

Signal Generators

Oscillators

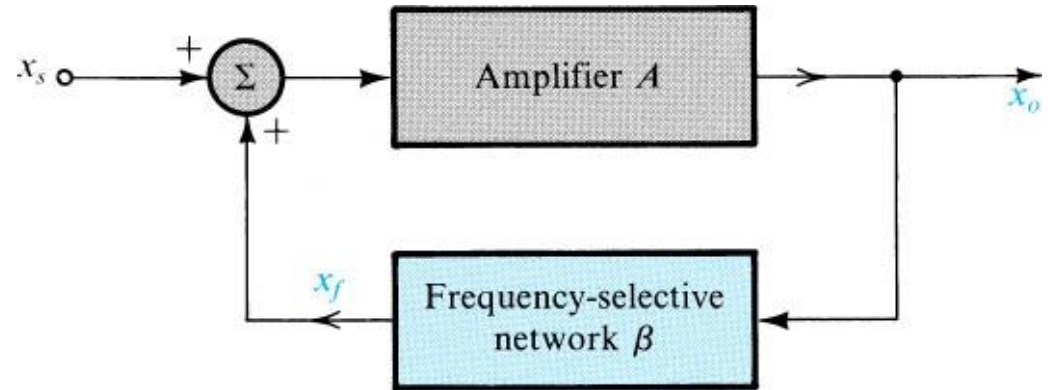
EE 359 Electronic Circuits

HW:

- **Due Friday Nov. 9 13.4, 13.14, 13.23, 13.27**

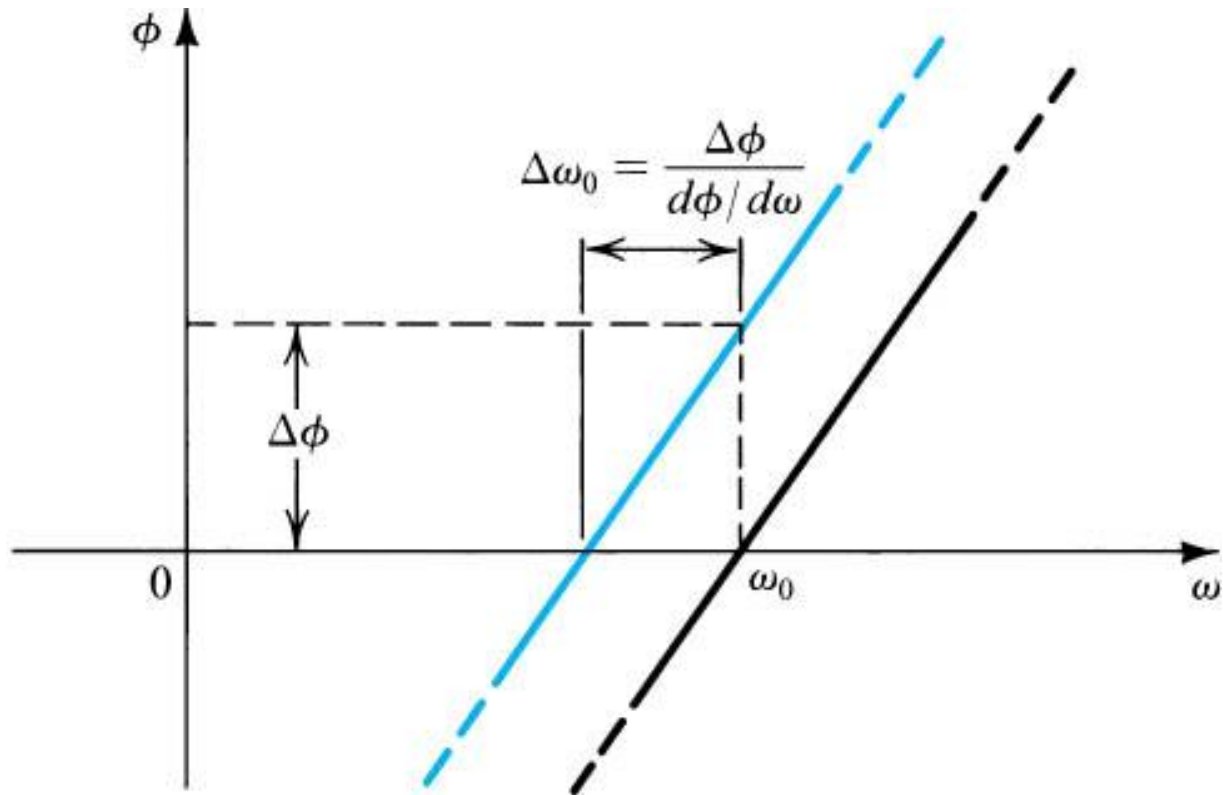
SIGNAL GENERATORS /OSCILLATORS

A positive-feedback loop is formed by an amplifier and a frequency-selective network

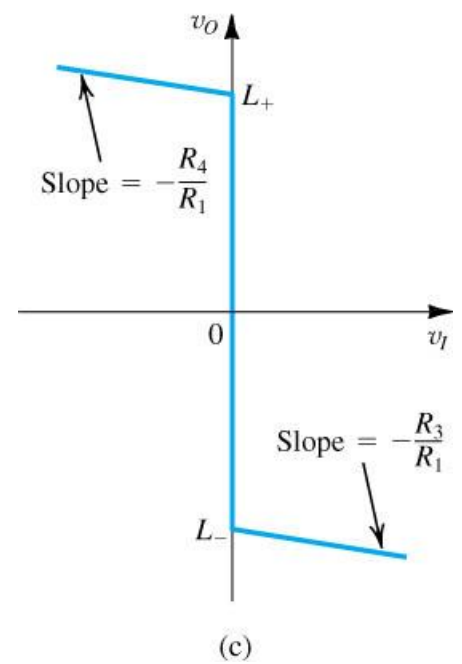
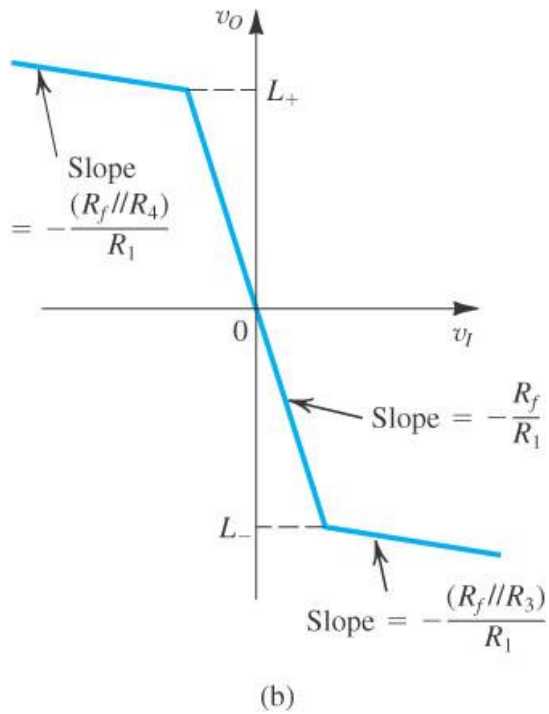
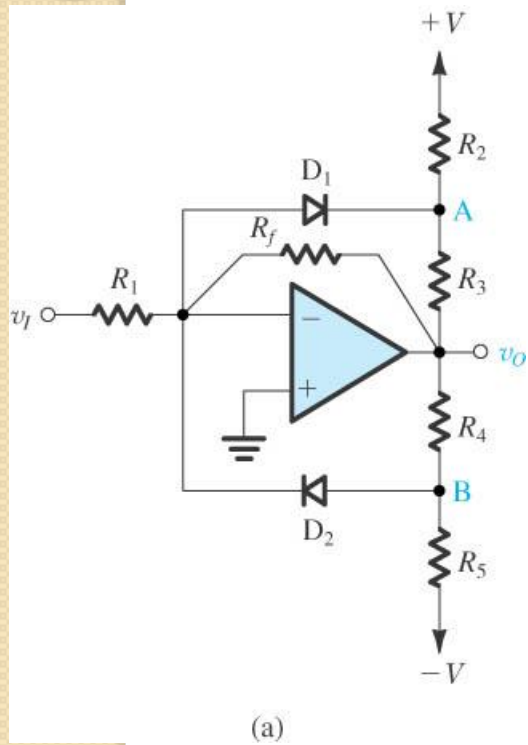


