Experiment – 7

Title: Study of differentiator and integrator circuit using Op-Amp

Objective:

I) To study OPAMP as a differentiator .
II) To study OPAMP as a integrator.

Theory:

Differentiator Amplifier:-

The basic differentiator amplifier circuit is the exact opposite to that of the Integrator Operational amplifier circuit. Here, the position of the capacitor and resistor have been reversed And now the Capacitor, C is connected to the input terminal of the inverting amplifier while the Resistor, Rf forms the negative feedback element across the operational amplifier. This circuit Performs the mathematical operation of Differentiation, i.e. it produces a voltage output which is proportional to rate-of-change of the input voltage and the current flowing through the Capacitor. In other words the faster or larger the change to the input voltage signal, the greater the input current, the greater will be the output voltage change in response becoming more of a “spike” in shape.

Integrator Amplifier:-

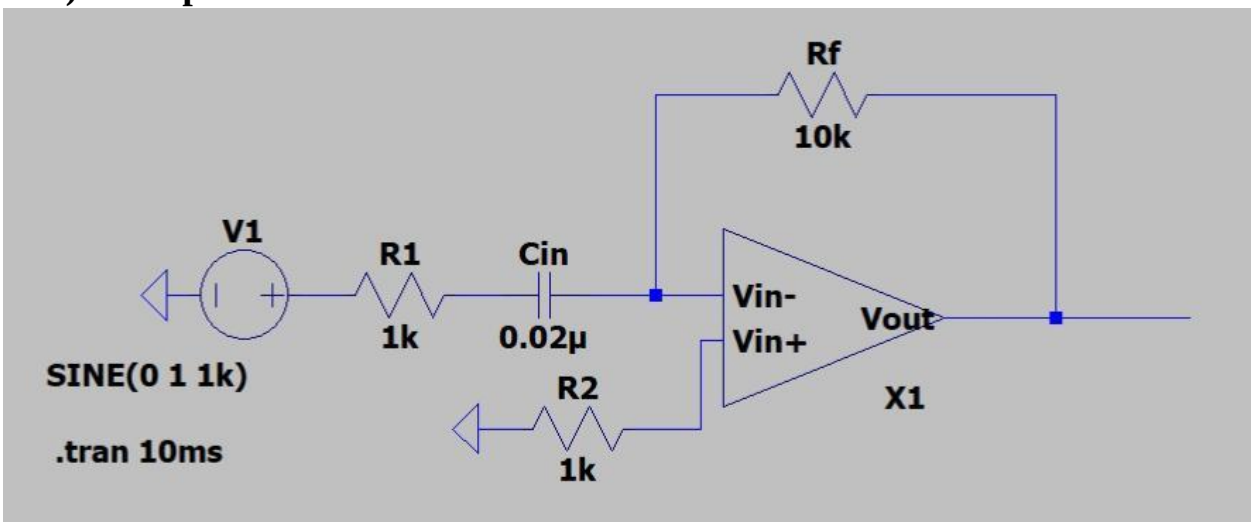
As its name implies, the Op-amp Integrator is an operational amplifier circuit that performs the mathematical operation of Integration, that is we can cause the output to respond to changes in the input voltage over time as the op-amp integrator produces an output voltage which is proportional to the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

In other words the magnitude of the output signal is determined by the length of time a voltage is present at its input as the current through the feedback loop charges or discharges the capacitor as the required negative feedback occurs through the capacitor.

