

ECE 614 - Lecture 25

Note Title

12/2/2014

$$SQNR = 6.02 N + 1.76$$

INL/DNL

$ENOB = N_{eff}$

$$\frac{SNDR - 1.76}{6.02}$$

SNDR/DR

SFDR

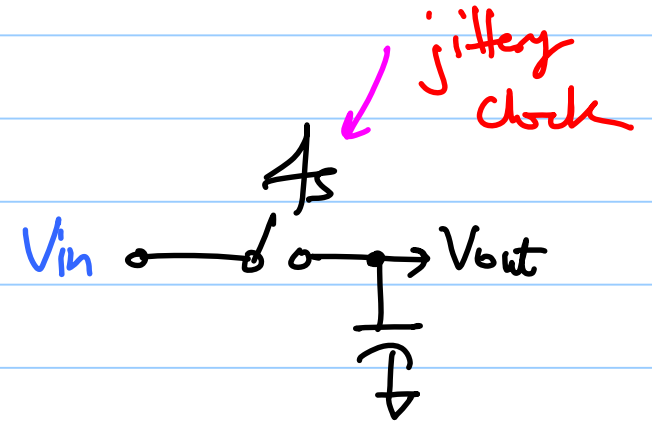
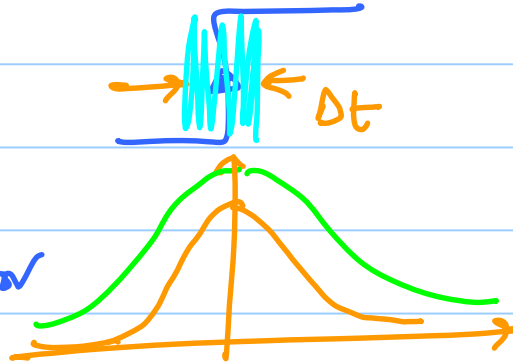
↓
Spur free DR

