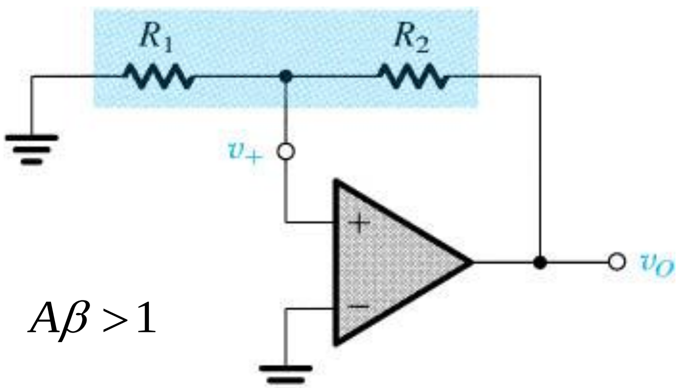
Lecture-2

Astable, Monostable and Bistable multivibrators, Schmitt trigger

Generation of Square and Triangular Waveforms

Bistable Multivibrators



$$A\beta > 1$$

$$\beta = R_1/(R_1 + R_2)$$

Figure A positive-feedback loop capable of bistable operation.

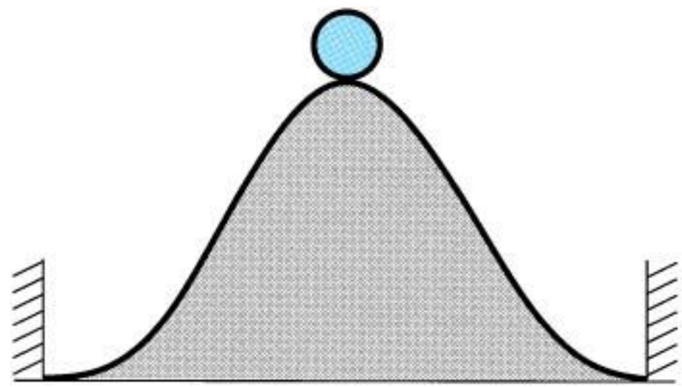
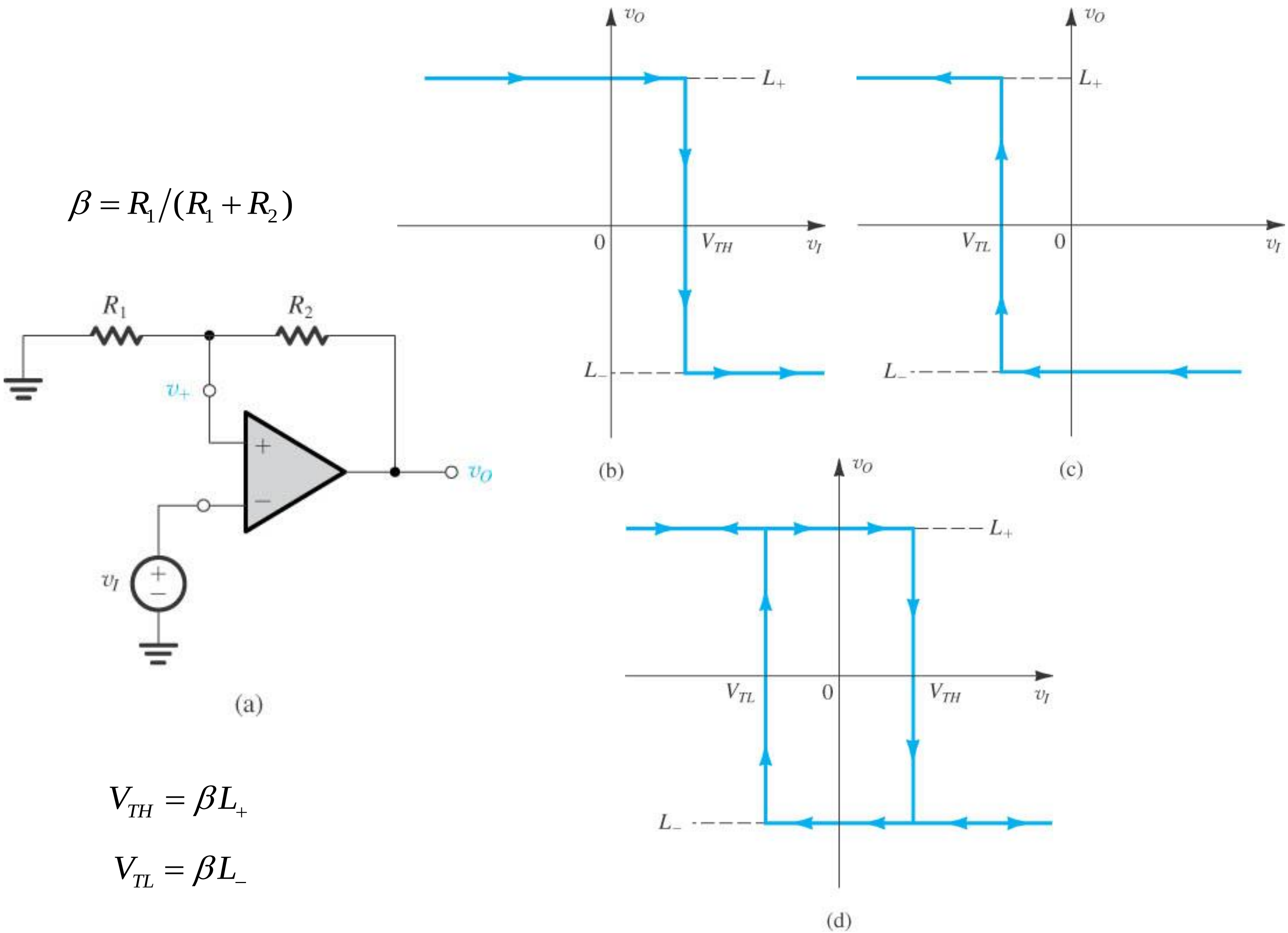


