

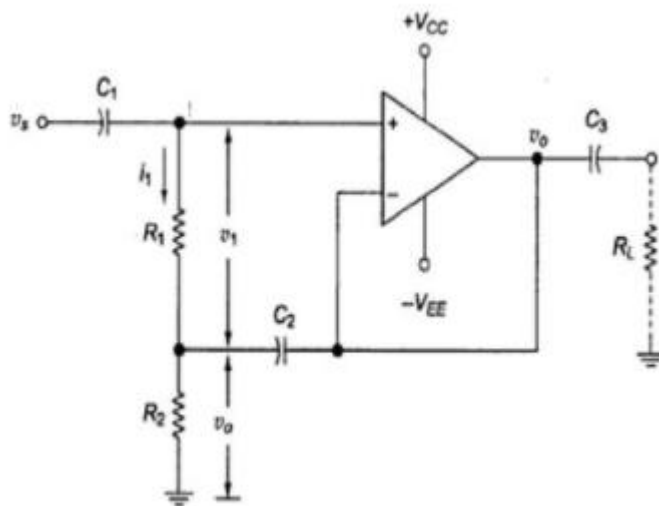
Research Migration Project

Name of the participant: ABDUL SAMAD

Title of the circuit: Simulation of high impedance capacitor coupled Voltage Follower circuit

Theory/Description: This circuit buffers AC signals while blocking DC offsets using an input capacitor. The op-amp voltage follower provides high input impedance (protects weak sources like sensors) and low output impedance (drives loads). A resistor to ground stabilizes DC bias, and the RC pair forms a high-pass filter, setting a lower frequency cutoff. Ideal for isolating AC signals (audio, sensors) without loading the source or distorting the output.

Circuit Diagram(s) :



Voltage Follower Circuit Theory

1. Configuration:

- a. The voltage follower is a special case of the non-inverting amplifier where the feedback resistor R_f is zero (or negligible), and the input resistor R_{in} is infinite (open circuit).
- b. The output v_O is directly connected to the inverting input (v_1), forming a unity-gain feedback loop.

2. Key Characteristics:

- a. Gain (A_v):

$$A_v = 1 + R_f/R_{in} = 1 \text{ (since } R_f = 0 \text{ and } R_{in} \rightarrow \infty) \quad A_v = 1 + R_{in}/R_f = 1 \text{ (since } R_f = 0 \text{ and } R_{in} \rightarrow \infty)$$

Thus, $v_O = v_1$.

- b. Input Impedance: Very high (ideally infinite), making it suitable for buffering high-impedance sources.
- c. Output Impedance: Very low (ideally zero), allowing it to drive low-impedance loads effectively.

3. Function:

- a. Acts as a buffer, isolating the input from the output while maintaining the same voltage level.
- b. Prevents loading effects when connecting a high-impedance source to a low-impedance load.

4. Applications:

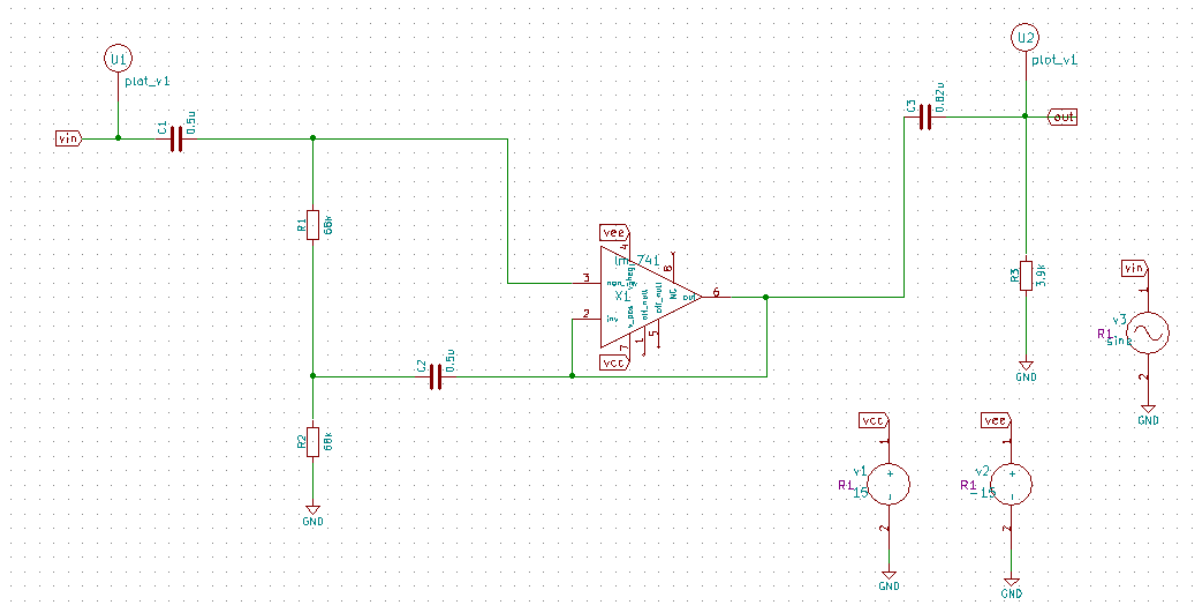
- a. Signal buffering in sensor circuits.
- b. Impedance matching between stages in multi-stage amplifiers.
- c. Driving transmission lines or heavy loads without signal degradation.

