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KEY=AND - HUDSON HARRELL

Pragmatic Power Morgan & Claypool Publishers *Pragmatic Power* is focused on just three aspects of the AC electrical power system that supplies and moves the vast majority of electrical energy nearly everywhere in the world: three-phase power systems, transformers, and induction motors. The reader needs to have had an introduction to electrical circuits and AC power, although the text begins with a review of the basics of AC power. Balanced three-phase systems are studied by developing their single-phase equivalents. The study includes a look at how the cost of "power" is affected by reactive power and power factor. Transformers are considered as a circuit element in a power system, one that can be reasonably modeled to simplify system analysis. Induction motors are presented as the most common way to change electrical energy into rotational energy. Examples include the correct selection of an induction motor for a particular rotating load. All of these topics include completely worked examples to aid the reader in understanding how to apply what has been learned. This short lecture book will be of use to students at any level of engineering, not just electrical, because it is intended for the practicing engineer or scientist looking for a practical, applied introduction to AC power systems. The authors "pragmatic" and applied style gives a unique and helpful "nonidealistic, practical, and opinionated" introduction to the topic. Table of Contents: Three-Phase Power: 3 > 3 x 1 / Transformers: Edison Lost / Induction Motors: Just One Moving Part **An Introduction to Logic Circuit Testing** Morgan & Claypool Publishers *An Introduction to Logic Circuit Testing* provides a detailed coverage of techniques for test generation and testable design of digital electronic circuits/systems. The material covered in the book should be sufficient for a course, or part of a course, in digital circuit testing for senior-level undergraduate and first-year graduate students in Electrical Engineering and Computer Science. The book will also be a valuable resource for engineers working in the industry. This book has four chapters. Chapter 1 deals with various types of faults that may occur in very large scale integration (VLSI)-based digital circuits. Chapter 2 introduces the major concepts of all test generation techniques such as redundancy, fault coverage, sensitization, and backtracking. Chapter 3 introduces the key concepts of testability, followed by some ad hoc design-for-testability rules that can be used to enhance testability of combinational circuits. Chapter 4 deals with test generation and response evaluation techniques used in BIST (built-in self-test) schemes for VLSI chips. Table of Contents: Introduction / Fault Detection in Logic Circuits / Design for Testability / Built-in Self-Test / References **Synthesis Lectures on Digital Circuits and Systems : Progress in Applications of Boolean Functions PSpice for Analog Communications Engineering** Springer Nature In *PSpice for Analog Communications Engineering* we simulate the difficult principles of analog modulation using the superb free simulation software Cadence Orcad PSpice V10.5. While use is made of analog behavioral model parts (ABM), we use actual circuitry in most of the simulation circuits. For example, we use the 4-quadrant multiplier IC AD633 as a modulator and import real speech as the modulating source and look at the trapezoidal method for measuring the modulation index. Modulation is the process of relocating signals to different parts of the radio frequency spectrum by modifying certain parameters of the carrier in accordance with the modulating/information signals. In amplitude modulation, the modulating source changes the carrier amplitude, but in frequency modulation it causes the carrier frequency to change (and in phase modulation it's the carrier phase). The digital equivalent of these modulation techniques are examined in PSpice for Digital communications Engineering where we examine QAM, FSK, PSK and variants. We examine a range of oscillators and plot Nyquist diagrams showing the marginal stability of these systems. The superhetrodyne principle, the backbone of modern receivers is simulated using discrete components followed by simulating complete AM and FM receivers. In this exercise we examine the problems of matching individual stages and the use of double-tuned RF circuits to accommodate the large FM signal bandwidth. **Pragmatic Logic** Morgan & Claypool Publishers *Pragmatic Logic* presents the analysis and design of digital logic systems. The author begins with a brief study of binary and hexadecimal number systems and then looks at the basics of Boolean algebra. The study of logic circuits is divided into two parts, combinational logic, which has no memory, and sequential logic, which does. Numerous examples highlight the principles being presented. The text ends with an introduction to digital logic design using Verilog, a hardware description language. The chapter on Verilog can be studied along with the other chapters in the text. After the reader has completed combinational logic in Chapters 4 and 5, sections 9.1 and 9.2 would be appropriate. Similarly, the rest of Chapter 9 could be studied after completing sequential logic in Chapters 6 and 7. This short lecture book will be of use to students at any level of electrical or computer engineering and for practicing engineers or scientists in any field looking for a practical and applied introduction to digital logic. The author's "pragmatic" and applied style gives a unique and helpful "non-idealist, practical, opinionated" introduction to digital systems. **PSpice for Digital Signal Processing** Morgan & Claypool Publishers *PSpice* is a software package that provides robust, advanced circuit analysis tools to improve design performance, yield, and reliability. Its capabilities enable engineers to create virtual prototypes of designs and maximize circuit performance automatically. This book is the fifth of a five-part series of books covering PSpice 10.5 and all of its applications. This book examines linear time invariant systems starting with the difference equation and applying the z-transform to produce a range of filter type i.e. low-pass, high-pass, and bandpass. Convolution