Figure A physical analogy for the operation of the bistable circuit. The ball cannot remain at the top of the hill for any length of time (a state of unstable equilibrium or metastability); the inevitably present disturbance will cause the ball to fall to one side or the other, where it can remain indefinitely (the two stable states).

$$\beta = R_1/(R_1 + R_2)$$

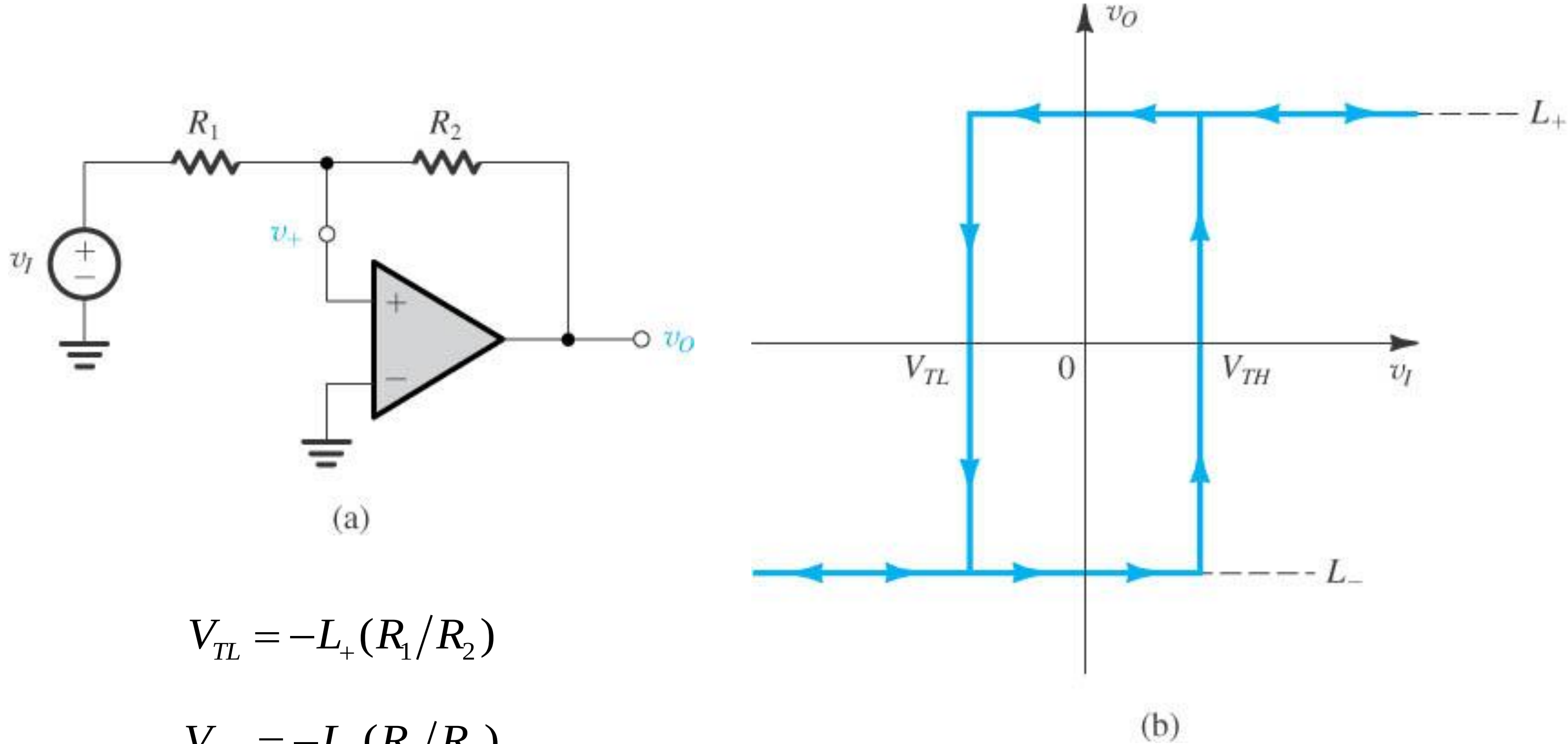


$$V_{TH} = \beta L_+$$

$$V_{TL} = \beta L_-$$

Figure **(a)** The bistable circuit of Fig. 13.17 with the negative input terminal of the op amp disconnected from ground and connected to an input signal v_I. **(b)** The transfer characteristic of the circuit in (a) for increasing v_I. **(c)** The transfer characteristic for decreasing v_I. **(d)** The complete transfer characteristics.

