ECE 615 - Lecture 18

"Wireless LANs"

Note Title 11/5/2013

Continuous-time ΔΣ Modulators

802.11 a/b/g/n

ac

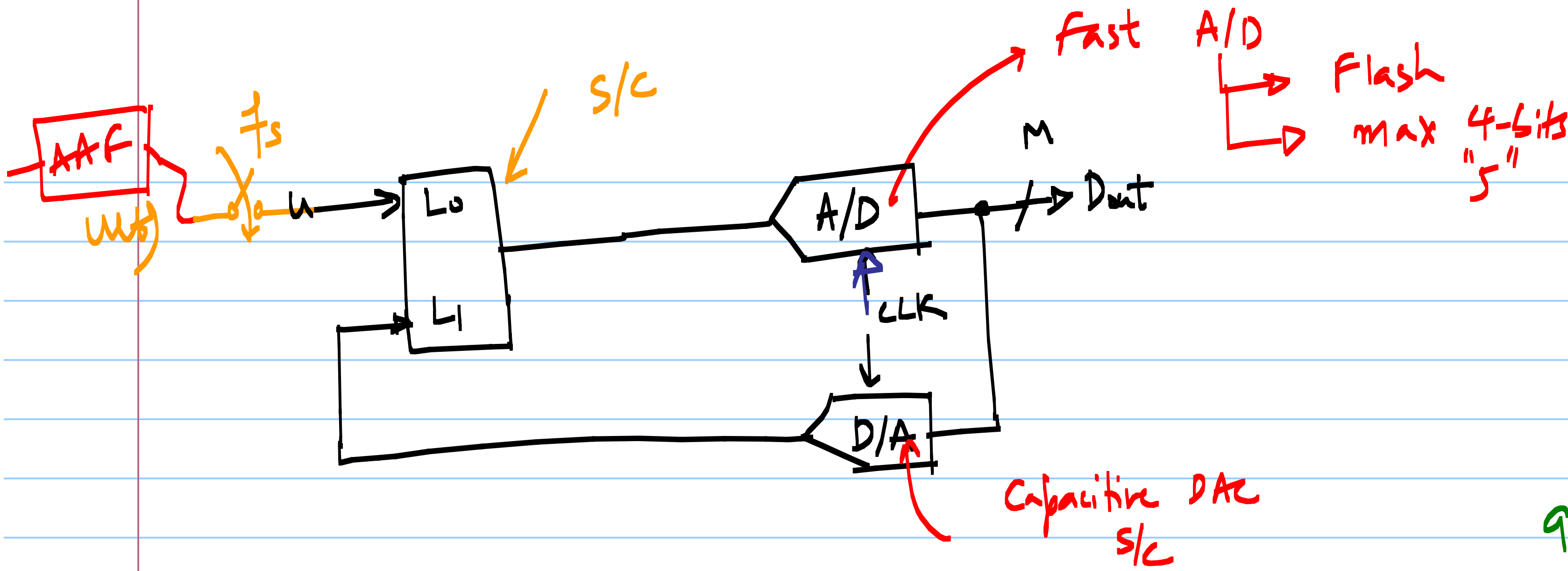
↓

40/80/160 BW

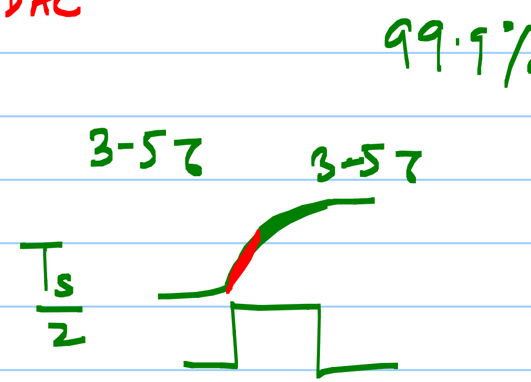
↓

6-9 GHz

≥12 bits

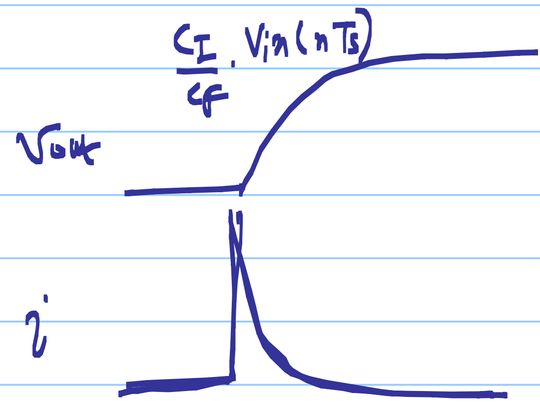


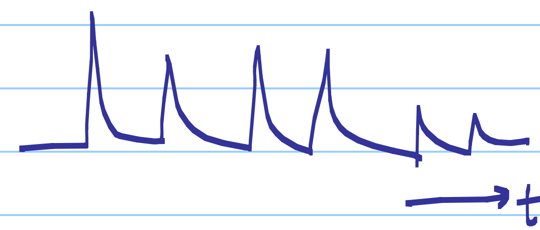
