Transistor Oscillators

An oscillator is an electronic device which converts d.c. power from the supply into a.c. power in the load without any input signal.

Classification of Oscillators

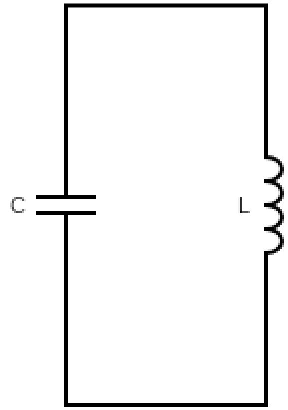
1. Sinusodial Oscillator 2. Relaxation Oscillator

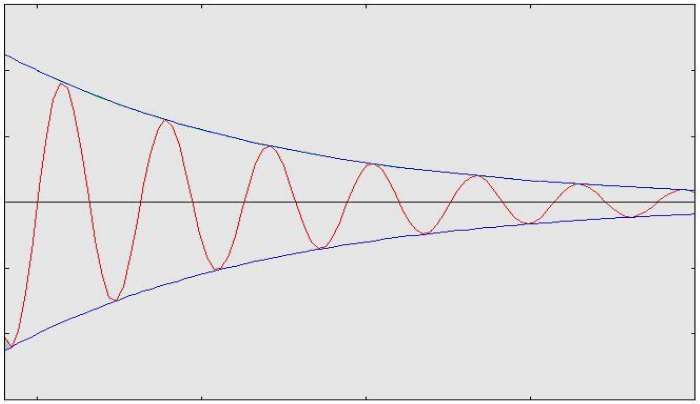
On the basis of frequency selector

1. RC oscillator 2. LC Oscillator 3. Crystal Oscillator .

Basic oscillator circuit is LC tank circuit.

Tank Circuit



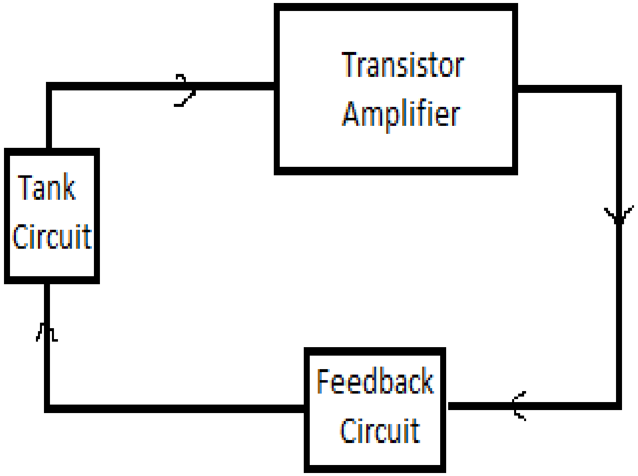


Frequency of oscillations is given by

$$f=1/2(LC)^{1/2}$$

Every time energy is transferred from the capacitor, C to inductor, L and back from L to C some energy losses occur which decay the oscillations to zero over time.

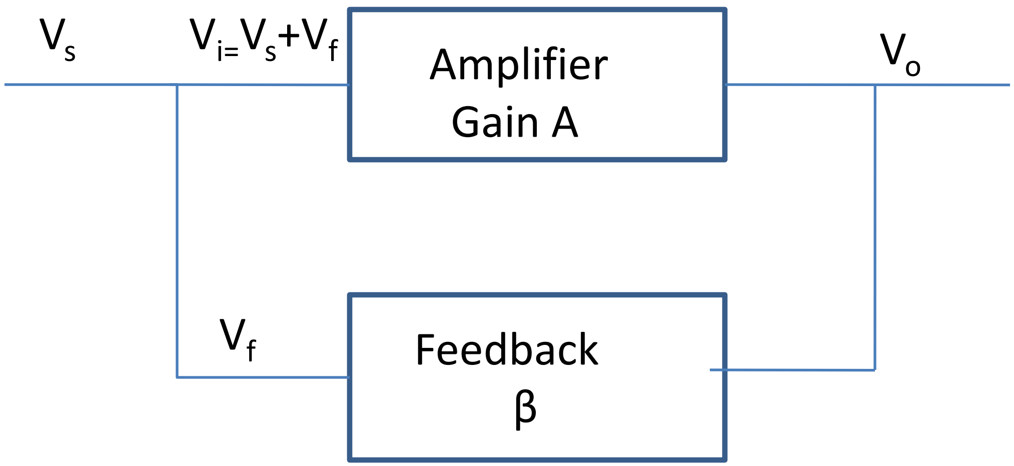
To keep the oscillations going in an LC tank circuit, we have to replace all the energy lost in each oscillation and also maintain the amplitude of these oscillations at a constant level.



