

## 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 *Bodvrow*.

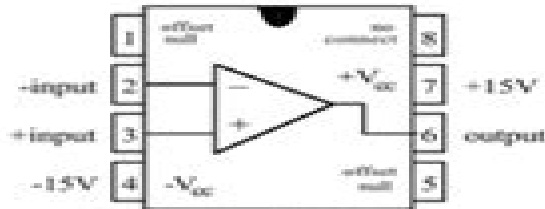


Figure 1: Pinout for the 741 op-amp.

### 1. 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.

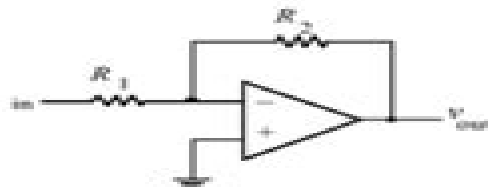


Figure 2: The inverting amplifier.

At first, use  $R_1 = 1\text{k}\Omega$  and  $R_2 = 33\text{k}\Omega$ . Derive the gain formula  $A_v = -R_2/R_1$  and experimentally verify the gain for a 100Hz sine wave. Also calculate and measure the gain with  $R_2 = 10\text{k}\Omega$  and  $R_2 = 100\text{k}\Omega$ . 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  $R_1 = 1\text{k}\Omega$  and  $R_2 = 33\text{k}\Omega$ . For your report, derive and experimentally verify the gain relation

$$A_v = \frac{R_1 + R_2}{R_1}$$

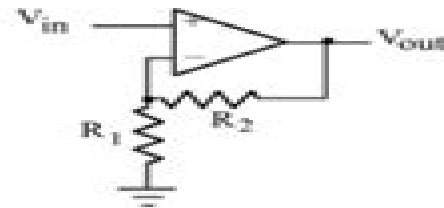


Figure 3: The noninverting amplifier.

### 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.

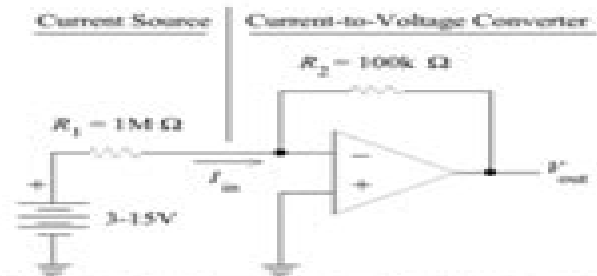


Figure 4: Current source with current-to-voltage converter.

Verify that  $V_{out} = -I_{in}R_2$  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  $V_{out}$  and compare this to a measured  $V_{out}$ . Include these measured values and calculations in your report along with a brief discussion of the agreement between theory and measurement.)