is examined, followed by digital oscillators, including quadrature carrier generation, are then examined. Several filter design methods are considered and include the bilinear transform, impulse invariant, and window techniques. A range of DSP applications are then considered and include the Hilbert transform, single sideband modulator using the Hilbert transform and quad oscillators, integrators and differentiators. Decimation and interpolation are simulated to demonstrate the usefulness of the multi-sampling environment. Decimation is also applied in a treatment on digital receivers. Lastly, we look at some musical applications for DSP such as reverberation/echo using real-world signals imported into PSpice using the program Wav2Ascii. The zero-forcing equalizer is dealt with in a simplistic manner and illustrates the effectiveness of equalizing signals in a receiver after transmission. Other books in the series: PSpice for Circuit Theory and Electronic Devices (9781598291568) PSpice for Filters and Transmission Lines (9781598291582) PSpice for Analog Communications Engineering (9781598291605) PSpice for Digital Communications Engineering (9781598291629) **Pragmatic Circuits D-C and Time Domain** Morgan & Claypool Publishers *Pragmatic Circuits: DC and Time Domain* deals primarily with circuits and how they function, beginning with a review of Kirchhoff's and Ohm's Laws analysis of d-c circuits and op-amps, and the sinusoidal steady state. The author then looks at formal circuit analysis through nodal and mesh equations. Useful theorems like Thevenin are added to the circuits toolbox. This first of three volumes ends with a chapter on design. The two follow-up volumes in the *Pragmatic Circuits* series include titles on Frequency Domain and Signals and Filters. These short lecture books will be of use to students at any level of electrical engineering and for practicing engineers, or scientists, in any field looking for a practical and applied introduction to circuits and signals. The author's "pragmatic" and applied style gives a unique and helpful "non-idealistic, practical, opinionated" introduction to circuits. **PSpice for Circuit Theory and Electronic Devices** Morgan & Claypool Publishers *PSpice for Circuit Theory and Electronic Devices* is one of a series of five PSpice books and introduces the latest Cadence Orcad PSpice version 10.5 by simulating a range of DC and AC exercises. It is aimed primarily at those wishing to get up to speed with this version but will be of use to high school students, undergraduate students, and of course, lecturers. Circuit theorems are applied to a range of circuits and the calculations by hand after analysis are then compared to the simulated results. The Laplace transform and the s-plane are used to analyze CR and LR circuits where transient signals are involved. Here, the Probe output graphs demonstrate what a great learning tool PSpice is by providing the reader with a visual verification of any theoretical calculations. Series and parallel-tuned resonant circuits are investigated where the difficult concepts of dynamic impedance and selectivity are best understood by sweeping different circuit parameters through a range of values. Obtaining semiconductor device characteristics as a laboratory exercise has fallen out of favour of late, but nevertheless, is still a useful exercise for understanding or modelling semiconductor devices. Inverting and non-inverting operational amplifiers characteristics such as gain-bandwidth are investigated and we will see the dependency of bandwidth on the gain using the performance analysis facility. Power amplifiers are examined where PSpice/Probe demonstrates very nicely the problems of cross-over distortion and other problems associated with power transistors. We examine power supplies and the problems of regulation, ground bounce, and power factor correction. Lastly, we look at MOSFET device characteristics and show how these devices are used to form basic CMOS logic gates such as NAND and NOR gates. **PSpice for Digital Communications Engineering** Morgan & Claypool Publishers *PSpice for Digital Communications Engineering* shows how to simulate digital communication systems and modulation methods using the very powerful Cadence Orcad PSpice version 10.5 suite of software programs. Fourier series and Fourier transform are applied to signals to set the ground work for the modulation techniques introduced in later chapters. Various baseband signals, including duo-binary baseband signaling, are generated and the spectra are examined to detail the unsuitability of these signals for accessing the public switched network. Pulse code modulation and time-division multiplexing circuits are examined and simulated where sampling and quantization noise topics are discussed. We construct a single-channel PCM system from transmission to receiver i.e. end-to-end, and import real speech signals to examine the problems associated with aliasing, sample and hold. Companding is addressed here and we look at the A and mu law characteristics for achieving better signal to quantization noise ratios. Several types of delta modulators are examined and also the concept of time division multiplexing is considered. Multi-level signaling techniques such as QPSK and QAM are analyzed and simulated and "home-made meters", such as scatter and eye meters, are used to assess the performance of these modulation systems in the presence of noise. The raised-cosine family of filters for shaping data before transmission is examined in depth where bandwidth efficiency and channel capacity is discussed. We plot several graphs in Probe to compare the efficiency of these systems. Direct spread spectrum is the last topic to be examined and simulated to show the advantages of spreading the signal over a wide bandwidth and giving good signal security at the same time. **High-speed Digital System Design** Morgan & Claypool Publishers "E-health is closely related with networks and telecommunications when dealing with applications of collecting or transferring medical data from distant locations for performing remote medical collaborations and diagnosis. In this book we provide an overview of the fields of image and signal processing for networked and distributed e-health applications and their supporting technologies. The book is structured in 10 chapters, starting the discussion from the lower end, that of acquisition and processing of biosignals and medical images and ending in complex virtual reality systems and techniques providing more intuitive interaction in a networked medical environment. The book also discusses networked clinical decision support systems and corresponding medical standards, WWW-based applications, medical collaborative platforms, wireless networking, and the concepts of ambient intelligence and pervasive computing in electronic healthcare systems."