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1. **Aim of the experiment:**

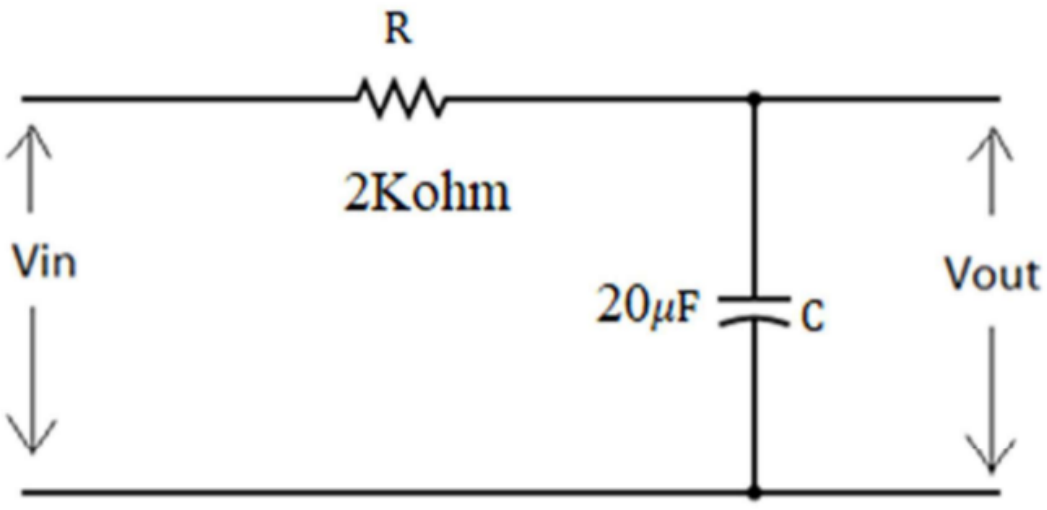
   To

   - Mention circuit can act as an integrator or differentiator.
   - Range of input pulse width so that circuit behaves as integrator/differentiator.

Apply square wave input of 1.2V pp to the circuit as shown in the figure. Mention whether the circuit can act as an integrator or differentiator.

Also mention the range of input pulse width so that the circuit behaves as integrator/differentiator.

Choose one among the mentioned pulse width range of square input wave and simulate the circuit. Show the corresponding input and output waveform over time axis.

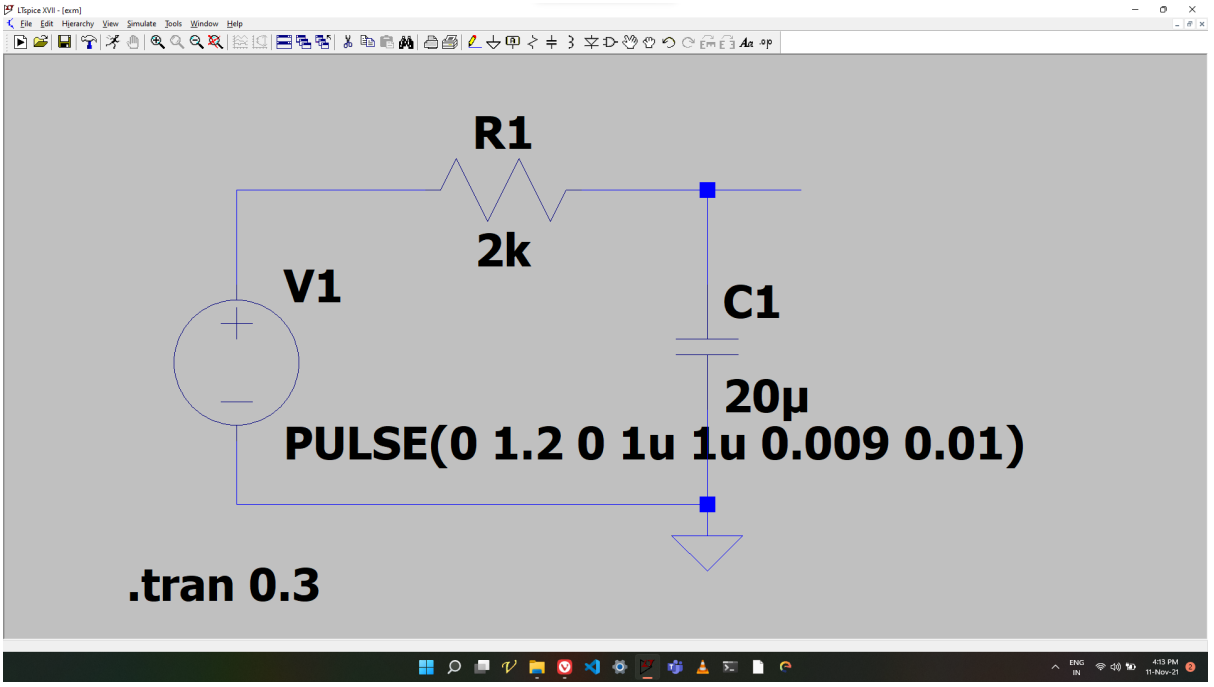


2. **Tools used:** Pulse voltage source, Resistor, Capacitor, Oscilloscope.