S/C ⇒ opamp settling ⇒ f_{un}, SR, A_v



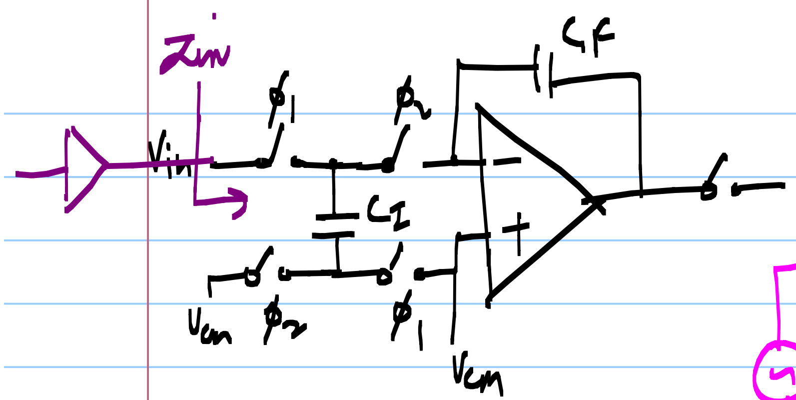
* opamp can only slew for 25% of settling time

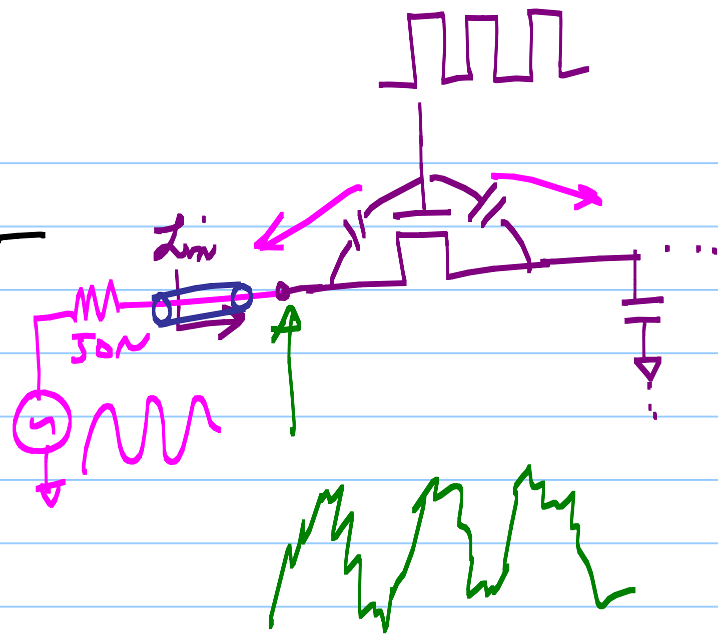
* Opamp power consumption

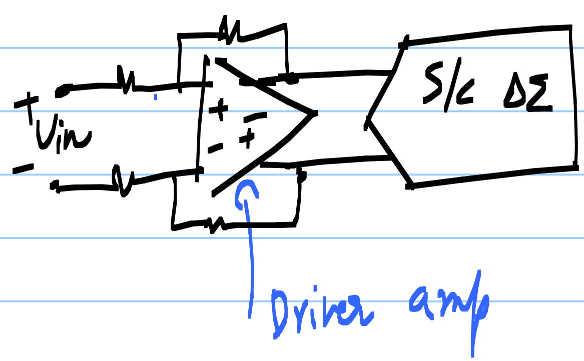




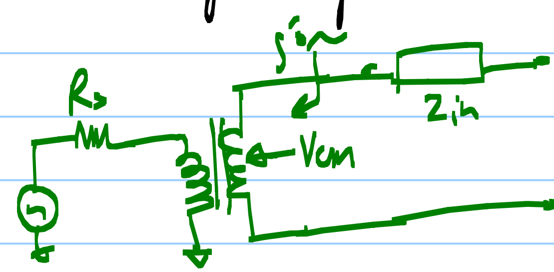
opamp o/p is changing discretely.