--Publishers' Website. **Finite State Machine Datapath Design, Optimization, and Implementation** Morgan & Claypool Publishers *Finite State Machine-Datapath Design, Optimization, and Implementation* explores the design space of combined FSM/Datapath implementations. The lecture starts by examining performance issues in digital systems such as clock skew and its effect on setup and hold time constraints, and the use of pipelining for increasing system clock frequency. This is followed by definitions for latency and throughput, with associated resource tradeoffs explored in detail through the use of dataflow graphs and scheduling tables applied to examples taken from digital signal processing applications. Also, design issues relating to functionality, interfacing, and performance for different types of memories commonly found in ASICs and FPGAs such as FIFOs, single-ports, dual-ports, and register files are examined. Finally, design issues regarding cooperating Finite State Machine/Datapaths are explored. All design examples are presented in implementation-neutral Verilog code and block diagrams, with associated design files available as downloads for both Altera Quartus and Xilinx Virtex FPGA platforms. A working knowledge of Verilog, logic synthesis, and basic digital design techniques is required. This lecture is suitable as a companion to the synthesis lecture titled *Introduction to Logic Synthesis using Verilog HDL*. **Circuit Analysis with Multisim** Morgan & Claypool Publishers This book is concerned with circuit simulation using National Instruments Multisim. It focuses on the use and comprehension of the working techniques for electrical and electronic circuit simulation. The first chapters are devoted to basic circuit analysis. It starts by describing in detail how to perform a DC analysis using only resistors and independent and controlled sources. Then, it introduces capacitors and inductors to make a transient analysis. In the case of transient analysis, it is possible to have an initial condition either in the capacitor voltage or in the inductor current, or both. Fourier analysis is discussed in the context of transient analysis. Next, we make a treatment of AC

analysis to simulate the frequency response of a circuit. Then, we introduce diodes, transistors, and circuits composed by them and perform DC, transient, and AC analyses. The book ends with simulation of digital circuits. A practical approach is followed through the chapters, using step-by-step examples to introduce new Multisim circuit elements, tools, analyses, and virtual instruments for measurement. The examples are clearly commented and illustrated. The different tools available on Multisim are used when appropriate so readers learn which analyses are available to them. This is part of the learning outcomes that should result after each set of end-of-chapter exercises is worked out. Table of Contents: Introduction to Circuit Simulation / Resistive Circuits / Time Domain Analysis -- Transient Analysis / Frequency Domain Analysis -- AC Analysis / Semiconductor Devices / Digital Circuits **Microcontrollers Fundamentals for Engineers and Scientists** Morgan & Claypool Publishers Microcontrollers Fundamentals for Engineers and Scientists provides practicing scientists and engineers a tutorial on the fundamental concepts and the use of microcontrollers. Today, microcontrollers, or single integrated circuit (chip) computers, play critical roles in almost all instrumentation and control systems. There are a number of books that explore the fascinating world of microcontroller theory and applications. However, most of these are geared toward undergraduate and graduate students taking an electrical and/or computer engineering course. Furthermore, these texts have been written with a particular model of microcontroller as the target discussion. These textbooks also require a requisite knowledge of digital design fundamentals. In this textbook, authors Steven Barrett and Daniel Pack present the fundamental concepts common to all microcontrollers. The book presents the over-arching theory of microcontroller operation and provides a detailed discussion on constituent subsystems available in most microcontrollers. The text can be readily applied to a wide variety of microcontroller technologies, allowing practicing scientists and engineers to become acquainted with basic concepts prior to beginning a design involving a specific microcontroller. Both authors have used a wide variety of microcontrollers from various manufacturers and have found that the fundamental principles of a given microcontroller are easily transferred to other controllers. Although this is a relatively small textbook, it is packed with useful information and allows students and professionals to quickly come up to speed on microcontroller concepts. **Introduction to Logic Synthesis Using Verilog HDL** Morgan & Claypool Publishers Introduction to Logic Synthesis Using Verilog HDL explains how to write accurate Verilog descriptions of digital systems that can be synthesized into digital system netlists with desirable characteristics. The book contains numerous Verilog examples that begin with simple combinational networks and progress to synchronous sequential logic systems. Common pitfalls in the development of synthesizable Verilog HDL are also discussed along with methods for avoiding them. The target audience is anyone with a basic understanding of digital logic principles who wishes to learn how to model digital systems in the Verilog HDL in a manner that also allows for automatic synthesis. A wide range of readers, from hobbyists and undergraduate students to seasoned professionals, will find this a compelling and approachable work. The book provides concise coverage of the material and includes many