

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*.

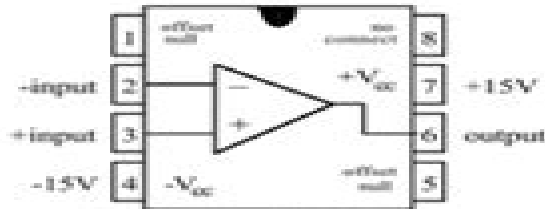


Figure 1: Pinout for the 741 op-amp.

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

Susan S. Mathew, Saji T. Chacko



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 BSc, MSc, 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, BSc, MSc, 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

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Kazimierczuk, Agasthya Ayachit, 2015-08-13 Designed to complement a range of power electronics study resources this unique lab manual helps students to gain a deep understanding of the operation modeling analysis design and performance of pulse width modulated PWM DC DC power converters Exercises focus on three essential areas of power electronics open loop power stages small signal modeling design of feedback loops and PWM DC DC converter control schemes and semiconductor devices such as silicon silicon carbide and gallium nitride Meeting the standards required by industrial employers the lab manual combines programming language with a simulation tool designed for proficiency in the theoretical and practical concepts Students and instructors can choose from an extensive list of topics involving simulations on MATLAB SABER or SPICE based platforms enabling readers to gain the most out of the prelab inlab and postlab activities The laboratory exercises have been taught and continuously improved for over 25 years by Marian K Kazimierczuk thanks to constructive student feedback and valuable suggestions on possible workroom improvements This up to date and informative teaching material is now available for the benefit of a wide audience Key features Includes complete designs to give students a quick overview of the converters their characteristics and fundamental analysis of operation Compatible with any programming tool MATLAB Mathematica or Maple and any circuit simulation tool PSpice LTSpice Synopsys SABER PLECS etc Quick design section enables students and instructors to verify their design methodology for instant simulations Presents lab exercises based on the most recent advancements in power electronics including multiple output power converters modeling current and voltage mode control schemes and power semiconductor devices Provides comprehensive appendices to aid basic understanding of the fundamental circuits programming and simulation tools Contains a quick component selection list of power MOSFETs and diodes together with their ratings important specifications and Spice models

Laboratory Manual for Microelectronic Circuits Kenneth C. Smith, Adel S. Sedra, 1991 This manual contains approximately 35 experiments It follows the organization of the text and includes experiments for all major topics To help instructor s choose and prepare for the experiments this manual identifies the core experiments all students should perform and includes manufacturers data sheets for the most common components **LABORATORY EXPERIMENTS AND**

PSPICE SIMULATIONS IN ANALOG ELECTRONICS L. K. MAHESHWARI, M. M. S. ANAND, 2006-01-01 This laboratory

manual for students of Electronics Electrical Instrumentation 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

EXTENSIVE INSTRUCTOR RESOURCES Putting the Lab Together is an extensive resource for instructors who are considering starting a lab based on this book Includes an overview of a typical lab station suggestions for choosing measurement equipment equipment list with relevant information and detailed information on parts required This resource is openly available

Instructor s Manual includes hints for choosing lab TAs hints on how to run the lab experiments guidelines for shortening or combining experiments answers to experiment questions and suggestions for projects and exams This manual is available to instructors who adopt the book

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

Additional laboratory experiments should be determined by the instructor Therefore you can choose those that you want done Some students are more efficient in the laboratory than others Therefore some would be able to

complete more experiments in a semester than others. Also many of these experiments cannot be completed in one two hour laboratory period. If space is available the circuits could be left intact from one period to the next. Or you might want to select steps in an experiment that you want to delete. Neither the values of the components or the magnitudes of the power supplies as given in the instructions are critical. Therefore you could in most cases change them if the ones recommended are not available.

Laboratory Manual Tony Cook, 1998-12-03 Physics Lab - II Mr. Rohit Manglik, 2024-07-11 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources. Specializing in competitive exams and academic support, EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels.

