Lecture 12

Improving SNR using Averaging

OCT. 6, 2014

SNRD ⇆ SINAD

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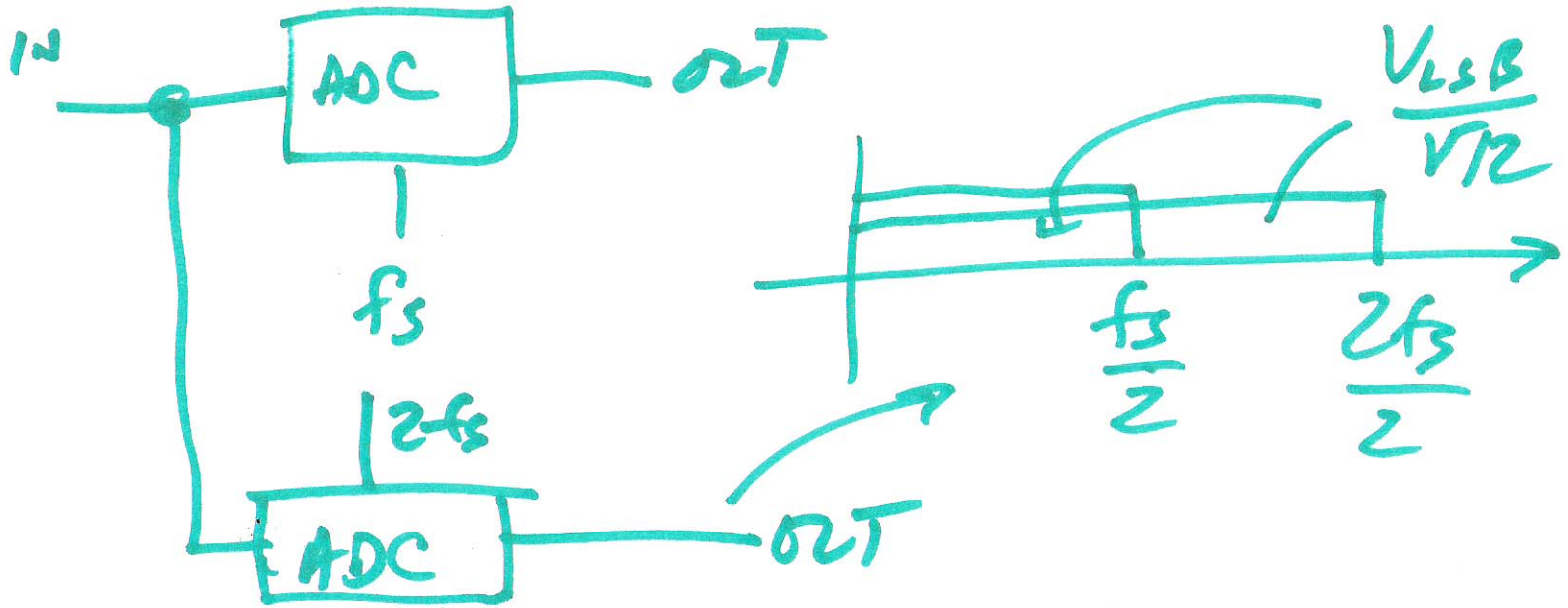