examples, enabling readers to quickly generate high-quality synthesizable Verilog models. **Designing Asynchronous Circuits Using NULL Convention Logic (NCL)** Morgan & Claypool Publishers Designing Asynchronous Circuits using NULL Convention Logic (NCL) begins with an introduction to asynchronous (clockless) logic in general, and then focuses on delay-insensitive asynchronous logic design using the NCL paradigm. The book details design of input-complete and observable dual-rail and quad-rail combinational circuits, and then discusses implementation of sequential circuits, which require datapath feedback. Next, throughput optimization techniques are presented, including pipelining, embedding registration, early completion, and NULL cycle reduction. Subsequently, low-power design techniques, such as wavefront steering and Multi-Threshold CMOS (MTCMOS) for NCL, are discussed. The book culminates with a comprehensive design example of an optimized Greatest Common Divisor circuit. Readers should have prior knowledge of basic logic design concepts, such as Boolean algebra and Karnaugh maps. After studying this book, readers should have a good understanding of the differences between asynchronous and synchronous circuits, and should be able to design arbitrary NCL circuits, optimized for area, throughput, and power. Table of Contents: Introduction to Asynchronous Logic / Overview of NULL Convention Logic (NCL) / Combinational NCL Circuit Design / Sequential NCL Circuit Design / NCL Throughput Optimization / Low-Power NCL Design / Comprehensive NCL Design Example **Multiple Valued Logic Concepts and Representations** Morgan & Claypool Publishers Multiple Valued Logic: Concepts and Representations begins with a survey of the use of multiple-valued logic in several modern application areas including electronic design automation algorithms and circuit design. The mathematical basis and concepts of various algebras and systems of multiple valued logic are provided including comparisons among various systems and examples of their application. The book also provides an examination of alternative representations of multiple-valued logic suitable for implementation as data structures in automated computer applications. Decision diagram structures for multiple valued applications are described in detail with particular emphasis on the recently developed quantum multiple valued decision diagram. Table of Contents: Multiple Valued Logic Applications / MVL Concepts and Algebra / Functional Representations / Reversible and Quantum Circuits / Quantum Multiple-Valued Decision Diagrams / Summary / Bibliography **Progress in Applications of Boolean Functions** Morgan & Claypool Publishers This book brings together five topics on the application of Boolean functions. They are 1. Equivalence classes of Boolean functions: The number of n -variable functions is large, even for values as small as $n = 6$, and there has been much research on classifying functions. There are many classifications, each with their own distinct merit. 2. Boolean functions for cryptography: The process of encrypting/decrypting plaintext messages often depends on Boolean functions with specific properties. For example, highly nonlinear functions are valued because they are less susceptible to linear attacks. 3. Boolean differential calculus: An operation analogous to taking the derivative of a real-valued function offers important insight into the properties of Boolean functions. One can determine tests or susceptibility to hazards. 4. Reversible logic: Most logic functions are irreversible; it is impossible to reconstruct the input, given the output. However, Boolean functions that are reversible are necessary for quantum computing, and hold significant promise for low-power computing. 5. Data mining: The process of extracting subtle patterns from enormous amounts of data has benefited from the use of a graph-based representation of Boolean functions. This has use in surveillance, fraud detection, scientific discovery including bio-informatics, genetics, medicine, and education. Written by experts, these chapters present a tutorial view of new and emerging technologies in Boolean functions. Table of Contents: Equivalence Classes of Boolean Functions / Boolean Functions for Cryptography / Boolean Differential Calculus / Synthesis of Boolean Functions in Reversible Logic / Data Mining Using Binary Decision Diagrams **Introduction to Embedded Systems Using ANSI C and the Arduino Development Environment** Springer Nature Many electrical and computer engineering projects involve some kind of embedded system in which a microcontroller sits at the center as the primary source of control. The recently-developed Arduino development platform includes an inexpensive hardware development board hosting an eight-bit ATMEGA ATmega-family processor and a Java-based software-development environment. These features allow an embedded systems beginner the ability to focus their attention on learning how to write embedded software instead of wasting time overcoming the engineering CAD tools learning curve. The goal of this text is to introduce fundamental methods for creating embedded software in general, with a focus on ANSI C. The Arduino development platform provides a great means for accomplishing this task. As such, this work presents embedded software development using 100% ANSI C for the Arduino's ATmega328P processor. We deviate from using the Arduino-specific Wiring libraries in an attempt to provide the most general embedded methods. In this way, the reader will acquire essential knowledge necessary for work on future projects involving other processors. Particular attention is paid to the notorious issue of using C pointers in order to gain direct access to microprocessor registers, which ultimately allow control over all peripheral interfacing. Table of Contents: Introduction / ANSI C / Introduction to Arduino / Embedded Debugging / ATmega328P Architecture / General-Purpose Input/Output / Timer Ports / Analog Input Ports / Interrupt Processing / Serial Communications / Assembly Language / Non-volatile Memory **PSpice for Filters and Transmission Lines** Morgan & Claypool Publishers In this book, PSpice for Filters and Transmission Lines, we examine a range of active and passive filters where each design is simulated using the latest Cadence