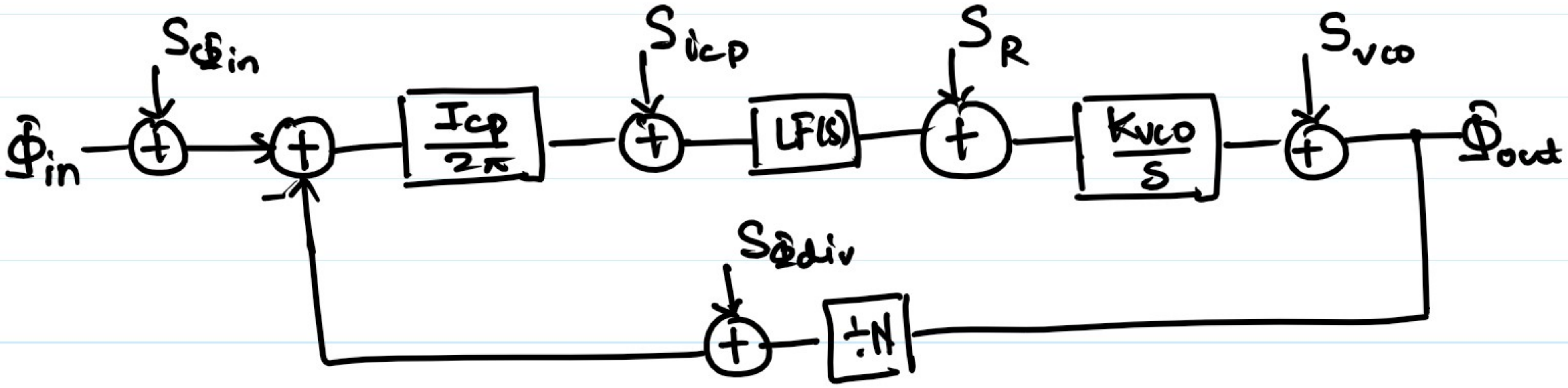
Lecture 12

Tuesday, February 7, 2017 8:22 AM

Noise analysis in CP-PLL



$$\text{Noise Transfer Function (NTF)} = \frac{\Phi_{out}(s)}{\Phi_n(s)}$$

$$\text{Total noise power spectral density} = \sum S_i \, |NTF_i|^2 = S$$

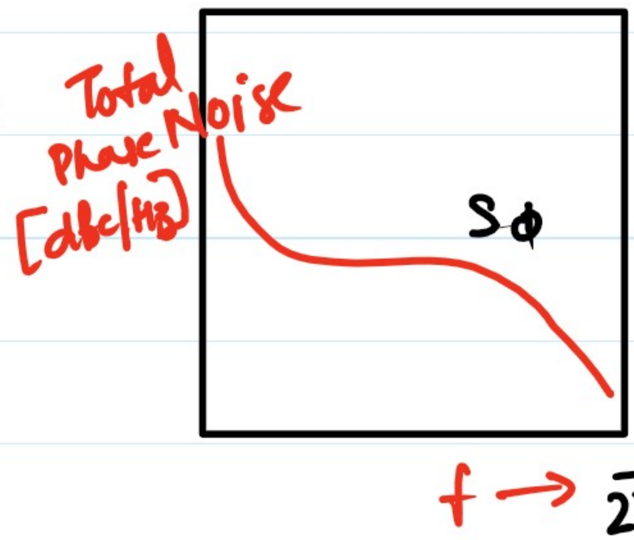
[rad²/Hz]

$$\text{Total noise power} = \int_0^{\infty} S_{total}\, df \quad [\text{rad}^2]$$

Frequency dom. method

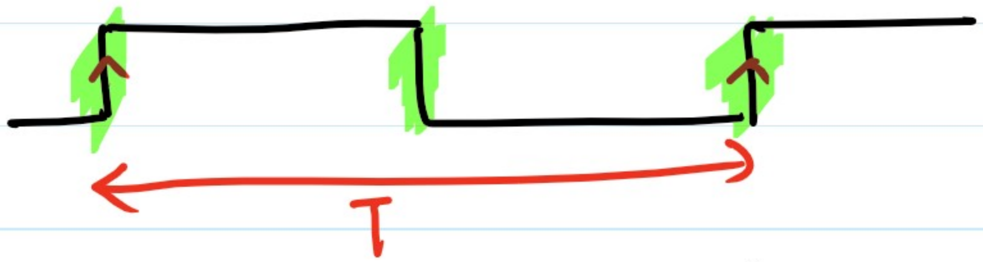
$$\text{Jitter} = \frac{T_{out}}{2\pi}\sqrt{\int_0^{\infty} S_{total}\, df} \quad [s]$$

