Miller and Bootstrap Time-Base Generators:

To produce perfect voltage sweeps , there is a need to charge capacitor linearly instead of

Exponentially.

We know voltage across the capacitor is $v(t) = \frac{1}{C}\int idt$

If current flowing through capacitor is constant , then

$$v(t) = \frac{i}{C}t = \alpha t$$

It represents voltage across the capacitor increases linearly with time. Means capacitor charges linearly.

So if a **constant current** is flowing through a capacitor then capacitor charges linearly.

Basic principles:

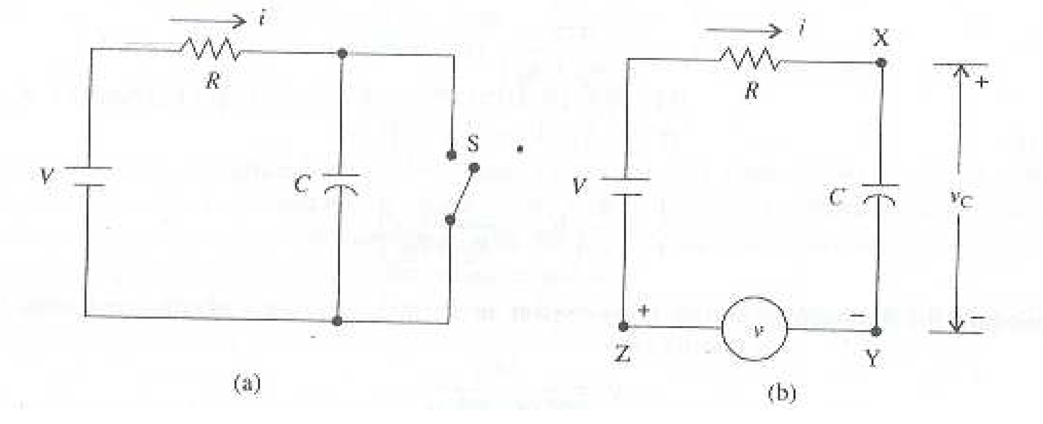
The basic sweep circuit(exponential charging circuit) is shown in figure(a). here

Current flowing through a capacitor is not constant. To make the current flowing

Through a capacitor is a constant one there is a need to introduce an auxiliary voltage

Source as shown in figure (b). consider magnitude of auxiliary voltage source is always

Kept equal to the voltage drop across capacitor.



Then by applying KVL to figure (b),

$$V - iR - v_C + v_C = 0$$

$$i = \frac{V}{R} = constant$$

So in figure (b) current flowing through capacitor is constant.

in figure (b) no one terminal is grounded but generally we requires grounding.

If point Z is grounded:

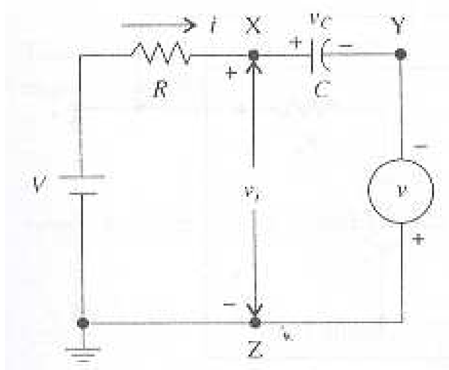
Now figure (b) is redrawn as shown below

Here a linear sweep will appear between

Point Y and Z .

Here linear sweep will increase in the negative

Direction.

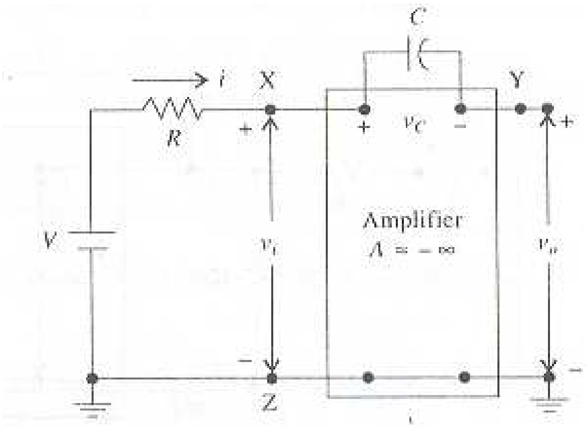


Now we need to replace an auxiliary (imaginary) voltage source with an existing

electronic device like an amplifier.

Let us now replace the auxiliary voltage source by an amplifier with output terminals YZ

and input terminals XZ as in figure below.



Since we have assumed that the magnitude of the auxiliary voltage source equals the voltage across the capacitor at every instant of time, then the input $v_i(t)$ to the amplifier is zero. So to get finite output ,the amplifier gain A should ideally be infinite.