# Lab Manual For Various Op Amp Circuits

**Farzin Asadi**



## Lab Manual For Various Op Amp Circuits:

**Analog Electronic Circuits Laboratory Manual** Farzin Asadi, 2023-04-06 This is a book for a lab course meant to accompany or follow any standard course in electronic circuit analysis. It has been written for sophomore or junior electrical and computer engineering students either concurrently with their electronic circuit analysis class or following that class. This book is appropriate for non-majors such as students in other branches of engineering and in physics for which electronic circuits is a required course or elective and for whom a working knowledge of electronic circuits is desirable. This book has the following objectives: 1 To support, verify and supplement the theory to show the relations and differences between theory and practice; 2 To teach measurement techniques; 3 To convince students that what they are taught in their lecture classes is real and useful; 4 To help make students tinkers and make them used to asking what-if questions. **ELECTRONICS LAB MANUAL (VOLUME 2)** NAVAS, K. A., 2018-10-01 This book is evolved from the experience of the author who taught all lab courses in his three decades of teaching in various universities in India. The objective of this lab manual is to provide information to undergraduate students to practice experiments in electronics laboratories. This book covers 118 experiments for linear analog integrated circuits lab, communication engineering lab, power electronics lab, microwave lab, and optical communication lab. The experiments described in this book enable the students to learn various analog integrated circuits and their functions, analog and digital communication techniques, power electronics circuits and their functions, microwave equipment and components, optical communication devices. This book is intended for the B.Tech students of Electronics and Communication Engineering, Electrical and Electronics Engineering, Biomedical Electronics, Instrumentation and Control, Computer Science and Applied Electronics. It is designed not only for engineering students but can also be used by B.Sc., M.Sc., Physics and Diploma students. **KEY FEATURES** Contains aim, components and equipment required, theory, circuit diagram, pin-outs of active devices, design tables, graphs, alternate circuits, and troubleshooting techniques for each experiment. Includes viva voce and examination questions with their answers. Provides exposure on various devices. **TARGET AUDIENCE** B.Tech, Electronics and Communication Engineering, Electrical and Electronics Engineering, Biomedical Electronics, Instrumentation and Control, Computer Science and Applied Electronics, B.Sc., M.Sc., Physics, Diploma Engineering. **Laboratory Manual for Introductory Electronics Experiments** L. K. Maheshwari, M. M. S. Anand, 1979 **Laboratory Manual for Nonlinear Physics with Maple for Scientists and Engineers** Richard H. Enns, George McGuire, 1997-03-20 Science demands that all theory must be checked by experiment. Richard Feynman, Nobel Laureate in physics 1965, reminds us in a wonderful quote that 'The test of all knowledge is experiment. Experiment is the sole judge of scientific truth.' 1 It is because nonlinear physics can be so profoundly counter-intuitive that these laboratory investigations are so important. This manual is designed to be used with the text Nonlinear Physics with Maple for Scientists and Engineers. Understanding is enhanced when experiments are used to check, so please attempt as many of the activities as you can. As you perform theory, these activities, we hope that you will be

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Communication and Computer engineering disciplines has been prepared in the form of a standalone text offering the necessary theory and circuit diagrams with each experiment Procedures for setting up the circuits and measuring and evaluating their performance are designed to support the material of the authors book Analog Electronics also published by PHI Learning There are twenty five experiments The experiments cover the basic transistor circuits the linear op amp circuits the active filters the non linear op amp circuits the signal generators the voltage regulators the power amplifiers the high frequency amplifiers and the data converters In addition to the hands on experiments using traditional test equipment and components this manual describes the simulation of circuits using PSPICE as well For PSPICE simulation any available standard SPICE software may be used including the latest version OrCAD V10 Demo software This feature allows the instructor to adopt a single laboratory manual for both types of experiments

*A First Lab in Circuits and Electronics*  
Yannis P. Tsividis, 2018-03-07 Written by an award winning educator and researcher the sixteen experiments in this book have been extensively class tested and fine tuned This lab manual like no other provides an exciting active exploration of concepts and measurements and encourages students to tinker experiment and become creative on their own This benefits their further study and subsequent professional work The manual includes self contained background for all electronics experiments so that the lab can be run concurrently with any circuits or electronics course at any level It uses circuits in real applications which students can relate to in order to motivate them and convince them that what they learn is for real As a result the material is not only made interesting but helps motivate further study in circuits electronics communications and semiconductor devices

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**Laboratory Manual for Electronics via Waveform**

**Analysis** Edwin C. Craig, 2012-12-06 To the Instructor The purpose of this laboratory manual is not just to help students to set up electronic circuits that function as they should The important thing is the electronic concepts that the student learns in the process of setting up and studying these circuits Quite often a student learns more electronics when he has to trouble shoot a circuit than when the circuit performs as it should when first built It is unlikely that any students would be able to complete all of these experiments in one semester The author believes that all students should have laboratory experiences with power supplies amplifiers oscillators and integrated circuits Additionallabomtory experiments should be de termined by the instructor Therefore you can choose those that you want done Some students are more efficient in the labomtory than others Therefore some would be able to complete more exper iments in a semester than others Also many of these

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students problem solving skills and deepen their understanding of topics covered in electric circuit analysis courses

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