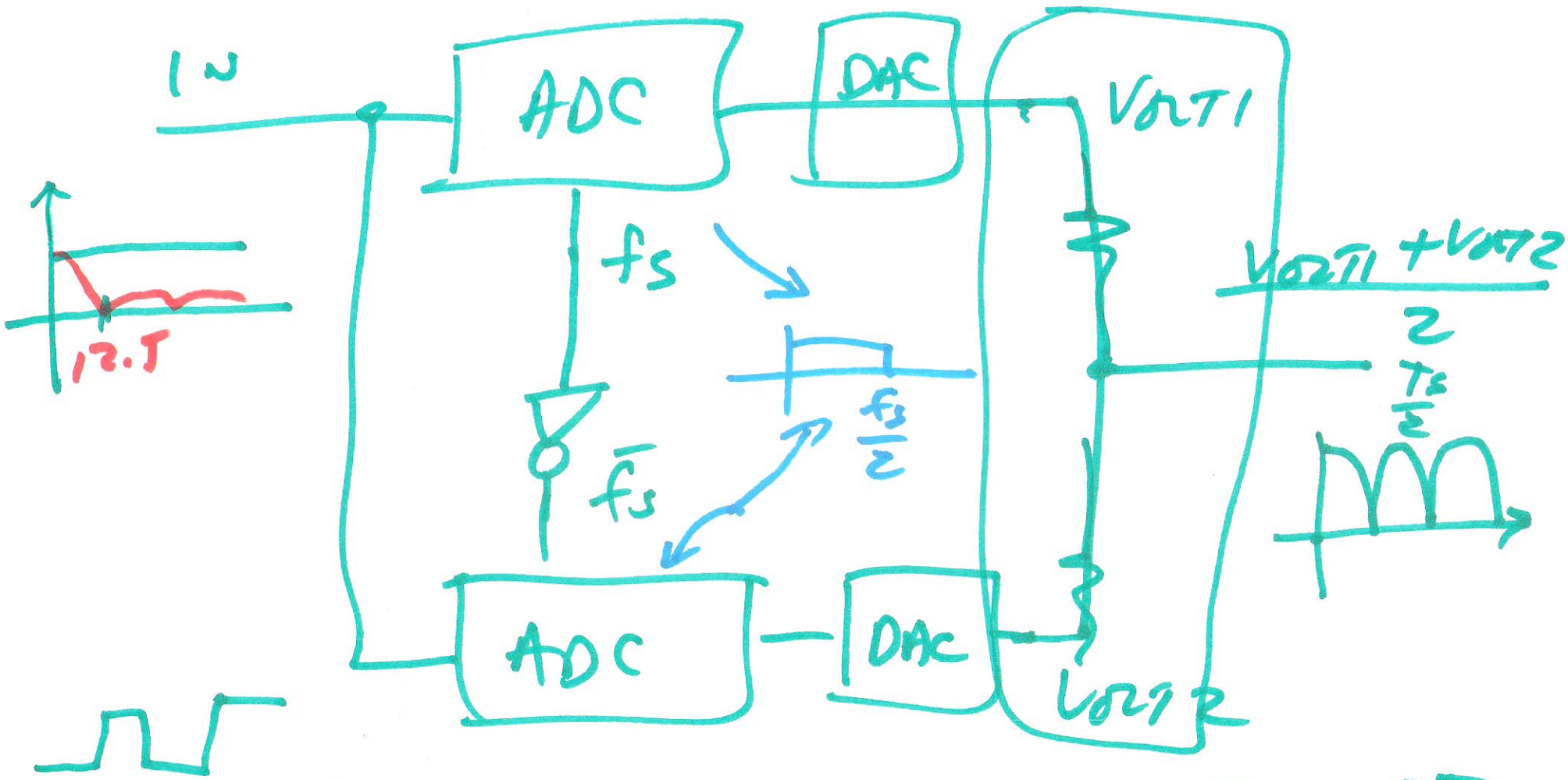
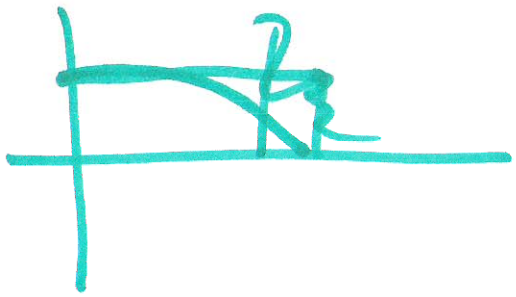
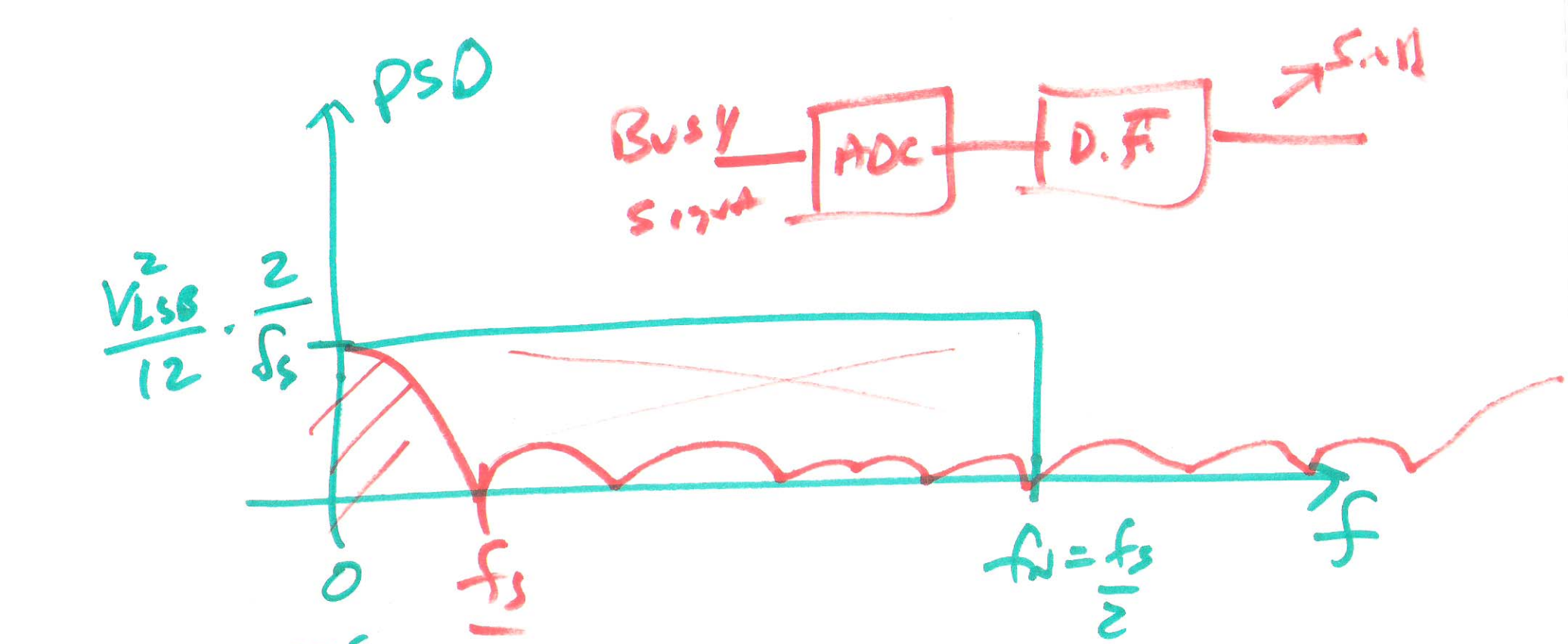
SNR ⇒ SNQR