Transisor Oscillator

$A\beta=1$ is called Barkhausen criterion for sustained oscillation

V_s= Non zero for Amplifier
=Zero for oscillators



$V_o= AV_i$

$V_o= A(V_s +V_f)$

$V_o= A(V_s + \beta V_o)$

$AV_s= V_o(1 - A\beta)$

$A_f = V_o/V_s =A/(1 - A\beta)$

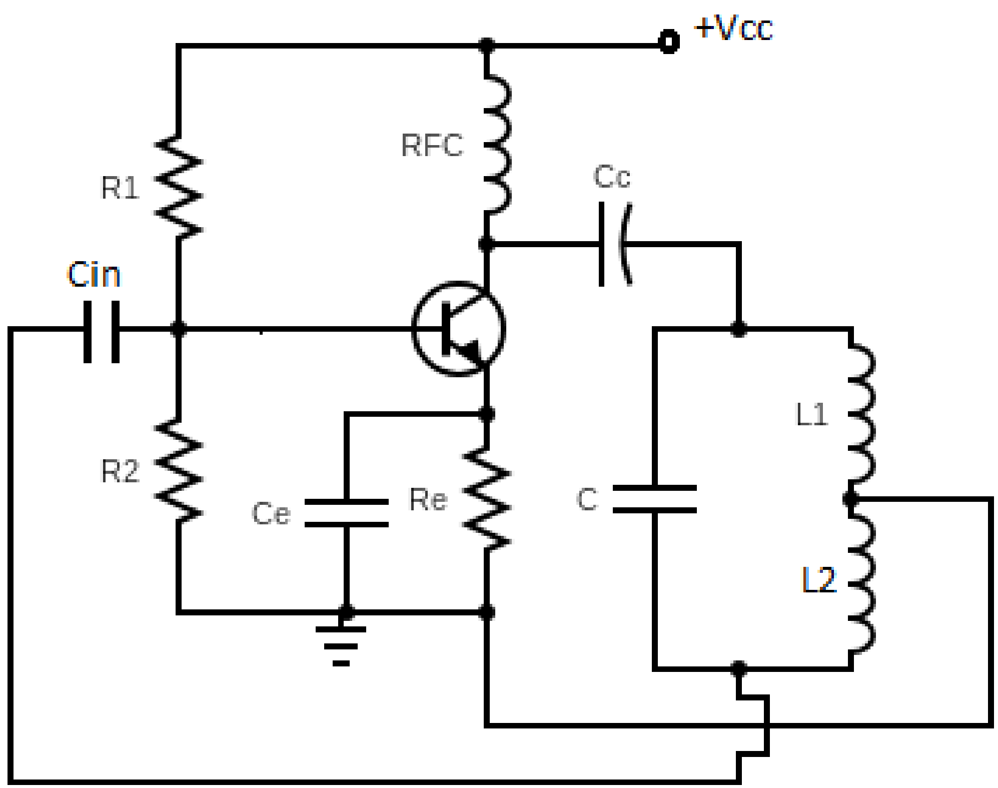
if $A\beta=1 \Rightarrow 1 – A\beta=0$

$\Rightarrow V_o/V_s$ = infinity

$\Rightarrow V_s =0$

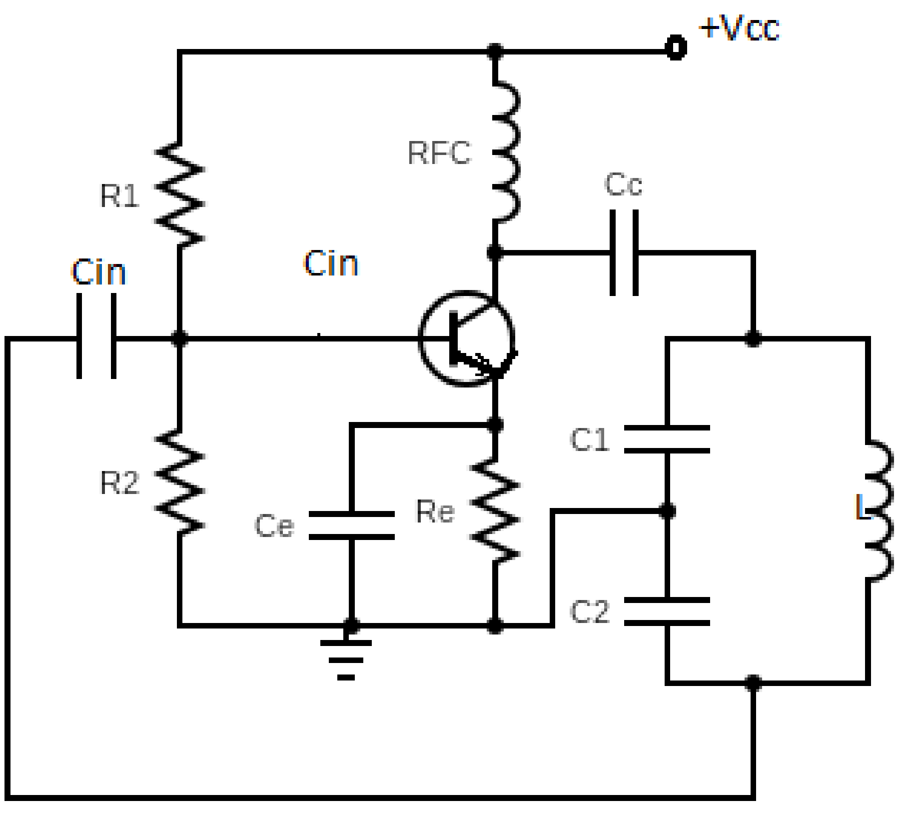
Hartley Oscillator

$$f = \frac{1}{2\pi\{C(L_1+L_2+2M)\}^{1/2}}$$