Circuit Analysis (Assuming Ideal Op-Amp)

- Input Voltage (v_1): Directly transferred to the output (v_O).
- Feedback: Ensures $v_1 \approx v_2$ (virtual short concept).

- Power Supply: $VCCVCC$ and $VEEVEE$ (or ground) provide biasing for the op-amp.

Schematic Designed -



INPUT -

The input can be DC or AC voltage.

Opamps are provided by +/- 15V

The input signal is 1khz AC voltage

Analysis Source Details Ngspice Model Device Modeling Subcircuits

Add parameters for sine source v3

Enter offset value (Volts/Amps):

Enter amplitude (Volts/Amps):

Enter frequency (Hz):

Enter delay time (seconds):

Enter damping factor (1/seconds):

Convert

Analysis Source Details Ngspice Model Device Modeling Subcircuits

Select Analysis Type

☐ AC ☐ DC ☒ TRANSIENT

Transient Analysis

Start Time ms

Step Time ms

Stop Time ms

Convert

Analysis Source Details Ngspice Model Device Modeling Subcircuits

Add subcircuit for lm_741

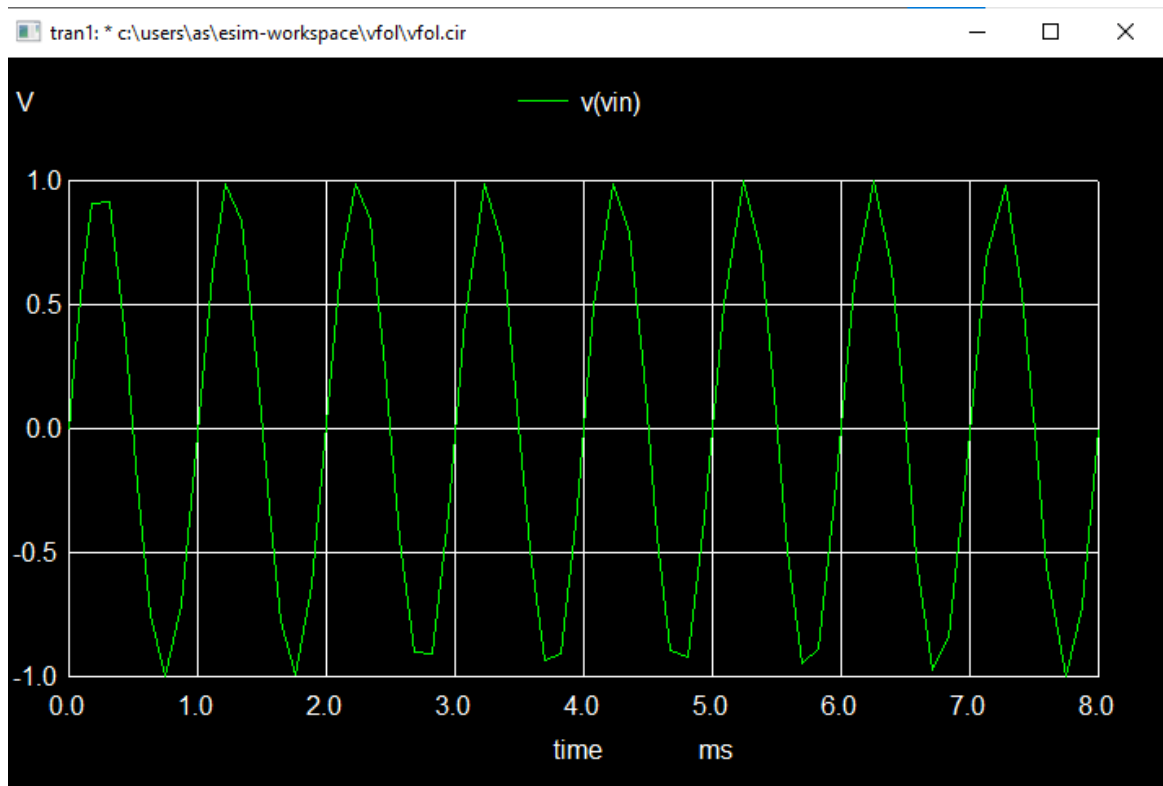
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OUTPUT -