Orcad V10.5 PSpice capture software. These filters cannot match the very high order digital signal processing (DSP) filters considered in PSpice for Digital Signal Processing, but nevertheless these filters have many uses. The active filters considered were designed using Butterworth and Chebyshev approximation loss functions rather than using the 'cookbook approach' so that the final design will meet a given specification in an exacting manner. Switched-capacitor filter circuits are examined and here we see how useful PSpice/Probe is in demonstrating how these filters, filter, as it were. Two-port networks are discussed as an introduction to transmission lines and, using a series of problems, we demonstrate quarter-wave and single-stub matching. The concept of time domain reflectometry as a fault location tool on transmission lines is then examined. In the last chapter we discuss the technique of importing and exporting speech signals into a PSpice schematic using a tailored-made program Wav2ascii. This is a novel technique that greatly extends the simulation boundaries of PSpice. Various digital circuits are also examined at the end of this chapter to demonstrate the use of the bus structure and other techniques. **Fundamentals of Electronics: Book 1 Electronic Devices and Circuit Applications** Morgan & Claypool Publishers This book, Electronic Devices and Circuit Application, is the first of four books of a larger work, Fundamentals of Electronics. It is comprised of four chapters describing the basic operation of each of the four fundamental building blocks of modern electronics: operational amplifiers, semiconductor diodes, bipolar junction transistors, and field effect transistors. Attention is focused on the reader obtaining a clear understanding of each of the devices when it is operated in equilibrium. Ideas fundamental to the study of electronic circuits are also developed in the book at a basic level to lessen the possibility of misunderstandings at a higher level. The difference between linear and non-linear operation is explored through the use of a variety of circuit examples including amplifiers constructed with operational amplifiers as the fundamental component and elementary digital logic gates constructed with various transistor types. Fundamentals of Electronics has been designed primarily for use in an upper division course in electronics for electrical engineering students. Typically such a course spans a full academic year consisting of two semesters or three quarters. As such, Electronic Devices and Circuit Applications, and the following two books, Amplifiers: Analysis and Design and Active Filters and Amplifier Frequency Response, form an appropriate body of material for such a course. Secondary applications include the use in a one-semester electronics course for engineers or as a reference for practicing engineers. **Boolean Differential Equations** Morgan & Claypool Publishers The Boolean Differential Calculus (BDC) is a very powerful theory that extends the structure of a Boolean Algebra significantly. Based on a small number of definitions, many theorems have been proven. The available operations have been efficiently implemented in several software packages. There is a very wide field of applications. While a Boolean Algebra is focused on values of logic functions, the BDC allows the evaluation of changes of function values. Such changes can be explored for pairs of function values as well as for whole subspaces. Due to the same basic data structures, the BDC can be applied to any task described by logic functions and equations together with the Boolean Algebra. The BDC can be widely used for the analysis, synthesis, and testing of digital circuits. Generally speaking, a Boolean differential equation (BDE) is an equation in which elements of the BDC appear. It includes variables, functions, and derivative operations of these functions. The solution of such a BDE is a set of Boolean functions. This is a significant extension of Boolean equations, which have sets of Boolean vectors as solutions. In the simplest BDE a derivative operation of the BDC on the left-hand side is equal to a logic function on the right-hand side. The solution of such a simple BDE means to execute an operation which is inverse to the given derivative. BDEs can be applied in the same fields as the BDC, however, their possibility to express sets of Boolean functions extends the application field significantly. **Synthesis and Optimization of FPGA-Based Systems** Springer Science & Business Media The book is composed of two parts. The first part introduces the concepts of the design of digital systems using contemporary field-programmable gate arrays (FPGAs). Various design techniques are discussed and illustrated by examples. The operation and effectiveness of these techniques is demonstrated through experiments that use relatively cheap prototyping boards that are widely available. The book begins with easily understandable introductory sections, continues with commonly used digital circuits, and then gradually extends to more advanced topics. The advanced topics include novel techniques where parallelism is applied extensively. These techniques involve not only core reconfigurable logical elements, but also use embedded blocks such as memories and digital signal processing slices and interactions with general-purpose and application-specific computing systems. Fully synthesizable specifications are provided in a hardware-description language (VHDL) and are ready to be tested and incorporated in engineering designs. A number of practical applications are discussed from areas such as data processing and vector-based computations (e.g. Hamming weight counters/comparators). The second part of the book covers the more theoretical aspects of finite state machine synthesis with the main objective of reducing basic FPGA resources, minimizing delays and achieving greater optimization of circuits and systems. **Arduino I Getting Started** Morgan & Claypool Publishers This book is about the Arduino microcontroller and the Arduino concept. The visionary Arduino team of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis launched a new innovation in microcontroller hardware in 2005, the concept of open-source hardware. Their approach was to openly share details of microcontroller-based