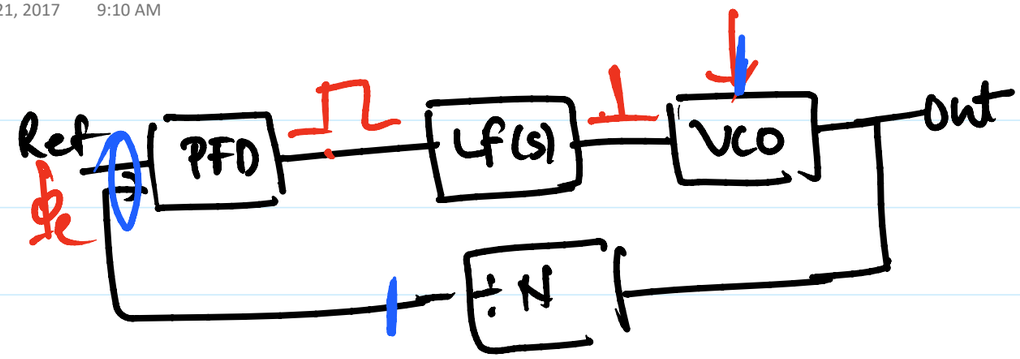
Lecture 22

Tuesday, February 21, 2017 9:10 AM



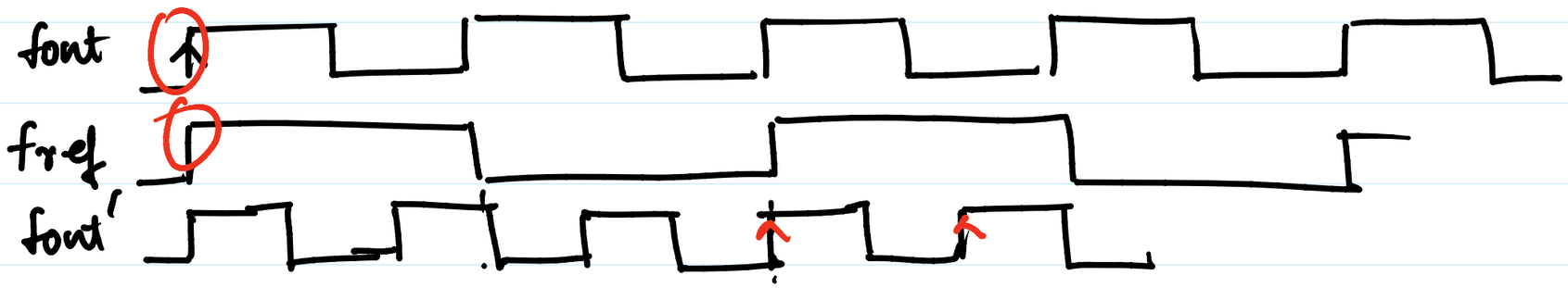
Vary fout by a) Ref
b) N

fout 900 MHz ± 50 MHz.

fref 25 MHz.