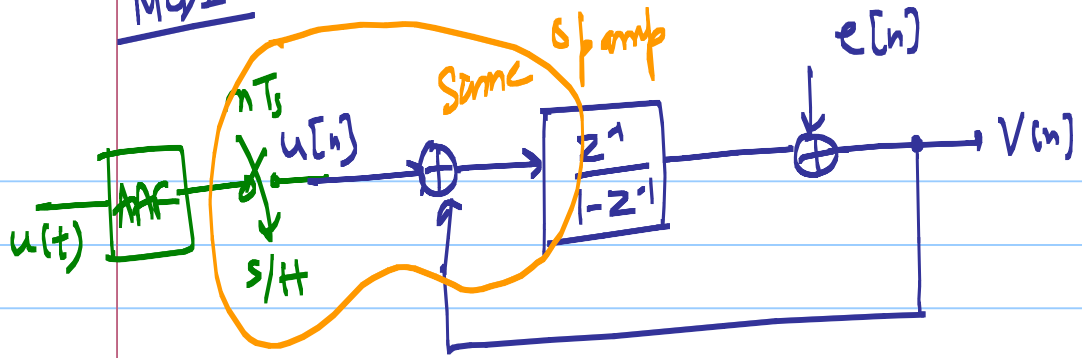




input impedance is not constant



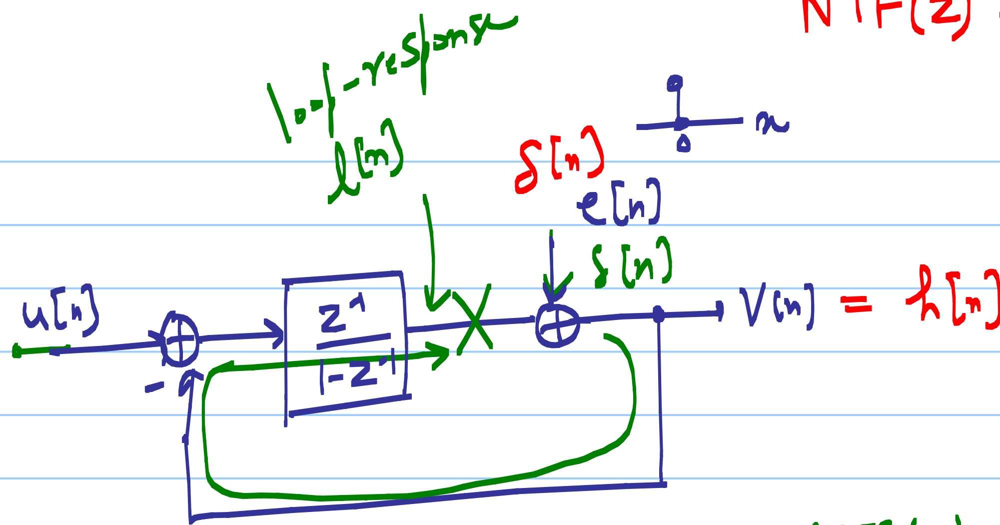
MOD1



→ Bottom plate sampling

→ delayed clock phase for charge-injection

$NTF(z) \leftrightarrow h[n]$



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

L(z) → loop response seen by quantization noise

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

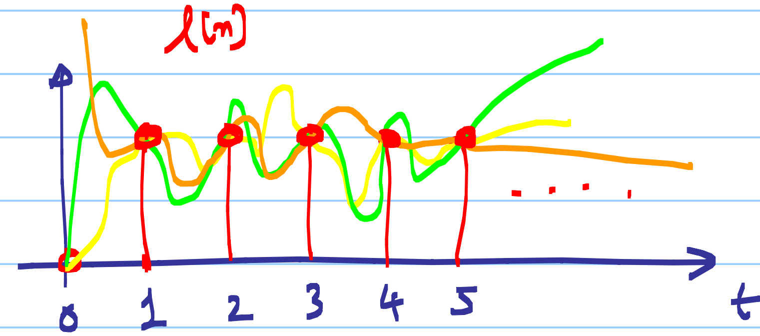
$$= \frac{1}{1-z^{-1}} - 1 = \frac{1 - 1 + z^{-1}}{1 - z^{-1}}$$