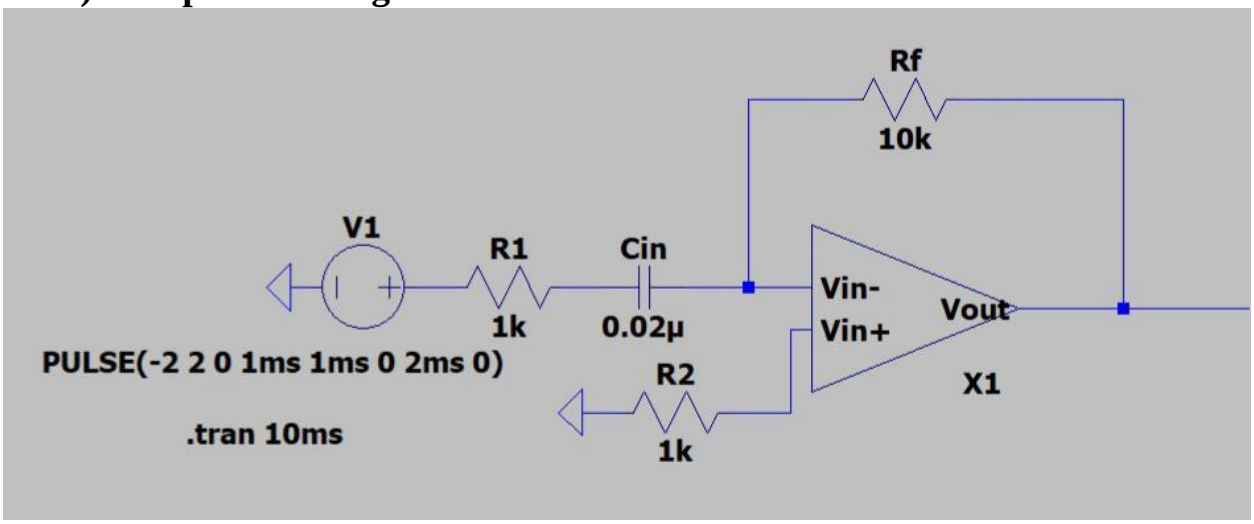
Circuit Diagram:-

Differentiator Amplifier:-

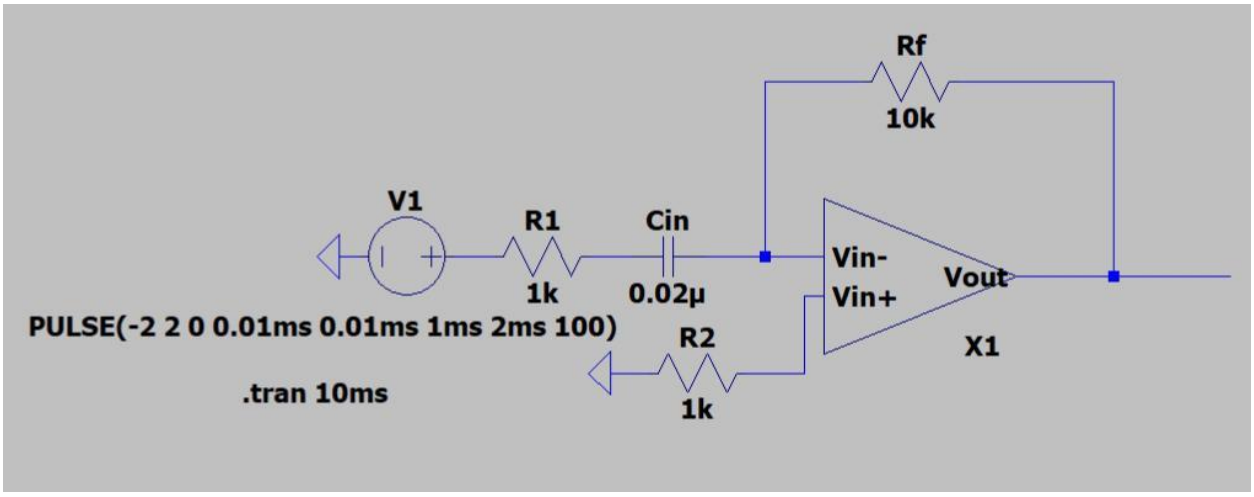