In an actual oscillator circuit, no input signal will be present

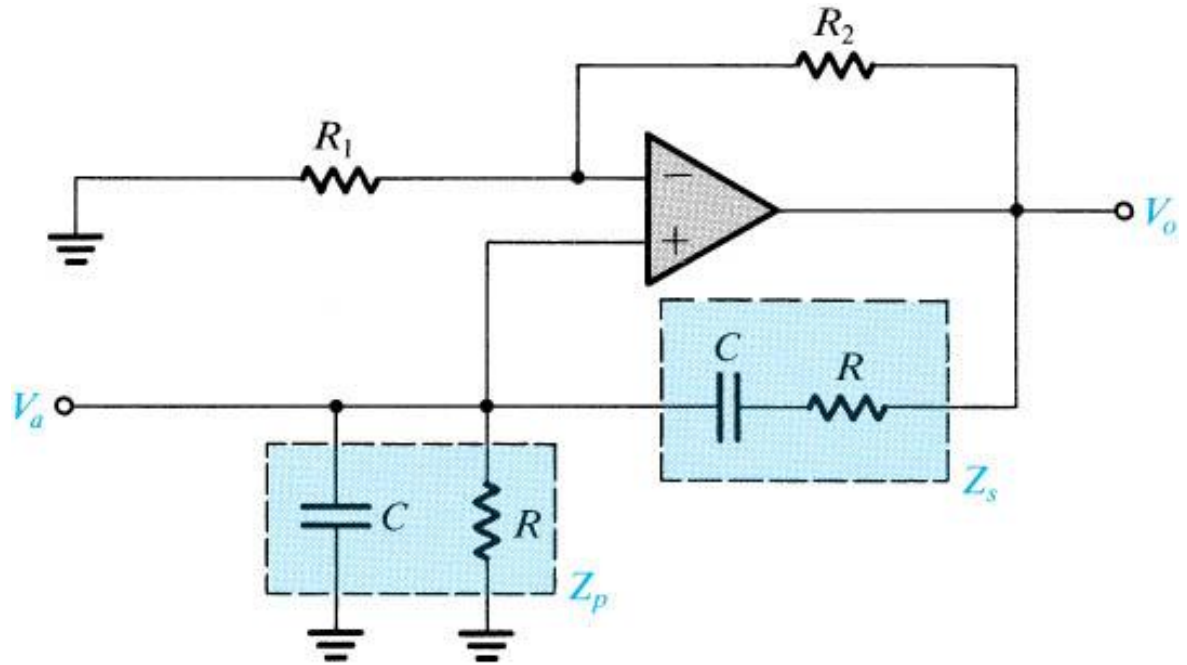
Oscillator-frequency stability



Limiter Ckt → Comparator



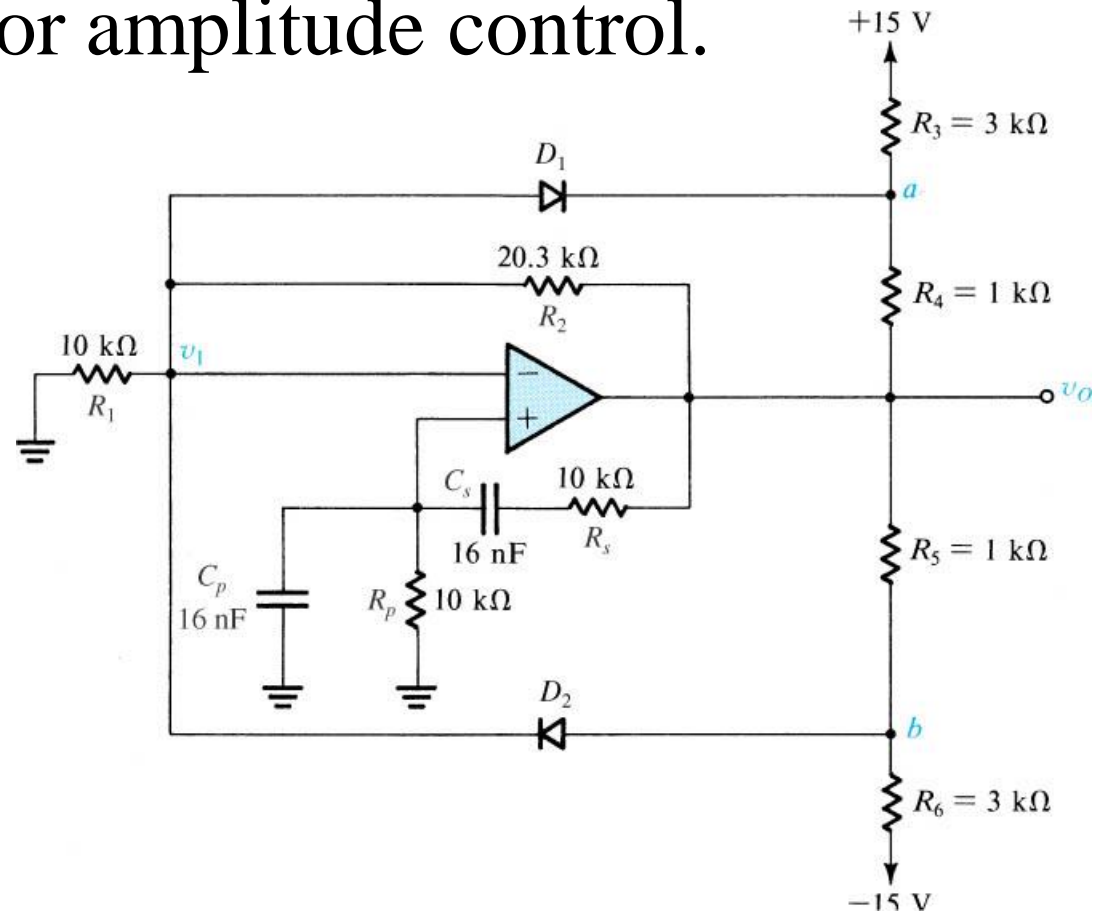
Wien-bridge oscillator



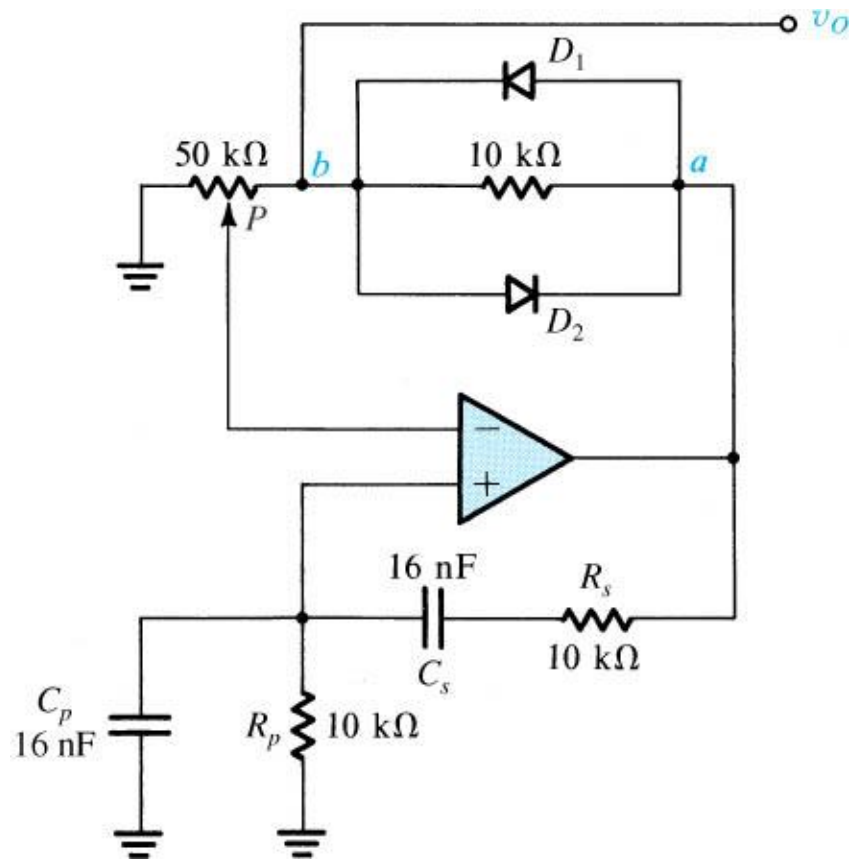
without amplitude
stabilization.

Wien bridge w/ Amp. Stabil.

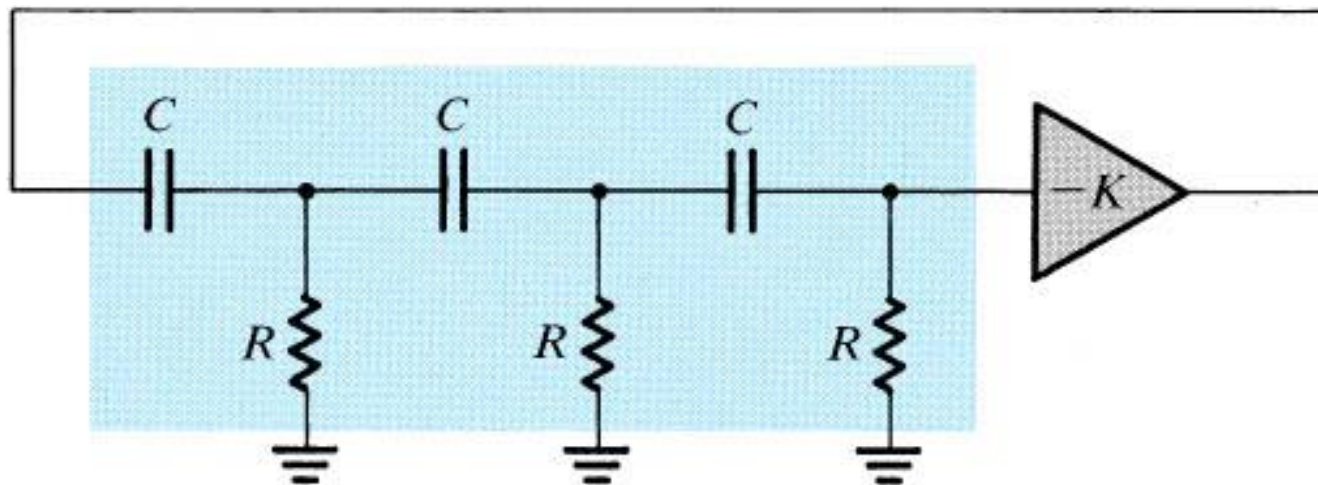
limiter used for amplitude control.



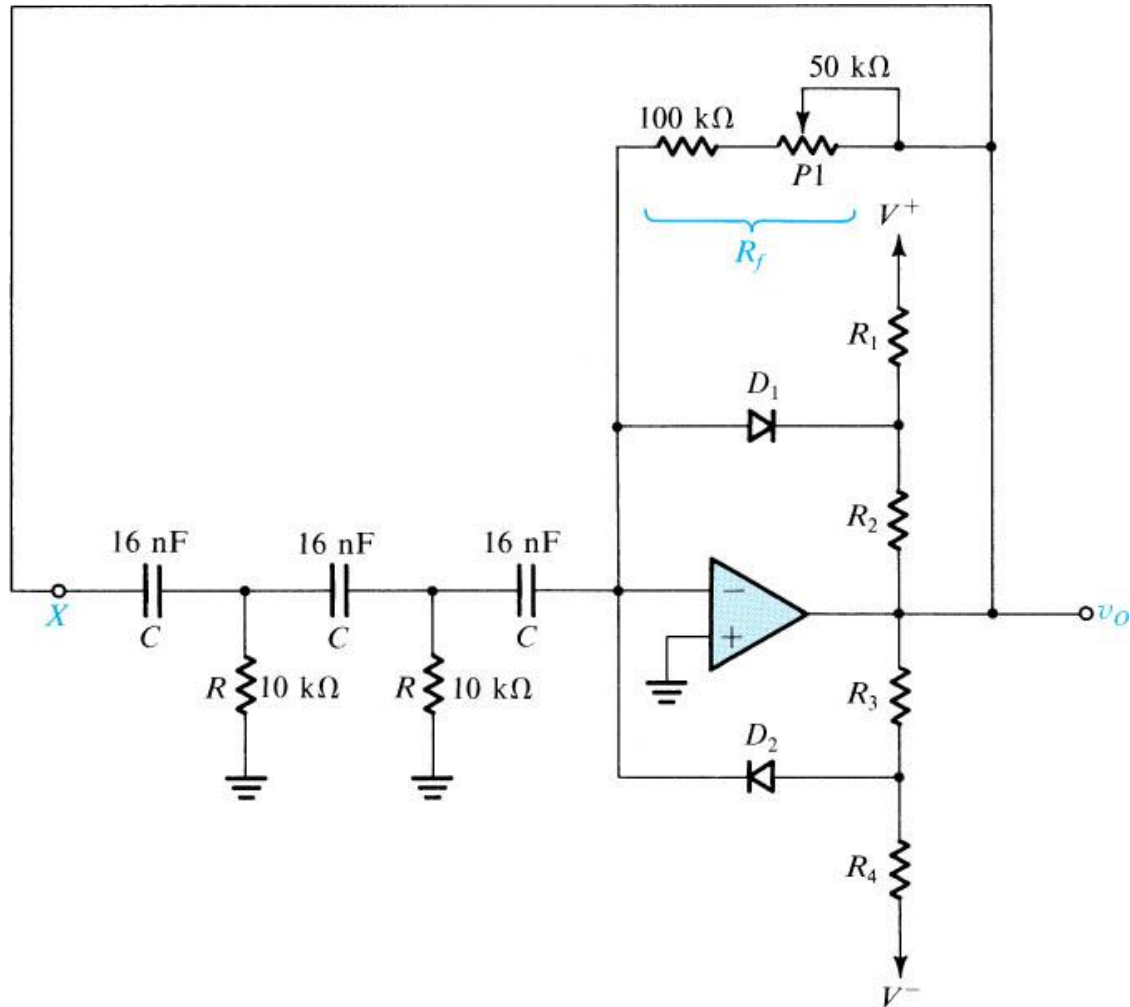
Alternate Wien bridge stabil.



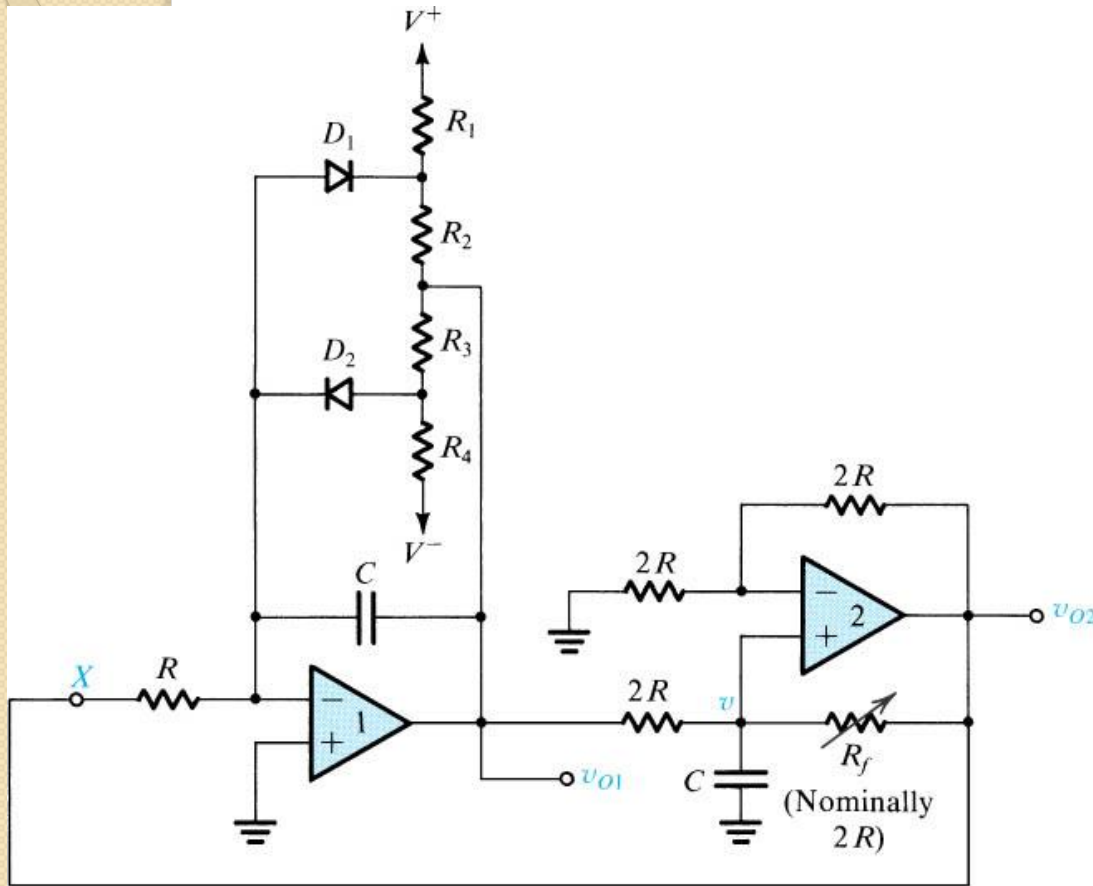
Phase Shift Oscillator



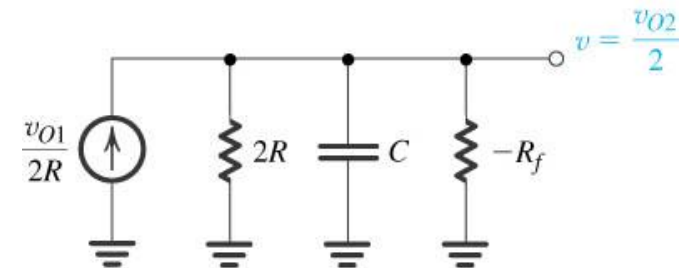
Phase Shift. Osc. W/ Stabil.



