

OpampIntegrator -- Overview



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OBJECTIVES

After performing this lab exercise, learner will be able to:

- Design & build Opamp Integrator circuit
- Use 2231A power supply to provide bipolar DC voltage (+/- 10V) to the OPAMP circuit
- Use digital oscilloscope's trigger to capture and display the signal
- Establish relationship between input and output signal

EQUIPMENT

To carry out this experiment, you will need:

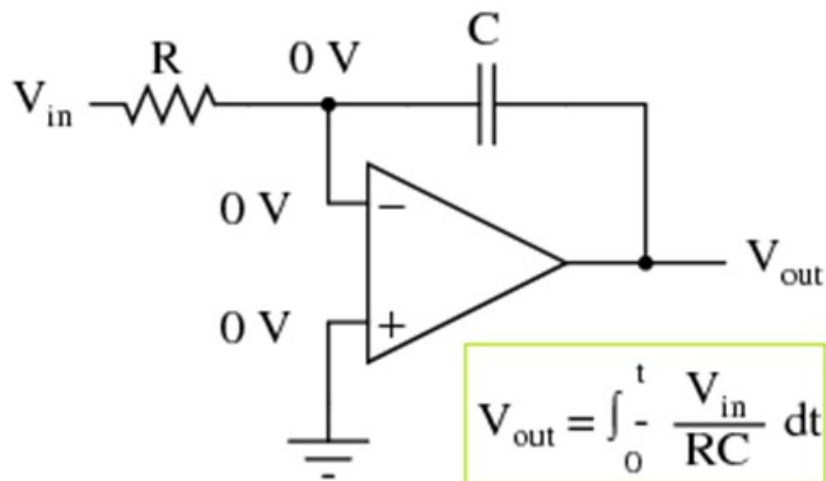
- TBS1KB - Digital Oscilloscope from Tektronix
- Voltage probe (provided with oscilloscope) / BNC cables
- Circuit components
 - Opamp (741 IC or equivalent),
 - Resistor and
 - capacitor
- Breadboard and connecting wires
- Regulated DC supply 0-30V DC (Keithley 2231A)
- Signal /Function generator (AFG3000 from Tektronix)

THEORY

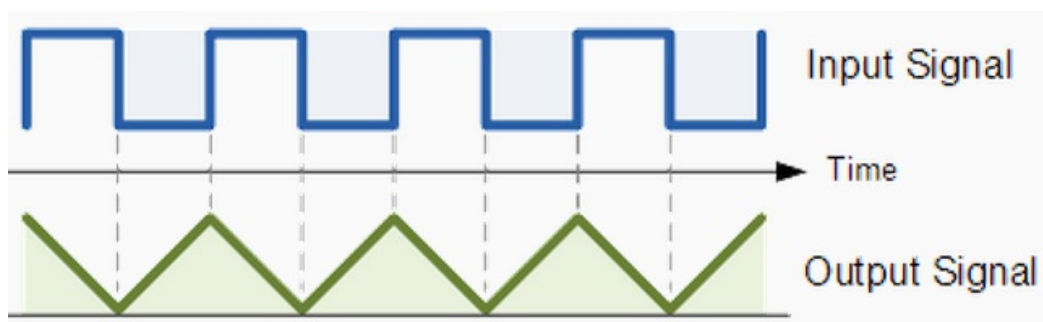
Key concepts:

- An opamp is a high-gain differential amplifier with very high input impedance.
- OPAMP integrator circuit produces output proportional to integral of its input.

