

Lab. of Electronics

Lab name : **Integrator and Differentiator Circuits** Student ID : B11102112 Name: Chiajui Lee

I. Purpose

Integrators and differentiators are fundamental electronic circuits with critical applications in electrical engineering. An integrator performs mathematical integration on input signals, while a differentiator calculates their time derivative. This experiment aims to:

1. **Understand** the core concepts and operating principles of these circuits
2. **Master** their design methodologies using operational amplifiers
3. **Explore** practical applications in analog signal processing

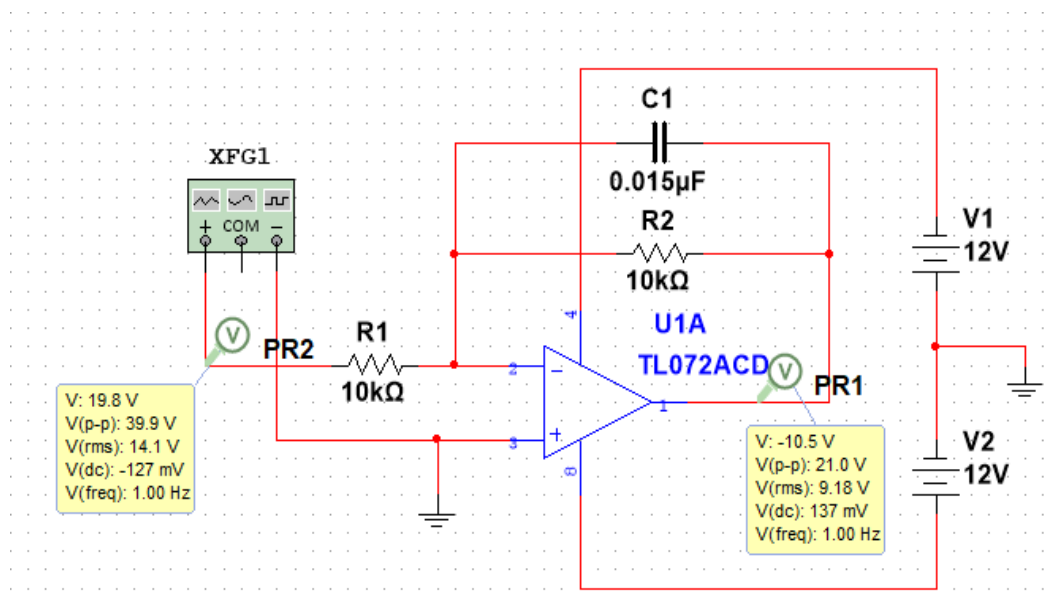
II. Steps

- A. Construct the circuit as specified in the problem using operational amplifiers (OPAs), capacitors, and resistors.
- B. Connect the power supply to provide +10V to pin 8 and -10V to pin 4 of the operational amplifier (OPA).
- C. Measure the output results using an oscilloscope.