3. Background knowledge (brief):

RC Integrator - The circuit that converts/integrates square wave input signal into an approximate triangular wave signal.

4. Circuit (hand-drawn/image):



_____R1 = 2KΩ , C1 = 20µ , Von = 1.2V , Trise = Tfall = 1µ.

5. Calculations/Implementation:

The given circuit is RC.So, it can only act as an Integrator circuit *provided $T << RC$*.

So,let us take f = 100Hz => T = 1/100 = 0.01s.

To determine condition for which circuit act as Integrator circuit:-

$$T << RC$$

$$RC = 20{,}000 \times 20 \times 10^{-6}$$

$$= 0.04$$

$$\boxed{T << 0.04}$$

∴ The Time period should be low than 0.04seconds.

(or)

$$\frac{1}{f} << 0.04 \quad (\because T = 1/f)$$

f = frequency of input pulse wave

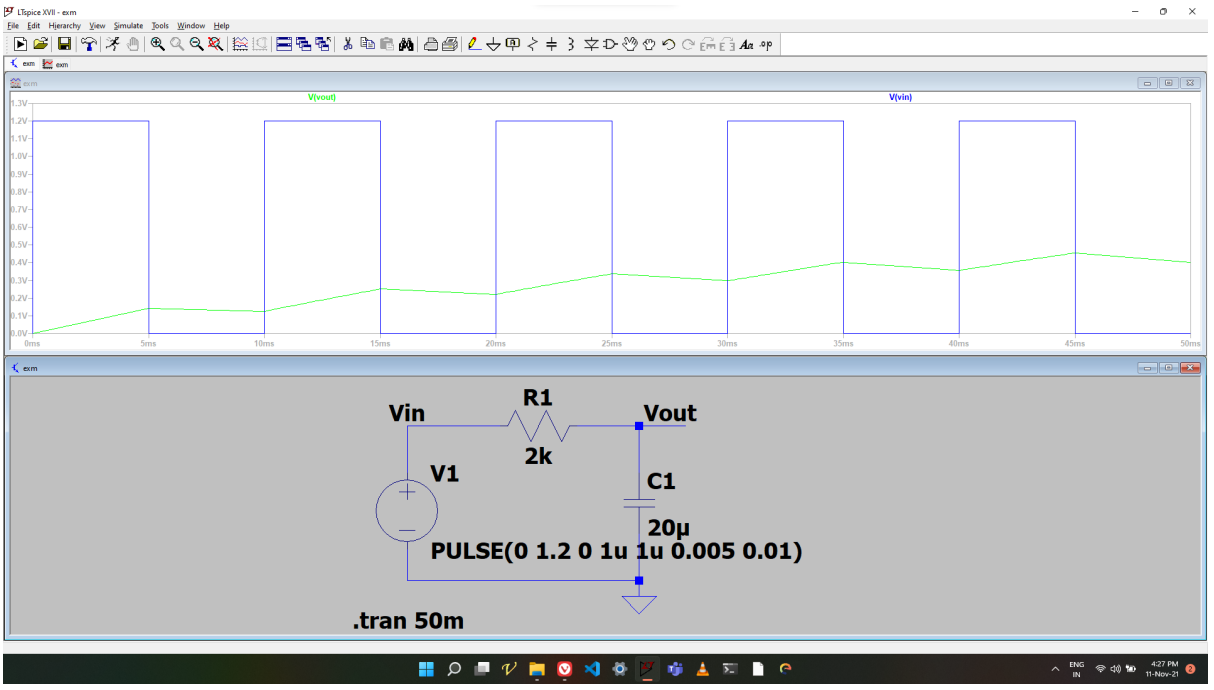
$$f >> \frac{1}{0.04}$$

$$\boxed{f >> 25}$$

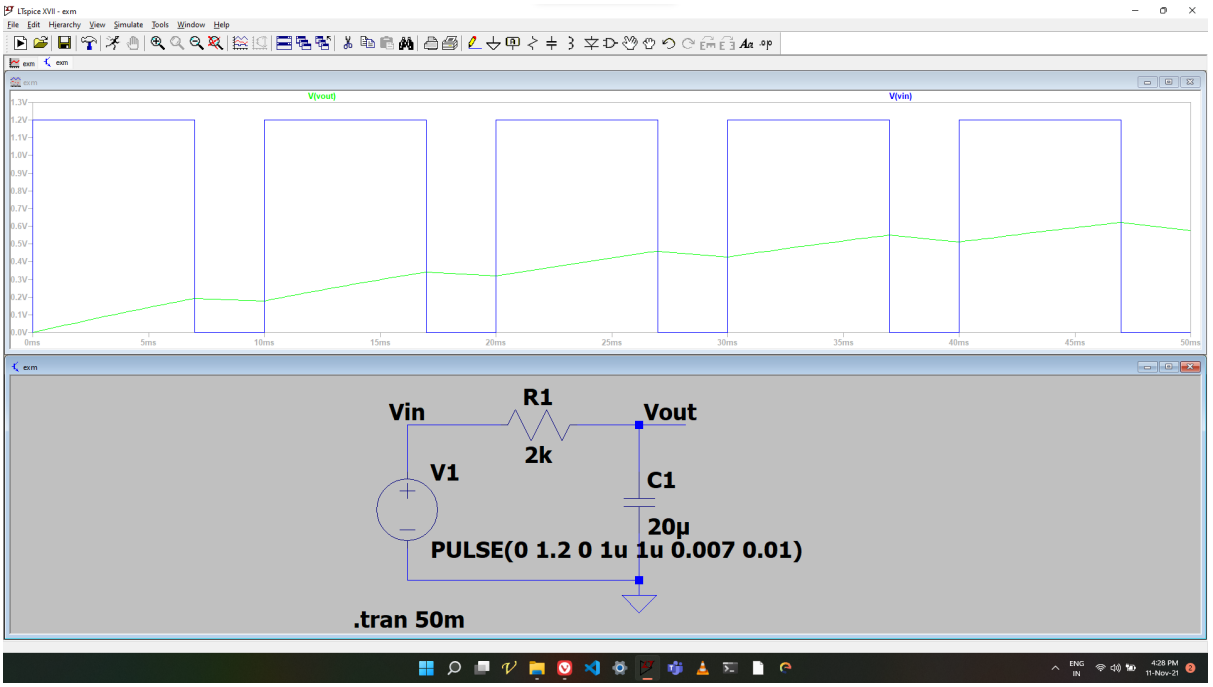
So, for the given circuit to act as Integrator frequency of input pulse wave should be larger than 25 Hz.

6. Graph (Image)/Screenshots:

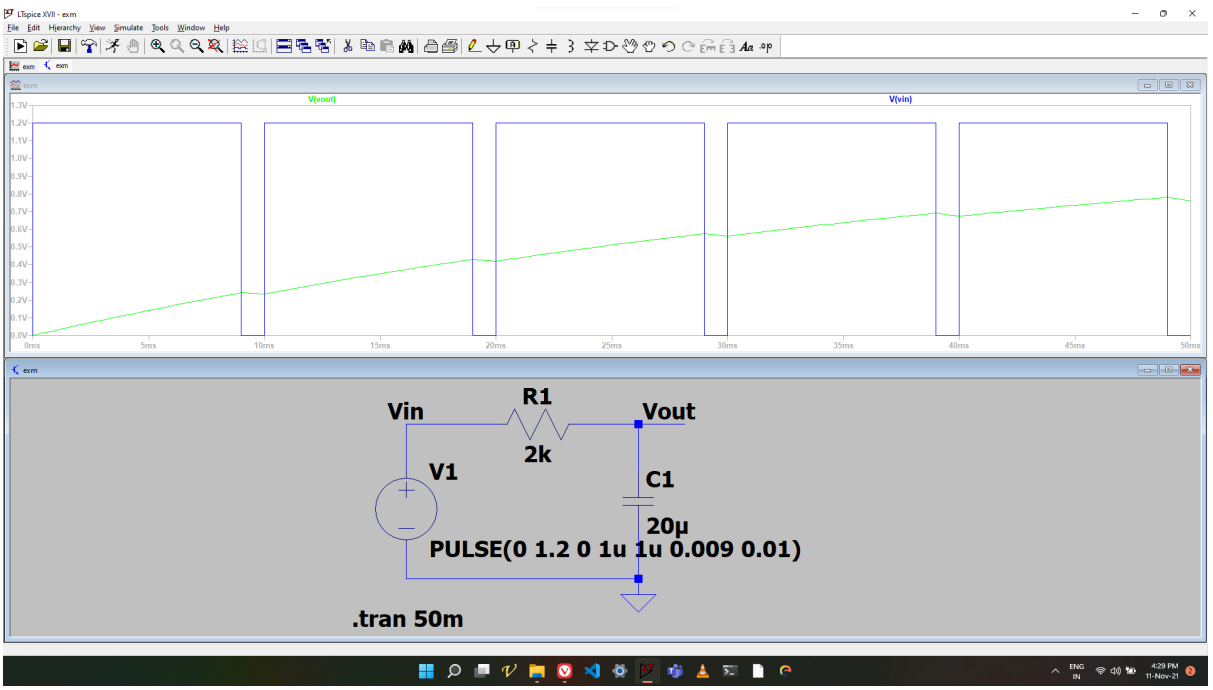
Tperiod = 0.01s , Ton = 0.005s.