Quad Osc. Circuit

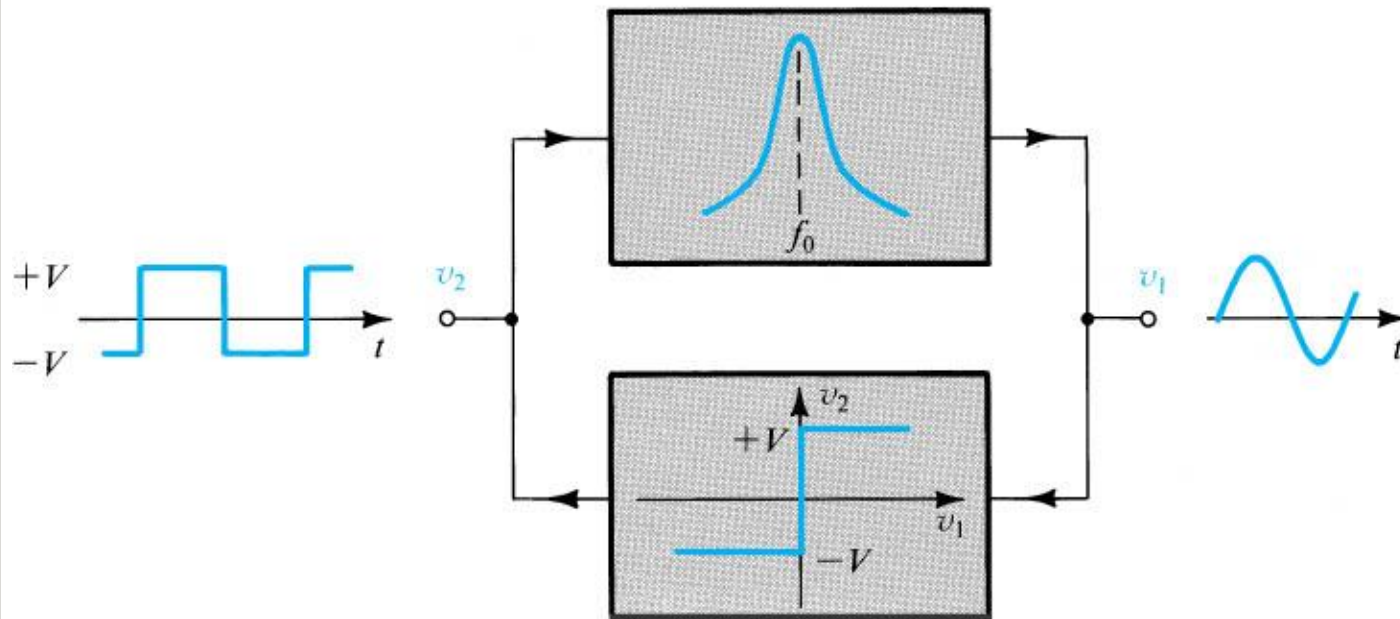


(a)

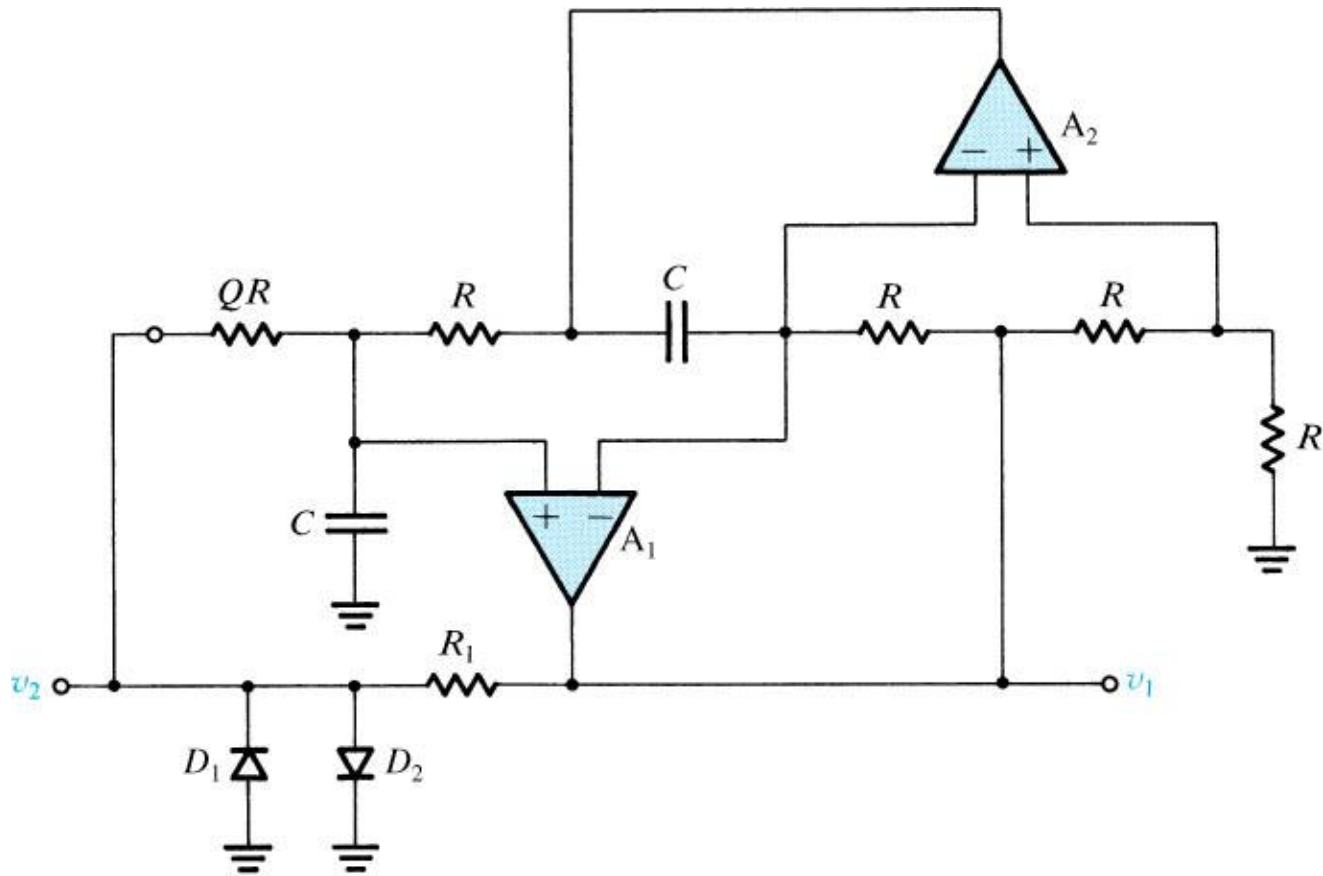


(b)

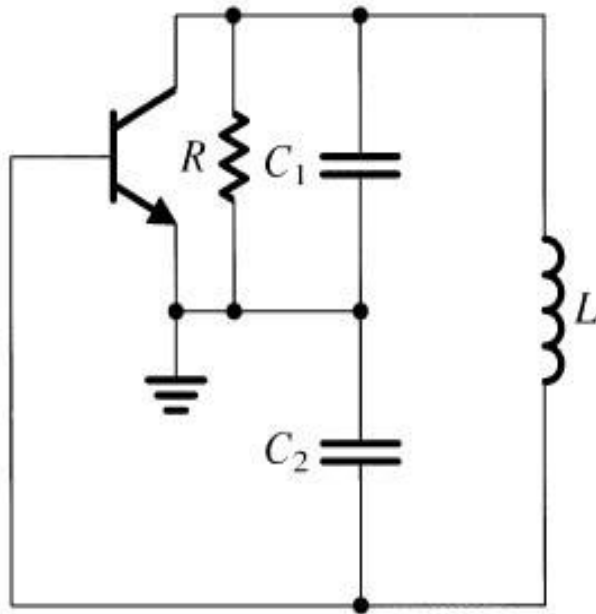
Active Tuned Osc.



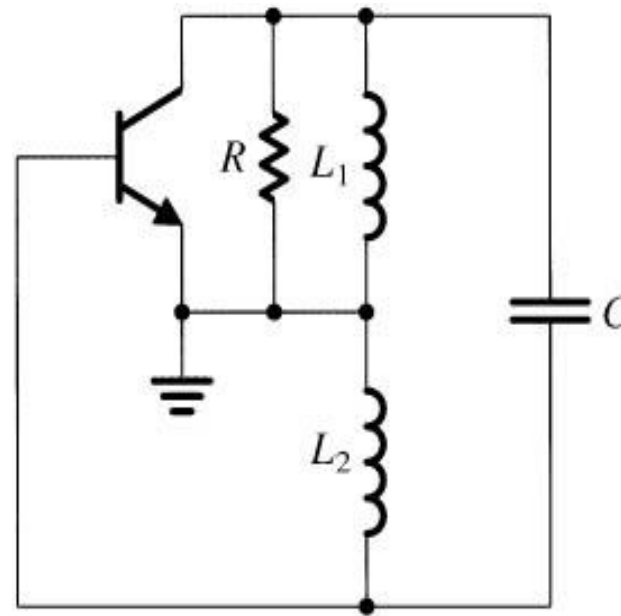
OPAMP based Tuned Amp. Osc.



Colpitts and Hartley Oscillators



(a)

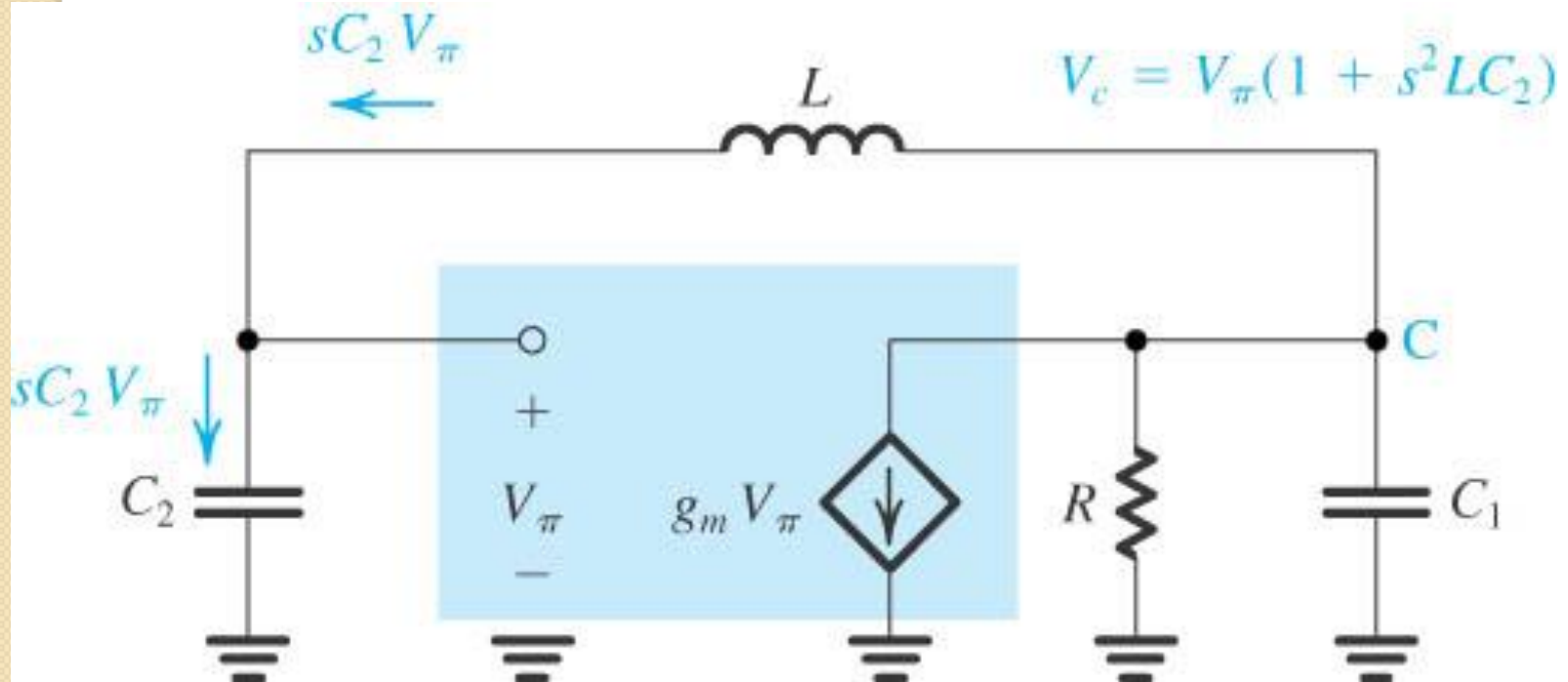


(b)

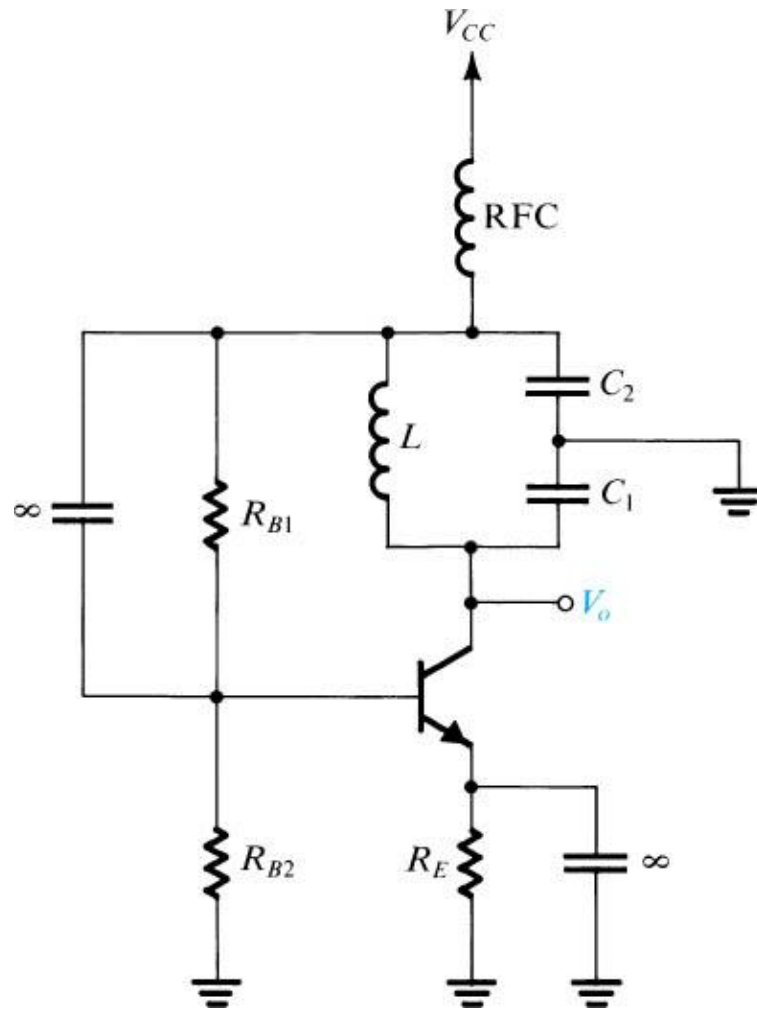
Equiv. Ckt

To simplify the analysis, neglect C_m and r_p

Consider C_p to be part of C_2 , and include r_o in R .