I) Input:- sine wave



II) Input :- Triangular wave

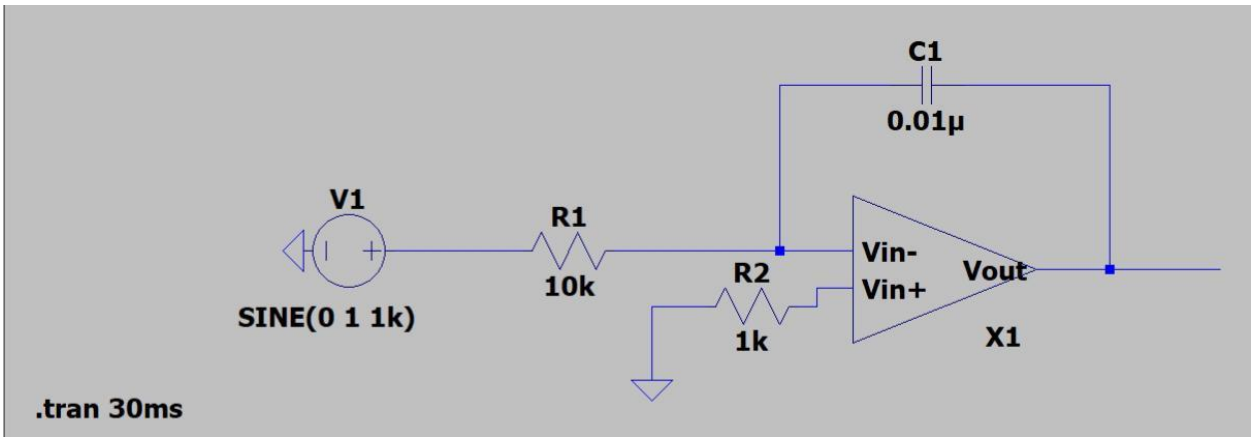


III) Input:- Square wavefrom

