Institute of Technology of Cambodia

Department Telecommunication and Networking

Report: Analog Electronic

Lab3: Operational amplifier

Group: I3-GTR-A

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Contents:

I. Objective

The experiment aims to provide a practical understanding of how an op-amp works as an inverting amplifier, including its gain, phase inversion, and the influence of external components.

II. Materials

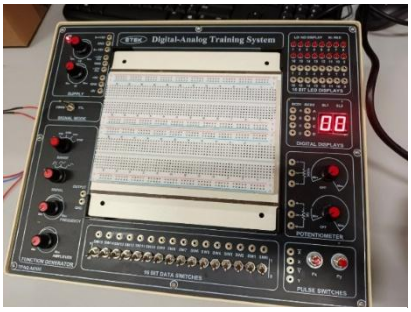


Figure 1: Breadboard

• **Breadboard** is used for prototyping electronic circuits. It allows for quick construction of temporary circuits with components and jumper wires. Breadboards enable testing and modifying designs before creating a permanent PCB version.

Figure 2: Jumper wire

• **Jumper wire** is a short wire used for temporary connections in a circuit. It usually has connectors at both ends and is often used in prototyping and troubleshooting.

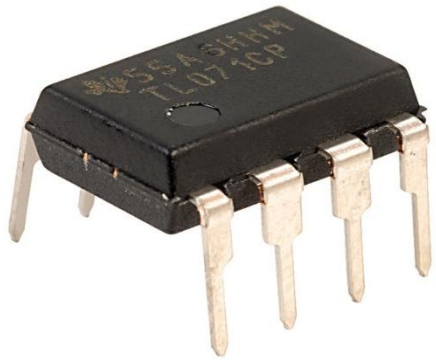


Figure 3: Operational amplifier (TL071CP)

• **The TL071CP** is a representative op-amp that allows you to explore the fundamental principles of inverting amplification and provides a foundation for understanding more complex op-amp circuits.

Figure 4: Resistor

• **Resistors** is important in electrical circuits for current limiting, voltage division, signal conditioning, power dissipation, biasing components, impedance matching, pull-up/down, timing circuits, and temperature sensing. In this experiment we need two resistors (1kΩ and 5kΩ).

Figure 5: Oscilloscope

• **Oscilloscope** is a key electronic tool for observing and measuring changing voltage signals over time.

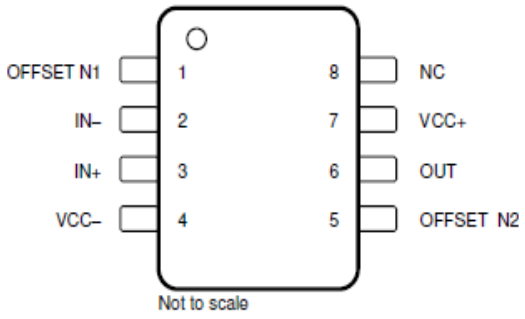
Figure 6: Multimeter

• **Multimeter** is a versatile electronic measuring instrument used for diagnosing electrical circuits and components.

III. Procedure

A. Inverting amplifier

First, we bring all the materials to keep it on the table and we should read all the instruction in Lab before. Then, we test it does it work or not by using multimeter if it doesn't work, we should tell teacher and change it. After that, we start ware the circuit on the **Analog experimental** before we use Operational amplifier (TL071CP) we should know its legs. Here is figure for define the lags of Operational amplifier (TL071CP):



NC- no internal connection

Figure 5-4. TL071x D, P, and PS Package,
8-Pin SOIC, PDIP, and SO

According to above figure we will know its legs.