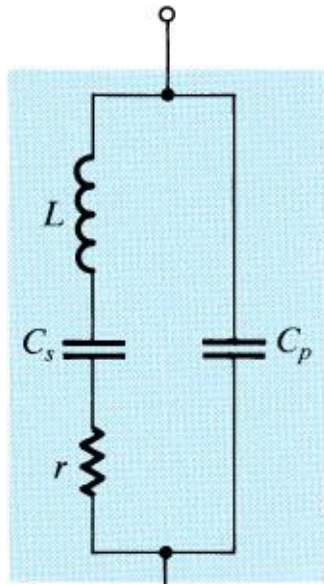
Collpits Oscillator



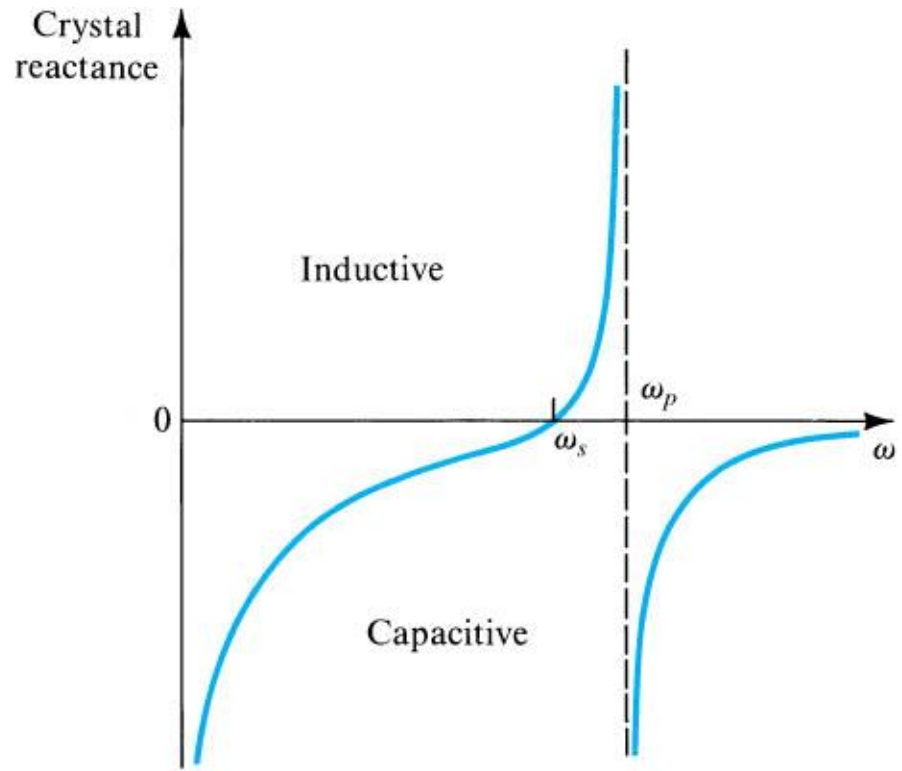
Piezoelectric Crystal



(a)



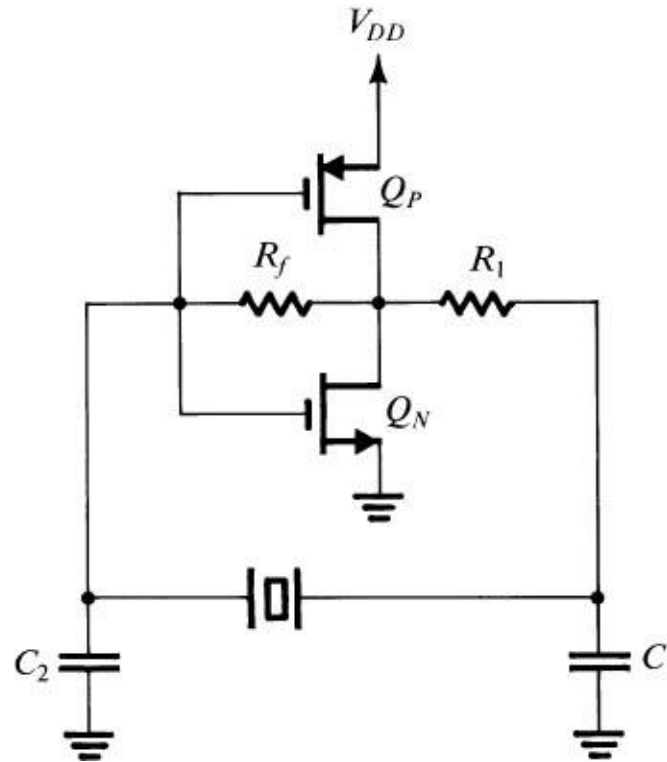
(b)



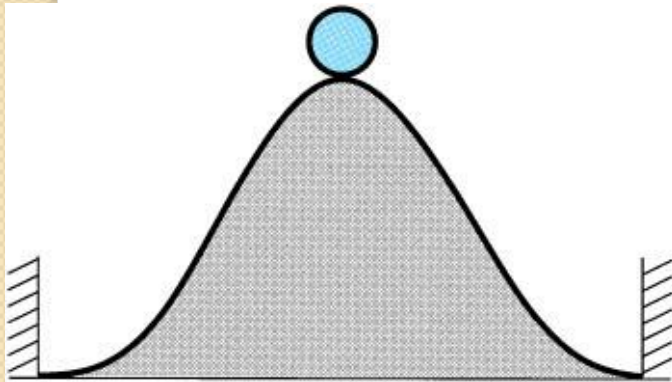
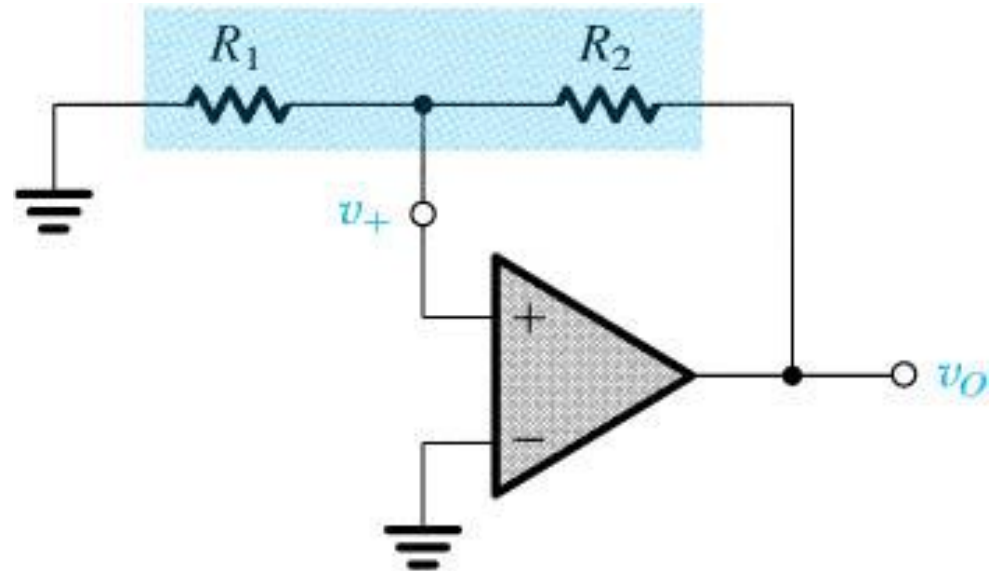
(c)

Pierce Oscillator

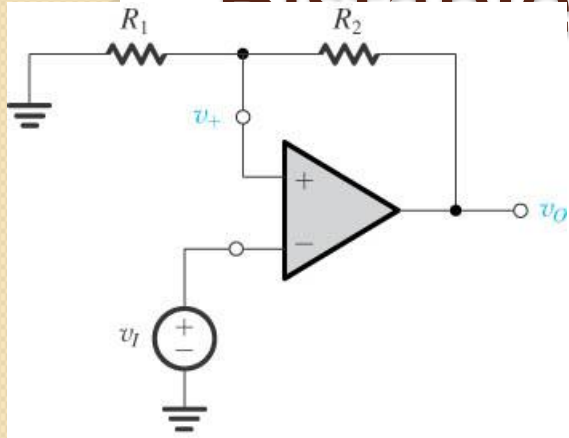
CMOS inverter as an amplifier.



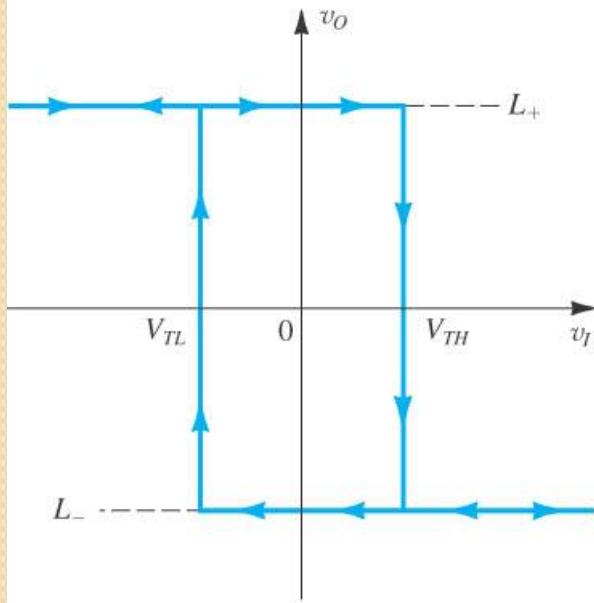
Bistable Operation



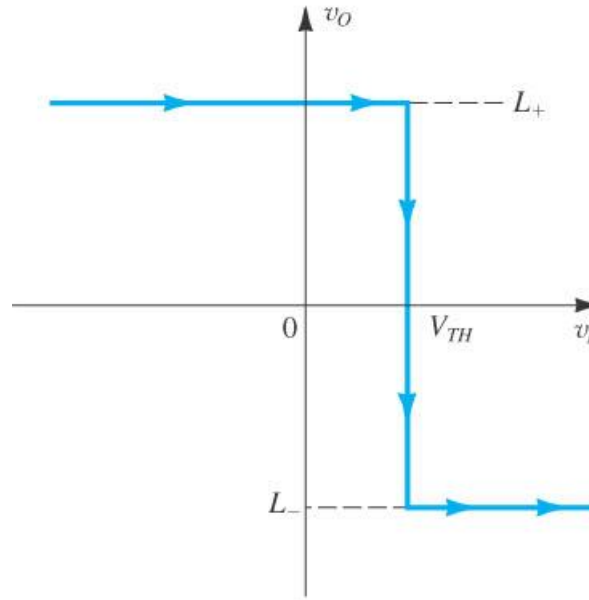
Distable



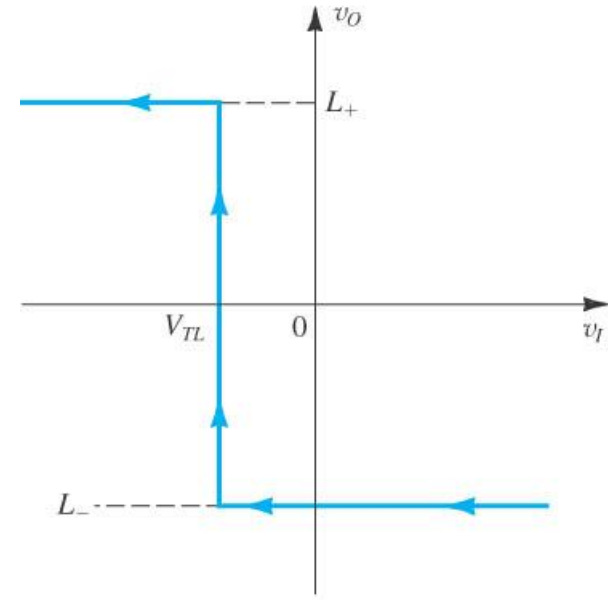
(a)



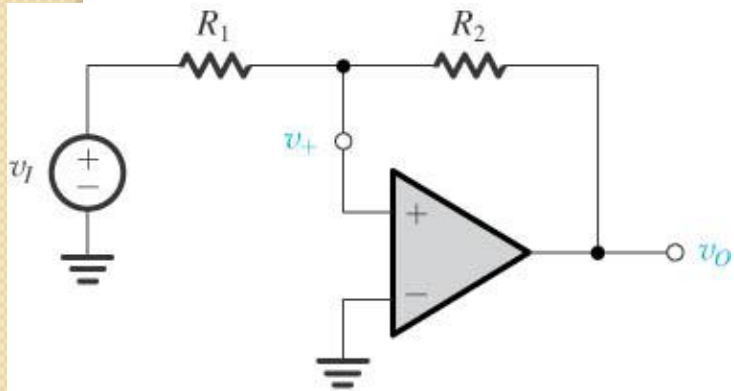
(d)