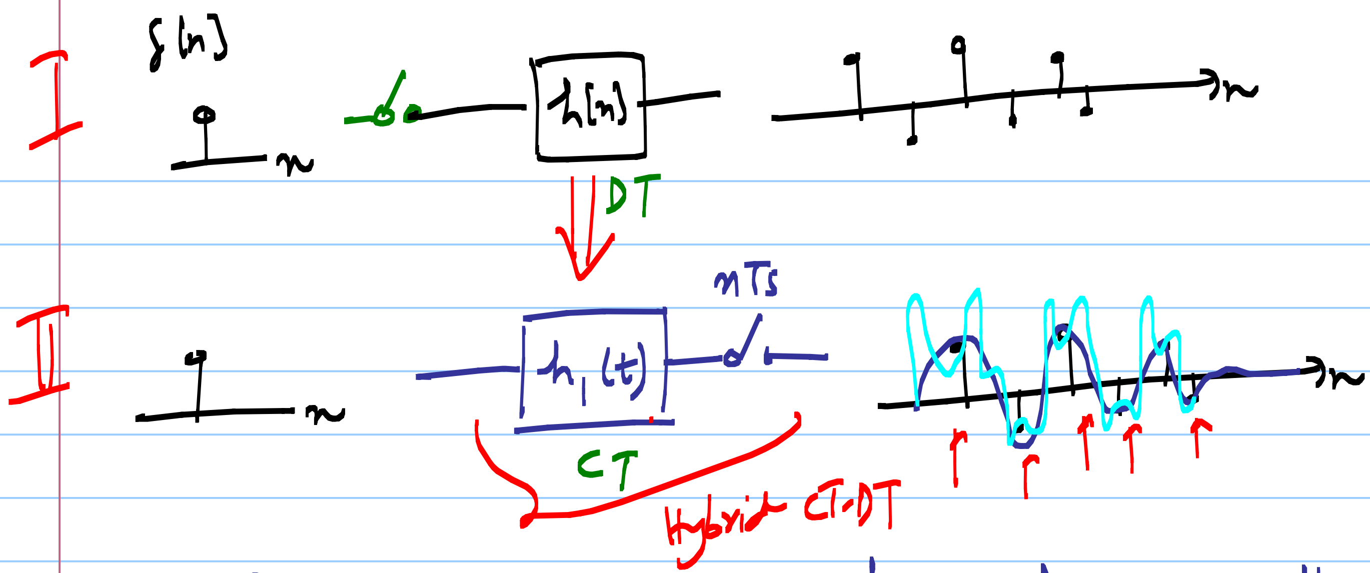
$$= \frac{z^{-1}}{1-z^{-1}}$$

$e[n] = \delta[n] = \{1, 0, 0 \cdots\}$

$f_s = 1\ Hz$

$l[n] = \{0, 1, 1, 1 \cdots\cdots\}$



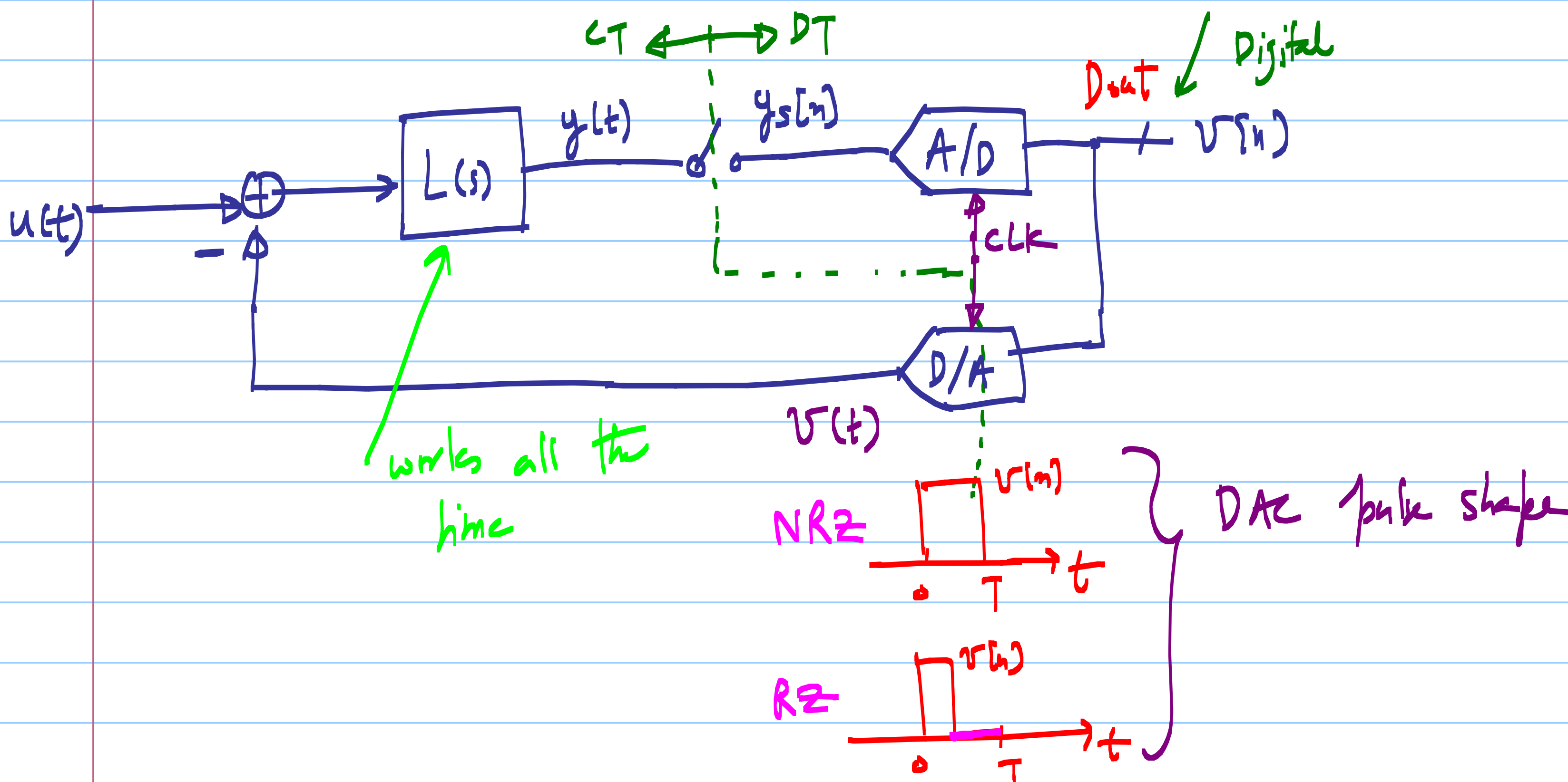


* Can use a CT impulse response $h_1(t)$ s.t. the sampled response is $h[n]$

