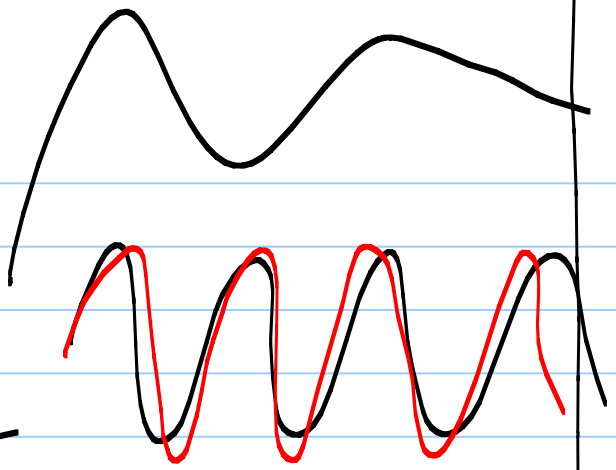
Lecture 14



$\cos(\theta)$

phase

periodic with a period 2π

$p(\theta)$

Periodic in time:

θ: linearly with time

$$\theta = 2\pi f_0 t + \phi_0$$

periodic with a period $\frac{1}{f_0}$

ϕ_0: Constant (phase offset)

Periodic + deviations

$$\theta = 2\pi f_0 t + \phi_0 + [\text{deviation from the ramp}]$$

Zero average

Periodic signal

θ : ramp $= 2\pi f_0 t + \Phi_0$

$$\omega = \frac{d\theta}{dt} \ (\text{rad/s}) : \text{constant}$$

$$= 2\pi f_0$$

$$f = \frac{1}{2\pi}\frac{d\theta}{dt} : (\text{Hz}) : \text{constant}$$

$$f = f_0$$

Period $T_0 = \frac{1}{f_0}$

+ deviations

θ: $2\pi f_0 t + \Phi_0 +$ [redacted]

zero average

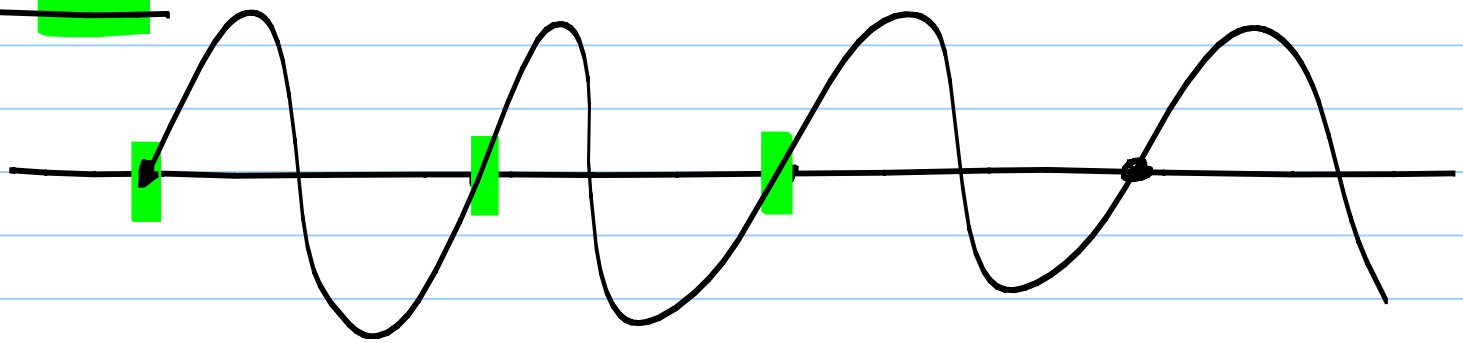
$$f = f_0 + \frac{1}{2\pi}\frac{d\phi}{dt}$$