Clock

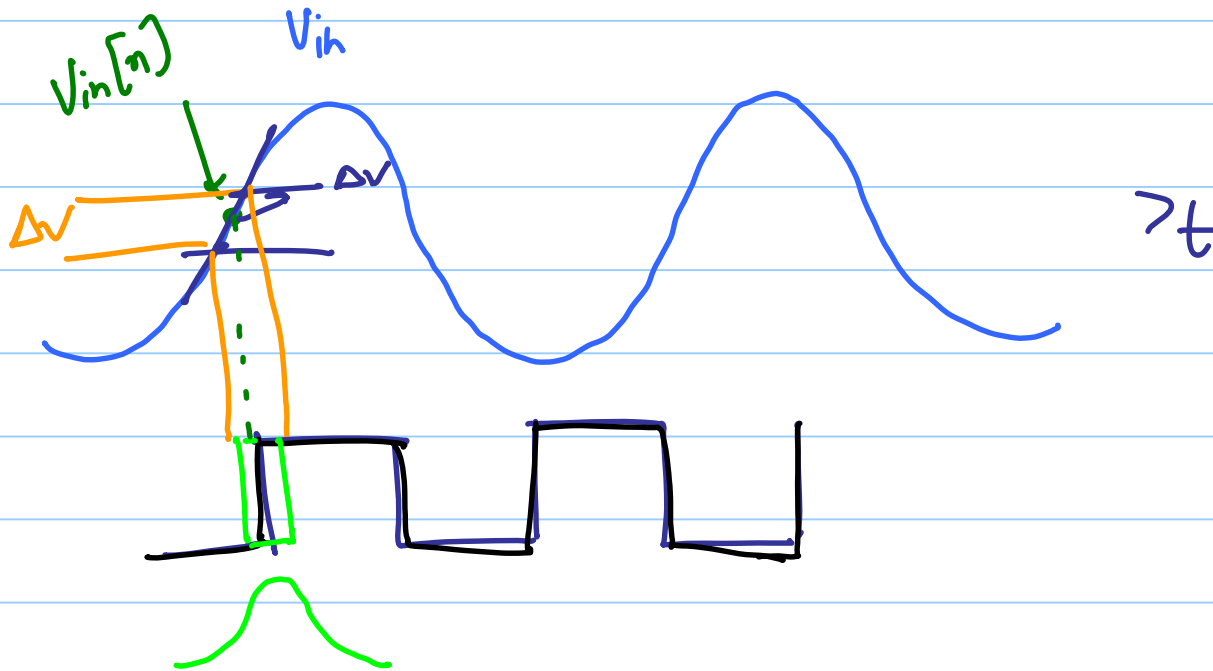


XTAL oscillator

↳ PLL



Aperture error



$$V_{in} = A \sin(2\pi f_{in} t)$$

f_s ← sampling clock rate

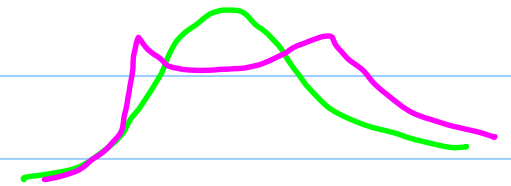
jitter-induced error

$$\Delta V = \left(\left. \frac{dV_{in}(t)}{dt} \right|_{t=nT_s} \right) \Delta t_j$$