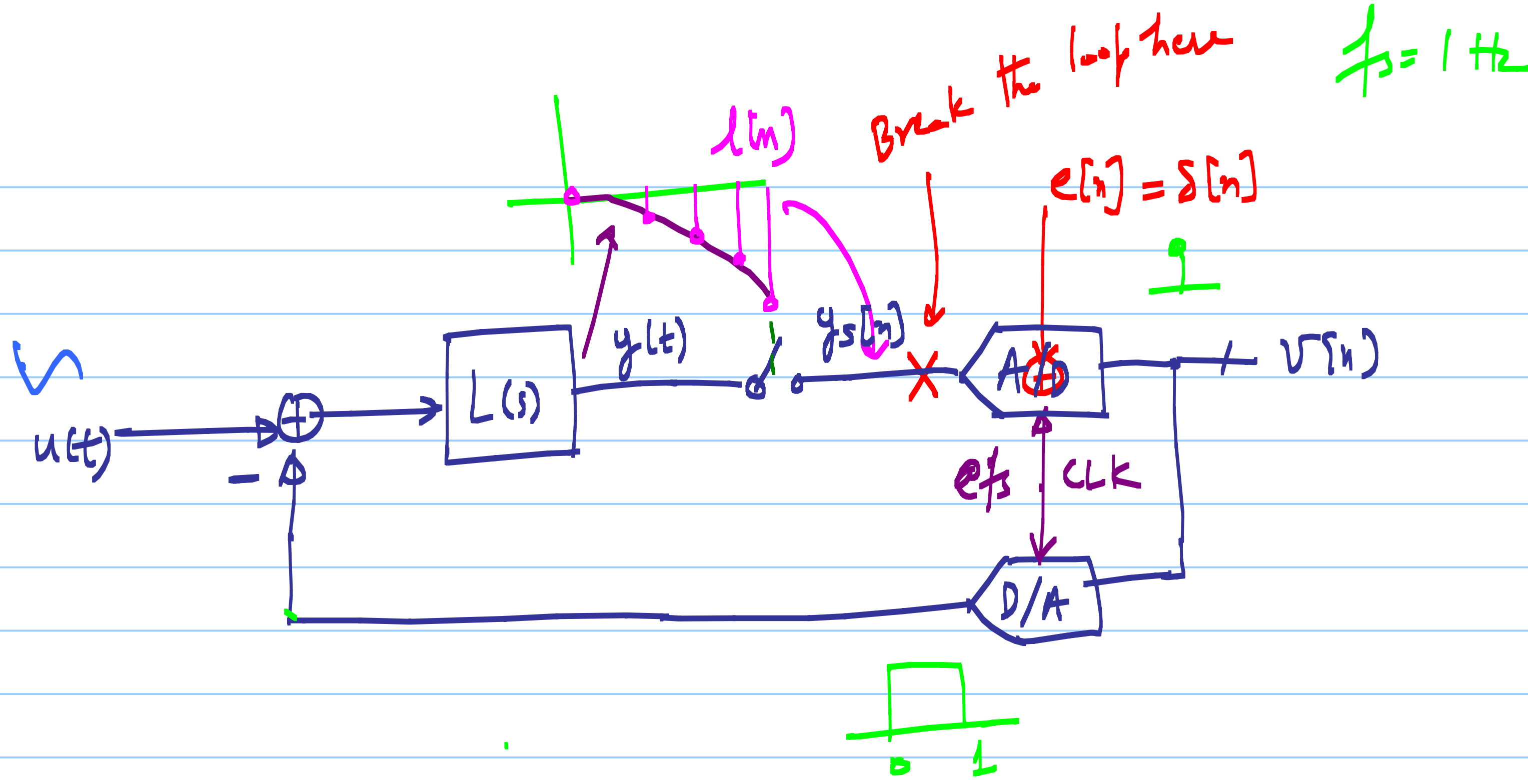
→ many $h_1(t)$ possibilities

→ **impulse invariance transformation**

Basic idea ⇒ find a CT filter whose sampled impulse response is same as the DT filter



* The loop-filter is realized using CT circuits, but made to look like a DT loop response