$\frac{900}{25} = 36$

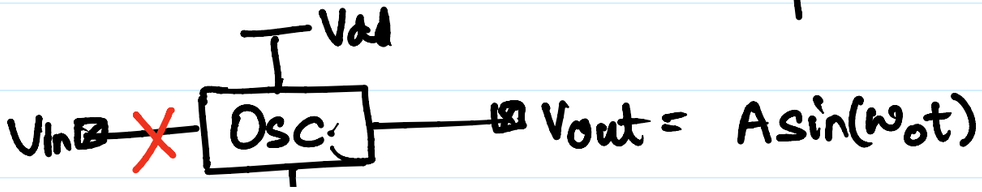
N : 34 ← 36 → 38

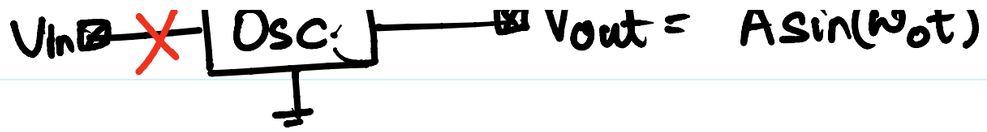


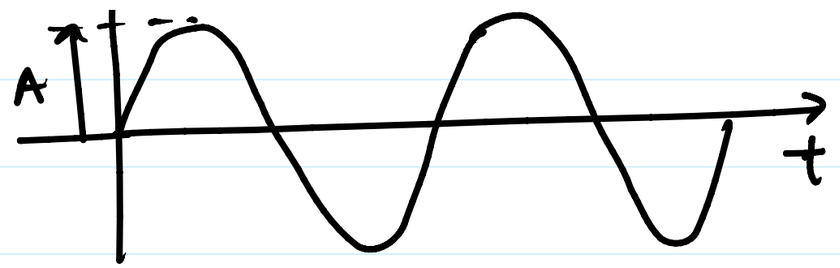
N = 2 → 3

Oscillators

An autonomous block which produces periodic output voltage/current signals







Amplitude : A

Oscillation freq. : $f = \frac{1}{T} = \frac{\omega_0}{2\pi}$

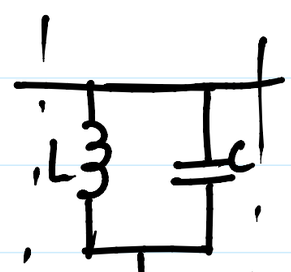
[Hz] [1/s] [rad/s]

Time period : T

Types of oscillator

1.) Crystal Oscillators
- Low frequency
- Stable frequency (10-100 ppm)
- Excellent phase noise
- Limited flow tuning range.
- Not easy to integrate on-chip

2) LC - oscillators



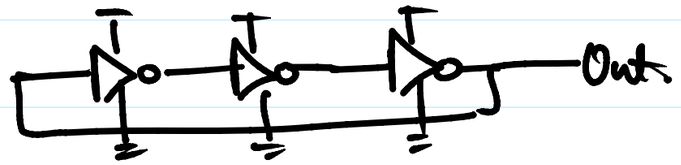
- Colpitts Oscillator

$\omega_0 = \frac{1}{\sqrt{LC}}$

- High frequency of oscillation.
- Moderate tuning range.

- Moderate tuning range.
- Moderate stability
- Good phase noise.
- Large area.

3) Ring oscillators
   - Poor stability.
   - Poor phase noise.
   - Wide tuning range.
   - Smallest area



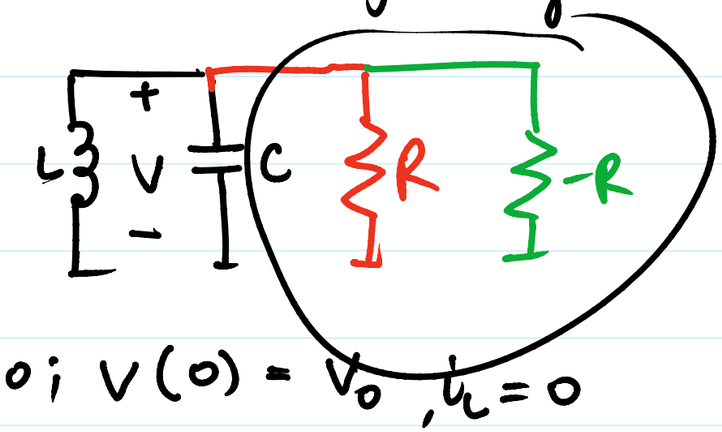
$f_{oct} = \frac{1}{6td}$

Oscillators

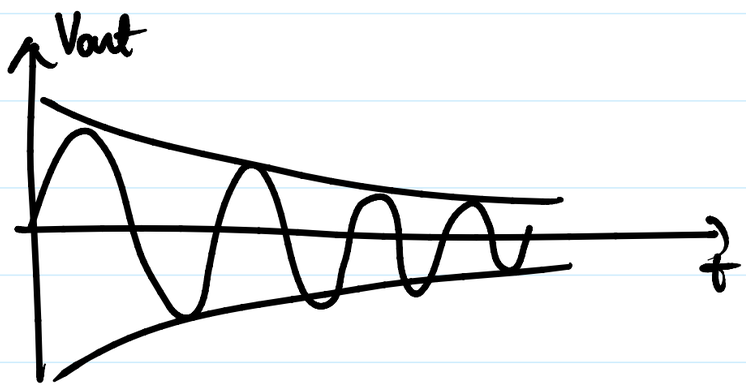
Negative feedback

Negative impedance

- Whether it will oscillate or not ?
- What is amplitude / frequency / timing error ?
- How wide is tuning range?