$$v_+ = v_I \frac{R_2}{R_1 + R_2} + v_O \frac{R_1}{R_1 + R_2}$$

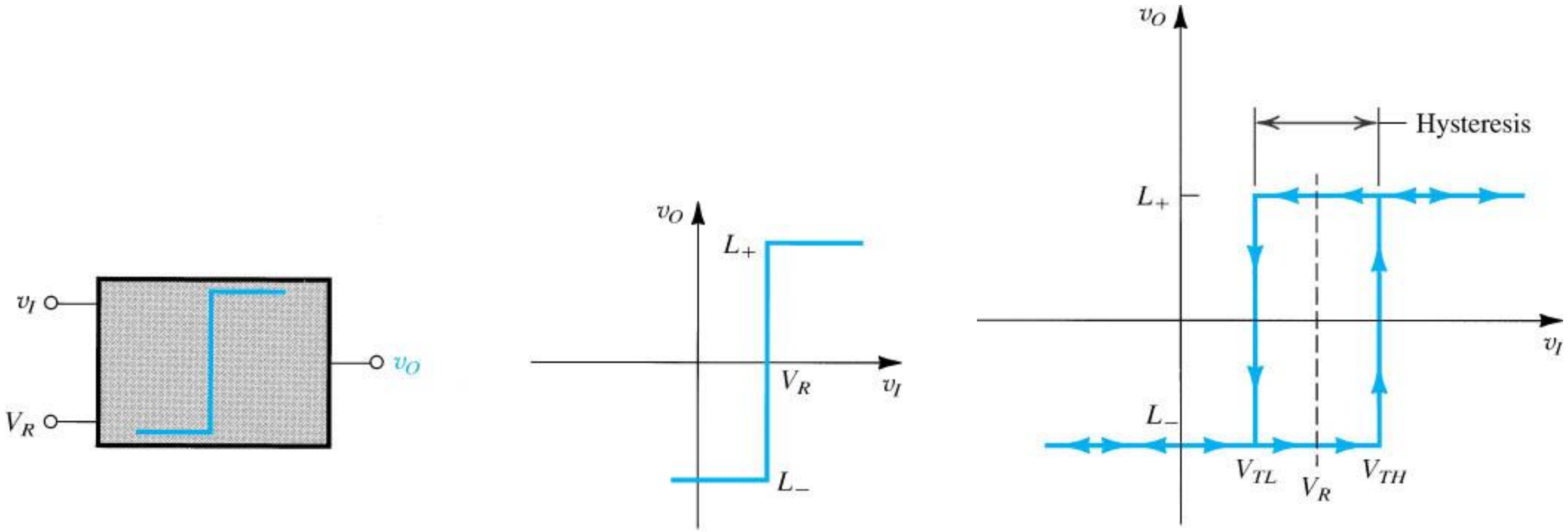


$$V_{TL} = -L_+(R_1/R_2)$$

$$V_{TH} = -L_-(R_1/R_2)$$

Figure (a) A bistable circuit derived from the positive-feedback loop of Fig. 13.17 by applying v_I through R_1. **(b)** The transfer characteristic of the circuit in (a) is noninverting. (Compare it to the inverting characteristic in Fig. 13.19d.)

Application of the Bistable Circuit as a Comparator



(a) (b)

Figure (a) Block diagram representation and transfer characteristic for a comparator having a reference, or threshold, voltage V_R. **(b)** Comparator characteristic with hysteresis.