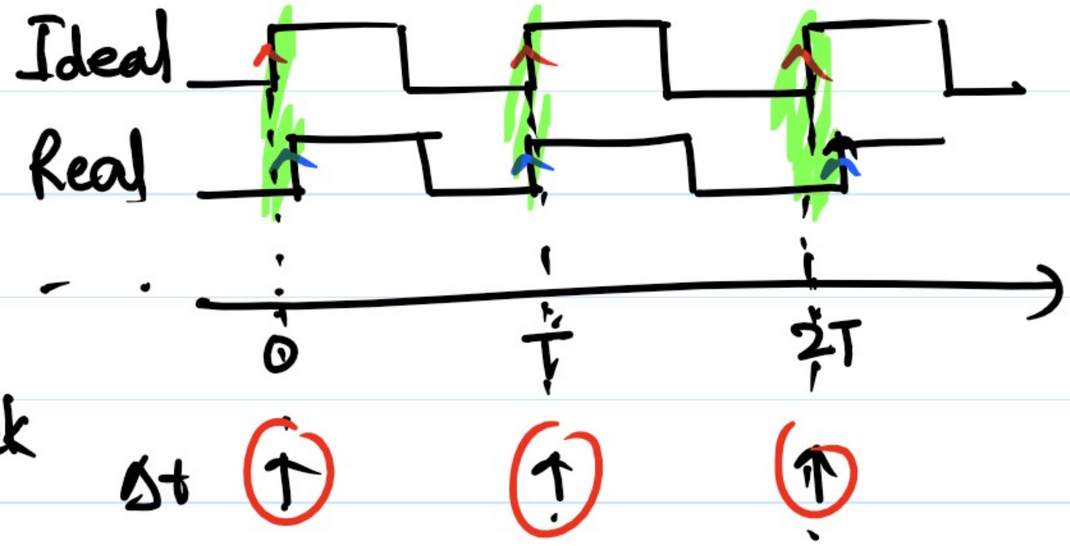
$$\text{Jitter [rad]} = \frac{1}{2\pi}\sqrt{\int_0^{\infty} S_{total}\, df}$$



$$\frac{1}{2\pi}\sqrt{\int S_\phi \cdot df} = \text{jitter}$$

= jitter





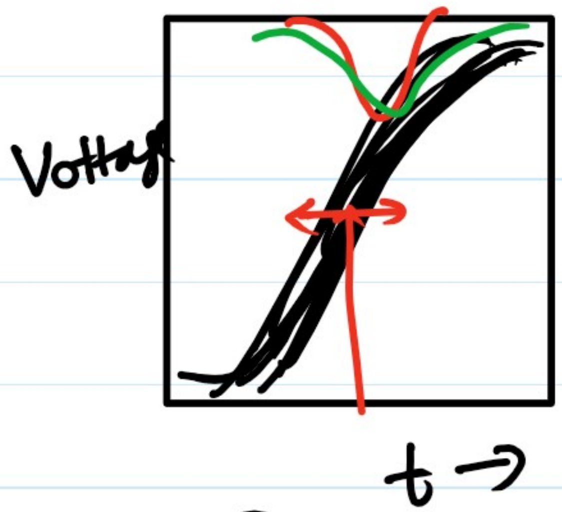
$\Delta t_i = \sum T_i - iT$; $i = 1, 2 \ldots$

T_i is time-period of i^{th} clock

$$\Delta t[i] = \underbrace{\sum_{k \leq i} T_k}_{} - i \times T$$

$$= \sum_{k \leq 0} (T_k - T) = \sum_{k \leq i} T_{p,i}$$

$$\sum \Delta t[i] = 0$$



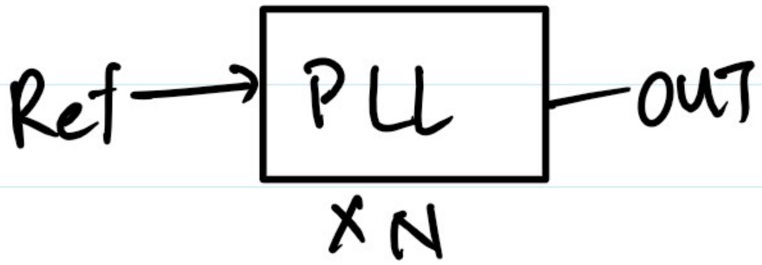
$$E[\Delta t] = \int (\Delta t) f(\Delta t) \cdot d(\Delta t)$$

$$E[x] = \int x \cdot \underbrace{f(x)}_{pdf} \cdot dx$$

Jitter is a statistical measure of deviation of real clock from ideal clk.

Absolute jitter = $E[\Delta t^2]$; Δt is a random variable

Period jitter = $E[(T_i - T)^2]$



— Peak-to-peak Jitter