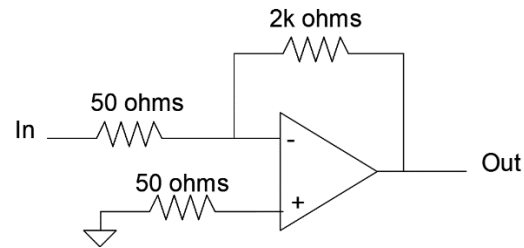




Using ChatGPT-4 to Design Hardware Circuits

To determine if ChatGPT-4 is capable of solving hardware design problems we tested it with some design problems. This question is part of our interview process for hardware engineers. The question is to calculate the output voltage when a 50mV sinewave is connected to the Input.



INPUT

The following prompt was provided.

For this question the accuracy of the answer is important and will require mathematical calculations. Please double check the results of all calculations.

I have an opamp circuit comprised of an operational amplifier U1 and 3 resistors R1, R2 and R3.

INPUT is the electrical node where the input signal will be applied.

R1 = 50 ohms.

R2 = 50 ohms.

R3 = 2000 ohms.

U1 is the opamp and it has 3 pins

Pin 1 is the negative input (-)

Pin 2 is the positive input (+)

Pin 3 is the output and will also be the circuit OUTPUT.

CIRCUIT WIRING

The following describes how the opamp and resistors are wired.

Pin 1 of R1 is connected to the INPUT node.

Pin 2 of R1 is connected to U1 pin 1 and R3 pin 1

Pin 2 of R3 is connected to the U1 pin 3

Pin 1 of R2 is connected to ground.

Pin 2 of R2 is connected to pin 2 of U1.

If a 50mV peak to peak sine wave is connected to the INPUT what will be the peak to peak output voltage at the OUTPUT?



ChatGPT-4 RESULT

The given opamp circuit appears to be an inverting amplifier configuration. In this case, the gain of the amplifier can be calculated as:

$$\text{Gain} = -R3 / R1$$

Given the resistor values:

$$R1 = 50 \text{ ohms}$$

$$R3 = 2000 \text{ ohms}$$

We can now calculate the gain:

$$\text{Gain} = -2000 / 50 = -40$$

Now, we have a 50mV peak-to-peak input sine wave. To find the output voltage, we can use the formula:

$$V_{out} = \text{Gain} * V_{in}$$

In this case, $V_{in} = 50\text{mV} = 0.050 \text{ V}$ (peak-to-peak). Now we can find the output voltage:

$$V_{out} = -40 * 0.050 \text{ V} = -2 \text{ V (peak-to-peak)}$$

So, the peak-to-peak output voltage at the OUTPUT is 2V. However, since it's an inverting amplifier, the output waveform will be inverted compared to the input waveform.

RESULT

The result is correct.

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