hardware design platforms to stimulate the sharing of ideas and promote innovation. This concept has been popular in the software world for many years. In June 2019, Joel Claypool and I met to plan the fourth edition of Arduino Microcontroller Processing for Everyone! Our goal has been to provide an accessible book on the rapidly changing world of Arduino for a wide variety of audiences including students of the fine arts, middle and senior high school students, engineering design students, and practicing scientists and engineers. To make the book more accessible to better serve our readers, we decided to change our approach and provide a series of smaller volumes. Each volume is written to a specific audience. This book, Arduino I: Getting Started is written for those looking for a quick tutorial on the Arduino environment, platforms, interface techniques, and applications. Arduino II will explore advanced techniques, applications, and systems design. Arduino III will explore Arduino applications in the Internet of Things (IoT). Arduino I: Getting Started covers three different Arduino products: the Arduino UNO R3 equipped with the Microchip ATmega328, the Arduino Mega 2560 equipped with the Microchip ATmega2560, and the wearable Arduino LilyPad. **Fundamentals of Electronics: Book 2 Amplifiers: Analysis and Design** Morgan & Claypool Publishers This book, Amplifiers: Analysis and Design, is the second of four books of a larger work, Fundamentals of Electronics. It is comprised of four chapters that describe the fundamentals of amplifier performance. Beginning with a review of two-port analysis, the first chapter introduces the modeling of the response of transistors to AC signals. Basic one-transistor amplifiers are extensively discussed. The next chapter expands the discussion to multiple transistor amplifiers. The coverage of simple amplifiers is concluded with a chapter that examines

power amplifiers. This discussion defines the limits of small-signal analysis and explores the realm where these simplifying assumptions are no longer valid and distortion becomes present. The final chapter concludes the book with the first of two chapters in *Fundamentals of Electronics* on the significant topic of feedback amplifiers. *Fundamentals of Electronics* has been designed primarily for use in an upper division course in electronics for electrical engineering students. Typically such a course spans a full academic year consisting of two semesters or three quarters. As such, *Amplifiers: Analysis and Design*, and two other books, *Electronic Devices and Circuit Applications*, and *Active Filters and Amplifier Frequency Response*, form an appropriate body of material for such a course. Secondary applications include the use with *Electronic Devices and Circuit Applications* in a one-semester electronics course for engineers or as a reference for practicing engineers. **Digital Circuits and Systems** This is the first volume in a new hardcover combined volume of *Synthesis Lectures*. This volume contains the following lectures: *Finite State Machine Datapath Design, Optimization, and Implementation; Introduction to Logic Synthesis using Verilog HDL; High-Speed Digital System Design; Microcontrollers Fundamentals for Engineers and Scientists* **Programming the ARM® Cortex®-M4-based STM32F4 Microcontrollers with Simulink®** Morgan & Claypool Publishers A microcontroller is a compact, integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory, and input/output (I/O) peripherals on a single chip. When they first became available, microcontrollers solely used Assembly language. Today, the C programming language (and some other high-level languages) can be used as well. Some of advanced microcontrollers support another programming technique as well: Graphical programming. In graphical programming, the user does not write any code but draws the block diagram of the system he wants. Then a software converts the drawn block diagram into a suitable code for the target device. Programming microcontrollers using graphical programming is quite easier than programming in C or Assembly. You can implement a complex system within hours with graphical programming while its implementation in C may take months. These features make the graphical programming an important option for engineers. This book study the graphical programming of STM32F4 high-performance microcontrollers with the aid of Simulink and Waijung blockset. Students of engineering (for instance, electrical, biomedical, mechatronics and robotic to name a few), engineers who work in industry, and anyone who want to learn the graphical programming of STM32F4 can benefit from this book. Prerequisite for this book is the basic knowledge of MATLAB Simulink. **Digital System Verification A Combined Formal Methods and Simulation Framework** Springer Nature Integrated circuit capacity follows Moore's law, and chips are commonly produced at the time of this writing with over 70 million gates per device. Ensuring correct functional behavior of such large designs before fabrication poses an extremely challenging problem. Formal verification validates the correctness of the implementation of a design with respect to its specification through mathematical proof techniques. Formal techniques have been emerging as commercialized EDA tools in the past decade. Simulation remains a predominantly used tool to validate a design in industry. After more than 50 years of development, simulation methods have reached a degree of maturity, however, new advances continue to be developed in the area. A simulation approach for functional verification can theoretically validate all possible behaviors of a design but requires excessive computational resources. Rapidly evolving markets demand short design cycles while the increasing complexity of a design causes simulation approaches to provide less and less coverage. Formal verification is an attractive alternative since 100% coverage can be achieved; however, large designs impose unrealistic computational requirements. Combining formal verification and simulation into a single integrated circuit validation framework is an attractive alternative. This book focuses on an Integrated Design Validation (IDV) system that provides a framework for design validation and takes advantage of current technology in the areas of