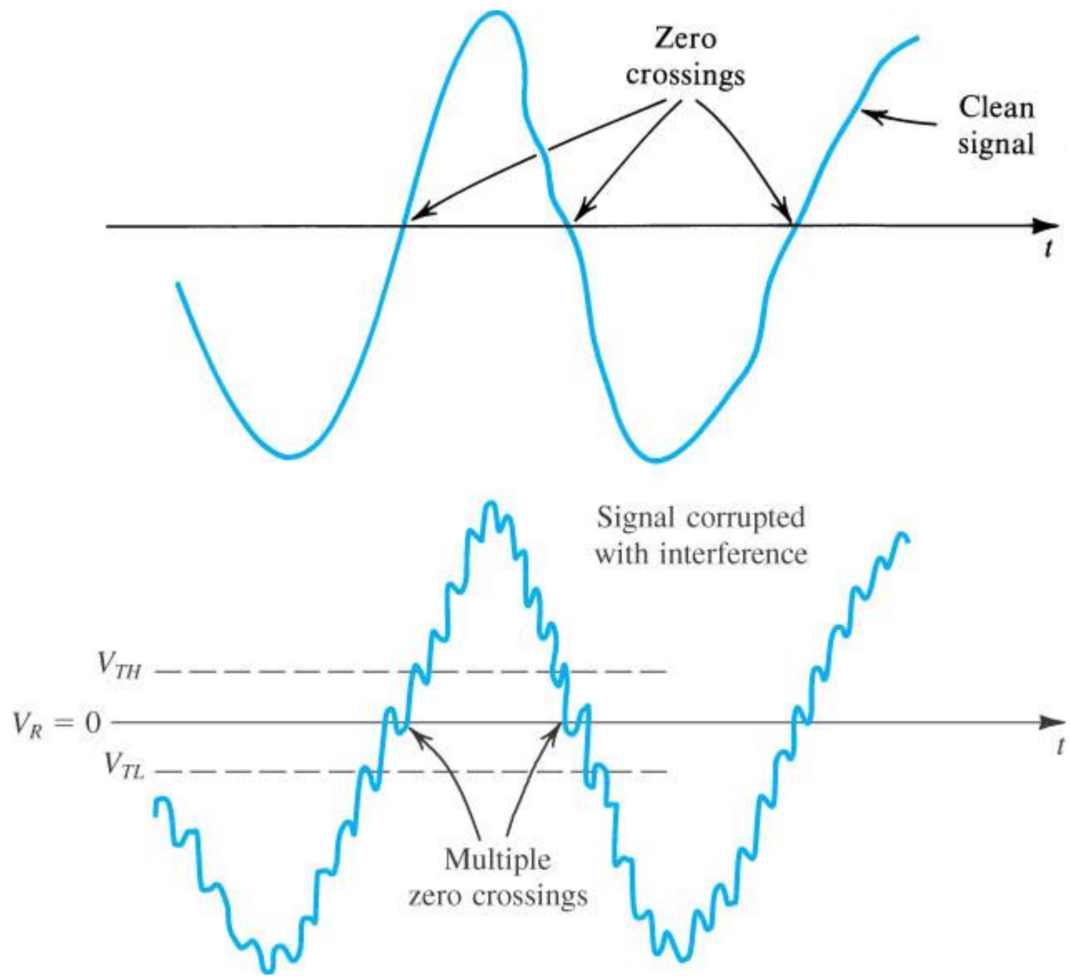