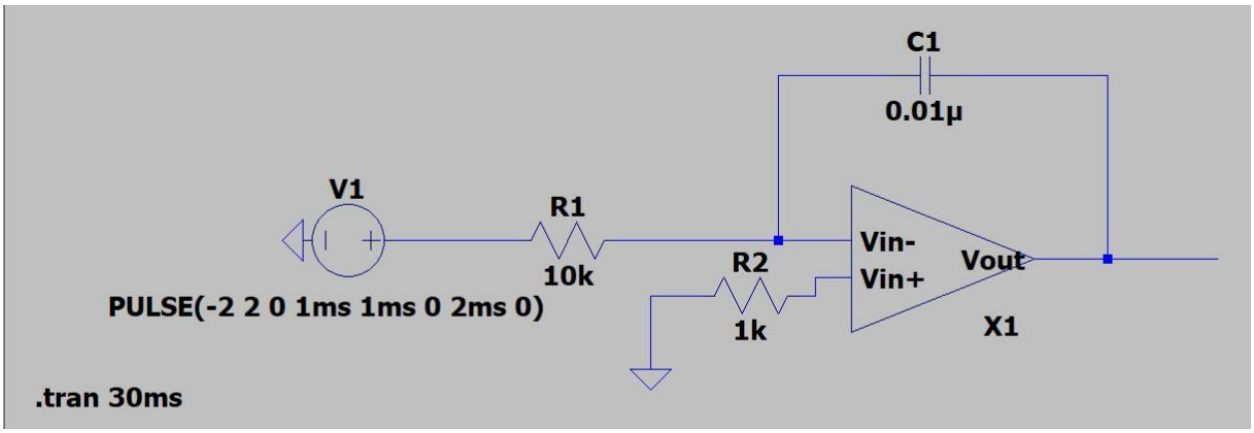


Integrator Amplifier:-

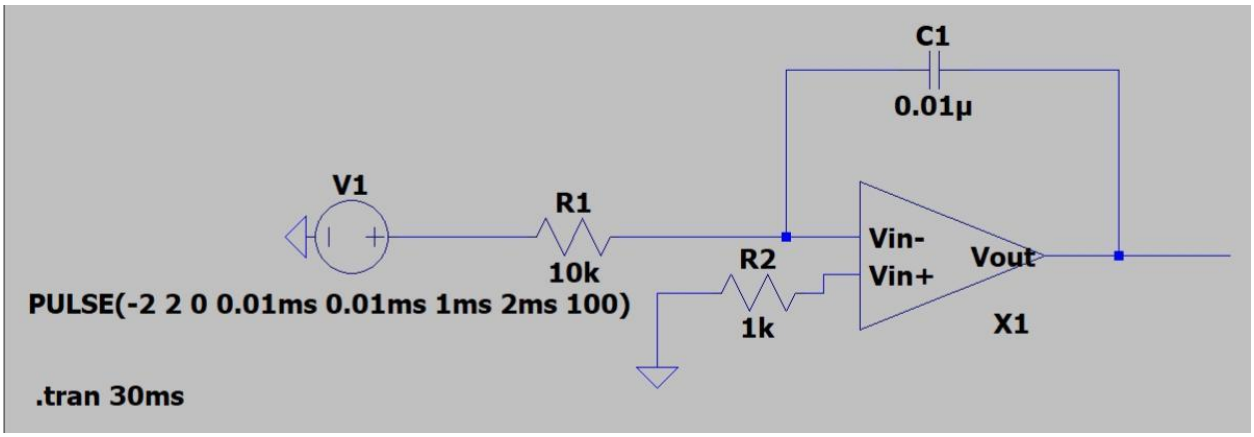
I) Input:- Sine wave



II) Input:-Triangular wave