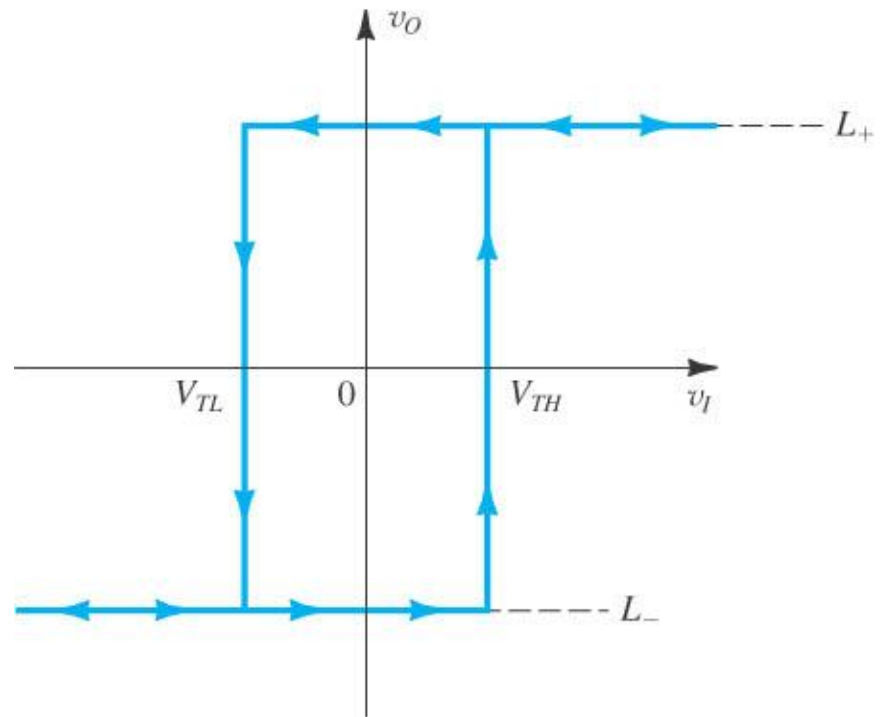
(b)



(c)

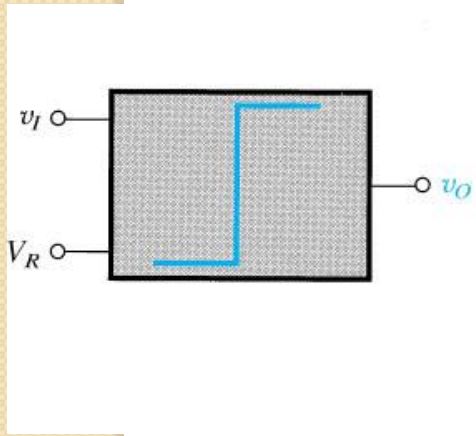


(a)

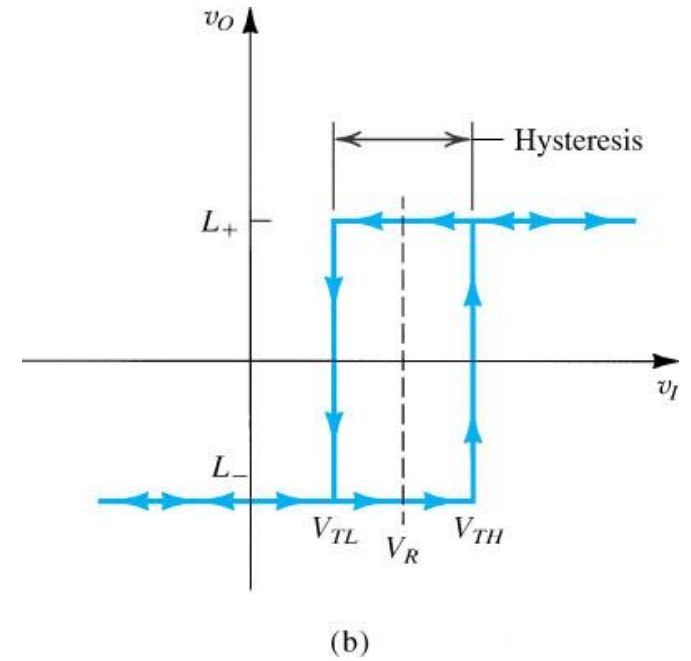
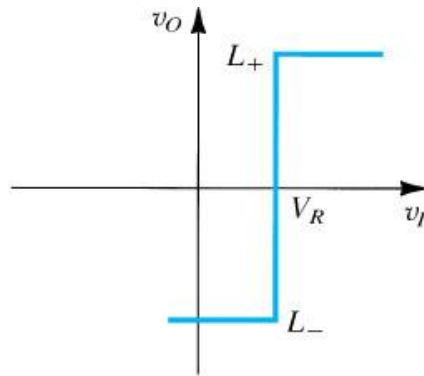


(b)

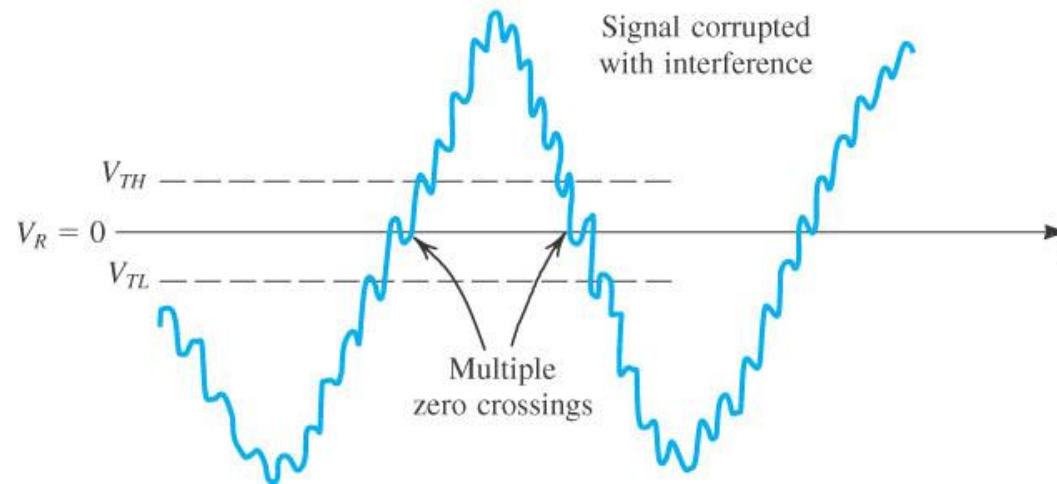
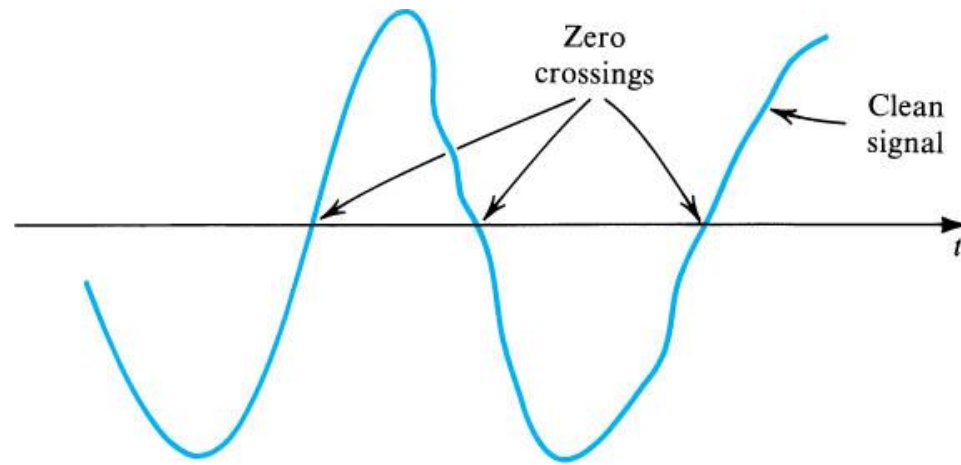
Hysteresis



(a)



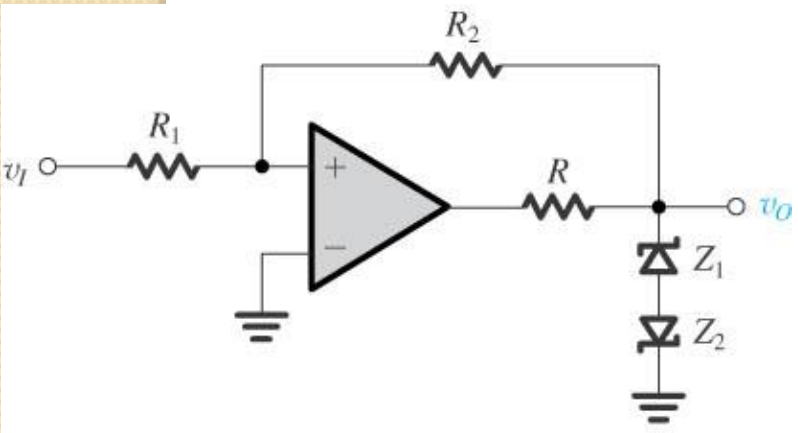
Noisy Signal



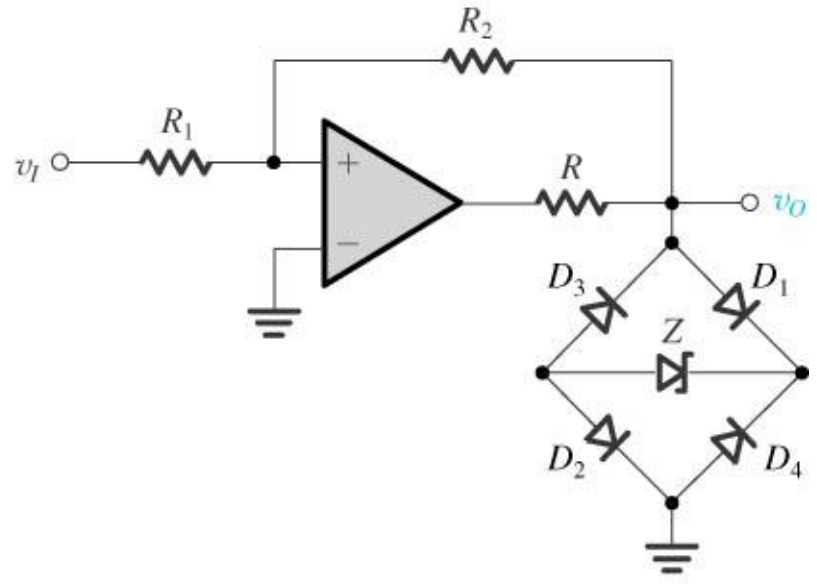
Limiter

a) $L_+ = V_{Z1} + V_D$ and $L_- = -(V_{Z2} + V_D)$,

(b) $L_+ = V_Z + V_{D1} + V_{D2}$ and $L_- = -(V_Z + V_{D3} + V_{D4})$.



(a)

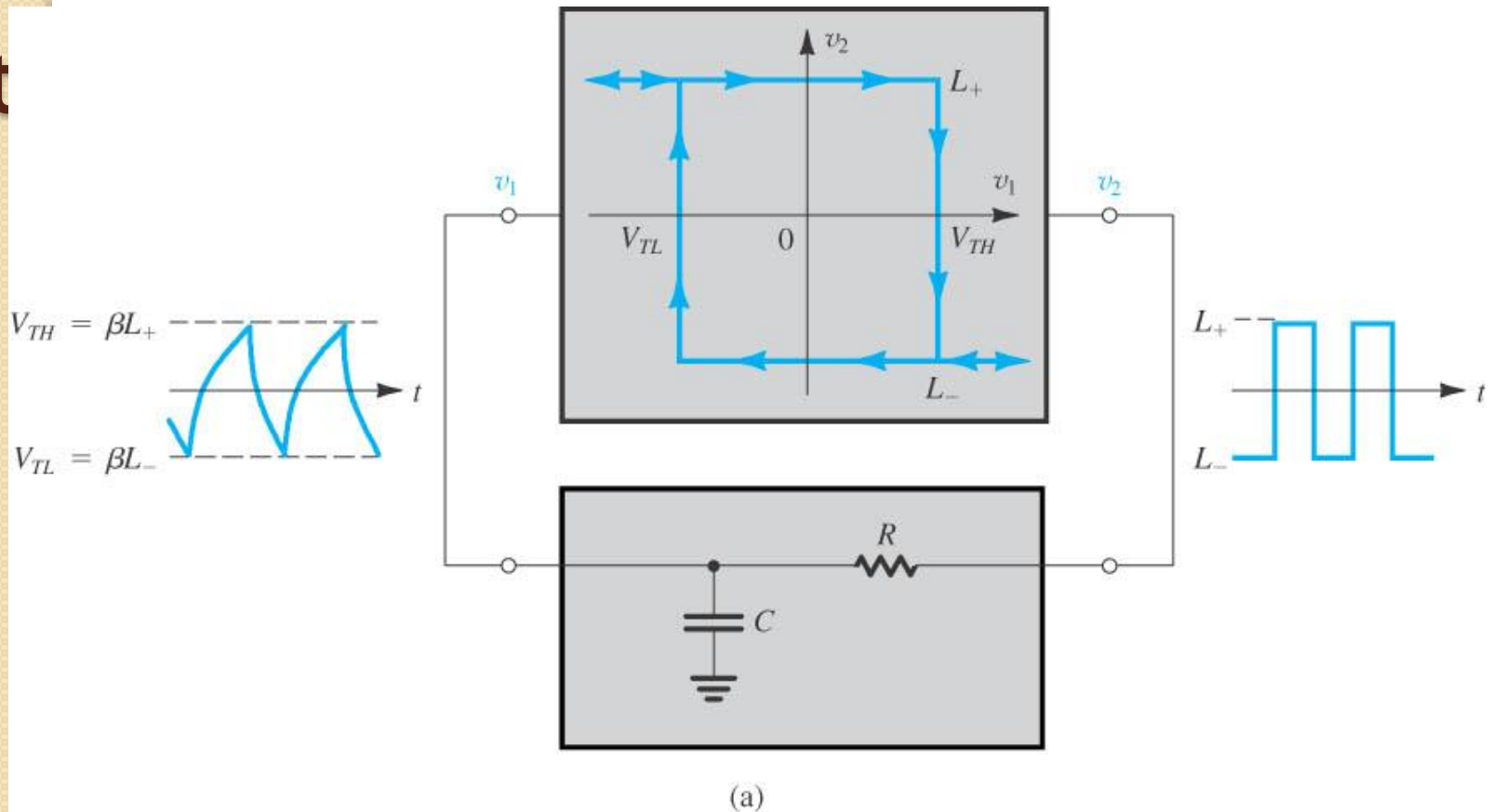


(b)

Limiter circuits = more precise output levels for bistable circuit.