A Laboratory Manual in Biophotonics Vadim Backman, Adam Wax, Hao F. Zhang, 2018-05-15 Biophotonics is a burgeoning field that has afforded researchers and medical practitioners alike an invaluable tool for implementing optical microscopy. Recent advances in research have enabled scientists to measure and visualize the structural composition of cells and tissue while generating applications that aid in the detection of diseases such as cancer, Alzheimer's and atherosclerosis. Rather than divulge a perfunctory glance into the field of biophotonics, this textbook aims to fully immerse senior undergraduates, graduates and research professionals in the fundamental knowledge necessary for acquiring a more advanced awareness of concepts and pushing the field beyond its current boundaries. The authors furnish readers with a pragmatic quantitative and systematic view of biophotonics, engaging such topics as light tissue interaction, the use of optical instrumentation and formulating new methods for performing analysis. Designed for use in classroom lectures, seminars or professional laboratories, the inclusion and incorporation of this textbook can greatly benefit readers as it serves as a comprehensive introduction to current optical techniques used in biomedical applications. Caters to the needs of graduate and undergraduate students as well as R & D professionals engaged in biophotonics research. Guides readers in the field of biophotonics beginning with basic concepts before proceeding to more advanced topics and applications. Serves as a primary text for attaining an in depth systematic view of principles and applications related to biophotonics. Presents a quantitative overview of the fundamentals of biophotonic technologies. Equips readers to apply fundamentals to practical aspects of biophotonics.

Industrial Electronic Circuits Laboratory Manual Farzin Asadi, 2024-01-06 Industrial Electronics is a branch of electronics which is used for industrial applications. It plays a crucial role in the efficient and smooth operation of manufacturing facilities and industrial processes. This book introduces the commonly used building blocks in industrial electronics. The reader learns which circuit can be used for which application. It is suitable as a laboratory manual for courses like industrial electronics or power electronics.

A Problem-Solving Approach to Electric Circuits Farzin Asadi, 2025-09-30 This book is designed for students taking circuit analysis courses. It includes examples and exercises that help students review and sharpen their knowledge of the subject while enhancing their classroom performance. Offering detailed solutions, multiple methods for

solving problems and clear explanations of concepts this book aims to improve students problem solving skills and deepen their understanding of topics covered in electric circuit analysis courses Practical Interfacing in the Laboratory Stephen E. Derenzo, 2003-05-29 This text describes in practical terms how to use a desk top computer to monitor and control laboratory experiments The author clearly explains how to design electronic circuits and write computer programs to sense analyse and display real world quantities including displacement temperature force sound light and biomedical potentials The book includes numerous laboratory exercises and appendices that provide practical information on microcomputer architecture and interfacing including complete circuit diagrams and component lists Topics include analog amplification and signal processing digital to analog and analog to digital conversion electronic sensors and actuators digital and analog interfacing circuits and programming Only a very basic knowledge of electronics is assumed making it ideal for college level laboratory courses and for practising engineers and scientists Op Amp Applications Handbook Walt Jung, 2005 A complete and up to date op amp reference for electronics engineers from the most famous op amp guru Digital Circuits Laboratory Manual Farzin Asadi, 2023-08-30 Digital systems are an important part of modern life This book introduces the basic building blocks of digital systems and how these blocks can be used to design a digital system It can be used as a laboratory manual for courses such as Digital Logic and Digital Electronics All of the experiments in this book can be done in a simulation environment like Proteus or NI MultiSim or on the breadboard in a real laboratory environment EP363/P360 Course Notes and Laboratory Manual Raphael Littauer, 1985 **Fundamentals of Electrical and Electronics Engineering | AICTE Prescribed Textbook - English** Susan S. Mathew, Saji T. Chacko, 2021-11-01 Fundamentals of Electrical Electronics Engineering is a compulsory paper for the first year Diploma course in Engineering Technology Syllabus of this book is strictly aligned as per model curriculum of AICTE and academic content is amalgamated with the concept of outcome based education Books covers six topics Overview of Electronics Components and Signals Overview of Analog Circuits Overview of Digital Electronics Electric and magnetic Circuits A C Circuits and Transformer and Machines Each topic is written in easy and lucid manner A set of exercises at the end of each unit to test the student's comprehension is provided Some salient features of the book are Content of the book aligned with the mapping of Course Outcomes Programs Outcomes and Unit Outcomes The practical applications of the topics are discussed along with micro projects and activities for generating further curiosity as well as improving problem solving capacity The book provides lots of vital facts concepts principles and other interesting information QR Codes of video resources and websites to enhance use of ICT for relevant supportive knowledge have been provided Student and teacher centric course materials included in book in balanced manner Figures tables equations and comparative charts are inserted to improve clarity of the topics Objective questions and subjective questions are given for practices of students at the end of each unit Solved and unsolved problems including numerical examples are solved with systematic steps **Foundations of Electronics and Circuits and Devices** Russell L.

Meade, 1994

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