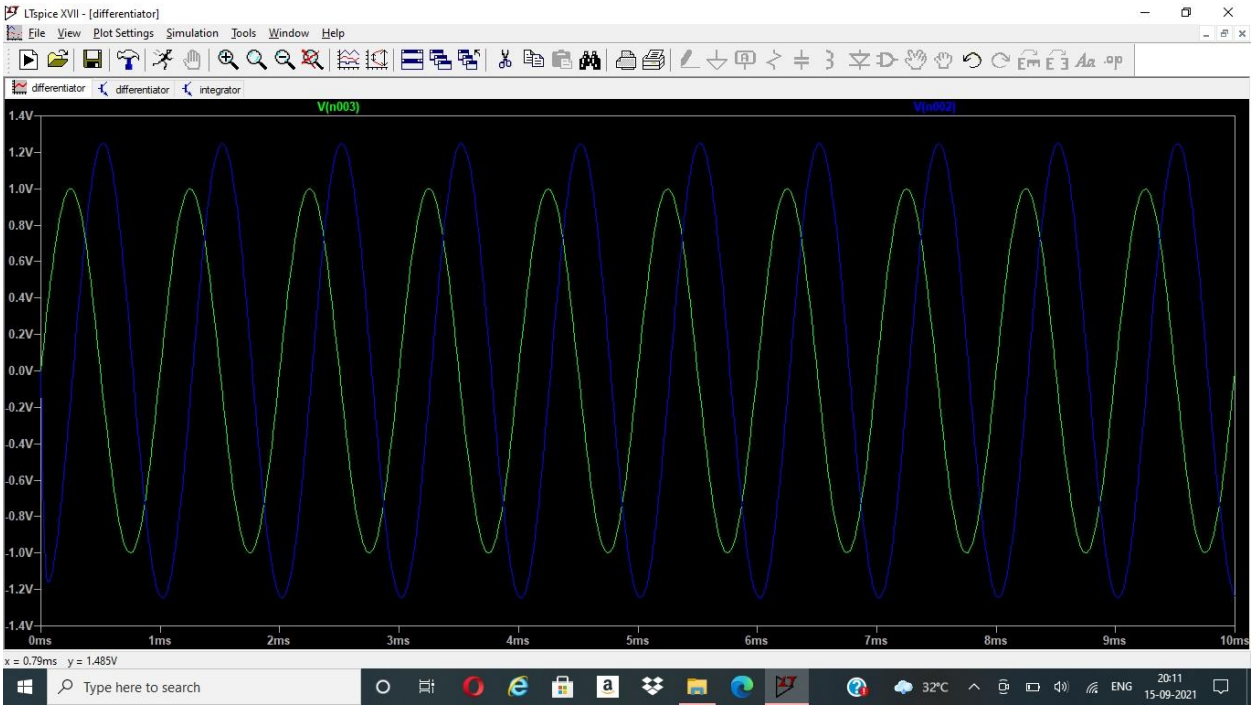
III) Input :- Square wave



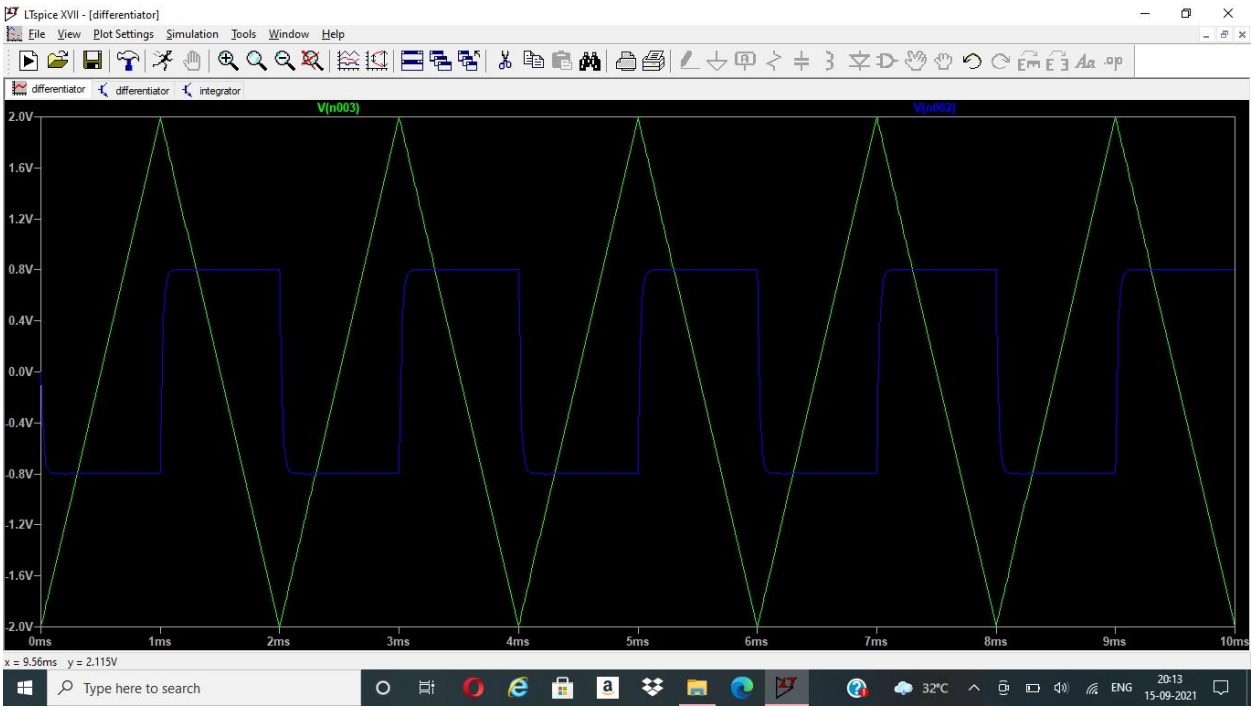