R according to current required for the proper operation of the zener diodes.

Ast

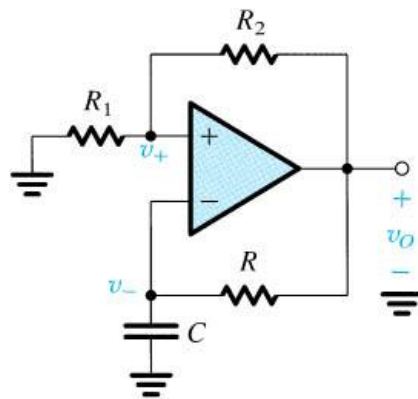


Abistable multivibrator with inverting transfer characteristics in a feedback loop with an RC circuit results in a square-wave generator.

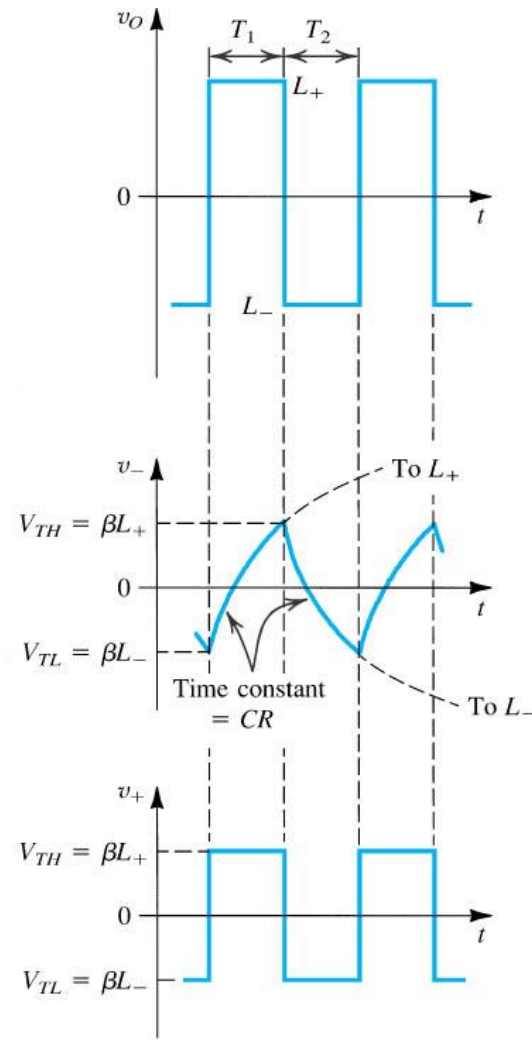
Astable

The circuit obtained when the bistable multivibrator is implemented with the circuit

(This circuit is called an astable multivibrator.)



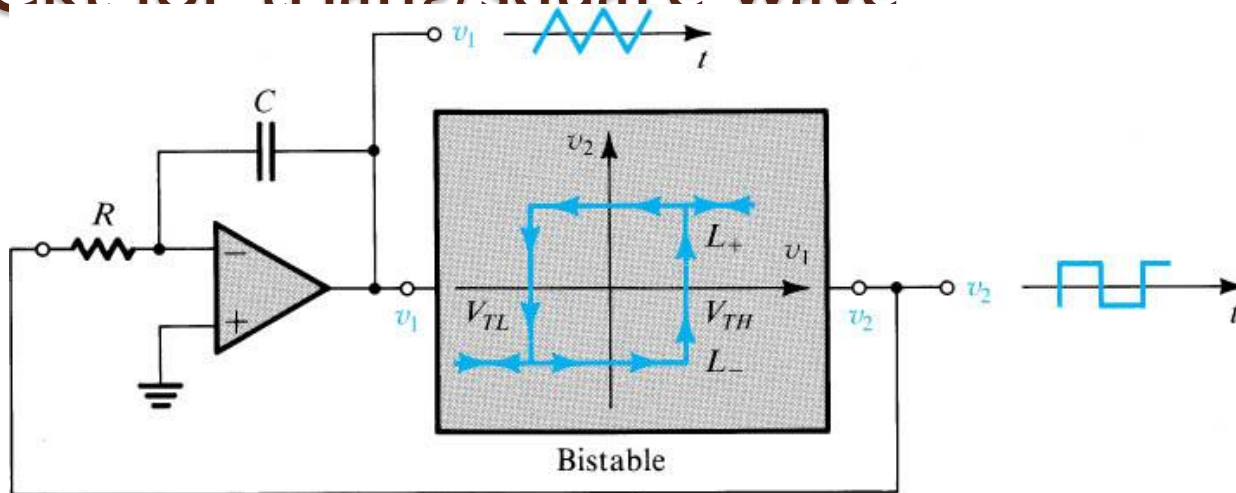
(b)



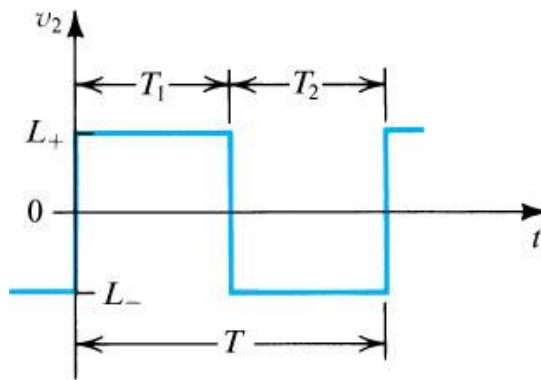
(c)

c) Waveforms at various nodes of the circuit in (b).

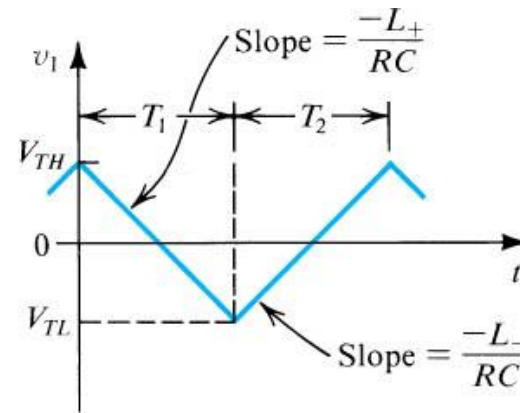
Ckt for triang/square wave



(a)

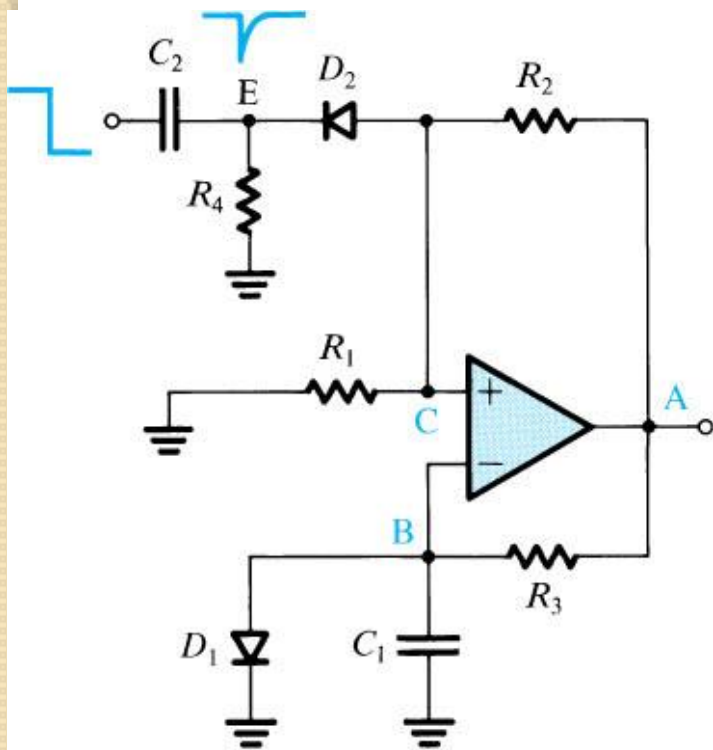


(b)

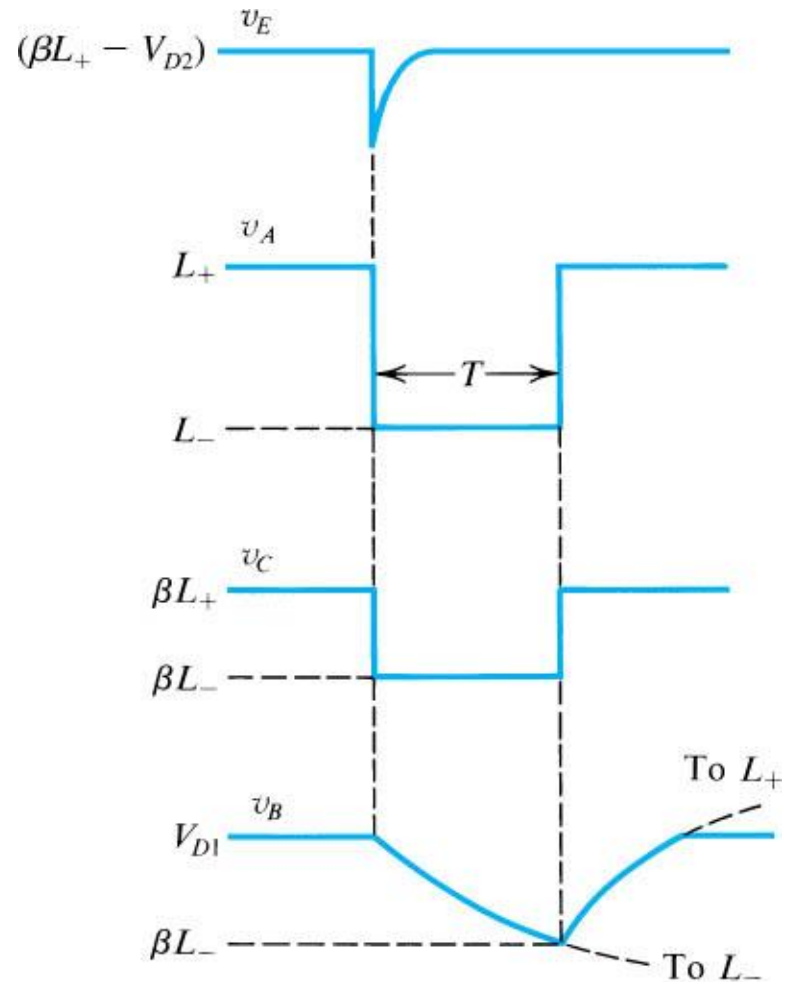


(c)

A general scheme for generating triangular and square waveforms.



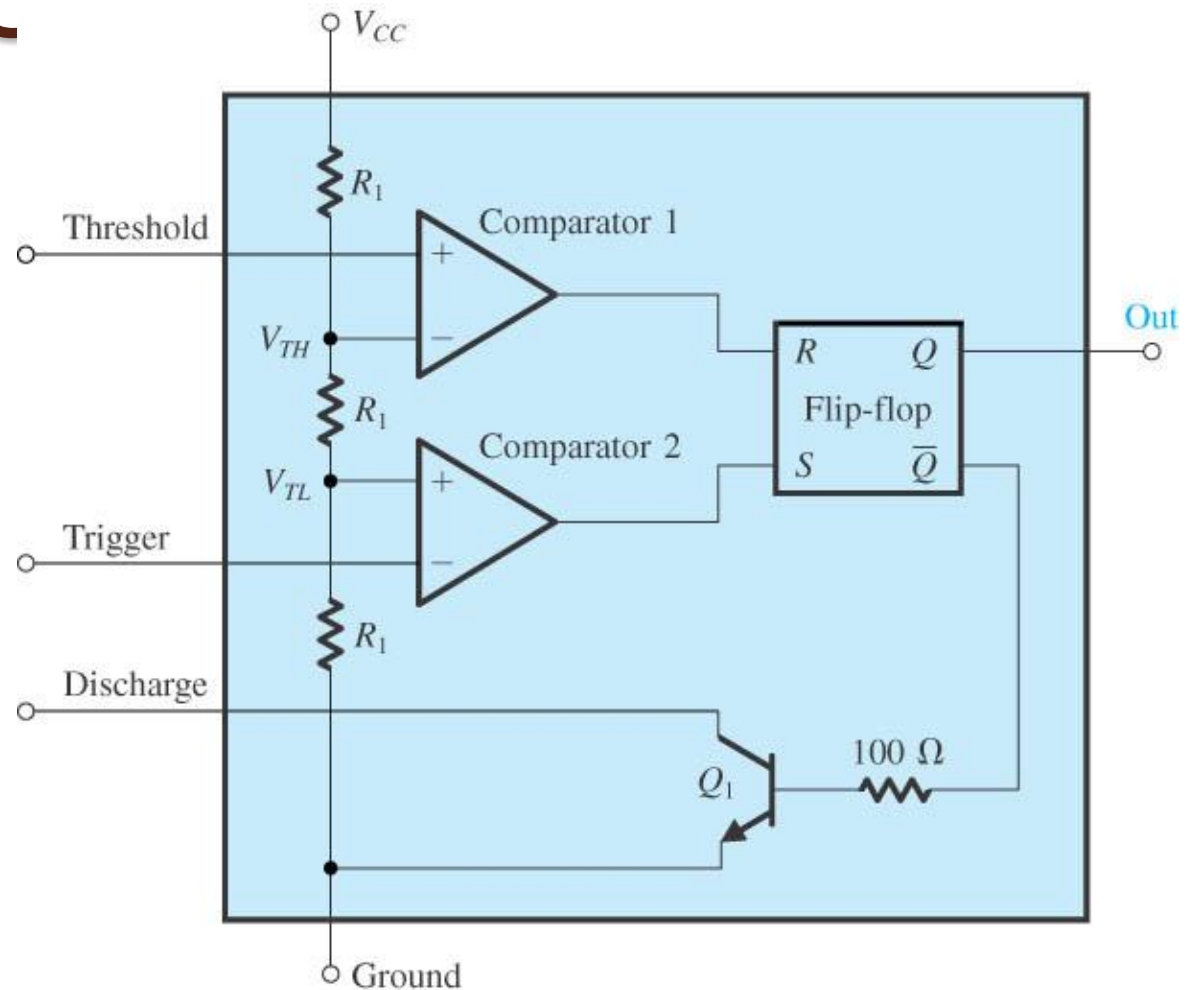
(a)



