Circuit Simulation Project

https://esim.fossee.in/circuit-simulation-project

Name of the participant : Manisharma Sugurthi

Title of the circuit :

"Design and Simulation of Waveform Generators: Sawtooth and Triangular Waves for Advanced Circuit Applications"

Theory/Description :

Sawtooth and triangular wave generators are widely used in applications like signal processing, communication systems, and testing equipment. A triangular wave generator creates a waveform with equal rise and fall times, making it ideal for oscillators and timing circuits. On the other hand, a sawtooth wave generator produces a waveform where the rise and fall times are uneven, which is useful in devices like function generators, synthesizers, and TV signal processing. These waveforms are typically generated using circuits built with operational amplifiers, combining a comparator and an integrator.

In the circuit, the comparator switches its output between V_{ref} and $-V_{ref}$ depending on the input voltage. This alternating output is sent to the integrator, which converts it into a smooth, linear ramp signal, producing a triangular waveform with perfectly balanced rise and fall times.

To create a sawtooth wave, a simple modification is made: a variable DC voltage is applied to the integrator's non-inverting input using a potentiometer. If the potentiometer is set in the middle, the waveform stays triangular with equal rise and fall times. Moving the potentiometer towards a negative voltage makes the rise time longer than the fall time, creating a sawtooth with a steep drop. Conversely, adjusting it towards a positive voltage makes the fall time longer than the rise time, producing a steep rise. This setup allows easy control over the waveform's shape, making the circuit versatile for various needs.

Circuit Diagram(s) :

Fig 1. Triangular Wave Generator

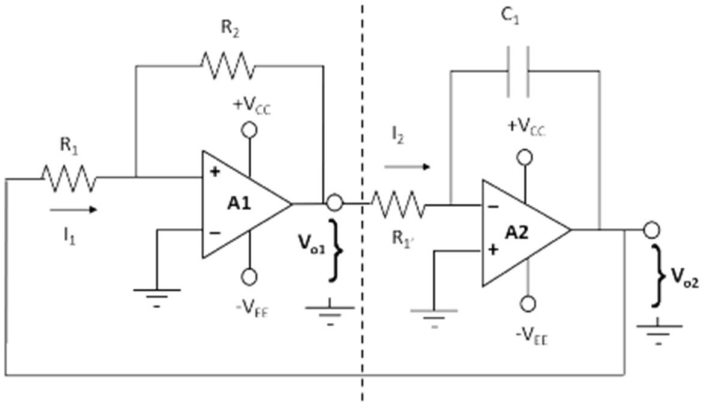
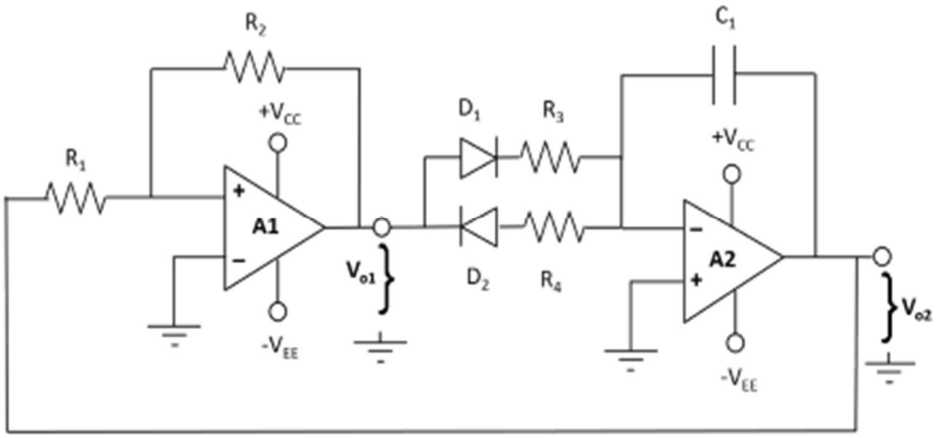


Fig 2. Sawtooth Wave Generator



Results (Input, Output waveforms and/or Multimeter readings) :

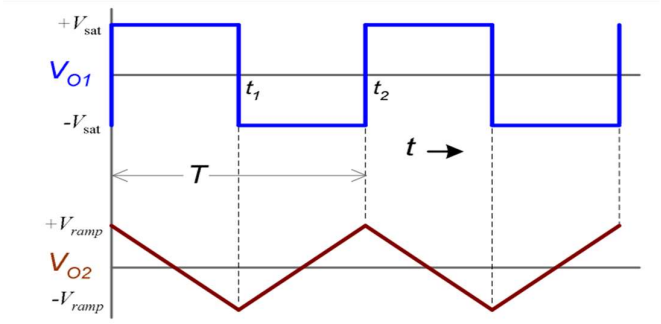


Fig 3.Input and Output Waveforms of triangular wave generator

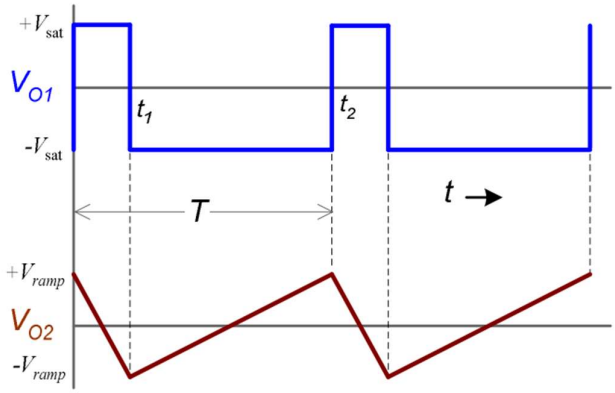


Fig 4.Input and Output Waveforms of Sawtooth wave generator

Source/Reference(s) :

1. Sergio Franco, "Design With Operational Amplifiers And Analog Integrated Circuits", 3rd edition, Tata McGraw Hill Education (India) Private Limited, 2007
2. D. Roy Choudhury and Snail Jain, "Linear Integrated Circuits", New Age International Private LImited, 2000