Graph(Output wavefrom):-

Differentiator Amplifier:-

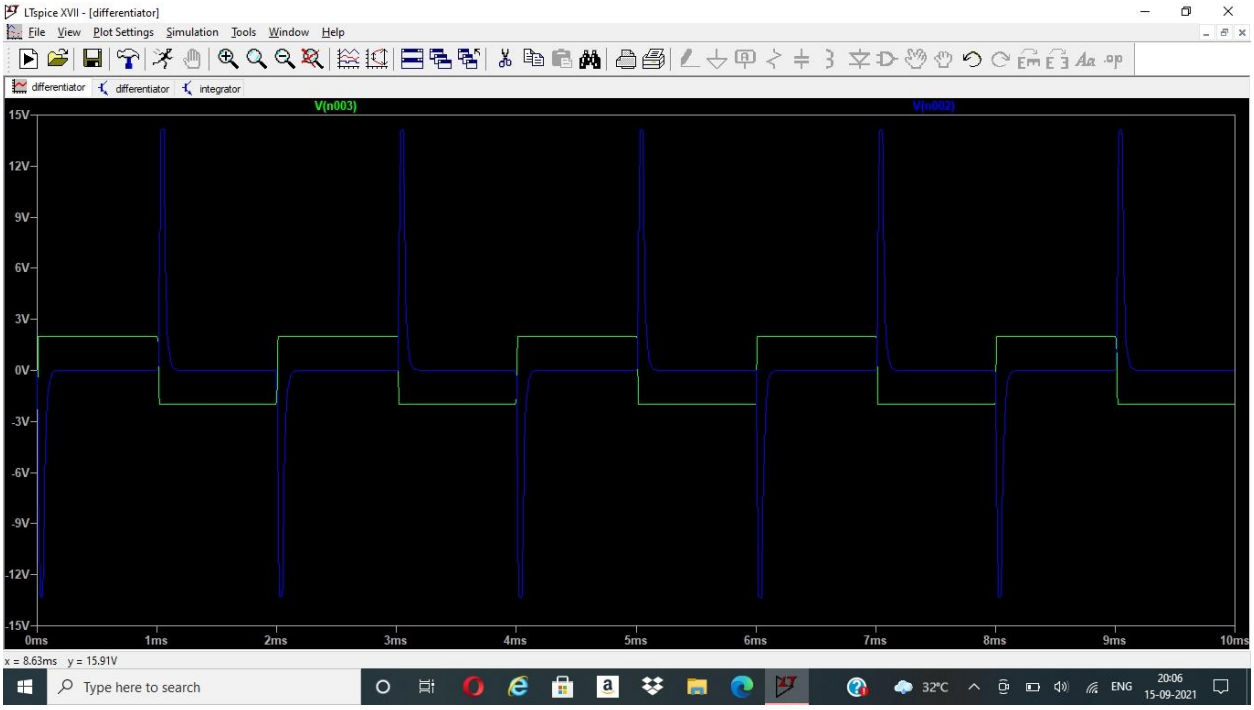
I) Input = Sine , output= cosine(inverted sine)