Integrator



- If a square wave is input to Integrator circuit, the output will be triangular wave



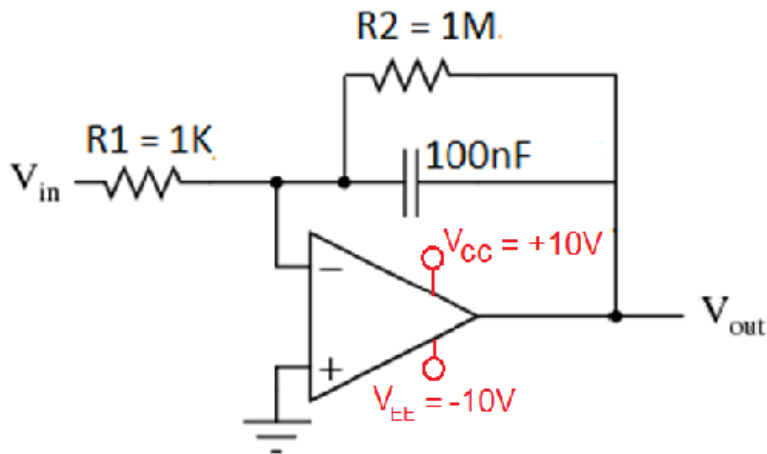
- 2231A power supply has 3 independent channels for DC power. **CH1** and **CH2** can be combined in series to provide bipolar (+/-) DC voltage needed for Opamp circuit.

OpampIntegrator -- Procedures

Step 1

DUT / CIRCUIT SETUP

- Build the circuit as shown below:



Step 2

AFG / SIGNAL GENERATOR SETUP

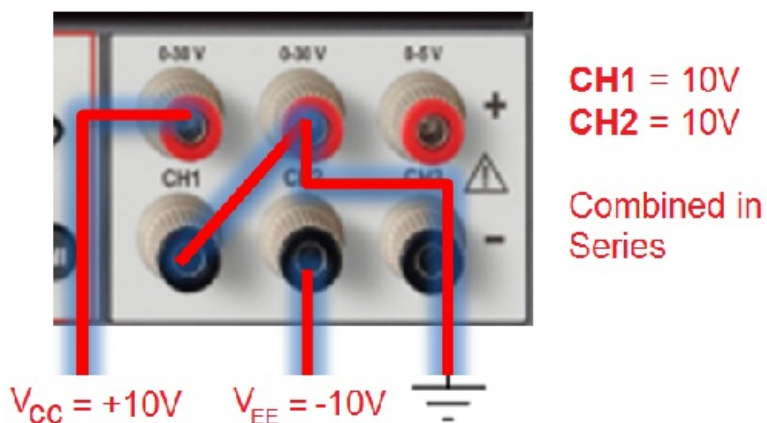
- Switch on the AFG signal to provide input to Diode circuit
- Set Square wave of 2Vpk-pk, 1kHz on signal generator / AFG

Step 3

POWER SUPPLY SETUP

We will have to use 2 channels of DC power supply, connected in series:

1. Select **CH1**
2. Set voltage as 2V
3. Select **CH2**
4. Set voltage to be 2V
5. Press **MENU** button on the front panel and select **Combine Ch1 + Ch2**
6. Push the down arrow key to select the option **V1+V2 Series**
7. Ensure the connections as below (for Vcc and Vee - bipolar supply to Opamp circuit)



Step 4

OSCILLOSCOPE PROBING

- Power ON the oscilloscope
- Connect the Channel 1 probe of the oscilloscope to V_{in}
- Connect the Channel 2 probe to V_{out}
- Acquire the signal(s) from circuit on oscilloscope

Step 5

- Do the Autoset on the scope to efficiently capture and view the signal
- If AUTOSET feature is not enabled, then manually set the horizontal and vertical scale, and trigger condition to view 3-4 cycles of waveform without any clipping.

Step 6

ADDING OSCILLOSCOPE MEASUREMENTS

- Go to measurement menu by pressing **MEASURE** button on the scope front panel
- Press **CH1** and select **MAXIMUM** and **MINIMUM** measurement using Multi-Purpose Knob (**MPK**) button
- Add similar measurements for **CH2**
- You can navigate through the measurement list by rotating the **MPK** knob and select a measurement by pressing it

Step 7

- Record the measurement values and waveform / screenshot
- Verify the measurement parameters against designed (calculated based on circuit components)

Step 8

CAN YOU ANSWER THIS?

- What will be the output of the integrator circuit if the input is a sine wave?