Lab 2: Op Amp Circuits

U.C. Davis Physics 116A

INTRODUCTION

This lab introduces the operational amplifier or "op amp". The circuit is already constructed for you on a single IC (integrated circuit) and in this lab we will use the IC in several of its most popular configurations. For an introduction to op amps, see section 2.4 in Bobvow.

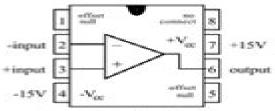


Figure 1: Pinout for the 741 op amp.

I. INVERTING AMPLIFIER

The pinout diagram for the LM741 op amp IC is shown in figure 1. Use this to construct the inverting op amp circuit shown in figure 2.

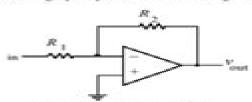


Figure 2: The inverting amplifier.

At first, use $R_1 = 1k\Omega$ and $R_2 = 33k\Omega$. Derive the gain formula $A_V = -R_2 f R_1$ and experimentally verify the gain for a 100Hz sine wave. Also calculate and measure the gain with $R_2 = 10k\Omega$ and $R_2 = 100k\Omega$. For your lab report, give your derivation and compare the 2 calculated and measured gains. Why is this called an inverting amp?

2. NONINVERTING AMPLIFIER

Construct the noninverting amplifier shown in figure 3 with $R_1 = 18\Omega$ and $R_2 = 33k\Omega$. For your report, derive and experimentally verify the gain relation

$$A_{v'} = \frac{R_1 + R_2}{R_i}$$

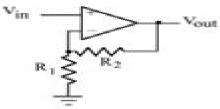


Figure 3: The noninverting amplefier.

3. CURRENT-TO-VOLTAGE CONVERTER

An op amp can be used to produce a voltage proportional to a given current. Construct the circuit in figure 4.

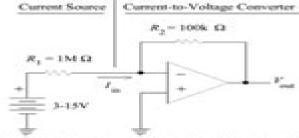
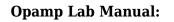


Figure 4: Current source with current-to-voltage converter.

Verify that $V_{cost} = -I_{in}R_2$ for this circuit. (That is, do the following for several voltage settings on the variable power supply: Measure the supply voltage and from this calculate I_{in} . Use the formula to calculate a theoretical V_{cost} and compare this to a measured V_{cost} . Include these measured values and calculations in your report along with a brief discussion of the agreement between theory and measurement.)

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