II) Input= Triangular, output= Square

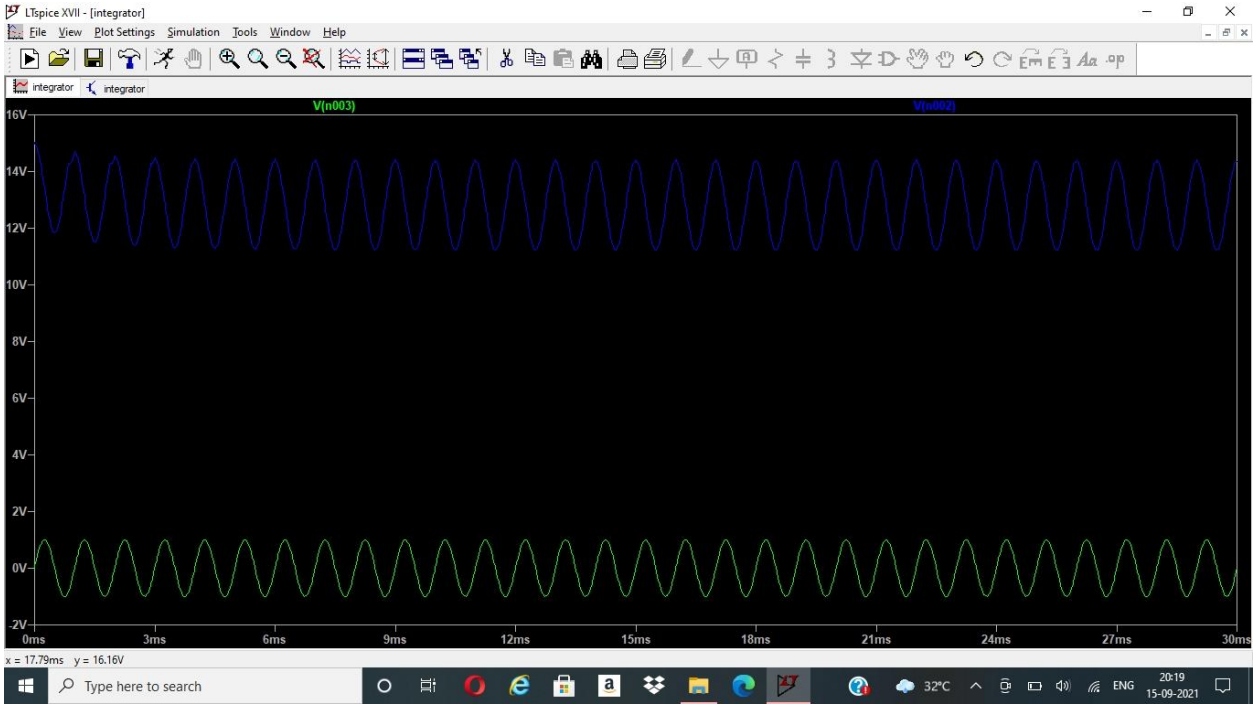


III) Input = Square, output= spikes

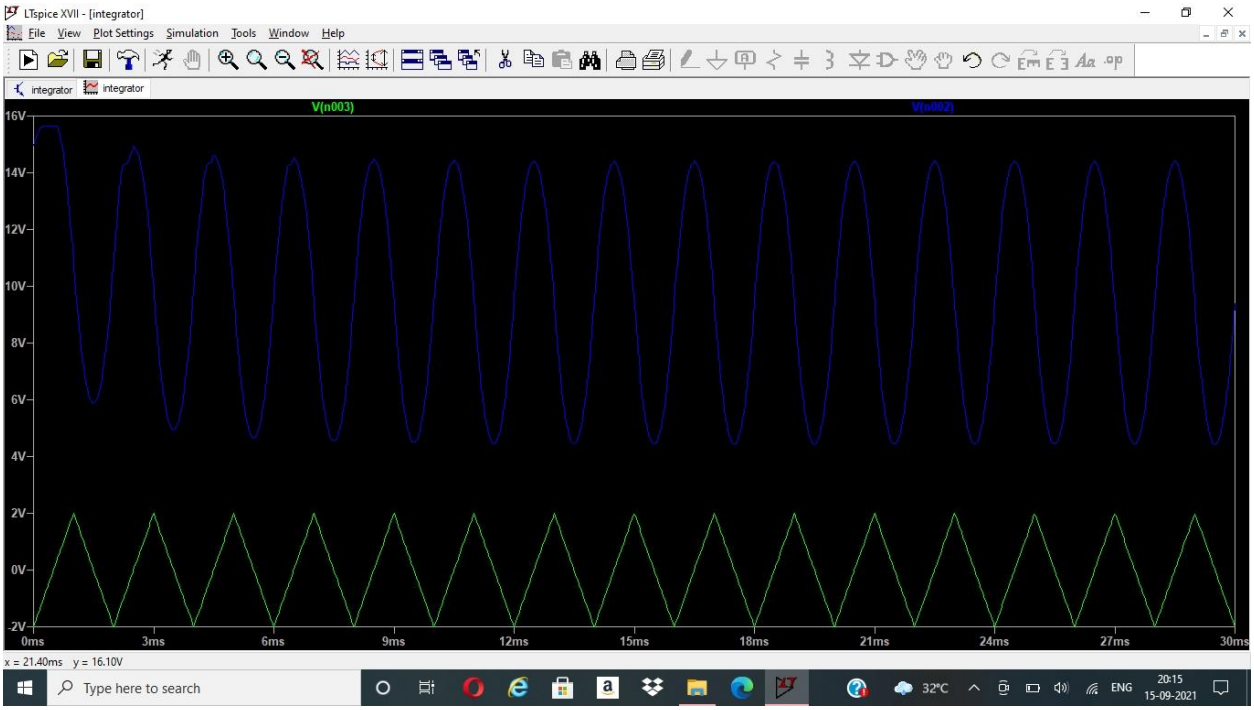


Integrator Amplifier:-

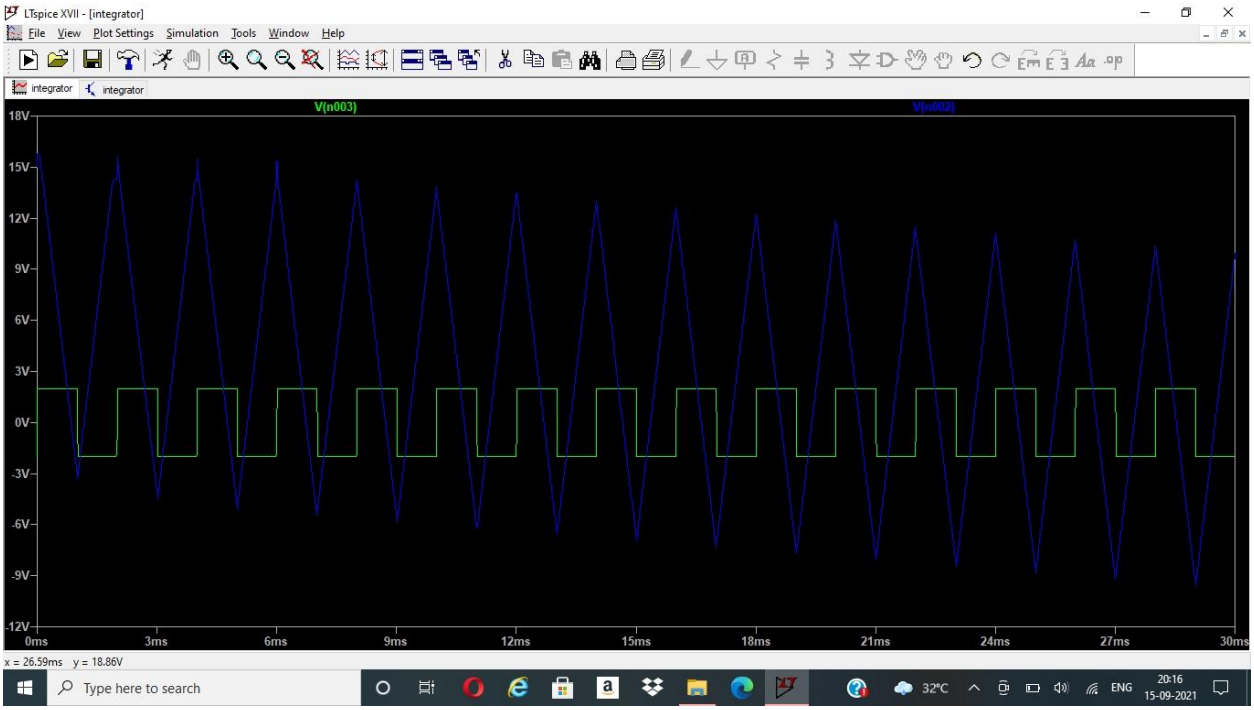
I) Input= sine , output= cosine



II) Input = Triangular , output =parabolic



III) Input = Square , output= Triangular



Result:

For differentiator Amplifier:-

Input wavefrom	Output wavefrom
Square	Spikes
Triangular	Square
Sine	Cosine(Inverted sine)

For Integrator Amplifier:-

Input wavefrom	Output wavefrom
Square	Triangular
Triangular	Parabolic

Sine	Cosine

Discussion:-

The differentiator and integrator circuit design output waveforms have been studied. From the result we can observe that differentiator circuit produces the output wavefrom which is the differentiation of input wavefrom while integrator circuit produces the output wavefrom which is the integration of input wavefrom.