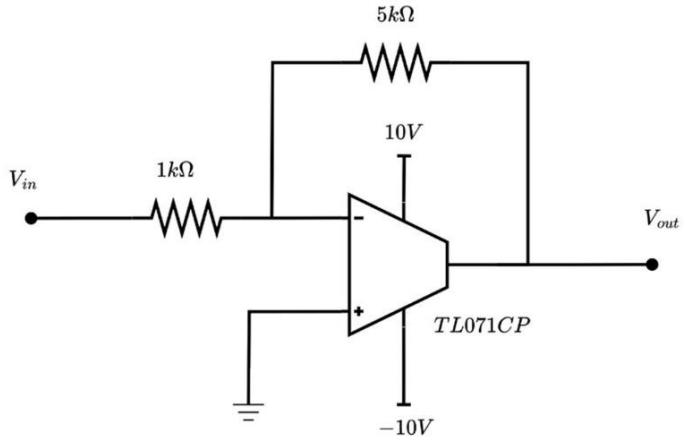


Figure7: Inverting input

We will construct the circuit as the Figure 7. First, we connect from type of supply that we can change voltage to the resistor1 (1k Ω), connect to leg2 IN- and connect to resistor2 (5kΩ). After that, we connect leg3 IN+ to the ground. We use type function generator, connect from output to leg7 Vcc+ and leg4 Vcc- to the ground. Then we connect from resistor2 to leg6 output. After we already connect on the Analog experimental, we use Oscilloscope for measure the input voltage and output voltage that we use two oscilloscope probes by using one for signal input and one more use for signal output and we connect to Oscilloscope in CH1 and CH2. we open the both Chanels and we put it in the same voltage for CH1 and CH2. Finally, we observe to the voltage in screen of Oscilloscope.

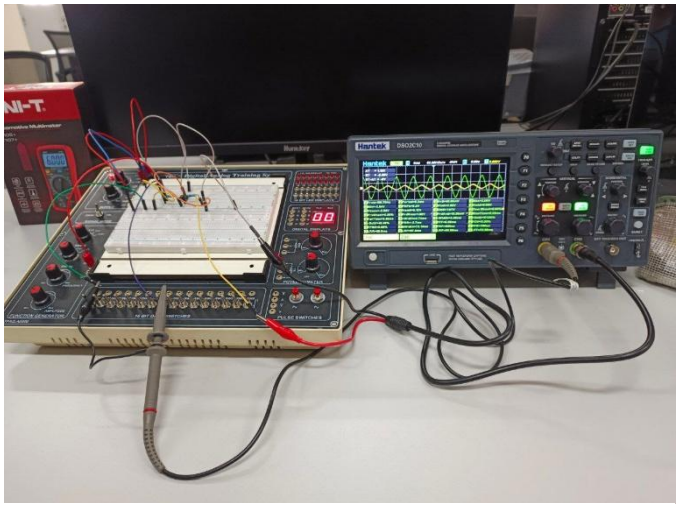


Figure 8: After connect the circuit

IV. Result and Conclusion

Here is the result:

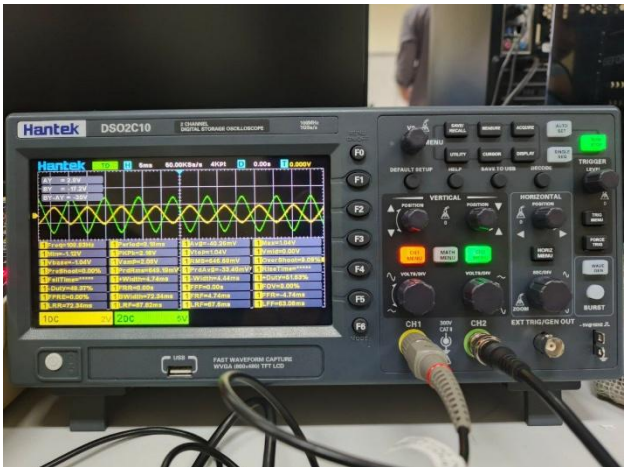


Figure 9: Input signal

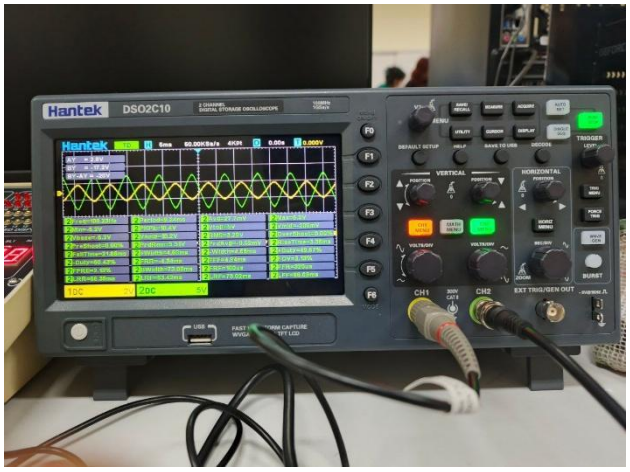


Figure 10: Output signal

Base on above figures: The key observation is the difference between the input and output signals. The changes in the square wave shape, after passing through the unknown system, show how the system alters the input signal.

From the obtained results, it can be concluded that the tested system is either a filter or is a circuit containing reactive components, such as inductors and capacitors. The distorted output signal suggests that the system is not uniformly amplifying or passing all frequencies present in the input square wave