timing uncertainty due to jitter

r.v. gaussian pdf

$$= A \cdot 2\pi f_{in} \cos(2\pi f_{in} t) \Big|_{t=nT_s} \cdot \Delta t_j$$



$$\Delta V \leq A \cdot 2\pi f_{in} \cdot \Delta t_j$$

JIN
variance

$$\sigma_{\Delta V}^2 = \frac{1}{2} (2\pi f_{in} A)^2 \sigma_{\Delta t_j}^2$$

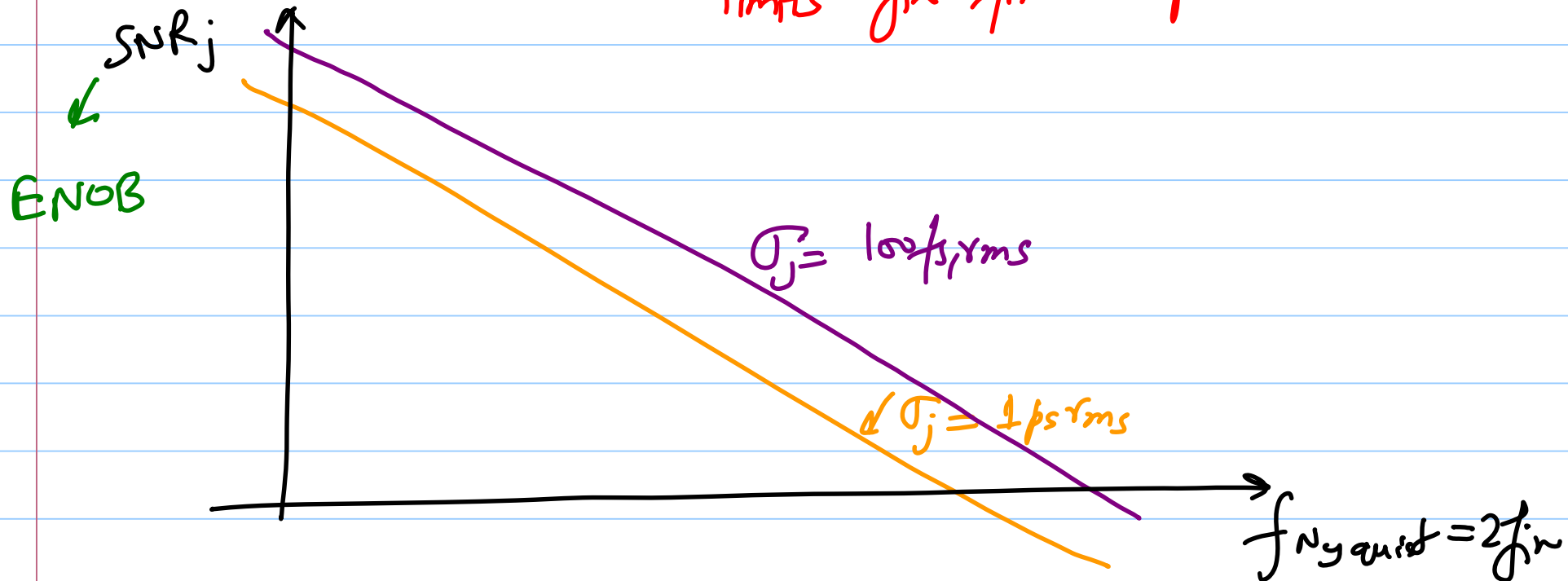
$\sigma_{\Delta t_j}$: rms jitter

$$E(\cos^2) = \frac{1}{2}$$

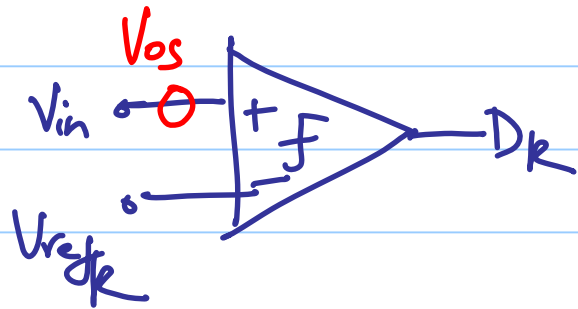
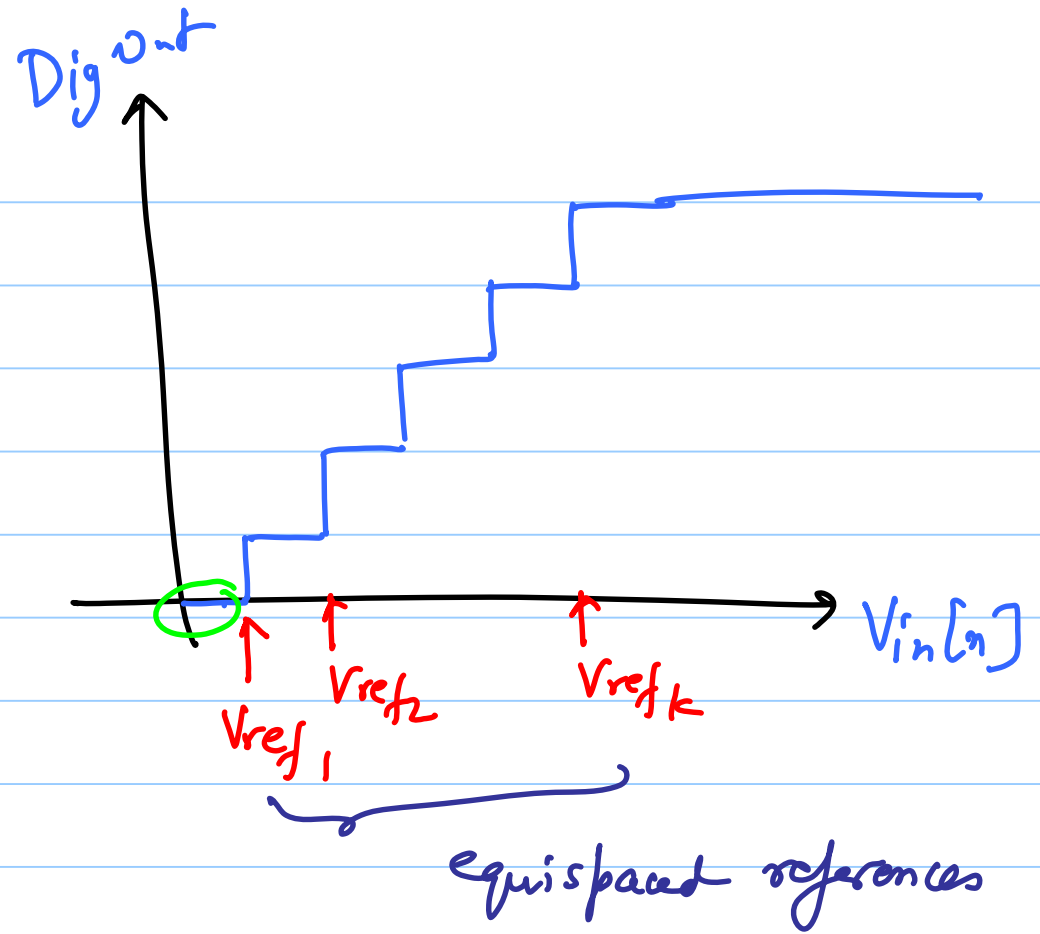
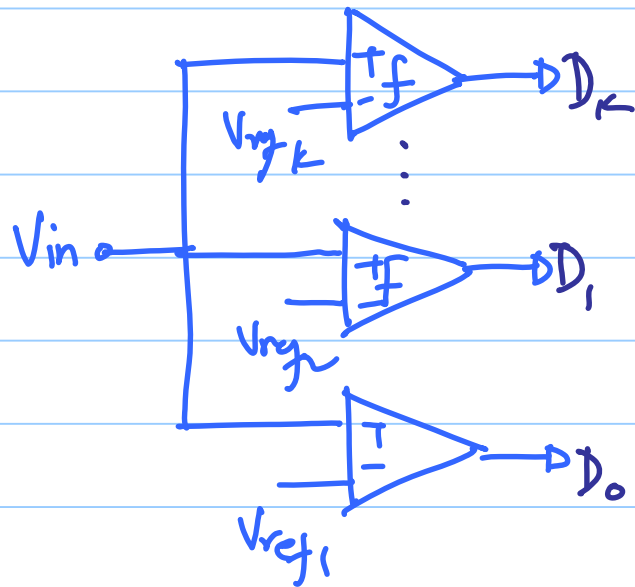
$$SNR_j = 10 \log_{10} \left[\frac{A^2/x}{(2\pi f_{in} A \sigma_j)^2} \right]$$