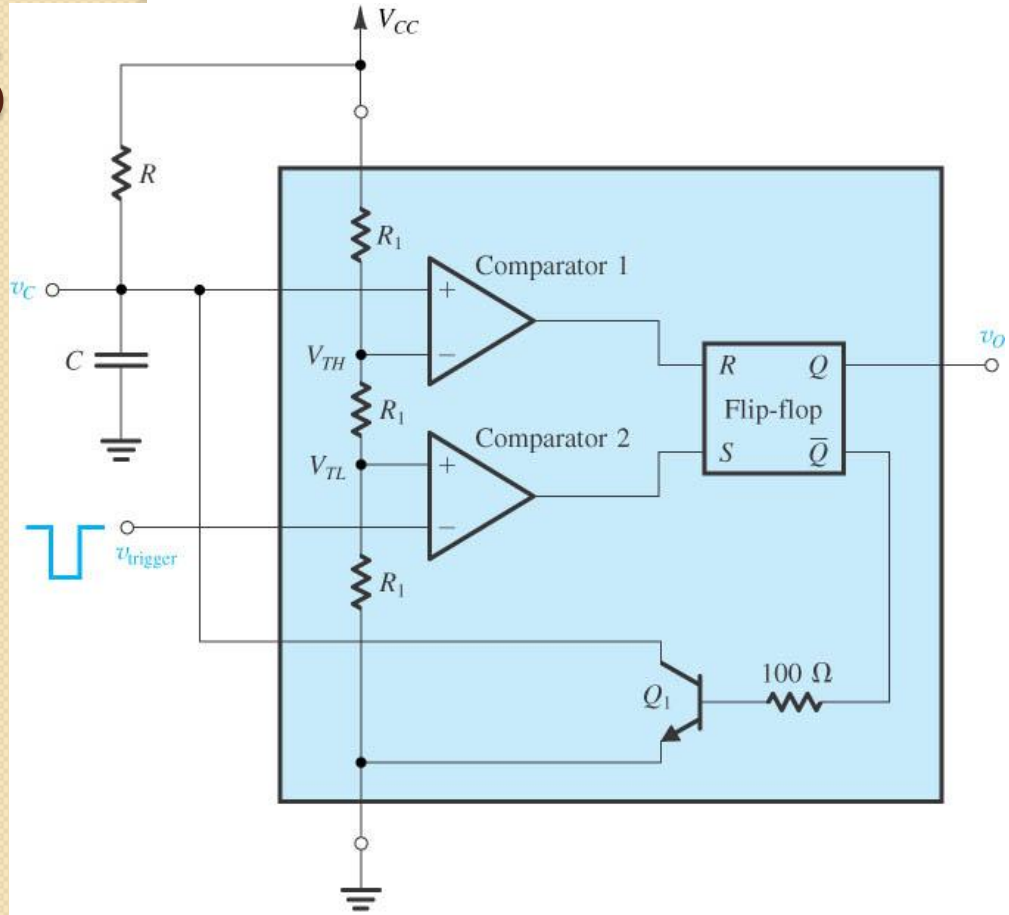
(b)

(a) An op-amp monostable circuit. **(b)** Signal waveforms in the circuit of (a).

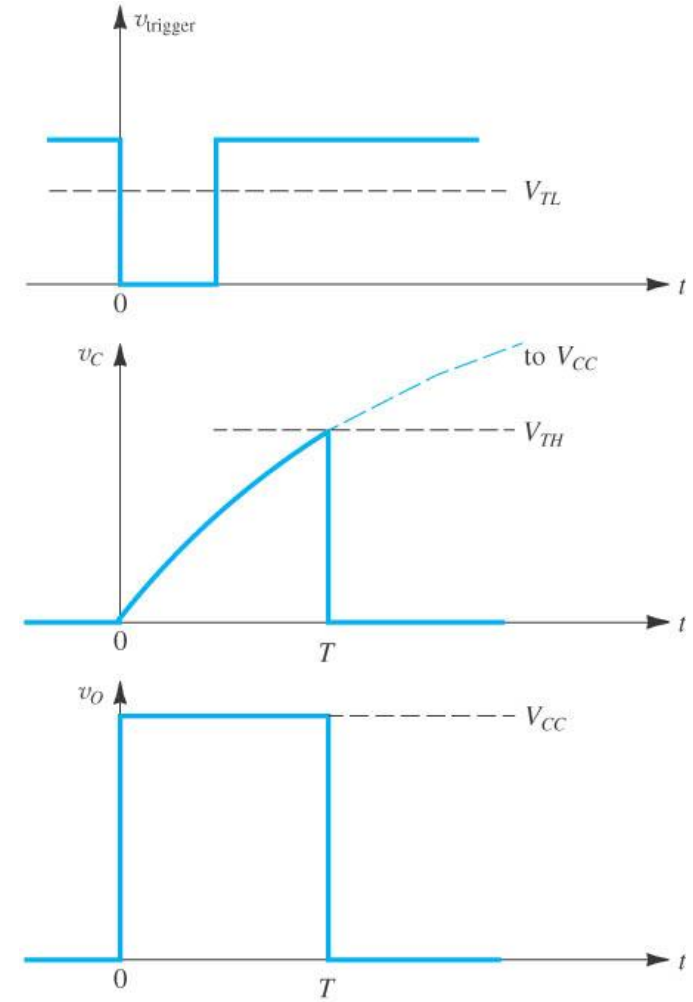
555 IC



internal circuit of the 555 integrated-circuit timer.

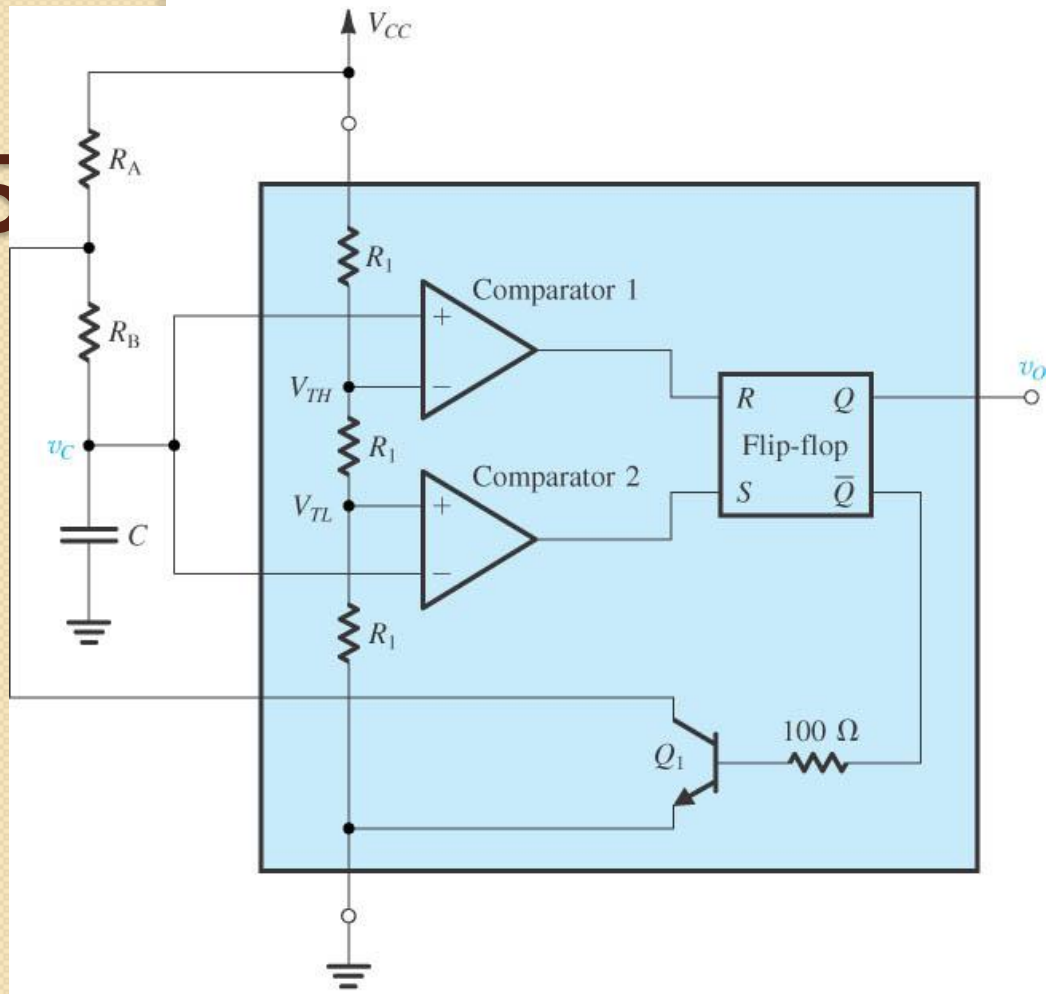


(a)

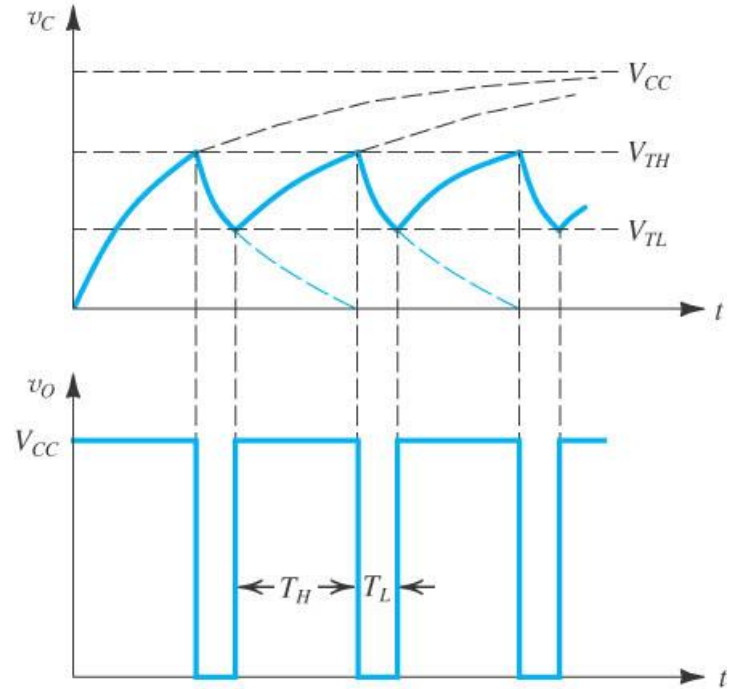


(b)

a) The 555 timer connected to implement a monostable multivibrator. **(b)** Waveforms of the circuit in (a).



(a)

