Symmetric square wave generator (or) Astable multivibrator:

The ckt represents a square wave generator. Some part of output signal is feedback to positive terminal of op-amp i.e., βV_o.

where V_o – is output voltage.

β – feedback factor.

where β can calculated by applying super position theorem.

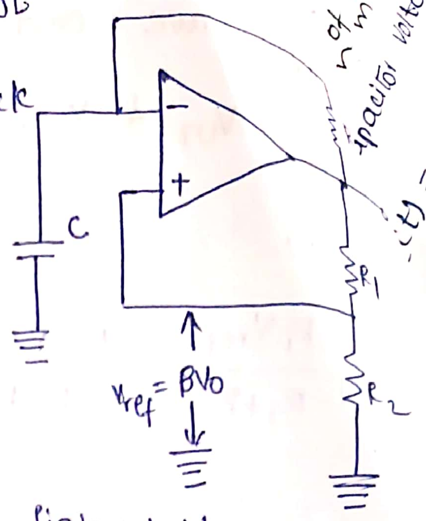


fig:- Astable multivibrator.

Both the states are Quasi states.

$$\beta = \frac{R_2}{R_1+R_2}$$

$$V_{ref} = \beta V_o = \frac{R_2}{R_1+R_2} V_o$$

V_{ref} varies inbetween $+\beta V_{sat}$ to $-\beta V_{sat}$.

The feedback is also feedback to Negative terminal through RC low pass combination.

Without any apply of input we are getting output so, it is called free running Oscillator.

When ever feedback voltage (V_{fed}) is greater than V_{ref} i.e., $V_{fed} > V_{ref}$ switching takes place (i.e., $+V_{sat} \to -V_{sat}$ (or) $-V_{sat} \to +V_{sat}$).

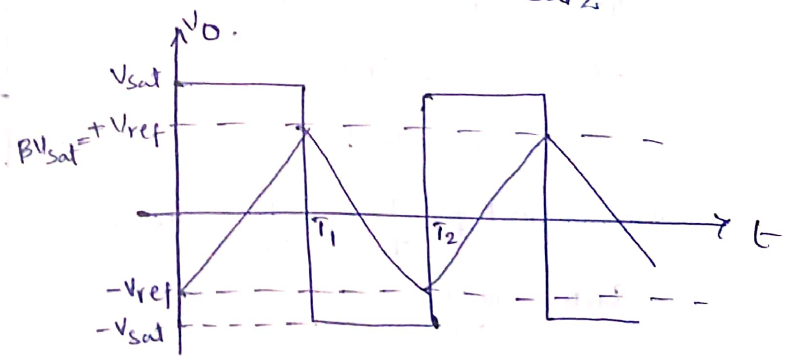
Initially. assume

if

$V_o = +V_{sat} \Rightarrow V_{ref} = \beta V_{sat}$.

capacitor gets charges upto $+V_{sat}$

when $\beta V_{sat} < V_{sat}$



$\therefore V_c > V_{ref}$

(Switching takes place)

$V_o = -V_{sat}$.

if $V_{ref} = -\beta V_{sat}$.

$V_o = -V_{sat}$.

f n^{of} sq. wave generator:-

Capacitor Voltage is given as

$$V_c(t) = V_{final} + (V_{initial} - V_{final})\, e^{-t/RC}$$

$$V_{final} = +V_{sat}$$

$$V_{initial} = -\beta V_{sat}$$

$$V_c(t) = V_{sat} + (-\beta V_{sat} - V_{sat})\, e^{-t/RC}$$

$$= V_{sat} - V_{sat}(1+\beta)\, e^{-t/RC}$$

$$V_c(t) = V_{sat}\left(1 - (1+\beta)\, e^{-t/RC}\right)$$

at time $t = T_1$ the capacitor charges to $+\beta V_{sat}$.

$$V_c(T_1) = \beta \cancel{V_{sat}} = \cancel{V_{sat}}\left(1 - (1+\beta)\, e^{-t_1/RC}\right)$$

$$1-\beta = (1+\beta)\, e^{-T_1/RC}$$

$$e^{+T_1/RC} = \frac{1+\beta}{1-\beta}$$

$$T_1 = RC \ln\left(\frac{1+\beta}{1-\beta}\right).$$

total Time period $T = 2RC \ln\left(\frac{1+\beta}{1-\beta}\right)$ ($\because$ Symmetric square wave).

$$\beta = \frac{R_2}{R_1+R_2} = \frac{1}{2} = 0.5 \quad (\because R_1 = R_2)$$

$$T = 2RC \ln\left(\frac{1.5}{0.5}\right).$$

$$T = 2RC \ln 3.$$

If $R_1 = 1.17 R_2$ then

$$T = 2RC$$

$$f_0 = \frac{1}{2RC}.$$

$V_0 = +V_{sat}$ to $-V_{sat}$

$$V_0 = 2V_{sat}.$$