The above circuit is considered as **Miller integrator or Miller sweep circuit**

If point Y is grounded:

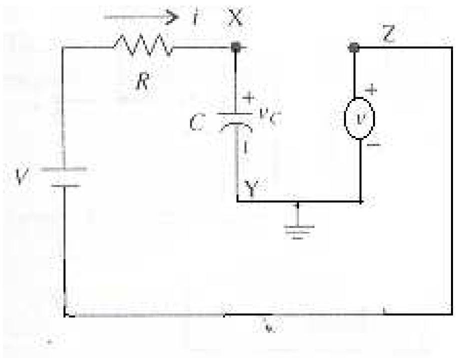
Now figure (b) is redrawn as shown below

Here a linear sweep will appear between

Point Z and Y .

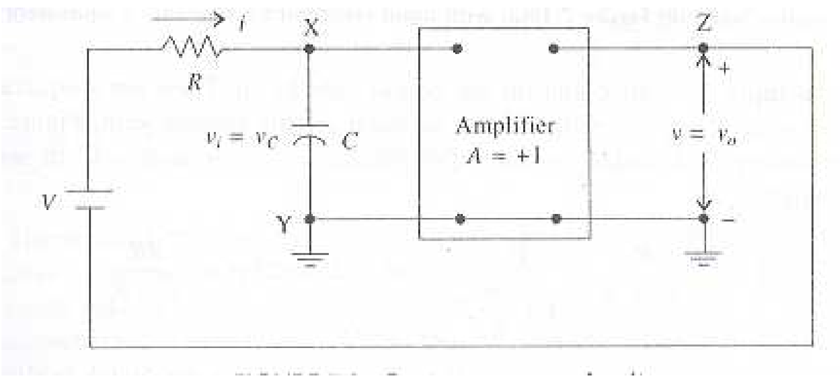
Here linear sweep will increase in the positive

Direction.



Let us now replace the auxiliary voltage source by an amplifier with output terminals ZY

and input terminals XY as in figure below.



Since we have assumed that v(t) = v_c(t) , Then $v_o(t) = v_i(t)$ and the amplifier

Voltage gain A must equal unity.

This circuit is referred to as a **Bootstrap sweep circuit**

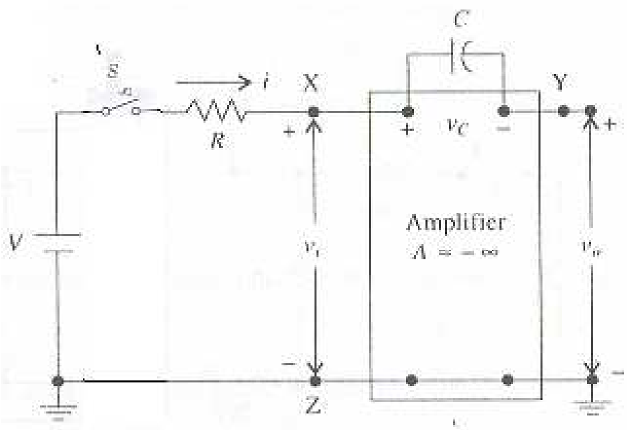
To control the charging and discharging of a capacitor switch is very much essential in

sweep circuits.

Miller sweep circuit with switch:

Circuit is shown below.

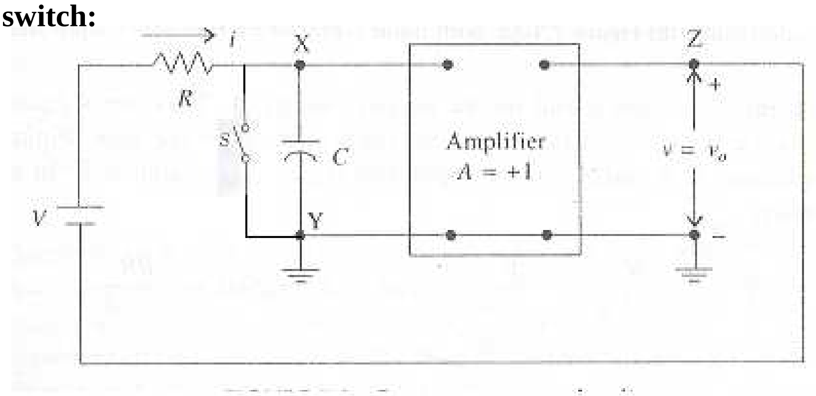
TIME BASE GENERATOR



Here if switch closes , capacitor charges

If switch is open , capacitor discharges.

Bootstrap sweep circuit with switch:



Circuit is shown below.

Here if switch is open ,

capacitor charges

If switch closes ,

capacitor discharges.