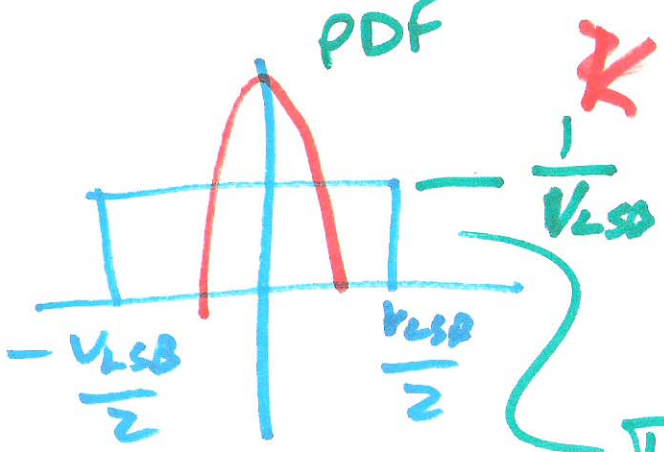




$$\frac{V_{OUT1} + V_{OUT2}}{2} \Rightarrow \frac{1 + z^{-1}}{2} = \frac{OUT}{IN}$$





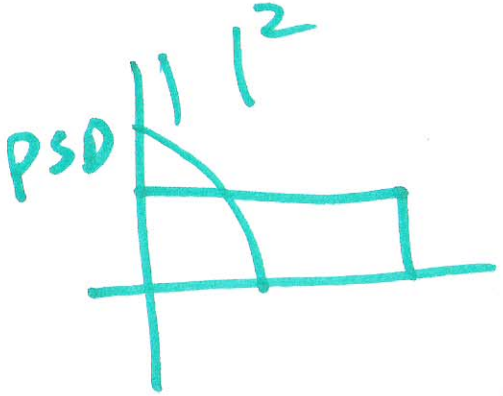


$$V_{QE,rms} = \frac{1}{\sqrt{K}} \cdot \frac{V_{LSB}}{\sqrt{12}}$$

σ = $\frac{V_{LSB}}{\sqrt{12}}$ (standard deviation)

$\sigma^2 = \frac{V_{LSB}^2}{12}$

EX. 5.15



$$|1+z^{-1}|^2 \Rightarrow 2\left|\cos^2 \pi \frac{f}{f_s}\right|$$

$$V_{QP}(f) = \frac{V_{LSB}^2}{12} \cdot \frac{1}{f_s}$$

$$\int_0^{\frac{f_s}{2}} \frac{V_{LSB}^2}{12} \frac{2}{f_s} \cdot 2\left(1+\cos 2\pi \frac{f}{f_s}\right) \cdot df$$

$$\frac{V_{LSB}^2}{6} \quad \frac{V_{LSB}^2}{3} \cdot \frac{f}{f_s}\Big|_0^{\frac{f_s}{2}} + \frac{V_{LSB}^2}{3} \cdot \frac{1}{f_s} \cdot \frac{f_s}{2\pi} \left(\sin 2\pi \frac{f}{f_s}\right)_0^{f_s/2}$$

$$= \frac{V_{LSB}^2}{6} = \frac{1}{2} \cdot V_{LSB}^2$$