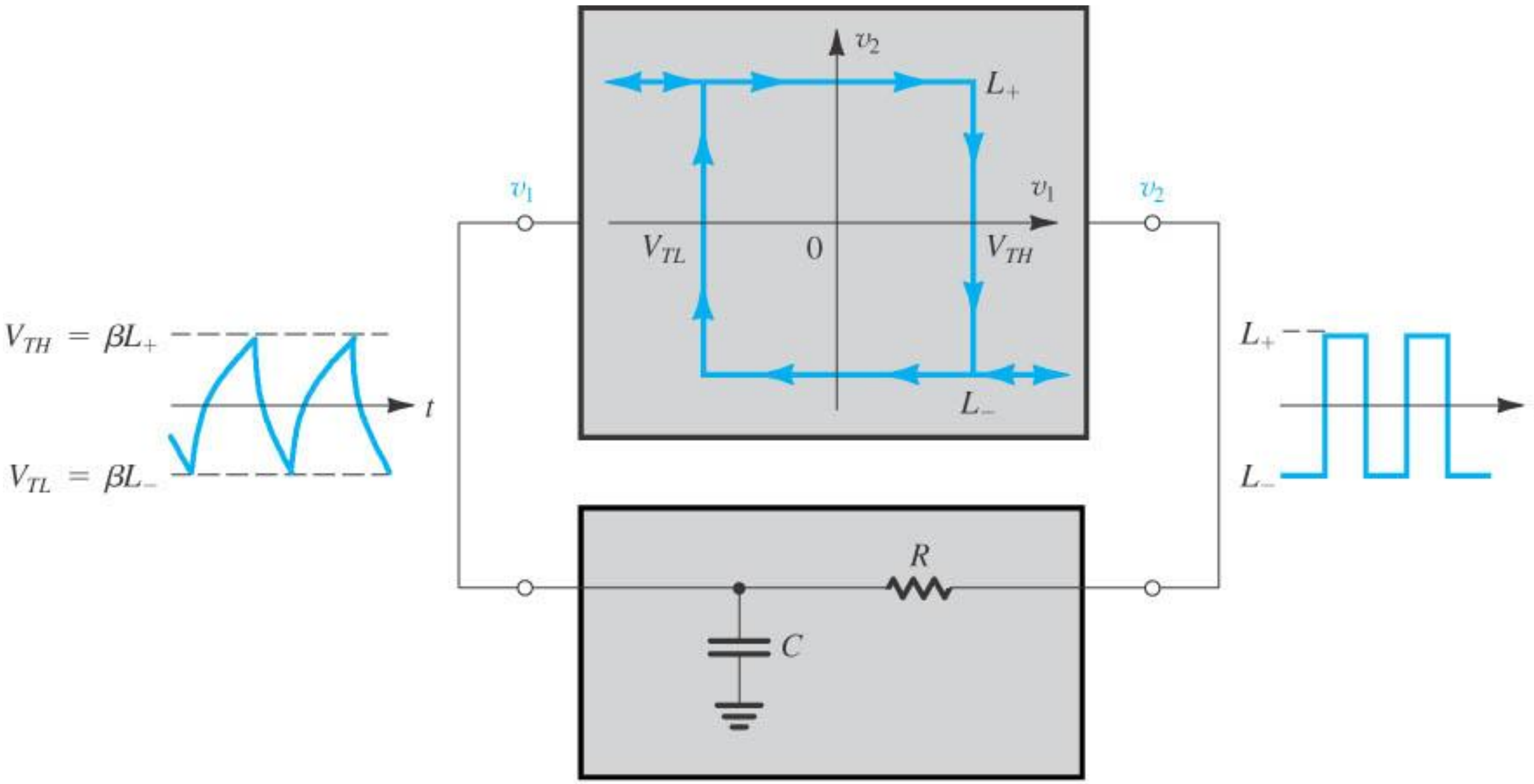