III. Data

A. Integrator Circuit

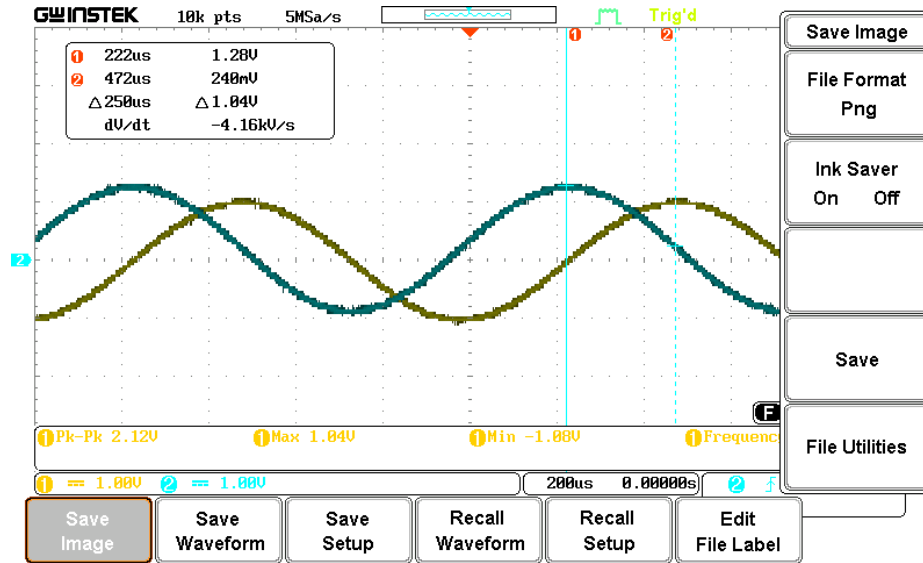
1. Circuit diagram



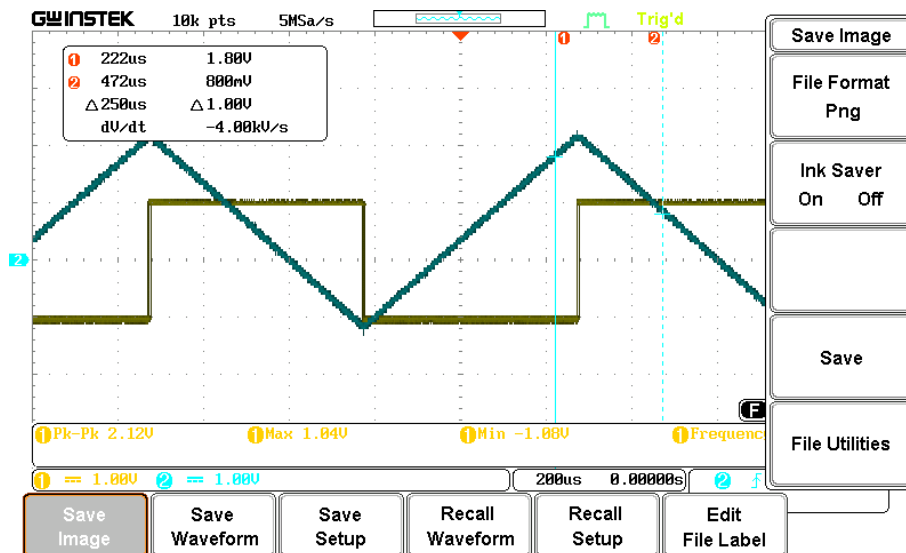
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2. Output waveform