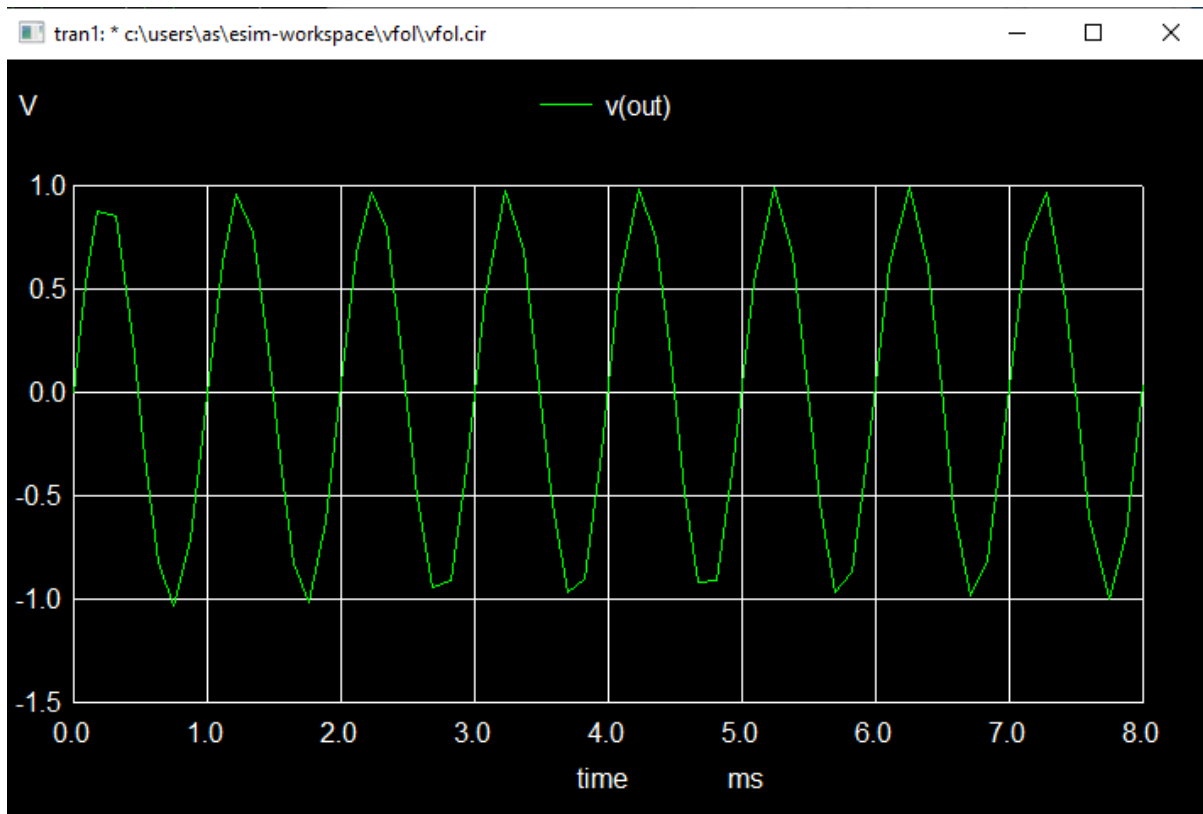
The circuit **preserves the input voltage** at the output ($v_0=v_1$).