Figure Illustrating the use of hysteresis in the comparator characteristics as a means of rejecting interference.

Astable Multivibrators

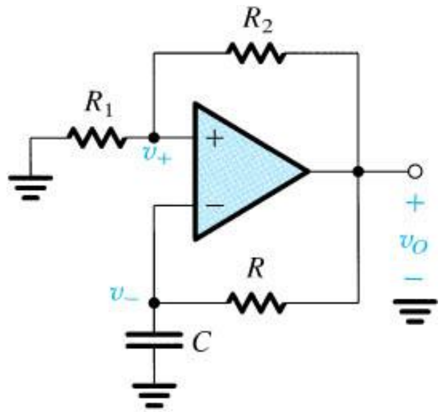


(a)

Figure (a) Connecting a bistable multivibrator with inverting transfer characteristics in a feedback loop with an RC circuit results in a square-wave generator.

$$\beta = R_1/(R_1 + R_2)$$

$$\tau = CR$$

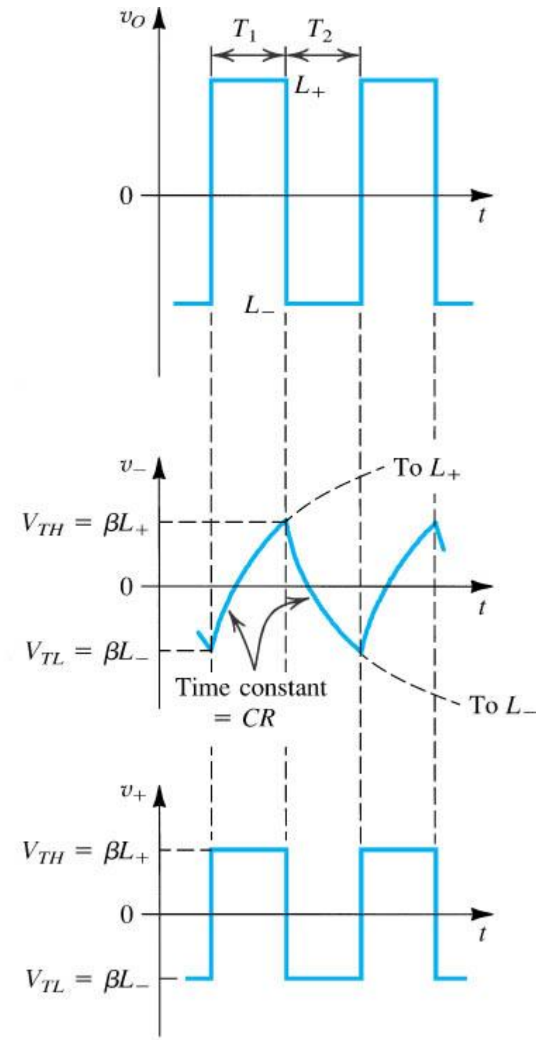


(b)

$$T_1: \quad v_- = L_+ - (L_+ - \beta L_-)e^{-t/\tau}$$

$$T_2: \quad v_- = L_- - (L_- - \beta L_+)e^{-t/\tau}$$

$$T = 2\tau \ln \frac{1+\beta}{1-\beta}$$



(c)

Figure *(Continued)* **(b)** The circuit obtained when the bistable multivibrator is implemented with the circuit of Fig. 13.19(a). **(c)** Waveforms at various nodes of the circuit in (b). This circuit is called an astable multivibrator.