Overall system is DT

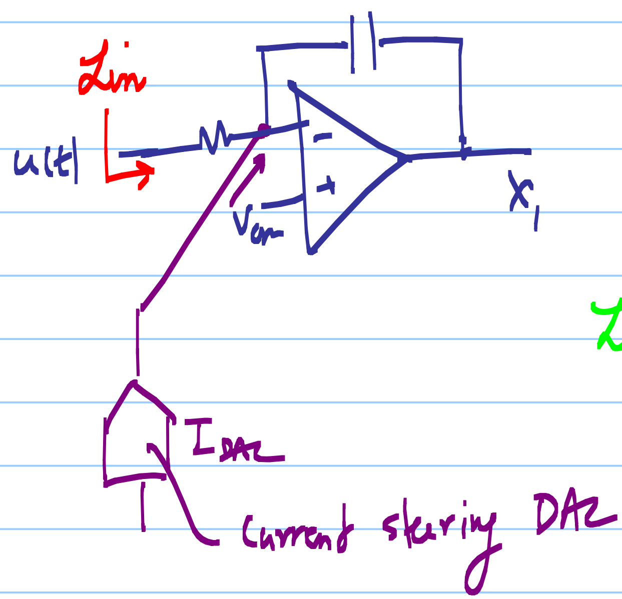
↳ A/D can't distinguish if the loop response is DT or CT

Advantages of CT ΔΣ ADCs

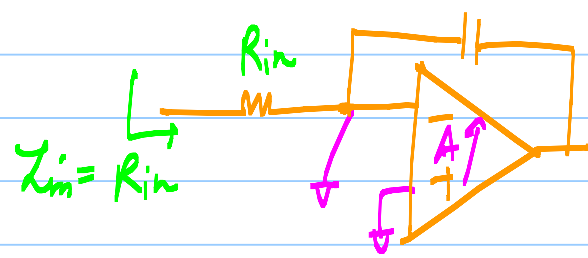
↳ lower power dissipation ⟺ high speed implementation & GHz-sampling ΔΣ ADCs