a. Sin-wave

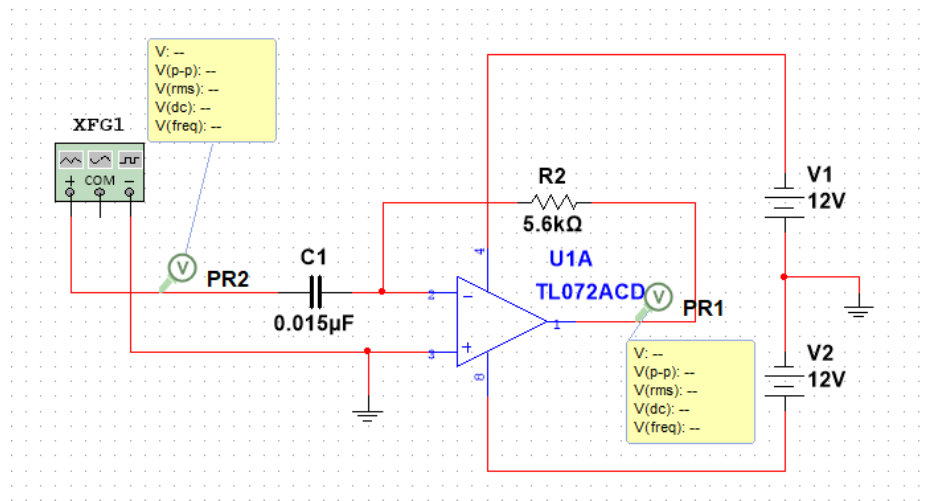


b. Square-wave



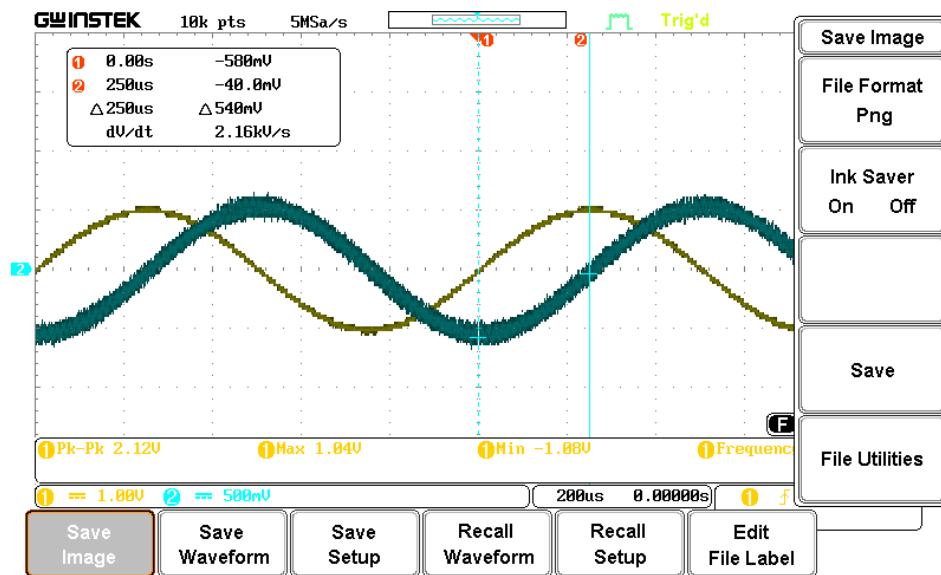
B. Astable Multivibrator Circuit

1. Circuit diagram

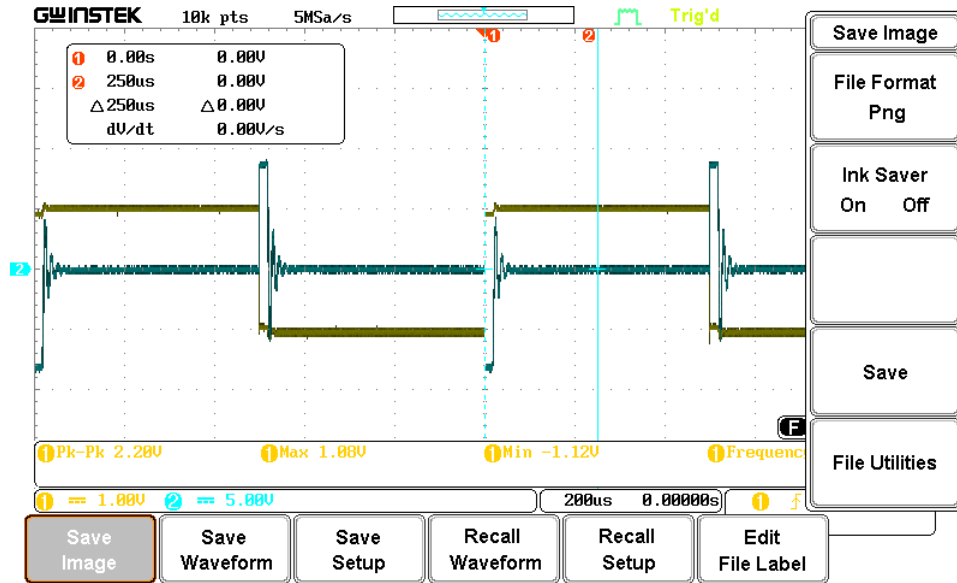


2. Output waveform

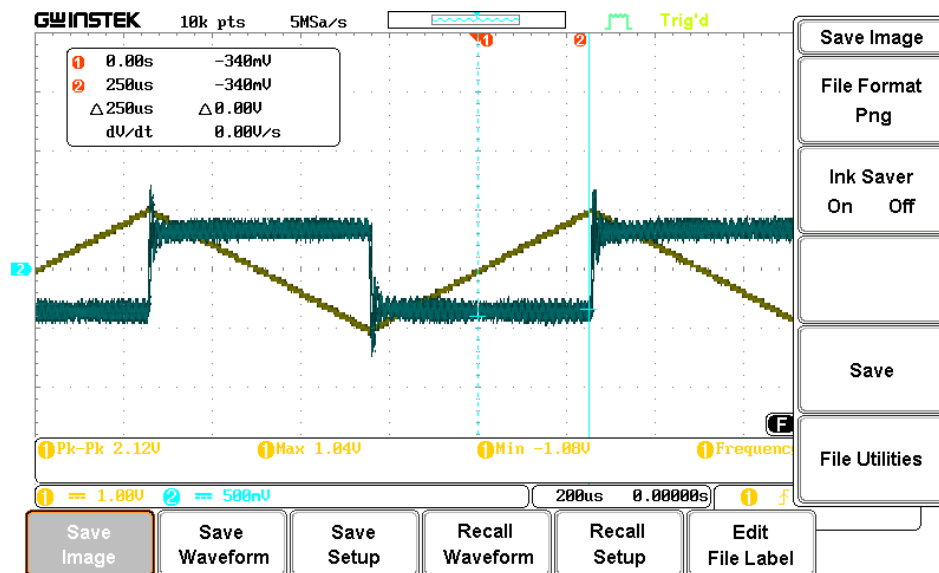
a. Sin-wave



b. Square-wave



c. Triangle-wave



IV. Reflections

This practical session focused on revisiting integrator and differentiator circuits. Although we had recently studied these concepts in electronics theory classes, conducting actual experiments with them provided valuable hands-on experience.

The experiment was relatively straightforward due to the circuits' fundamental nature. We followed these steps:

1. Built both circuits according to the laboratory instructions
2. Used an oscilloscope to analyze the input-output waveform relationships:
 - The integrator transformed square waves into triangular waveforms
 - The differentiator converted square wave edges into sharp spikes

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Key Technical Observations:

- Directly verified the mathematical operations (integration and differentiation) through waveform analysis
- Recognized their practical engineering applications in:
 - Active filter design
 - Signal processing systems
 - Feedback control mechanisms

The session effectively bridged theoretical knowledge with practical implementation, particularly regarding:

- Proper selection of RC time constants
- Addressing integrator drift issues
- Managing noise in differentiator circuits

Educational Value:

The experiment successfully demonstrated how abstract mathematical operations translate into tangible electronic functions, while highlighting important design considerations for real-world applications.