Generation of Triangular Waveforms

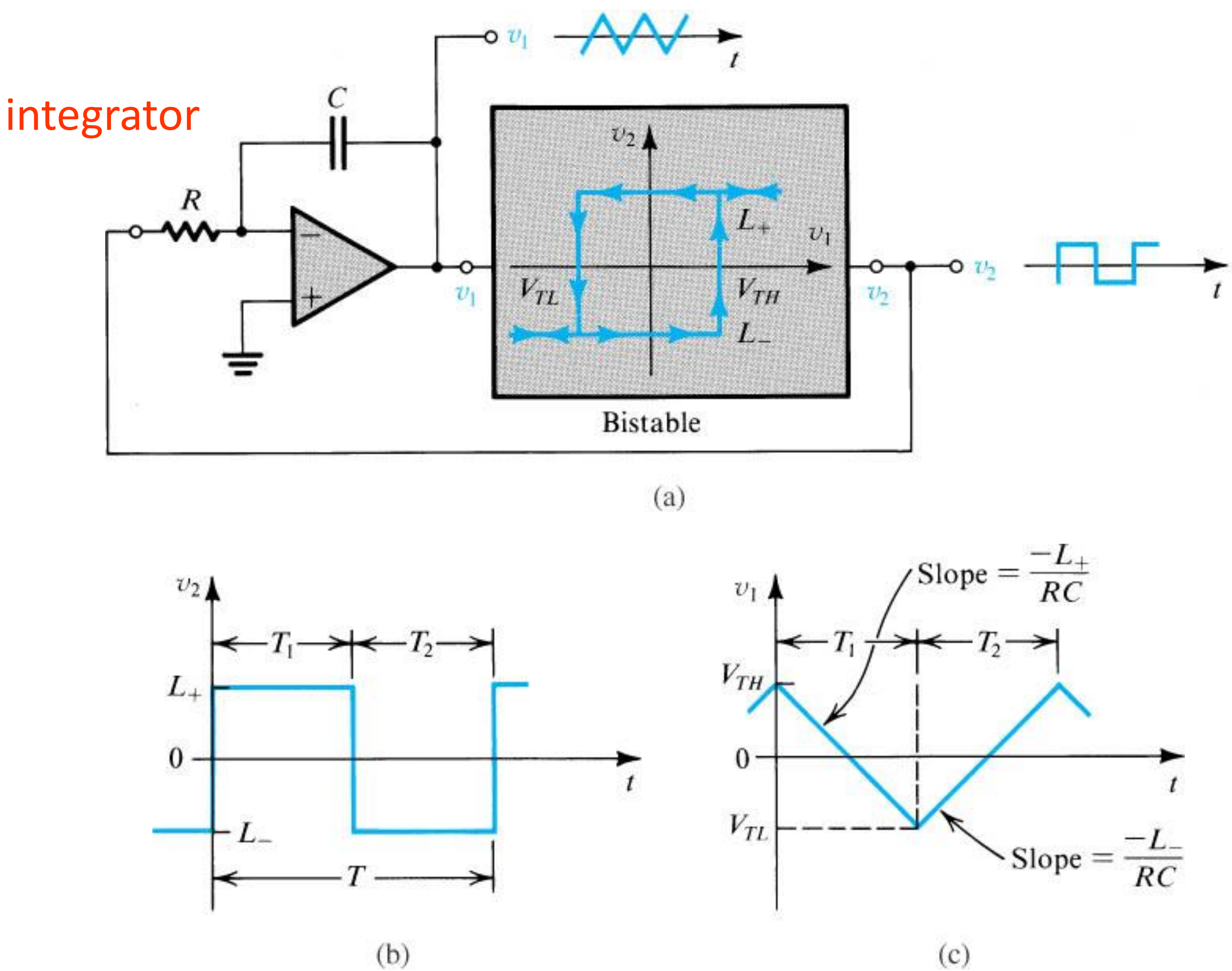


Figure A general scheme for generating triangular and square waveforms.

