Analog And Digital Circuits For Electronic Control System Applications Using The Ti Msp430 Microcontroller

The content has been carefully designed to meet the requirements of first and second year students of electronic engineering, communications engineering and telecommunications, following full honours degree programs or two-year courses including HNC/HND. A completely new analog electronics textbook for the digital age Coverage ideal for courses with a communications / wireless focus

Logic concepts; Boolean algebra; Combinational logic; Binary number operations; Flip-flops; Counter analysis and design; Sequential circuits; Digital circuit fault analysis; Analog-digital conversion; Computers and microprocessors.

This book is written for students, practicing engineers and scientists. It covers all important aspects of analog and digital circuit design. Part I describes semiconductor devices and their behavior with respect to the models used in circuit simulation. Basic circuits are analyzed in four steps: large-signal transfer characteristic, small-signal response, noise and distortion. Part II describes the use of operational amplifiers and A/D and D/A converters in low-frequency applications. Part III describes circuits for analog and digital communication over wireless channels. This includes the high-frequency behavior of passive components, amplifiers and mixers. Simulation programs are provided: PSpice for analog circuit design and ispLever for digital circuit design.

In the earlier stages of integrated circuit design, analog circuits consisted simply of type 741 operational amplifiers, and digital circuits of 7400-type gates. Today's designers must choose from a much larger and rapidly increasing variety of special integrated circuits marketed by a dynamic and creative industry. Only by a proper selection from this wide range can an economical and competitive solution be found to a given problem. For each individual case the designer must decide which parts of a circuit are best implemented by analog circuitry, which by conventional digital circuitry and which sections could be microprocessor controlled. In order to facilitate this decision for the designer who is not familiar with all these subjects, we have arranged the book so as to group the different circuits according to their field of application. Each chapter is thus written to stand on its own, with a minimum of cross-references. To enable the reader to proceed quickly from an idea to a working circuit, we discuss, for a large variety of problems, typical solutions, the applicability of which has been proved by thorough experimental investigation. Our thanks are here due to Prof. Dr. D. Seitzer for the provision of excellent laboratory facilities. The subject is extensive and the material presented has had to be limited. For this reason, we have omitted elementary circuit design, so that the book addresses the advanced student who has some back ground in electronics, and the practising engineer and scientist.

IS THE TOPIC ANALOG TESTING AND DIAGNOSIS TIMELY? Yes, indeed it is. Testing and Diagnosis is an important topic and fulfills a vital need for the electronic industry. The testing and diagnosis of digital electronic circuits has been successfully developed to the point that it can be automated. Unfortu nately, its development for analog electronic circuits is still in its Stone Age. The engineer's intuition is still the most powerful tool used in the industry! There are two reasons for this. One is that there has been no pressing need from the industry. Analog circuits are usually small in size. Sometimes, the engineer's experience and intuition are sufficient to fulfill the need. The other reason is that there are no breakthrough results from academic re search to provide the industry with critical ideas to develop tools. This is not because of a lack of effort. Both academic and industrial research groups have made major efforts to look into this problem. Unfortunately, the prob lem for analog circuits is fundamentally different from and much more diffi cult than its counterpart for digital circuits. These efforts have led to some important findings, but are still not at the point of being practically useful. However, these situations are now changing. The current trend for the design of VLSI chips is to use analog/digital hybrid circuits, instead of digital circuits from the past. Therefore, even Ix x Preface though the analog circuit may be small, the total circuit under testing is large.

Traditionally, encryption key generation for digital systems is done using two techniques: software algorithms and hardware. The problem with both approaches is. that they can be replicated because of their pseudo random nature. Hackers can use software to regenerate the encryption key by understanding and replicating the algorithm used to generate the key. This issue can be addressed by generating a random key that does not follow any pattern or algorithm. This project is proposing a highly effective solution to generate a random encryption key for digital systems, where a hybrid approach is used. The proposed circuit combines both analog and digital parts. The analog domain consists of Chua's circuit with a random noise source. Chua's circuit is an assembly of two capacitors, a resistor and an inductor capable of producing an oscillating waveform and the output is always unique. The addition of noise .to the circuit assures that Chua's circuit is getting excited by a randomized input, which creates a much more random output. Once the key is generated, the data is stored in a digital storage device. The analog part is simulated in PSpice and the digital domain is modeled in Verilog language. The output of the circuit consists of 8-bit digital signals that can be shown in the form of waveforms. The system consists of analog circuit diagram, Verilog code, digital circuit diagram and waveforms to represent the key stored in a memory block. The final outcome of the project is a randomly generated 8-bit encryption key for digital systems.

