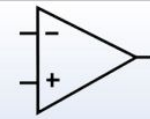# Operational Amplifiers
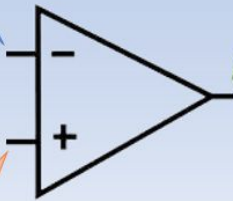
The operational amplifier (op amp)

A device for nearly ideal DC amplification. Used to perform mathematical operations such as adding, subtracting, integration and differentiation.

Terminology

Inverting input

Output

Non-inverting input

In a DC (steady state) circuit, op amps

1. Has no current flowing on the inverting input
2. Has no current flowing on the non-inverting input
3. Has no current flowing on the output
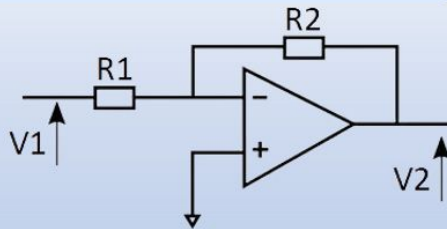4. The voltage between the inputs is 0

Assignment

a) Show that the gain A of the circuit is $A = \dfrac{V_2}{V_1} = 1 + \dfrac{R_2}{R_1}$!
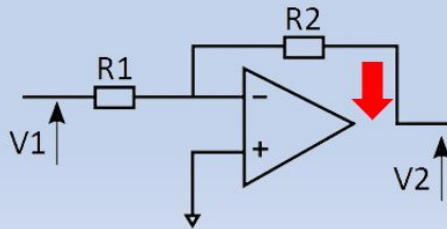
b) Why is it called a non-inverting circuit?

V1   V2   R2   R1
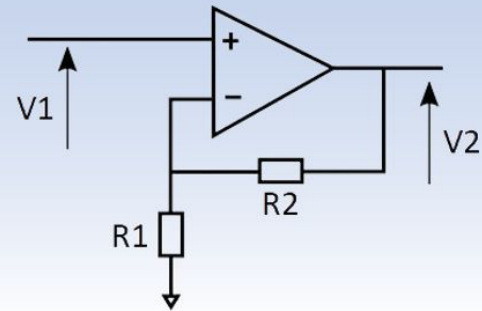
Example

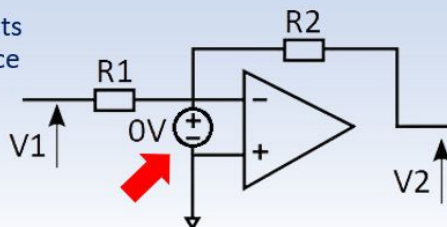Replacing an op amp with simple electric components
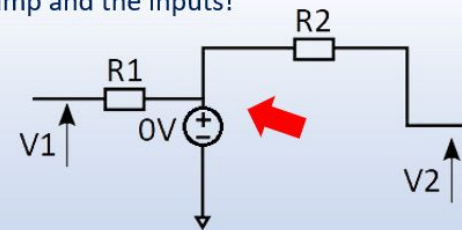
Step 0: Draw the circuit!

R2   R1   V1   V2

Step 1: Cut the output!

R2   R1   V1   V2

Step 2: Connect the inputs with a voltage source of 0V!

R2   R1   0V   V1   V2

Step 3: Delete the op amp and the inputs!

R2   R1   V1   0V   V2

Step 4: Reorganize the circuit!

R1   R2   V1   0V   V2
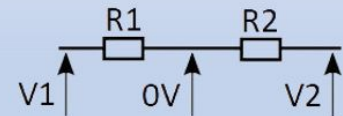
Step 5: Solve the circuit!

We can see that the current passing through R1 and R2 is identical. Using Ohm's law:

$$V_1 - 0 = V_1 = IR_1$$

$$0 - V_2 = -V_2 = IR_2$$

$$A = \frac{V_2}{V_1} = \frac{-IR_2}{IR_1} = -\frac{R_2}{R_1}$$

Péter Molnár

2024. 03. 31.