$t=0 ; V(0) = V_0 , t_c = 0$

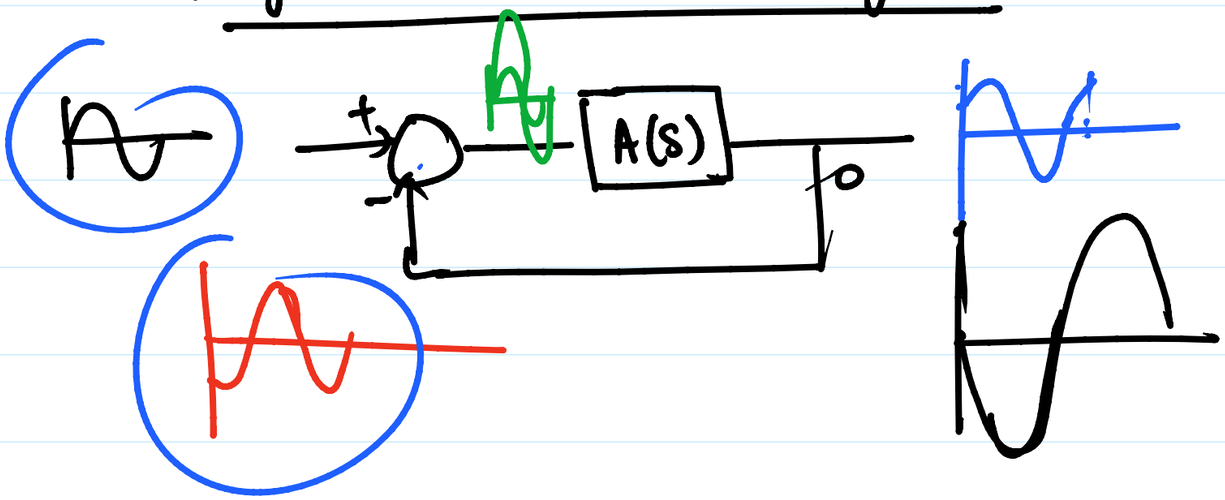


$$V_{out} = V_0 \cos(\omega_0 t)$$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

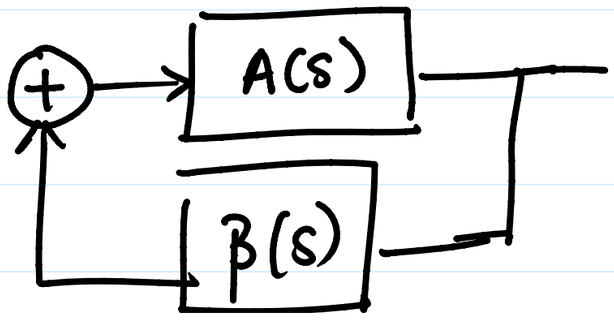
- Cancel +R with -R
- Compensating energy loss due to R

Negative feedback analysis.



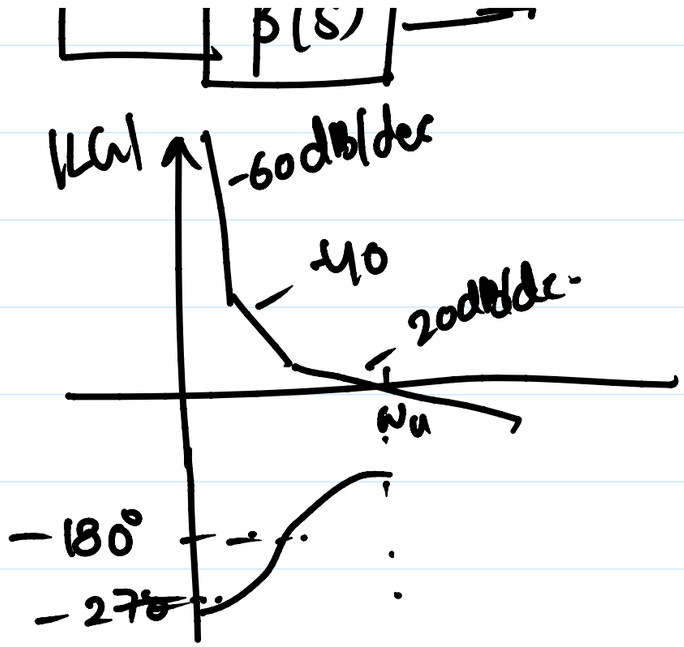
Barkhausen Criterion.

Necessary condition for sustained oscillations.



a) $|A(j\omega_0)\,\beta(j\omega_0)| = 1$

b) $\angle(A(j\omega_0)\,\beta(j\omega_0)) = 2k\pi, \quad k = 0, 1, 2, \ldots$


P(s)
|L(w)|
-60dB/dec
-40
-20dB/dec
ωu
-180°
-270