Oscillators

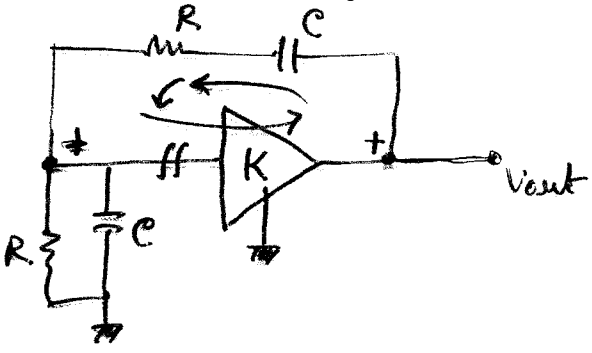
↳ some form of positive feedback

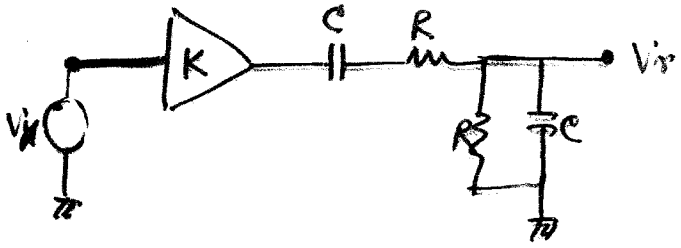
Oscillators
- ← Tuned (sinusoidal)
- → Untuned (square wave)

Criteria for oscillations

Loop gain : $T(j\omega) = +1 + j0$ or $1\angle 0°$

Wien Bridge Oscillator





$$T = \frac{V_r}{V_x}$$

$$T(s) = \frac{V_r}{V_x} = \frac{K \cdot \left(R \| \frac{1}{sC}\right)}{\left(R \| \frac{1}{sC}\right) + R + \frac{1}{sC}}$$

$$T(s) = \frac{sKRC}{(s^2R^2C^2 + s3RC + 1)}$$

$$T(j\omega) = \frac{j\omega KRC}{\underbrace{(1-\omega^2R^2C^2)}_{=0} + j3\omega RC} = (+1) + j0$$

$$(1-\omega^2R^2C^2) = 0 \Rightarrow T(j\omega) = \frac{K}{3} = 1 + j0$$

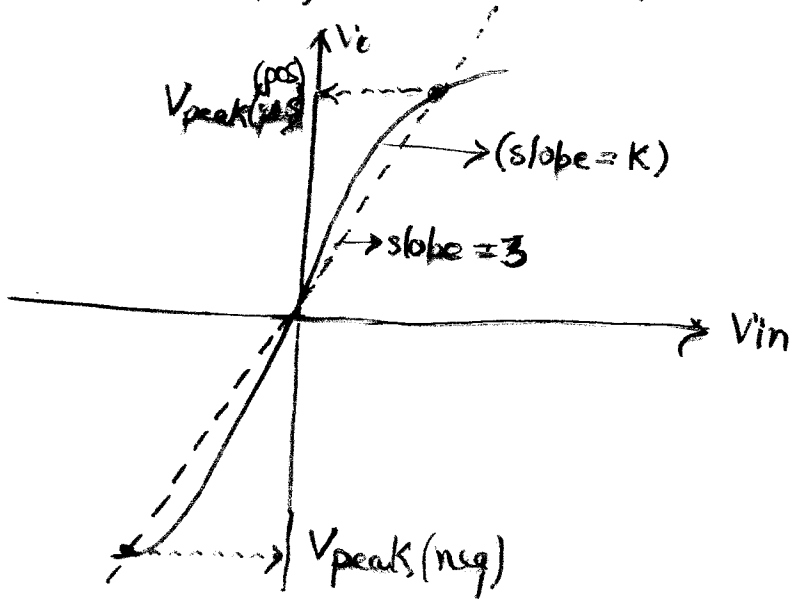
$$\boxed{\omega = \omega_{osc} = \frac{1}{RC}} \qquad \boxed{K = 3}$$

Ex: $R = 10k\Omega$, $C = 0.1\,\mu F$

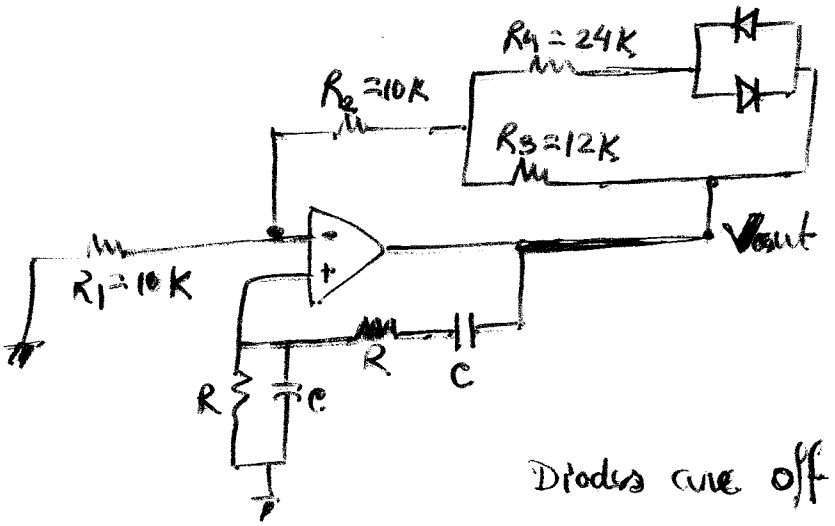
$$\omega_{osc} = \frac{1}{R \cdot C} = 10^3 \text{ rad/sec}$$

Amplitude stabilization.

Amplifier transfer function



Modified Wien Bridge Oscillator



Diodes are off

$$\text{Gain (K)} = \frac{R_1 + R_2 + R_3}{R_1} = 3.2$$

Diodes are on

$$\text{Gain (K)} = \frac{R_1 + R_2 + (R_3 \| R_4)}{R_1} = 2.8$$