simulation and formal verification resulting in a practical validation engine with reasonable runtime. After surveying the basic principles of formal verification and simulation, this book describes the IDV approach to integrated circuit functional validation. Table of Contents: Introduction / Formal Methods Background / Simulation Approaches / Integrated Design Validation System / Conclusion and Summary **Modeling Digital Switching Circuits with Linear Algebra** Morgan & Claypool Publishers Modeling Digital Switching Circuits with Linear Algebra describes an approach for modeling digital information and circuitry that is an alternative to Boolean algebra. While the Boolean algebraic model has been wildly successful and is responsible for many advances in modern information technology, the approach described in this book offers new insight and different ways of solving problems. Modeling the bit as a vector instead of a scalar value in the set $\{0, 1\}$ allows digital circuits to be characterized with transfer functions in the form of a linear transformation matrix. The use of transfer functions is ubiquitous in many areas of engineering and their rich background in linear systems theory and signal processing is easily applied to digital switching circuits with this model. The common tasks of circuit simulation and justification are specific examples of the application of the linear algebraic model and are described in detail. The advantages offered by the new model as compared to traditional methods are emphasized throughout the book. Furthermore, the new approach is easily generalized to other types of information processing circuits such as those based upon multiple-valued or quantum logic; thus providing a unifying mathematical framework common to each of these areas. Modeling Digital Switching Circuits with Linear Algebra provides a blend of theoretical concepts and practical issues involved in implementing the method for circuit design tasks. Data structures are described and are shown to not require any more resources for representing the underlying matrices and vectors than those currently used in modern electronic design automation (EDA) tools based on the Boolean model. Algorithms are described that perform simulation, justification, and other common EDA tasks in an efficient manner that are competitive with conventional design tools. The linear algebraic model can be used to implement common EDA tasks directly upon a structural netlist thus avoiding the intermediate step of transforming a circuit description into a representation of a set of switching functions as is commonly the case when conventional Boolean techniques are used. Implementation results are provided that empirically demonstrate the practicality of the linear algebraic model. **Fundamentals of Electronics: Book 4 Oscillators and Advanced Electronics Topics** Morgan & Claypool Publishers This book, *Oscillators and Advanced Electronics Topics*, is the final book of a larger, four-book set, *Fundamentals of Electronics*. It consists of five chapters that further develop practical electronic applications based on the fundamental principles developed in the first three books. This book begins by extending the principles of electronic feedback circuits to linear oscillator circuits. The second chapter explores non-linear oscillation, waveform generation, and waveshaping. The third chapter focuses on providing clean, reliable power for electronic applications where voltage regulation and transient suppression are the focus. Fundamentals of communication circuitry form the basis for the fourth chapter with voltage-controlled oscillators, mixers, and phase-lock loops being the primary focus. The final chapter expands upon early discussions of logic gate operation (introduced in Book 1) to explore gate speed and advanced gate topologies. *Fundamentals of Electronics* has been designed primarily for use in upper division courses in electronics for electrical engineering students and for working professionals. Typically such courses span a full academic year plus an additional semester or quarter. As such, *Oscillators and Advanced Electronics Topics* and the three companion book of *Fundamentals of Electronics* form an appropriate body of material for such courses. **Advanced Circuit Simulation Using Multisim Workbench** Morgan & Claypool Publishers Multisim is now the de facto standard for circuit simulation. It is a SPICE-based circuit simulator which combines analog, discrete-time, and mixed-mode circuits. In addition, it is the only simulator which incorporates microcontroller simulation in the same environment. It also includes a tool for printed circuit board design. *Advanced Circuit Simulation Using Multisim Workbench* is a companion book to *Circuit Analysis Using Multisim*, published by Morgan & Claypool in 2011. This new book covers advanced analyses and the creation of models and subcircuits. It also includes coverage of transmission lines, the special elements which are used to connect components in PCBs and integrated circuits. Finally, it includes a description of Ultiboard, the tool for PCB creation from a circuit description in Multisim. Both books completely cover most of the important features available for a successful circuit simulation with Multisim. Table of Contents: Models and Subcircuits / Transmission Lines / Other Types of Analyses / Simulating Microcontrollers / PCB Design With Ultiboard **Microcontroller Programming and Interfacing with Texas Instruments MSP430FR2433 and MSP430FR5994 Part I & II** Springer Nature This book provides a thorough introduction to the Texas Instruments MSP430TM microcontroller. The MSP430 is a 16-bit reduced instruction set (RISC) processor that features ultra-low power consumption and integrated digital and analog hardware. Variants of the MSP430 microcontroller have been in production since 1993. This provides for a host of MSP430 products including evaluation boards, compilers, software examples, and documentation. A thorough introduction to the MSP430 line of microcontrollers, programming techniques, and interface concepts are provided along with considerable tutorial information with many illustrated examples. Each chapter provides laboratory exercises to apply what has been presented in the chapter. The book is intended for an upper level undergraduate