[redacted]

zero average

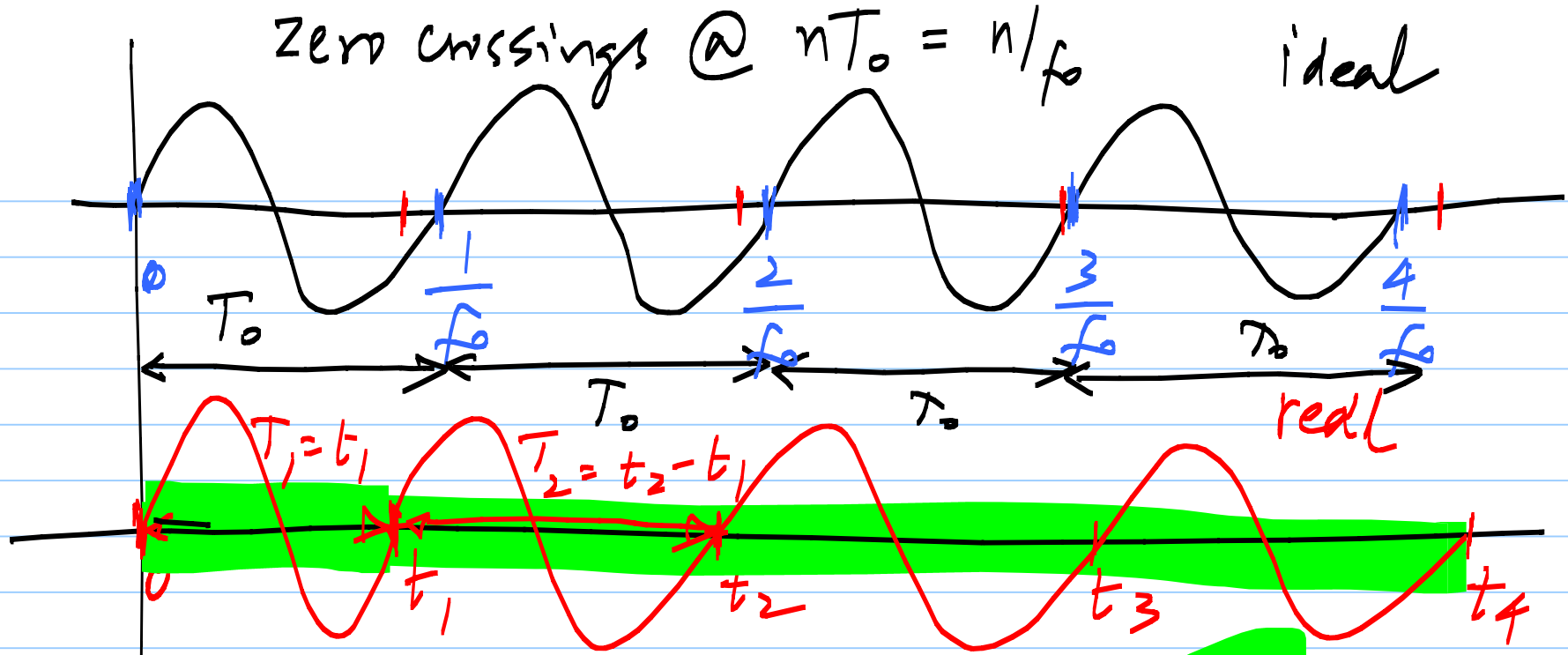
Waveform: not precisely known

$\cos(\theta(t)) + \alpha_3 \cos(3\theta(t))$



phase: sampled signals

sampled once/twice per cycle

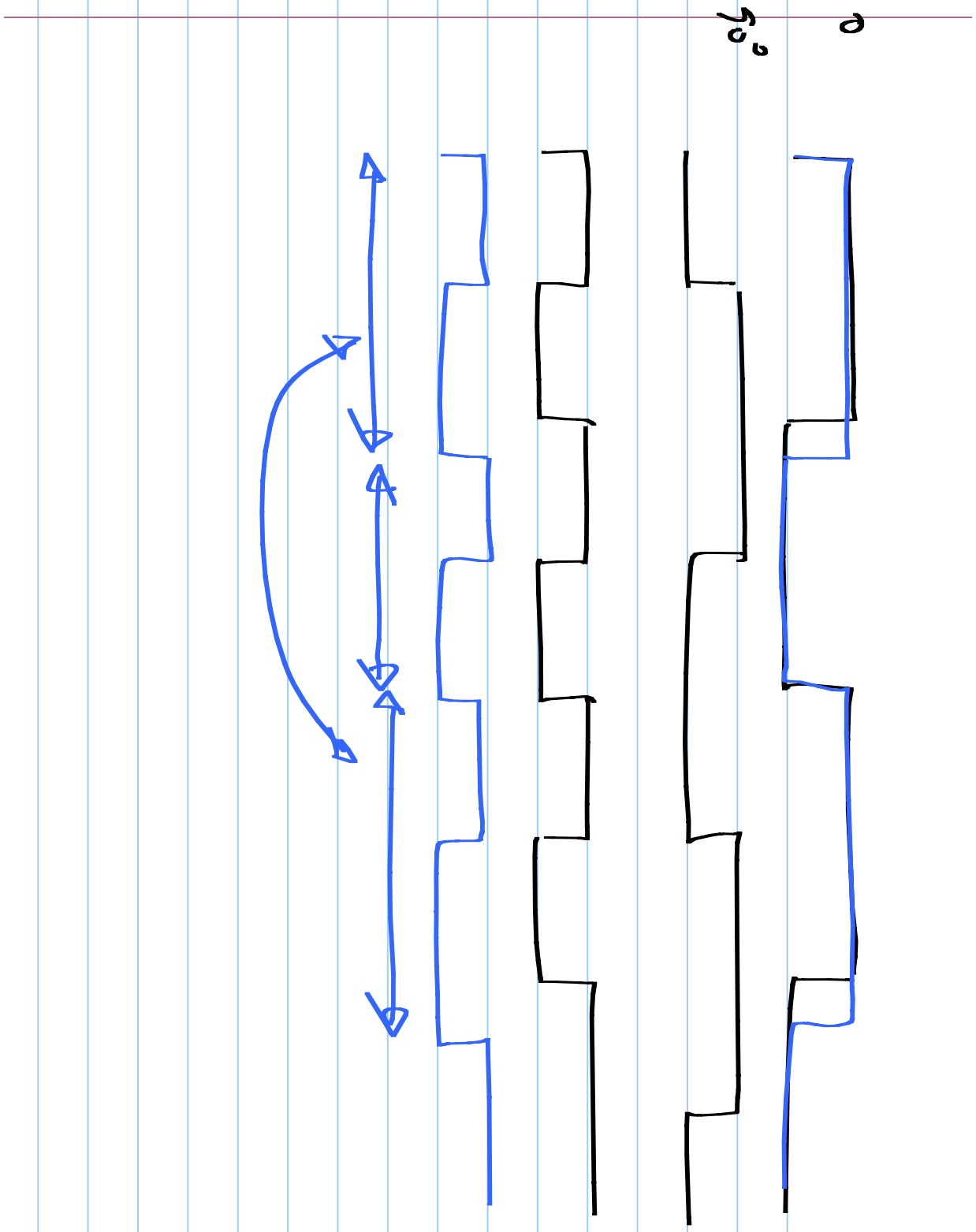


Jitter:

Absolute jitter = Σ

Period jitter = $T_n - T_0$

Cycle-cycle jitter = $T_n - T_{n-1}$

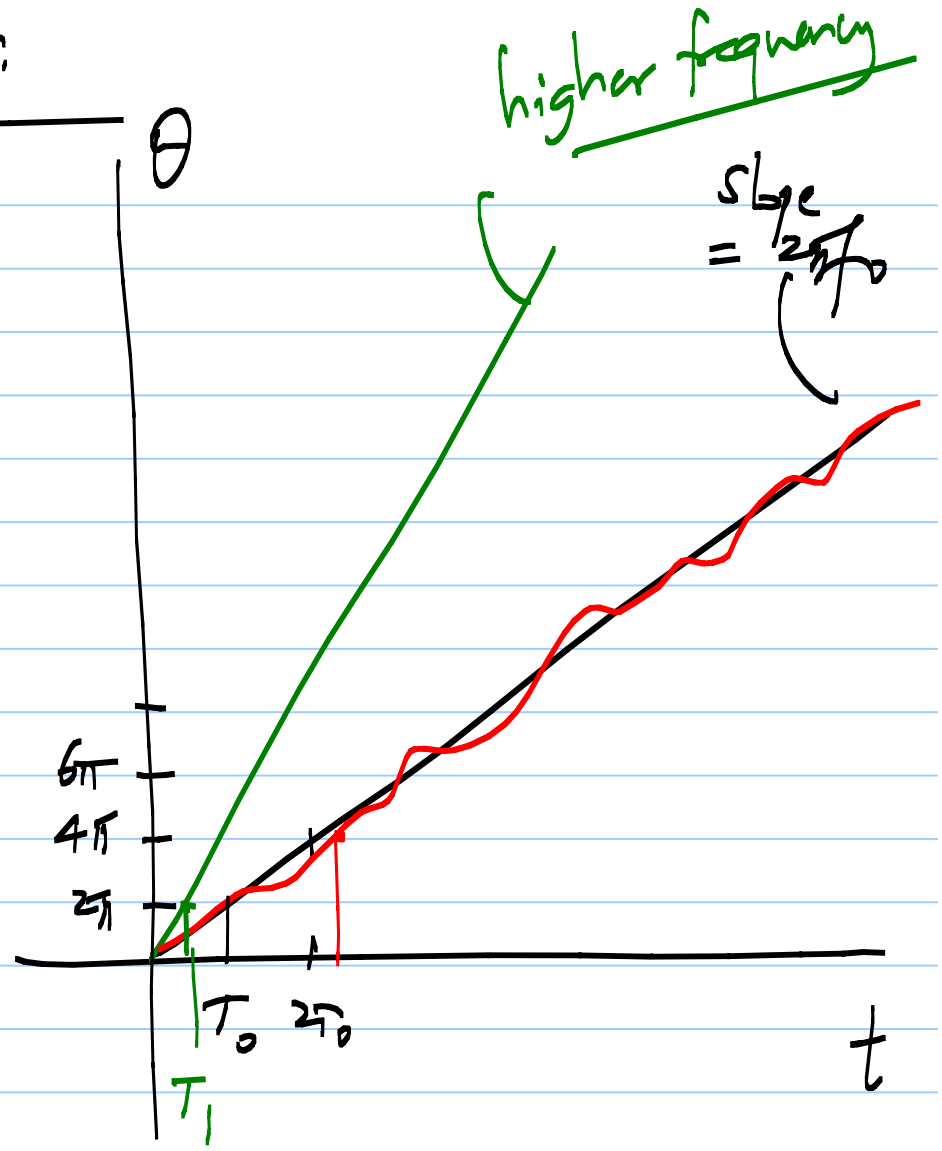


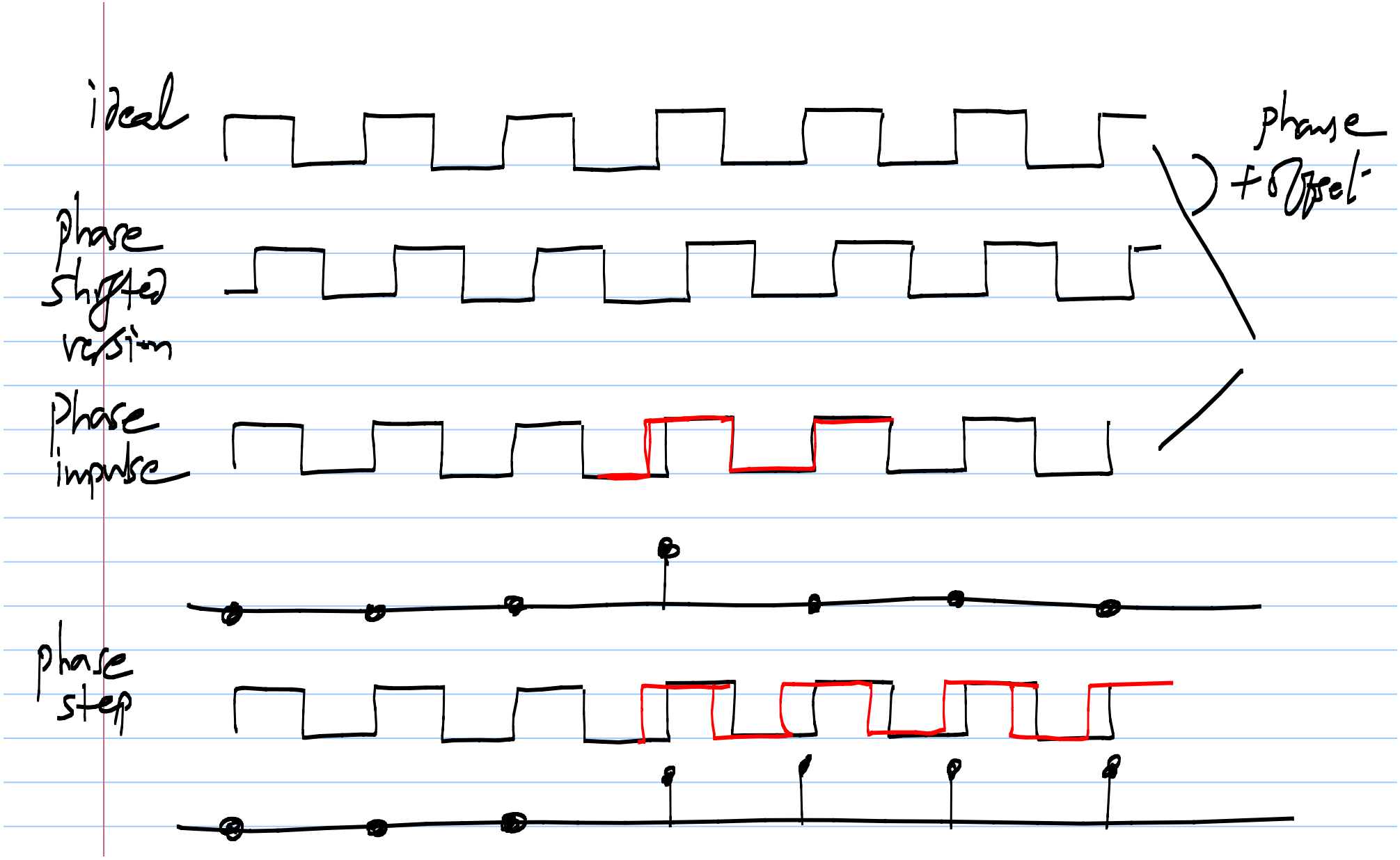
Phase & frequency:

$$\theta = 2\pi f_0 t + \Phi_0$$

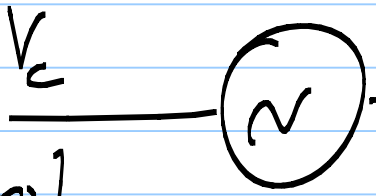
$$f = \frac{1}{2\pi}\frac{d\theta}{dt}$$

$$\theta' = 2\pi f_0 + \Phi_0 + \phi(t)$$




ideal
phase shifted version
phase impulse
phase step
phase offset

Voltage controlled oscillator (VCO)



$$f_{out} = f_0 + K_{VCO} \cdot V_c$$

(K_{VCO}: VCO gain (Hz/V))

$$\theta = 2\pi f_0 t + \Phi_0 + 2\pi K_{VCO} \int V_c \, dt$$