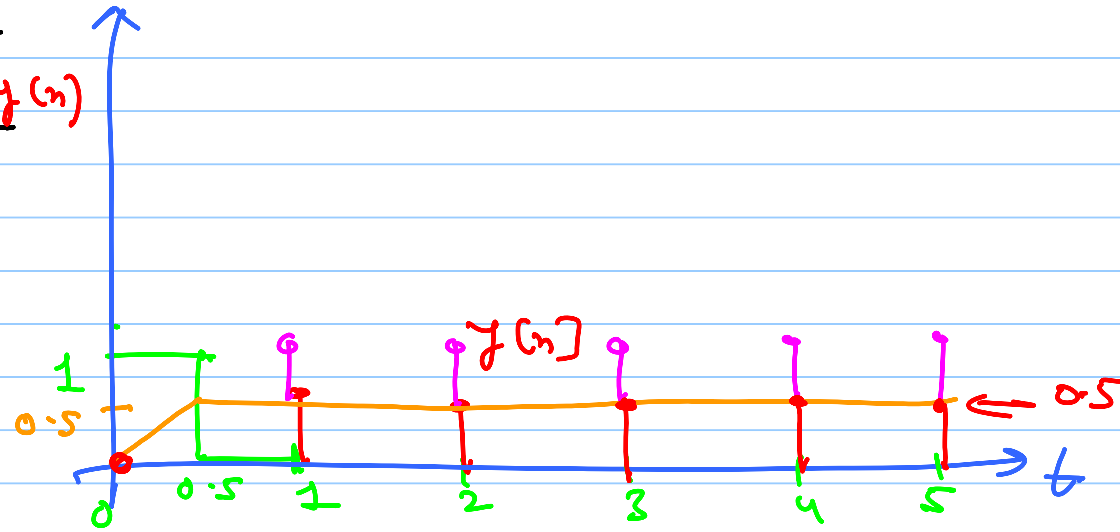
both y(n) are the same







RZ

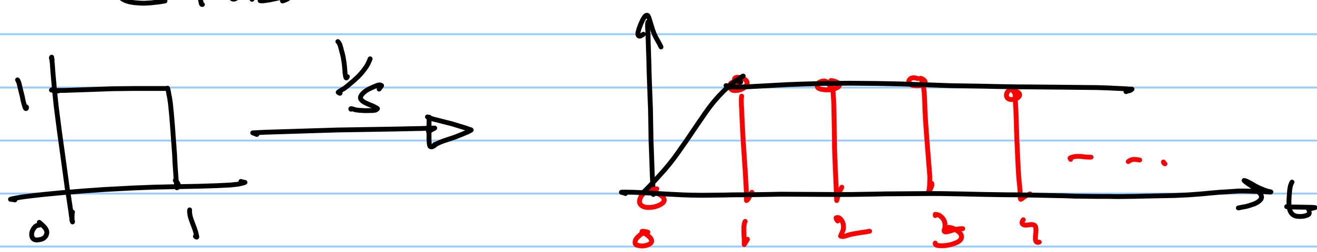


$$L(s) = \frac{2}{s}$$

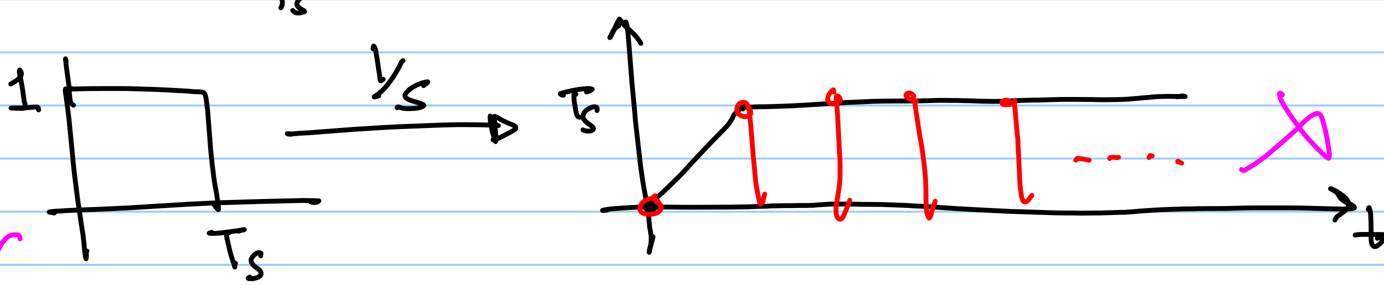
$$\{p(t),\ L(s)\} \Longrightarrow l[n] \overset{Z}{\longleftrightarrow} L(z) \longrightarrow NTF(z) = \frac{1}{1+L(z)}$$

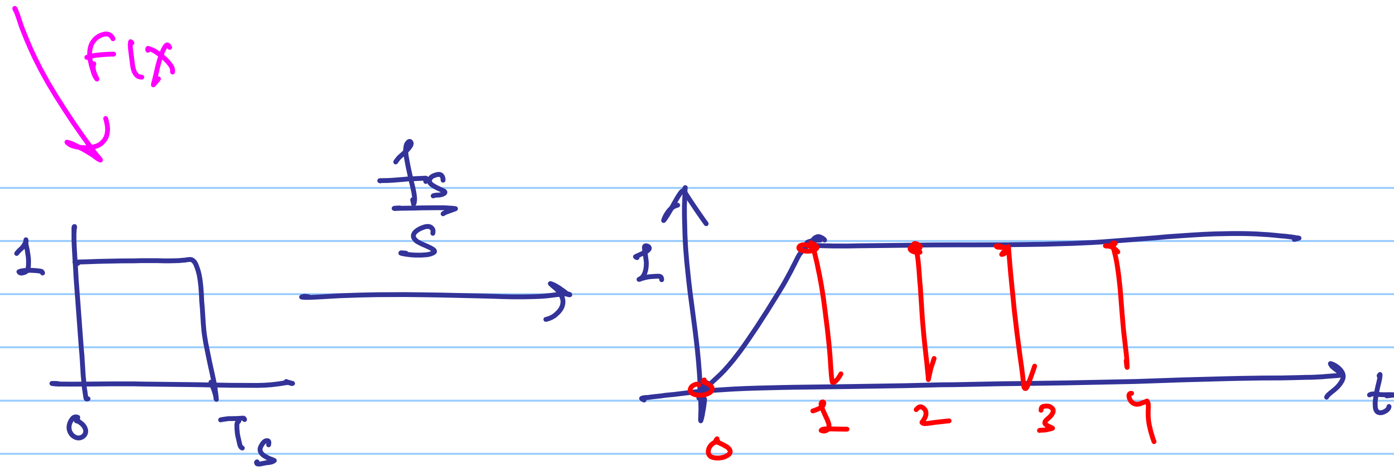
changing the sampling rate:

@ 1Hz



@ $f_s = \frac{1}{T_s}$





$$L(s) = \frac{f_s}{s} = \frac{1}{sT_s}$$

Not!

~~$\frac{f_s}{s}$~~