Lecture 37

DAC specifications

- bit resolution
- accuracy
- linearity
- setting time

ADC (A/D converters)

staircase:

problems with staircase :

b) susceptible to noise

successive approximation ADC

bits are set starting from _____

1)
2)
3)
4)

Ex 3-bit ADC , 0-7V
$V_{in} = 2.5V$

good:

bad:

Flash ADC

- resistor ladder
- input v_{in}
- _____ encoder

good:

bad:

Integrating ADC

Dual slope ADC

1)

$v_1 =$

2)

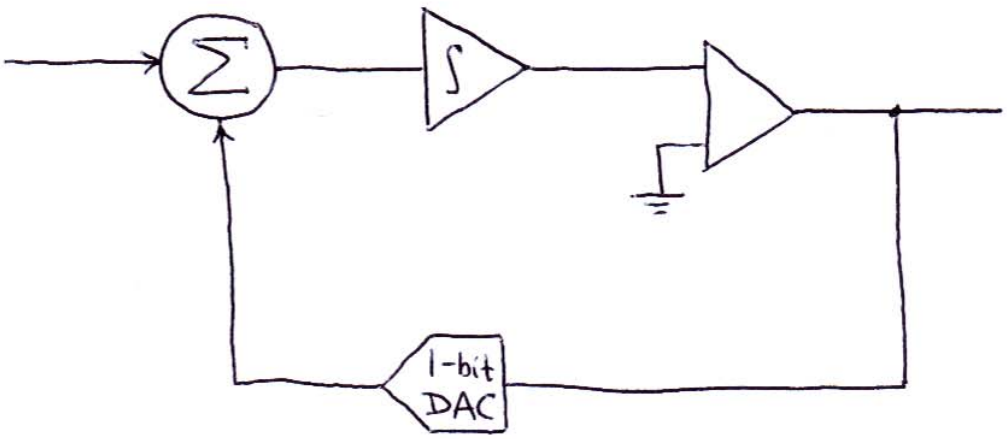
slope $\propto$ input voltage

good:

bad:

Lecture 38

Σ-Δ modulator



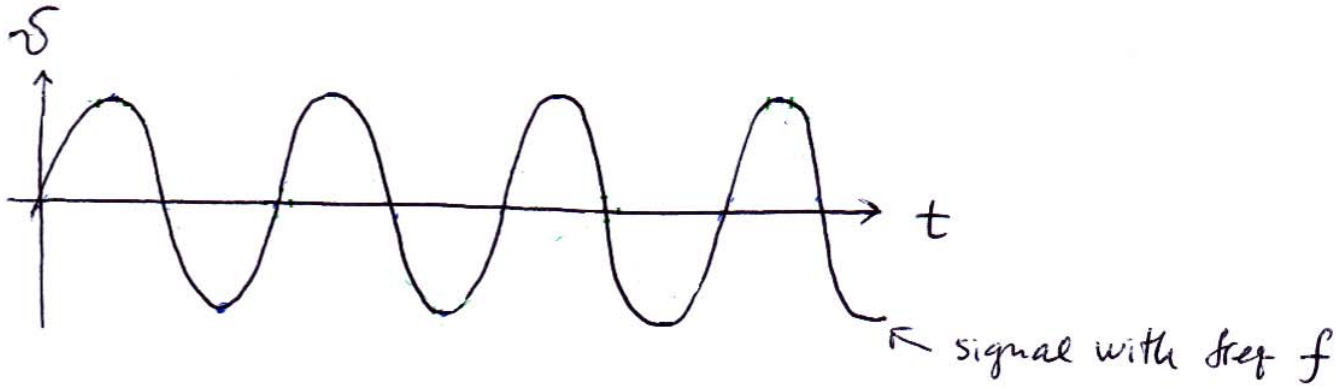
- Σ-Δ name

- unlike other ADC types,
- negative feedback theory:
- (parallel) binary output is obtained

Refer to the schematic

- op-amp #1
- op-amp #2
- op-amp #3

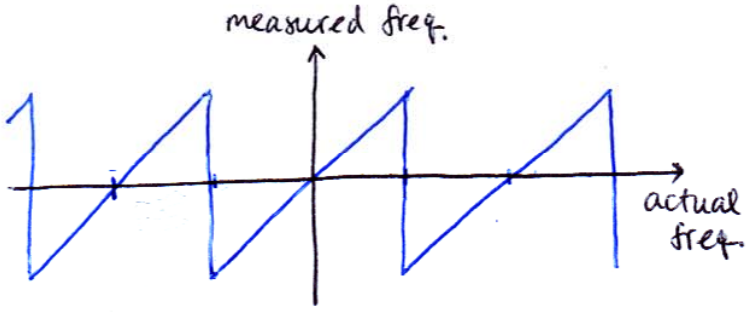
Nyquist sampling criterion & aliasing



- if

- if

- if



Effect of conversion time (t_c) on resolution

$$v_{in} = v_0 \sin(2\pi f t)$$

$$V_{p-p} = 2v_0$$

E.g. 8-bit ADC with $t_c = 10\mu s$ (100kHz)

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Sample & hold circuit

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General A/D converter layout

Digital scopes

Sampling

-

-

Real-time

-

-

PHYS 3360 / AEP 3630

Lecture 39

Electrical Noise

—

—

Signal to noise ratio

$SNR_{dB} =$

Noise figure

$NF_{dB} =$

—

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E.g. 1dB noise figure :

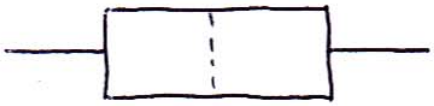
Sources of Noise

I. Intrinsic

II. Interference

Intrinsic sources of noise

1) Johnson (thermal) noise



$(v_n)_{rms} =$

- "white noise"

- "gaussian noise"

Ex: $R = 20k\Omega$ @ $T = 300K$, $B = 20kHz$

2) Shot noise

Ex: $i_s = 1A$, $B = 20kHz$

$i_s = 10pA$, —"—

- also

3) 1/f (flicker) noise

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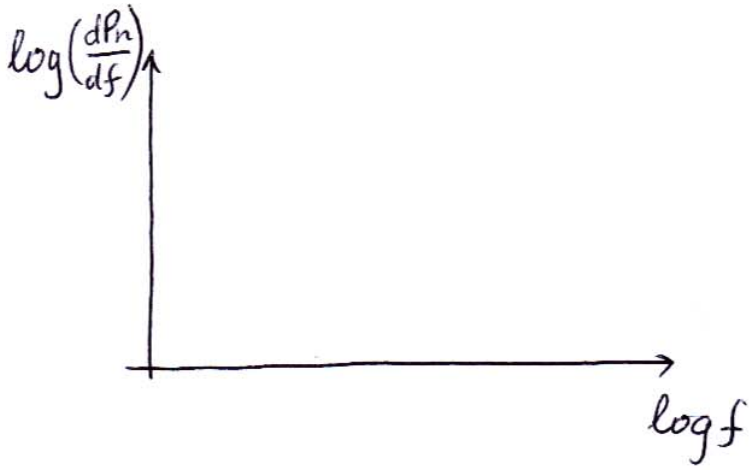

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- a.k.a.

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To minimize intrinsic noise

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- limit

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