This book contains the extended and revised editions of all the talks of the ninth AACD Workshop held in Hotel Bachmair, April 11 - 13 2000 in Rottach-Egern, Germany. The local organization was managed by Rudolf Koch of Infineon Technologies AG, Munich, Germany. The program consisted of six tutorials per day during three days. Experts in the field presented these tutorials and state of the art information is communicated. The audience at the end of the workshop selects program topics for the following workshop. The program committee, consisting of Johan Huijsing of Delft University of Technology, Willy Sansen of Katholieke Universiteit Leuven and Rudy van de Plassche of Broadcom Netherlands BV Bunnik elaborates the selected topics into a three-day program and selects experts in the field for presentation. Each AACD Workshop has given rise to publication of a book by Kluwer entitled "Analog Circuit Design". A series of nine books in a row provides valuable information and good overviews of all analog circuit techniques concerning design, CAD, simulation and device modeling. These books can be seen as a reference to those people involved in analog and mixed signal design. The aim of the workshop is to brainstorm on new and valuable design ideas in the area of analog circuit design. It is the hope of the program committee that this ninth book continues the tradition of emerging contributions to the design of analog and mixed signal systems in Europe and the rest of the world.

The goal of this book is to provide understanding and learning of the new design technique available to analog and digital system designers and the tools available to provide system solutions.

Unlike books currently on the market, this book attempts to satisfy two goals: combine circuits and electronics into a single, unified treatment, and establish a strong connection with the

contemporary world of digital systems. It will introduce a new way of looking not only at the treatment of circuits, but also at the treatment of introductory coursework in engineering in general. Using the concept of "abstraction," the book attempts to form a bridge between the world of physics and the world of large computer systems. In particular, it attempts to unify electrical engineering and computer science as the art of creating and exploiting successive abstractions to manage the complexity of building useful electrical systems. Computer systems are simply one type of electrical systems. +Balances circuits theory with practical digital electronics applications. +Illustrates concepts with real devices. +Supports the popular circuits and electronics course on the MIT OpenCourse Ware from which professionals worldwide study this new approach. +Written by two educators well known for their innovative teaching and research and their collaboration with industry. +Focuses on contemporary MOS technology.

Teaches analog and digital circuit theory by building working circuits. For college students and self-study.

For many applications, circuits that combine analog and digital signals can provide superior solutions to those produced with digital signals alone. Eighteen contributions in four sections--processing technology, circuit techniques and building blocks, design and applications, and CAD and supporting tools--detail and support this new approach. Annotation copyrighted by Book News, Inc., Portland, OR

A comprehensive and in-depth review of analog circuitlayout, schematic architecture, device, power network and ESDdesign This book will provide a balanced overview of analog circuitdesign layout, analog circuit schematic development,architecture of chips, and ESD design. It will start atan introductory level and will bring the reader right up to thestate-of-the-art. Two critical design aspects for analog and powerintegrated circuits are combined. The first design aspect coversanalog circuit design techniques to achieve the desired circuitperformance. The second and main aspect presents the additionalchallenges associated with the design of adequate and effective ESDprotection elements and schemes. A comprehensive list of practicalapplication examples is used to demonstrate the successfulcombination of both techniques and any potential designtrade-offs. Chapter One looks at analog design discipline, including layoutand analog matching and analog layout design practices. Chapter Twodiscusses analog design with circuits, examining: singletransistor amplifiers; multi-transistor amplifiers; active loadsand more. The third chapter covers analog design layout (alsoMOSFET layout), before Chapters Four and Five discuss analog designsynthesis. The next chapters introduce the reader to analog-digitalmixed signal design synthesis, analog signal pin ESD networks, andanalog ESD power clamps. Chapter Nine, the last chapter, covers ESDdesign in analog applications. Clearly describes analog design fundamentals (circuitfundamentals) as well as outlining the various ESDimplications Covers a large breadth of subjects and technologies, such asCMOS, LDMOS, BCD, SOI, and thick body SOI Establishes an "ESD analog design" discipline thatdistinguishes itself from the alternative ESD digital designfocus Focuses on circuit and circuit design applications Assessible, with the artwork and tutorial style of the ESD bookseries PowerPoint slides are available for university facultymembers Even in the world of digital circuits, analog and power circuitsare two very important but under-addressed topics, especially fromthe ESD aspect. Dr. Voldman's new book will serve as anessential and practical guide to the greater IC community. Withhigh practical and academic values this book is a"bible" for professionals, graduate students, deviceand circuit designers for investigating the physics of ESD and forproduct designs and testing.

The latest edition of this classic work on practical electronics contains improved coverage of microprocessors and microcomputers as well as interfacing components, such as D/A and A/D converters and multiplexers. The book also includes expanded treatment of equivalent circuits, Kirschoff's laws, and Nyquist and Bode diagrams and updated sections on transducers and digital circuitry.