$$SNR_j = -20 \log_{10} (2\pi f_{in} \sigma_j)$$

limits f_{in} for a parti



Flash ADC:



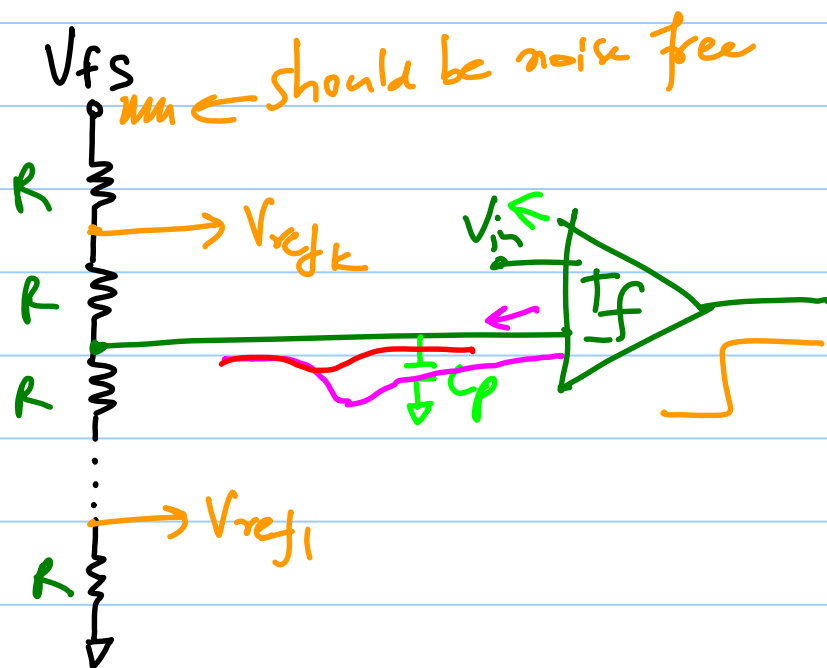
$$D_k = \begin{cases} 1, & V_{in} > V_{ref} \\ 0, & V_{in} < V_{ref} \end{cases}$$

$$\# \text{ of comparators} = 2^n - 1$$

(+) low latency

(-) not power & area efficient

Typically $N \leq 6$ bits

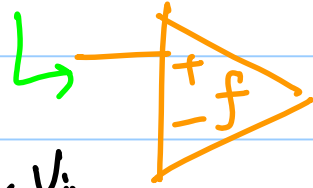


low R?

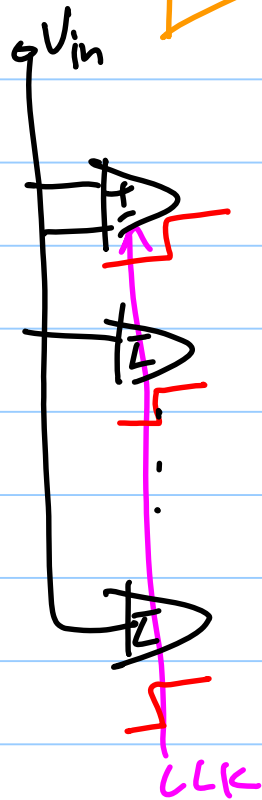
Large R?

$R_{eff} \uparrow \Rightarrow$ fast reference recovery after kick back

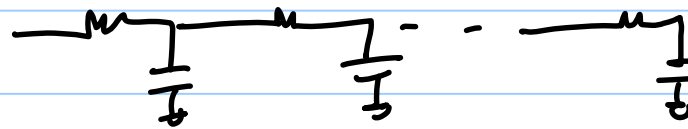
$C_{in} \rightarrow$ varies with time
& switching



Need a good buffer



clock skew



aperture error

@ high-speed it is preferred to use a S/H for ensuring good dynamic performance.