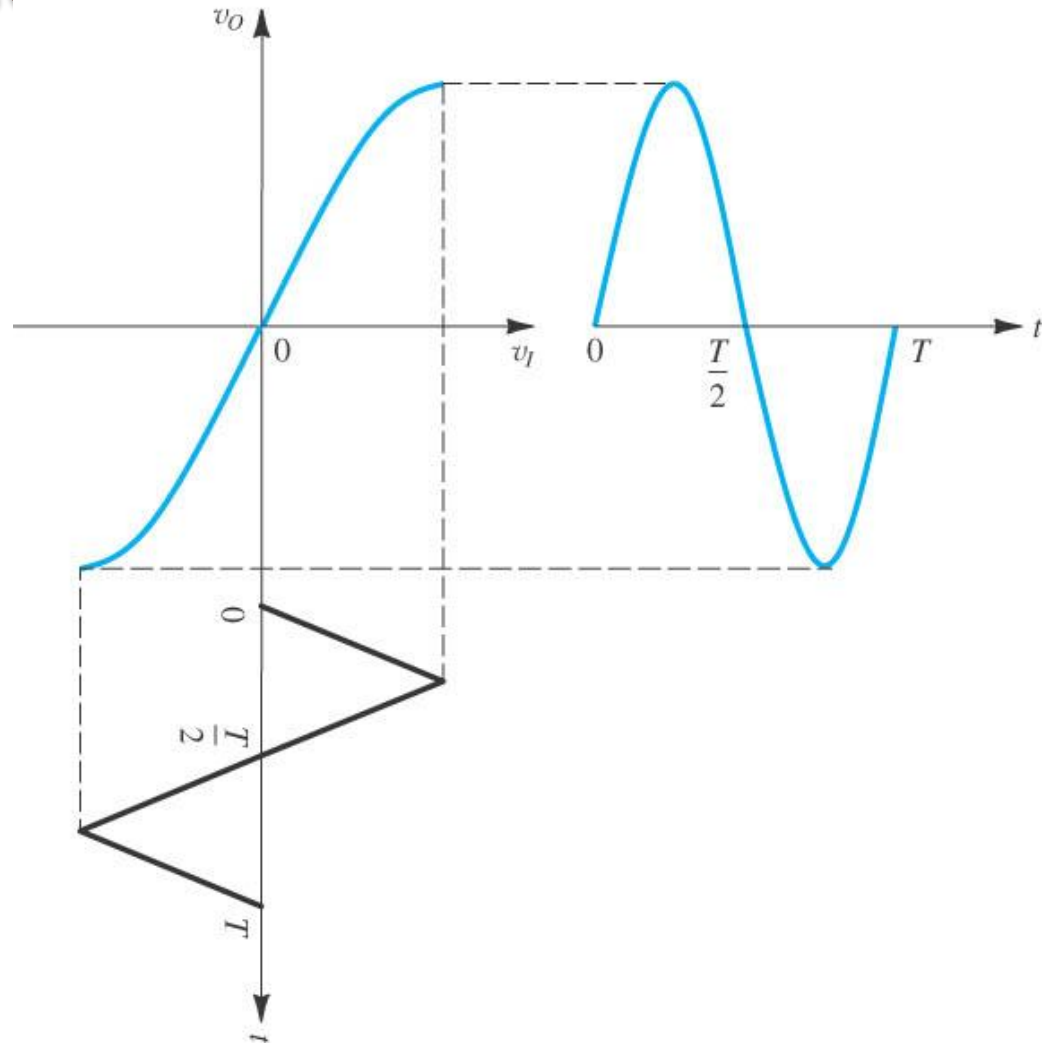


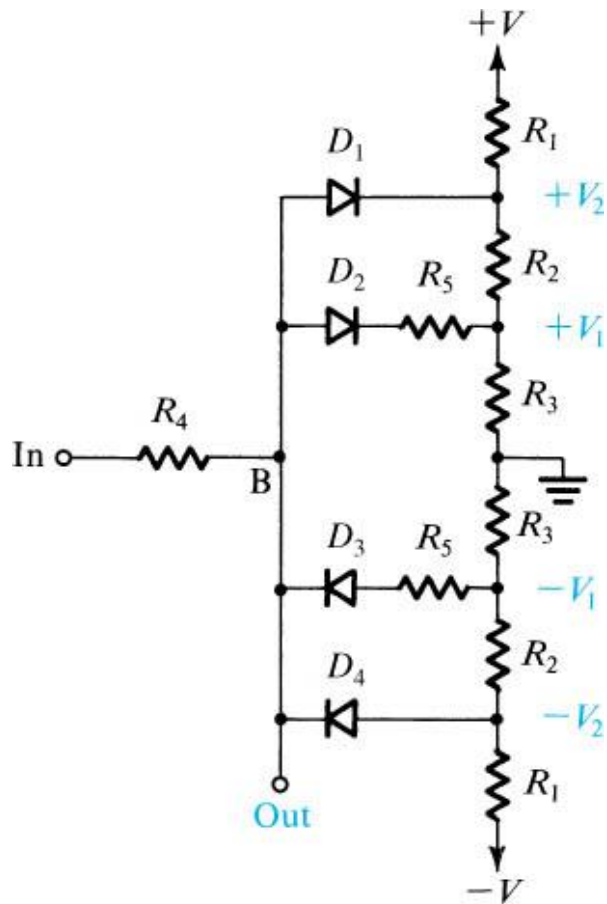
(b)

(a) The 555 timer connected to implement an astable multivibrator.
 (b) Waveforms of the circuit in (a).

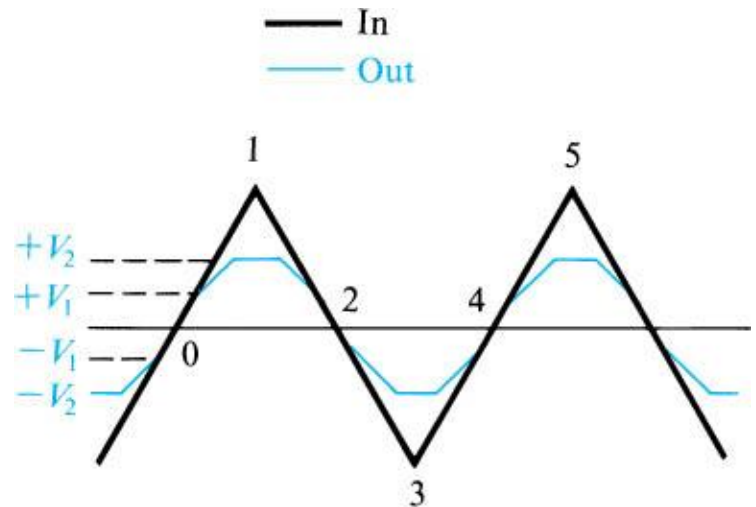
Triangle \rightarrow Sinusoid

Using a nonlinear (sinusoidal) transfer characteristic to shape a triangular waveform into a sinusoid.





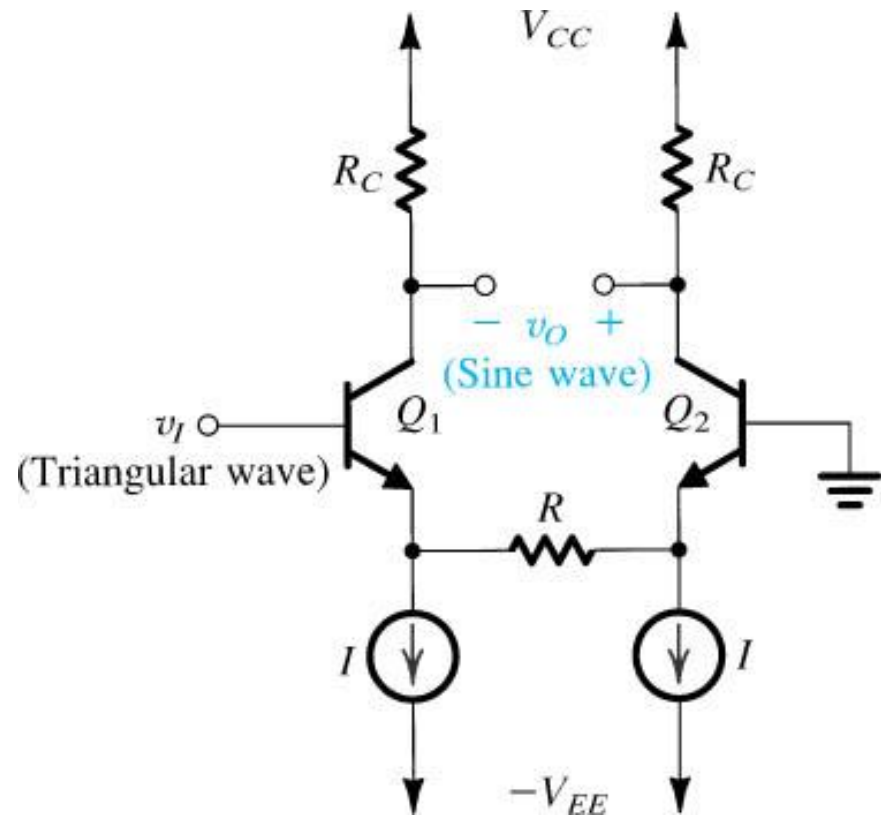
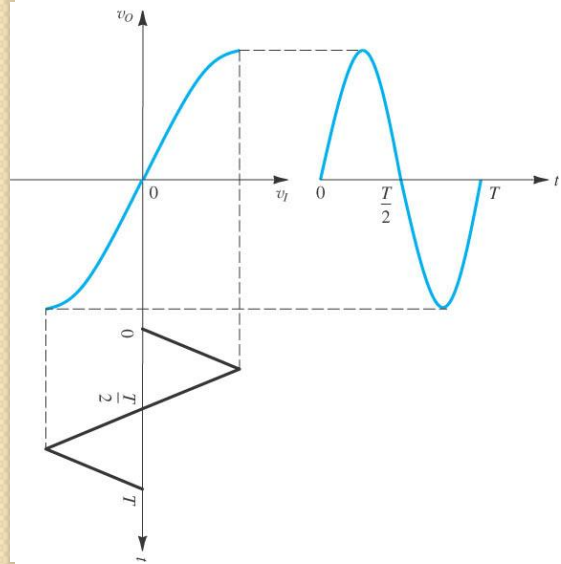
(a)



(b)

(a) A three-segment sine-wave shaper. **(b)** The input triangular waveform and the output approximately sinusoidal waveform.

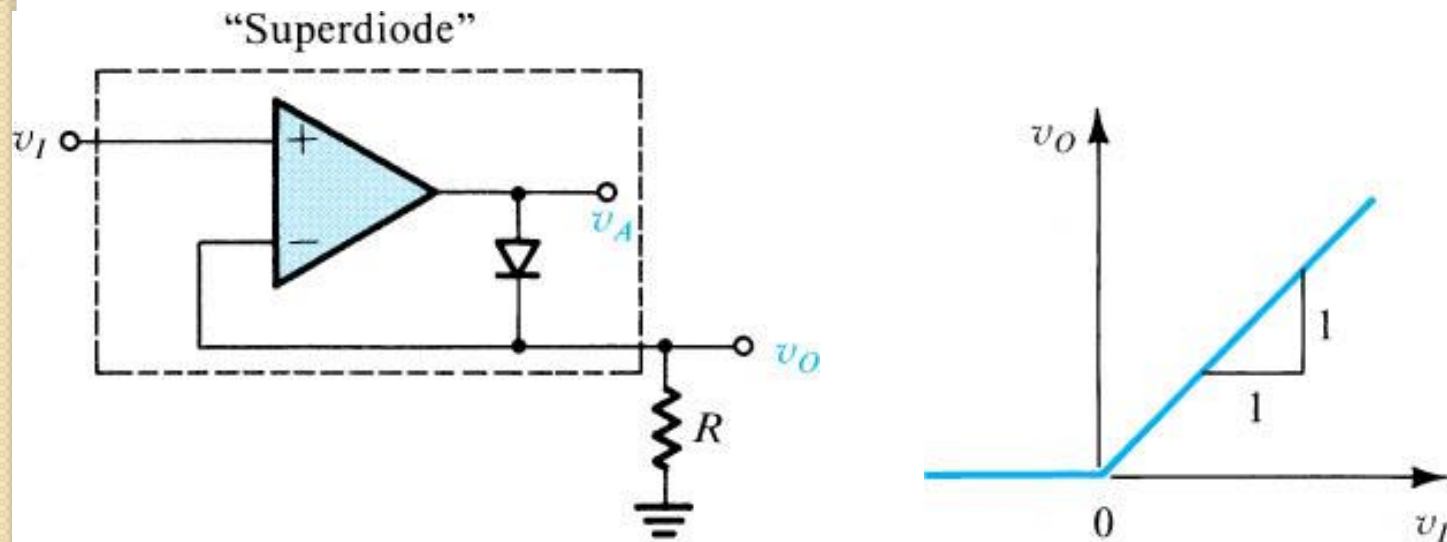
A differential pair with an emitter degeneration resistance used to implement a triangular-wave to sine-wave converter.



Superdiode

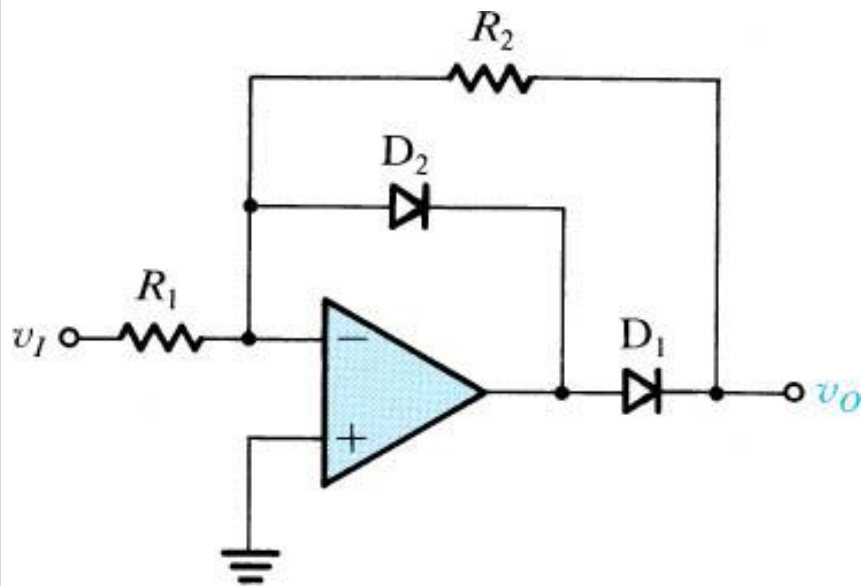
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when $v_I > 0$ and the diode conducts, the op amp supplies the load current, and the source is conveniently buffered, an added advantage.

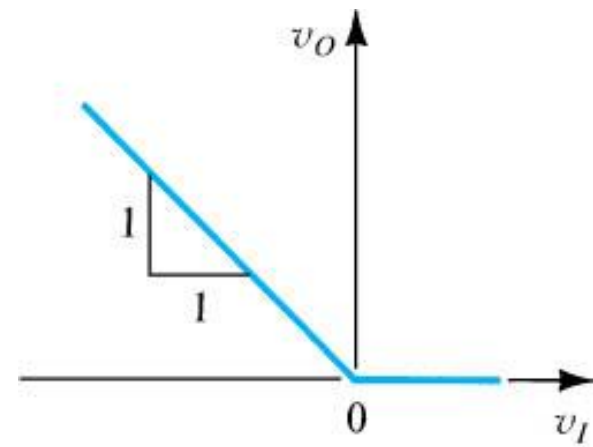


- (a) The “superdiode” precision half-wave rectifier and
(b) its almost ideal transfer characteristic.

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(a)



(b)

(a) An improved version of the precision half-wave rectifier: Diode D_2 is included to keep the feedback loop closed around the op amp during the off times of the rectifier diode D_1 , thus preventing the op amp from saturating.

(b) The transfer characteristic for $R_2 = R_1$.