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| Lab 4: Frequency Response and Operational Amplifier |

Student Name: Click or tap here to enter text.

Student Number: Click or tap here to enter text.

Preparation

1. Find the numerical values for Ad, Ac, CMRR, and f3dB for IB=1mA and CL=1nF. Show hand calculations.



Final answer: Click or tap here to enter text.

1. Find the input common-mode voltage that maximizes the output swing. Show hand calculations.



Final answer: Click or tap here to enter text.

1. Perform an AC analysis to determine the differential gain (Ad), common-mode gain (Ac), and common-mode rejection ratio (CMRR) at low frequencies.

* Apply a differential input signal and measure the output voltage to determine Ad.
* Apply a common-mode input signal and measure the output voltage to determine Ac.
* Calculate CMRR using the formula CMRR = 20 log(Ad/Ac).



Final answer: Click or tap here to enter text.

* Perform a transient analysis by applying a differential input signal with the common-mode voltage found in step 3. Observe and record the output swing.



Final answer: Click or tap here to enter text.

Lab: Operational amplifier

1. Adjust the bias current (IB) to 1 mA, and set the opamp inputs to the common-mode voltage found in preparation using two multi-turn potentiometers as shown in Figure 3(a).
2. Adjust one of the opamp input for Vo=Vx. (see Figure 1) where the opamp is at equilibrium. The opamp differential input at the equilibrium is the offset voltage of the opamp. Do not turn the potentiometers from this point. Find this offset.

Final Answer: Click or tap here to enter text.

1. Connect one of the opamp inputs to a signal generator via a large capacitor as shown in Figure 3(b). Apply a sinusoidal input signal and measure the output voltage to determine Ad.



Final answer: Click or tap here to enter text.

1. Connect both of the opamp inputs to a signal generator via separate capacitors as shown in Figure 3(c) and find the common-mode gain (Ac) of the opamp and the CMRR.



Final answer: Click or tap here to enter text.

1. Insert a 1-nF load capacitor at the opamp output and find the f3dB. Perform a frequency sweep and determine the -3 dB cutoff frequency where the gain drops by 3 dB from its low-frequency value.

Final answer: Click or tap here to enter text.

1. Compare the experimental results with simulation. Explain and justify any discrepancy.

Final answer: Click or tap here to enter text.