This text, through digital experiments, aims to teach the reader practical electronics circuit theory and building techniques. Step-by-step instructions are used to teach techniques for component identification, soldering and troubleshooting.

Analog and Digital Circuits for Electronic Control System ApplicationsUsing the TI MSP430 MicrocontrollerNewnes

In system design (in particular, industrial control systems), there is, and has been, a continuous need to sense real-world analog quantities (such as temperature, pressure, or humidity), make computations with them, and then perform some action with the result. In today's systems, the computations need to be made at increased speeds and the accuracy with which the computations must be made, even as the speed increases, must be the same or higher as time progresses. The advent of the microcontroller, and its extensive use in all types of control applications, many of them battery powered, has led to new control system design approaches. Rather than computing using analog quantities, the analog quantities are sensed, conditioned, and converted to digital, processed digitally, and then converted back to an analog output, which is then used to perform the necessary output action. This practical textbook covers the latest techniques in microcontroller-based control system design. It is aimed at engineering students and engineers new to working with microcontrollers. It covers the fundamentals of: 1. Sensors and the electrical signals they output. 2. The design and application of the electronic circuits that receive and condition (change or modify) the sensor analog signals. 3. The design and application of the circuits that convert analog signals to digital and digital signals to analog. 4. The makeup and operation of a microcontroller and how to program it. 5. The application of electronic circuits for system power control. The book, written by an experienced microcontroller engineer and textbook author, is suitable for community college students, technical school students, technicians and engineers just being introduced to microcontroller system design. It is an introductory book, focusing on real-world implementation of a basic control system, with real-world circuit examples. Readers will find clearly written discussion coupled with lots of illustrations. They will also find worked-out examples that illustrate principles within each chapter and quizzes to aid understanding. Besides these specifics, a hands-on project, suitable for an electronics microcontroller laboratory course, using the popular and low-cost TI MSP430 microcontroller, is discussed in detail. The accompanying CD-ROM contains microcontrollers application notes, code for the software examples, and problem solutions. * Seasoned Texas Instruments designer provides a ground-up perspective on embedded control systems * Pedagogical style provides a self-learning approach with examples, quizzes and review features * CD-ROM contains source code and more!

Electronic Circuits covers all important aspects and applications of modern analog and digital circuit design. The basics, such as analog and digital circuits, on operational amplifiers, combinatorial and sequential logic and memories, are treated in Part I, while Part II deals with applications. Each chapter offers solutions that enable the reader to understand ready-made circuits or to proceed quickly from an

idea to a working circuit, and always illustrated by an example. Analog applications cover such topics as analog computing circuits. The digital sections deal with AD and DA conversion, digital computing circuits, microprocessors and digital filters. This editions contains the basic electronics for mobile communications. The accompanying CD-ROM contains PSPICE software, an analog-circuit-simulation package, plus simulation examples and model libraries related to the book topics.

Today's control system designers face an ever-increasing "need for speed and accuracy in their system measurements and computations. New design approaches using microcontrollers and DSP are emerging, and designers must understand these new approaches, the tools available, and how best to apply them. This practical text covers the latest techniques in microcontroller-based control system design, making use of the popular MSP430 microcontroller from Texas Instruments. The book covers all the circuits of the system, including: · Sensors and their output signals · Design and application of signal conditioning circuits · A-to-D and D-to-A circuit design · Operation and application of the powerful and popular TI MSP430 microcontroller · Data transmission circuits · System power control circuitry Written by an experienced microcontroller engineer and textbook author, the book is lavishly illustrated and includes numerous specific circuit design examples, including a fully tested and documented hands-on project using the MSP430 that makes use of the principles described. For students, engineers, technicians, and hobbyists, this practical text provides the answers you need to design modern control systems quickly and easily. Seasoned Texas Instruments designer provides a ground-up perspective on embedded control systems Pedagogical style provides a self-learning approach with examples, quizzes and review features

Improve your circuit-design potential with this expert guide to the devices and technology used in mixed analog-digital VLSI chips for such high-volume applications as hard-disk drives, wireless telephones, and consumer electronics. The book provides you with a critical understanding of device models, fabrication technology, and layout as they apply to mixed analog-digital circuits.You will learn about the many device-modeling requirements for analog work, as well as the pitfalls in models used today for computer simulators such as Spice. Also included is information on fabrication technologies developed specifically for mixed-signal VLSI chips, plus guidance on the layout of mixed analog-digital chips for a high degree of analog-device matching and minimum digital-to-analog interference.This reference book features an intuitive introduction to MOSFET operation that will enable you to view with insight any MOSFET model ? besides thorough discussions on valuable large-signal and small-signal models.Filled with practical information, this first-of-its-kind book will help you grasp the nuances of mixed-signal VLSI-device models and layout that are crucial to the design of high-performance chips.