↳ ★ Inherent anti-aliasing (free AAF)

↳



↳



★ fixed input impedance ⇒ great for on-chip integration

1-bit CT → BJTs

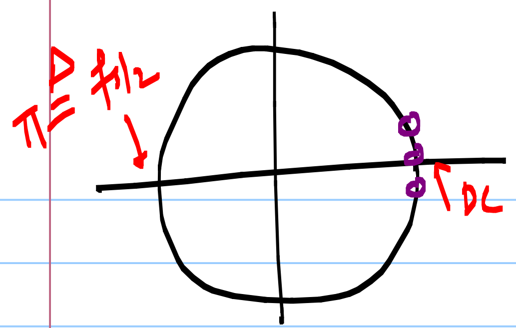
2^{nd}-order

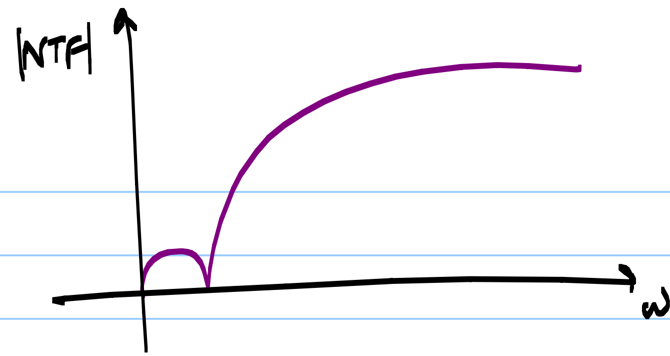
↓ 2^{nd}-order S/C

↓ 5^{th}-order S/C

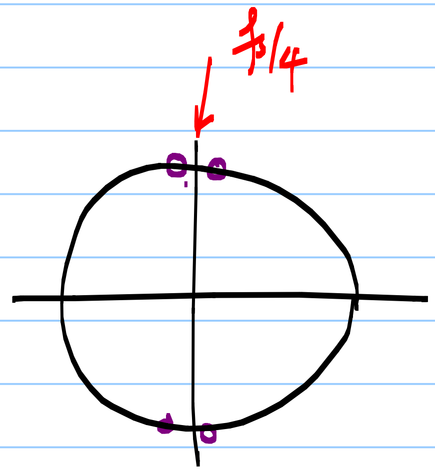
↓

5^{th}-order CT

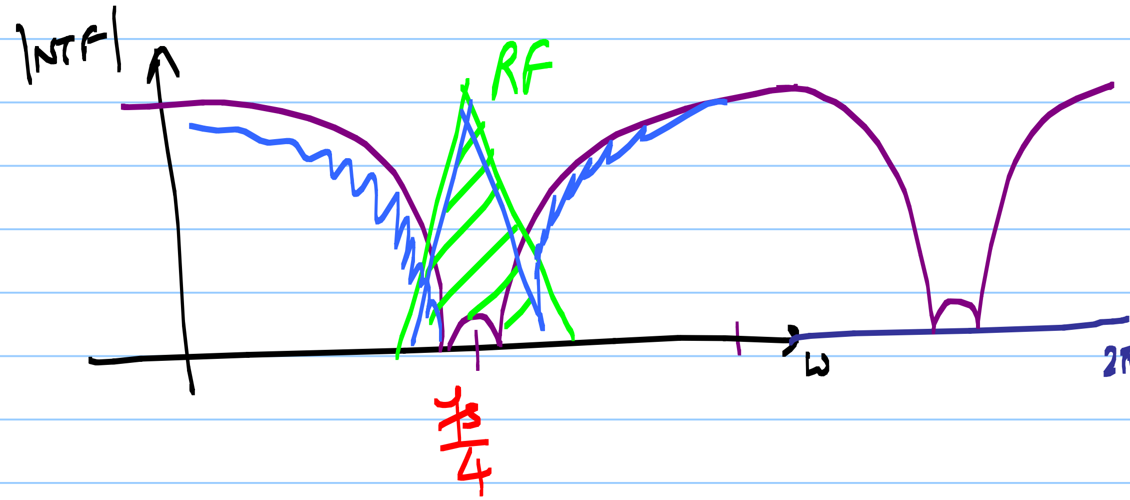




LP-ΔΣ



BP-ΔΣ



"RF → Digital Converter"