Experiment no.10

§ Integrator Op-amp §

10.1 Objective:

To design and study the Integrator operational amplifier.

10.2 Theory:

The integrator Op-amp produces an output voltage that is both proportional to the amplitude and duration of the input signal.

Operational amplifiers can be used as part of a positive or negative feedback amplifier or as an adder or subtractor type circuit using just pure resistances in both the input and the feedback loop.

But what if we went to change the purely resistive (R*f*) feedback element of an inverting amplifier to that of a frequency dependent reactance , (X) type complex element , such as a Capacitor , C . What would be the effect on the op-amps output voltage over its frequency range?

By replacing this feedback resistance with a capacitor we now have an RC Network connected across the operational amplifiers feedback path producing another type of operational amplifier circuit commonly called an Op-amp Integrator circuit as shown below:

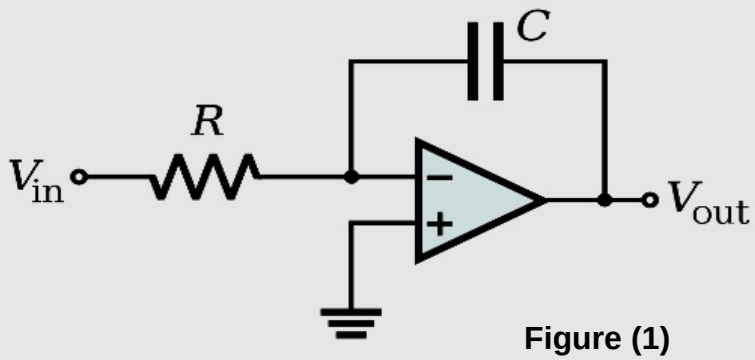

Figure (1)

$$V_{out} = -\int_0^t \frac{V_{in}}{RC}\,dt + V_{initial}$$

As its name implies , the Op-amp Integrator is an operational amplifier circuit that performs the mathematical operation of Integration, that is we can cause the output to respond to changes in the input voltage over time as the op-amp integrator produces an output voltage which is proportional to the integral of the input voltage.

- ***Op_amp Integrator Ramp Generator:***

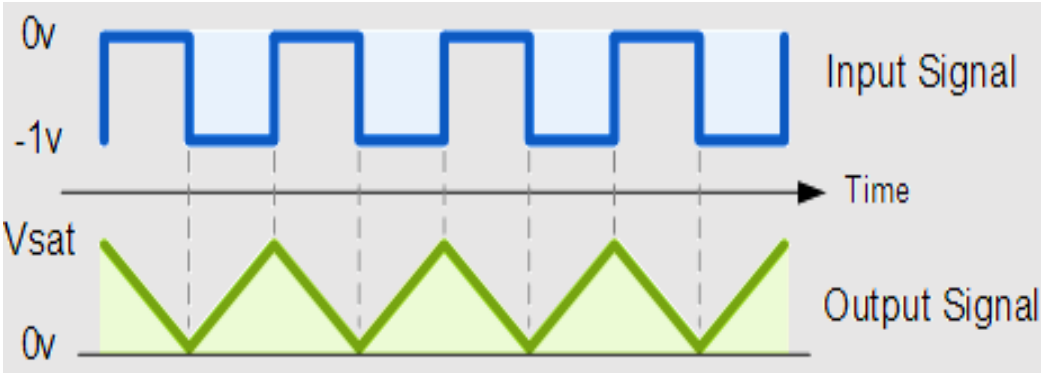

Figure (2)

$$V_{out} = -\frac{1}{R_{in}C}\int_0^t V_{in}\,dt = -\int_0^t V_{in}\frac{dt}{R_{in}.C}$$

10.3 Procedure:

1. Enter specific (input voltage) (1V) and frequency (200Hz) from the power supply device and draw input waveform (Square wave) by using Oscilloscope.

2. Connect the circuit shown in the figure (3).

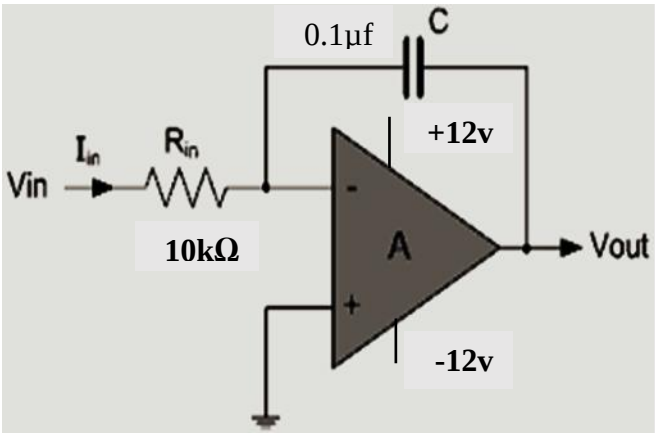

Figure (3)

3. Connect the first terminal of **OSC** to the output terminal of op-amp and second terminal of **OSC** to the ground.

4. Turn on the circuit and Draw output waveform (triangle wave) by using Oscilloscope. (Must be 4v opposite to the in/p waveform)

10.4 Discussion:

1. Calculate the value of the (Vout) theoretically?
2. What is the integrator operational amplifier?