The output signal is 1Khz AC as denoted by global label in schematic

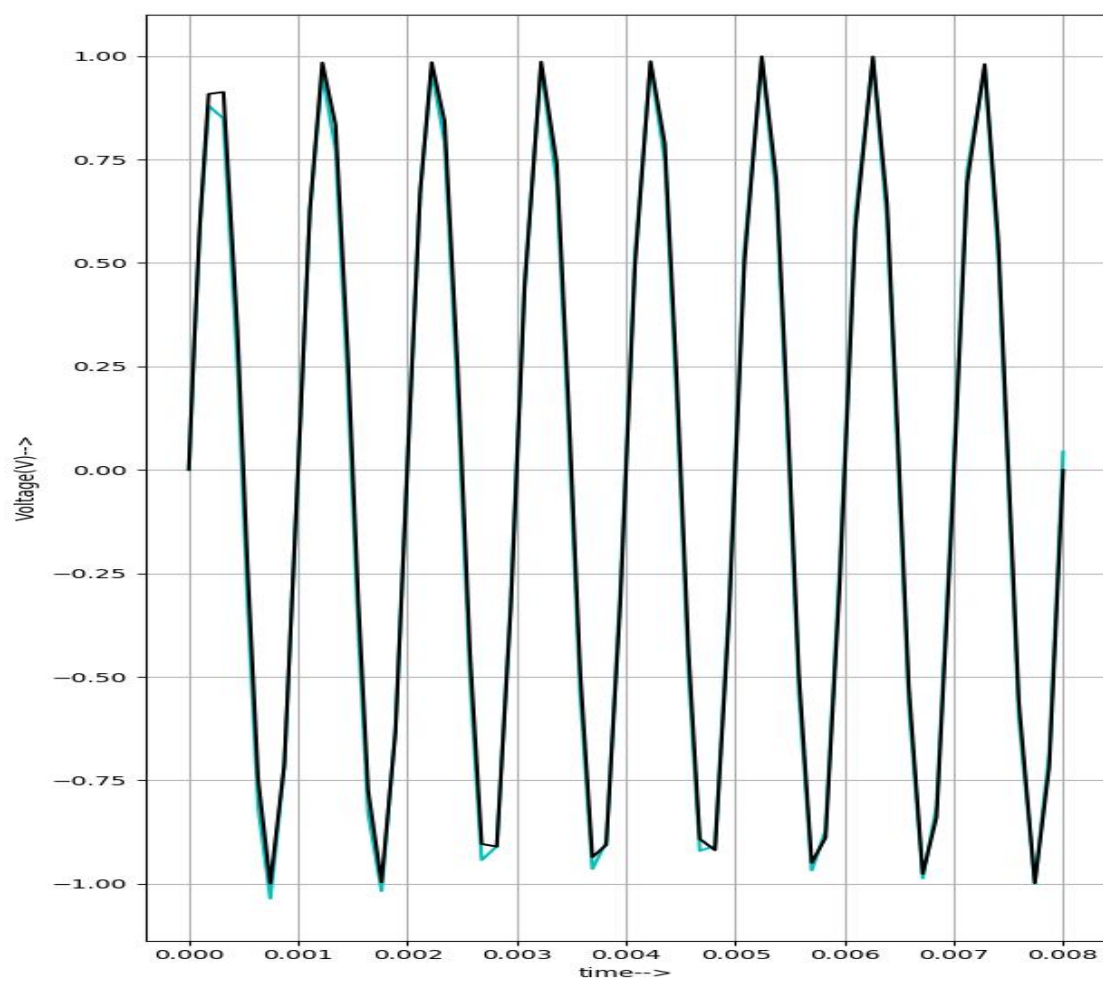
Results (Input, Output waveforms and/or Multimeter readings) :