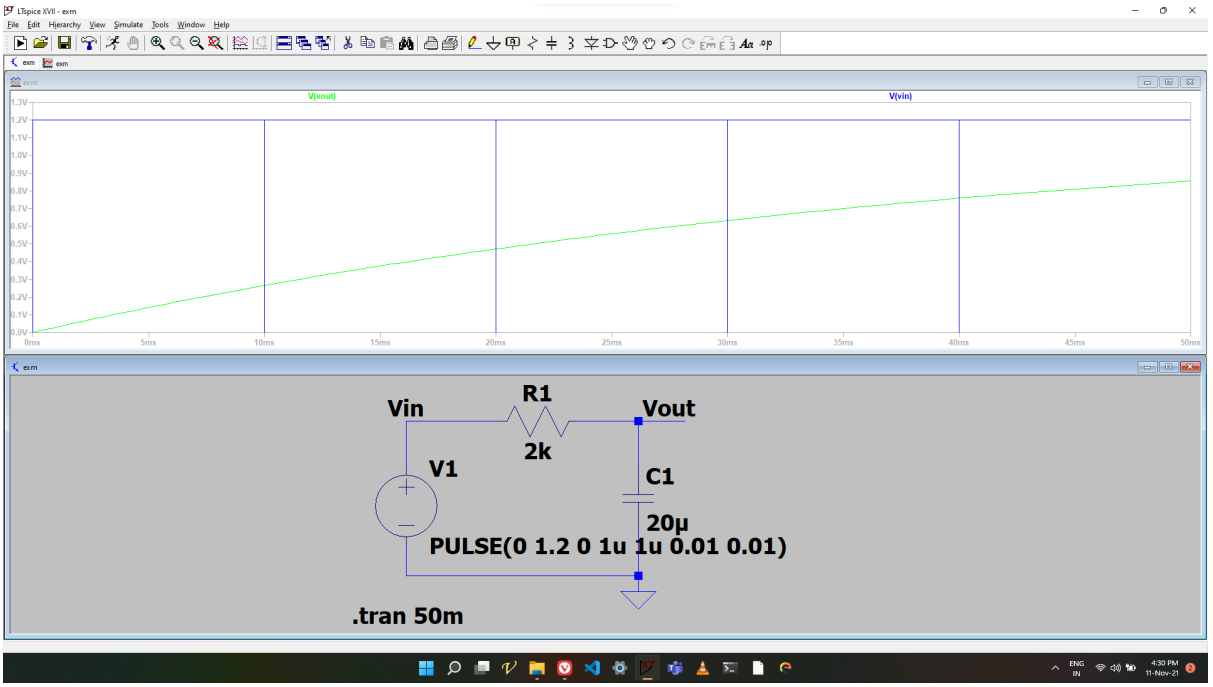
Tperiod = 0.01s , Ton = 0.007s



Tperiod = 0.01s , Ton = 0.009s



Tperiod = 0.01s , Ton = 0.01s



The above graph shows that when Ton = 0.01s, the output waveform is no longer triangular, which does not follow the basic rule of an Integrator circuit. So, the maximum on-time of the wave for which the given circuit behaves as an Integrator circuit is 0.009s, when f = 100Hz.

7. Conclusion:

- The given circuit can only behave as an Integrator circuit provided T << RC.
- When f >> 25Hz, the given circuit behaves as an integrator circuit.

- Also,the circuit is integrator only till on time is 0.009s,at f = 100Hz.