Monostable Multivibrators

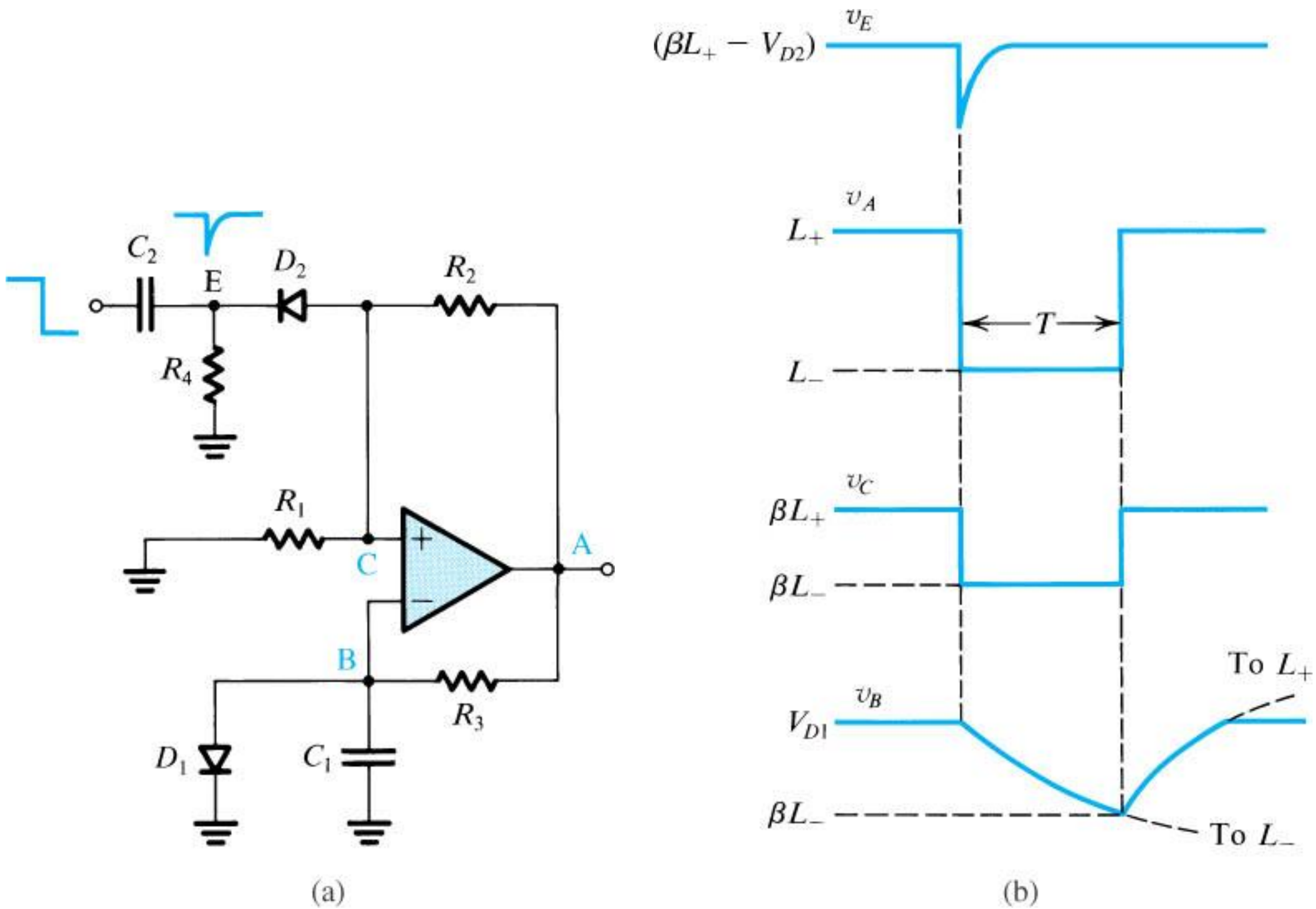


Figure (a) An op-amp monostable circuit. (**b**) Signal waveforms in the circuit of (a).