INPUT WAVE AC OF 1 KHz



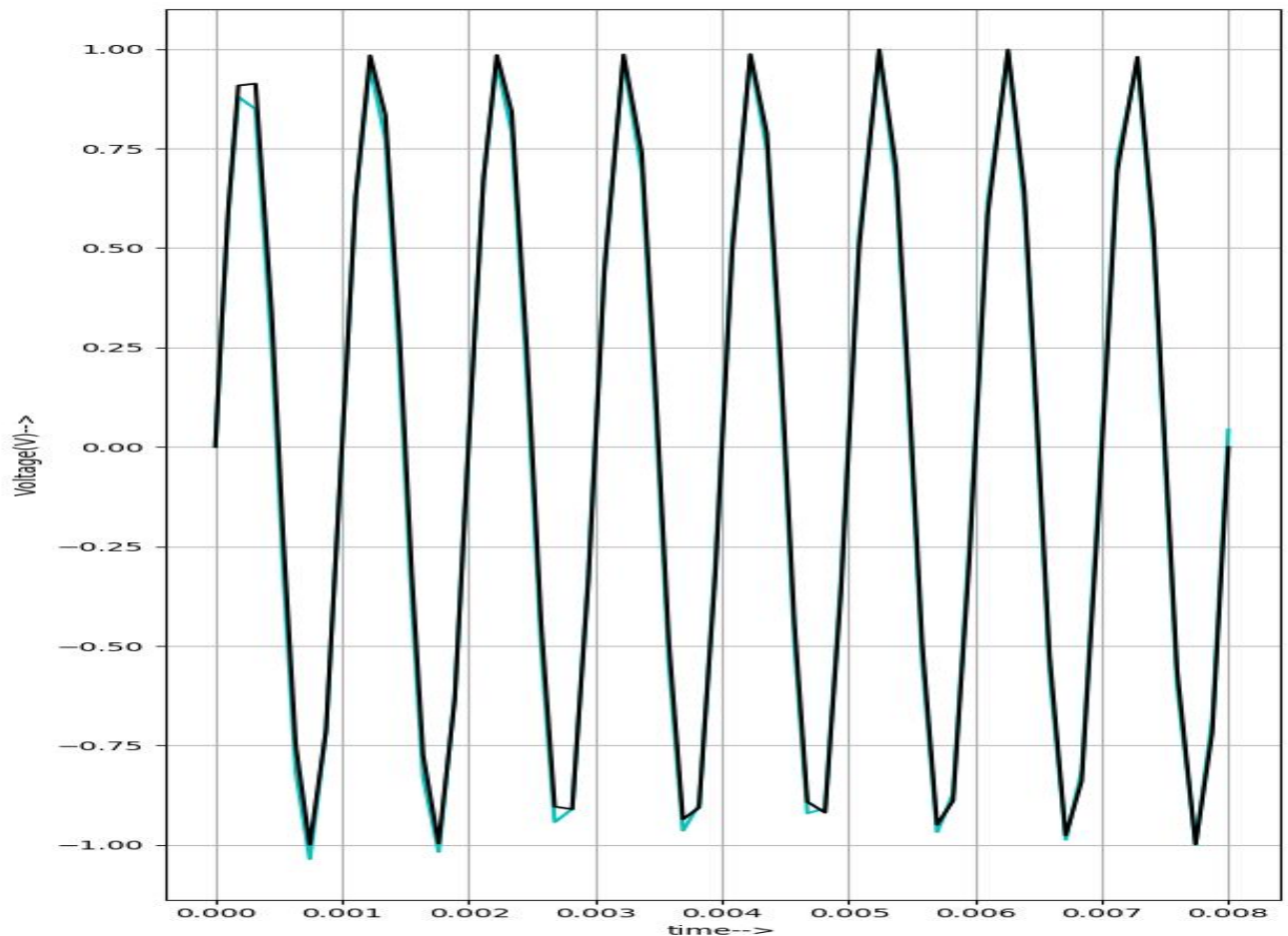
Output wave nearly same as input wave of AC 1Khz



Plot of input and output wave in a same graph

Conclusion -

The circuit outputs a clean, amplified AC signal matching the input waveform *without DC offset*, preserved at unity gain. It suppresses low frequencies below the RC high-pass cutoff (e.g., <2 Hz)



Source/Reference(s) :

<https://www.eeeguide.com/voltage-follower-circuit-diagram/>

[Voltage Follower Circuit Diagram | Capacitor-Coupled Voltage Follower \(eeeguide.com\)](#)

[Subject Name: LINEAR IC's AND APPLICATIONS Subject Code:10EC46 Prepared By: Aparna.P](#)

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