Shunt fed Hartley Oscillator

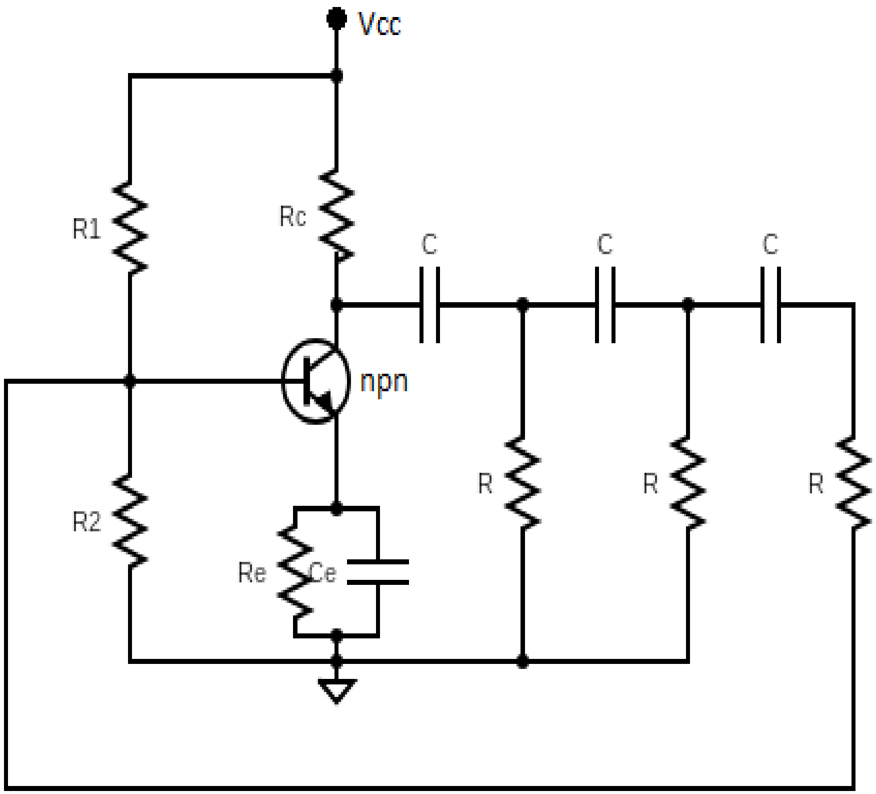
Colpitt's Oscillator



$f=1/2\pi\{1\backslash L(1/C1+1/C_2)\}^{1/2}$

The advantage of this type of capacitive circuit configuration is that with less self and mutual inductance within the tank circuit, frequency stability of the oscillator is improved along with a more simple design.

RC phase shift oscillator



Phase change through a series RC circuit is frequency dependent given by

$$\Phi=\tan^{-1}(X_c/R),$$

where $X_c=1/(j2\pi fC)$