course in microcontrollers or mechatronics but may also be used as a reference for capstone design projects. Also, practicing engineers already familiar with another microcontroller, who require a quick tutorial on the microcontroller, will find this book very useful. This second edition introduces the MSP-EXP430FR5994 and the MSP430-EXP430FR2433 LaunchPads. Both LaunchPads are equipped with a variety of peripherals and Ferroelectric Random Access Memory (FRAM). FRAM is a nonvolatile, low-power memory with functionality similar to flash memory. **Microchip AVR® Microcontroller Primer Programming and Interfacing, Third Edition** Springer Nature This textbook provides practicing scientists and engineers a primer on the Microchip AVR® microcontroller. The revised title of this book reflects the 2016 Microchip Technology acquisition of Atmel Corporation. In this third edition we highlight the popular ATmega164 microcontroller and other pin-for-pin controllers in the family with a complement of flash memory up to 128 KB. The third edition also provides an update on Atmel Studio, programming with a USB pod, the gcc compiler, the ImageCraft JumpStart C for AVR compiler, the Two-Wire Interface (TWI), and multiple examples at both the subsystem and system level. Our approach is to provide readers with the fundamental skills to quickly set up and operate with this internationally popular microcontroller. We cover the main subsystems aboard the ATmega164, providing a short theory section followed by a description of the related microcontroller subsystem with accompanying hardware and software to operate the subsystem. In all examples, we use the C programming language. We include a detailed chapter describing how to interface the microcontroller to a wide variety of input and output devices and conclude with several system level examples including a special effects light-emitting diode cube, autonomous robots, a multi-function weather station, and a motor speed control system. **Index Generation Functions** Springer Nature Index generation functions are binary-input integer valued functions. They represent functions of content addressable memories (CAMs). Applications include: IP address tables; terminal controllers; URL lists; computer virus scanning circuits; memory patch circuits; list of English words; code converters; and pattern matching circuits. This book shows memory-based realization of index generation functions. It shows: 1. methods to implement index generation functions by look-up table (LUT) cascades and index generation units (IGU), 2. methods to reduce the number of variables using linear transformations, and 3. methods to estimate the sizes of memories, with many illustrations, tables, examples, exercises, and their solutions. **Arduino I Getting Started** Springer Nature This book is about the Arduino microcontroller and the Arduino concept. The visionary Arduino team of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis launched a new innovation in microcontroller hardware in 2005, the concept of open-source hardware. Their approach was to openly share details of microcontroller-based hardware design platforms to stimulate the sharing of ideas and promote innovation. This concept has been popular in the software world for many years. In June 2019, Joel Claypool and I met to plan the fourth edition of *Arduino Microcontroller Processing for Everyone!* Our goal has been to provide an accessible book on the rapidly changing world of Arduino for a wide variety of audiences including students of the fine arts, middle and senior high school students, engineering design students, and practicing scientists and engineers. To make the book more accessible to better serve our readers, we decided to change our approach and provide a series of smaller volumes. Each volume is written to a specific audience. This book, *Arduino I: Getting Started* is written for those looking for a quick tutorial on the Arduino environment, platforms, interface techniques, and applications. *Arduino II* will explore advanced techniques, applications, and systems design. *Arduino III* will explore Arduino applications in the Internet of Things (IoT). *Arduino I: Getting Started* covers three different Arduino products: the Arduino UNO R3 equipped with the Microchip ATmega328, the Arduino Mega 2560 equipped with the Microchip ATmega2560, and the wearable Arduino LilyPad. **Circuit Analysis with Multisim** Springer Nature This book is concerned with circuit simulation using National Instruments Multisim. It focuses on the use and comprehension of the working techniques for electrical and electronic circuit simulation. The first chapters are devoted to basic circuit analysis. It starts by describing in detail how to perform a DC analysis using only resistors and independent and controlled sources. Then, it introduces capacitors and inductors to make a transient analysis. In the case of transient analysis, it is possible to have an initial condition either in the capacitor voltage or in the inductor current, or both. Fourier analysis is discussed in the context of transient analysis. Next, we make a treatment of AC analysis to simulate the frequency response of a circuit. Then, we introduce diodes, transistors, and circuits composed by them and perform DC, transient, and AC analyses. The book ends with simulation of digital circuits. A practical approach is followed through the chapters, using step-by-step examples to introduce new Multisim circuit elements, tools, analyses, and virtual instruments for measurement. The examples are clearly commented and illustrated. The different tools available on Multisim are used when appropriate so readers learn which analyses are available to them. This is part of the learning outcomes that should result after each set of end-of-chapter exercises is worked out. Table of Contents: Introduction to Circuit Simulation / Resistive Circuits / Time Domain Analysis -- Transient Analysis / Frequency Domain Analysis -- AC Analysis / Semiconductor Devices / Digital Circuits **Advanced Circuit Simulation Using Multisim Workbench** Springer Nature Multisim is now the de facto standard for circuit simulation. It is a SPICE-based circuit simulator which combines analog, discrete-time, and mixed-mode circuits. In addition, it is the only simulator which incorporates microcontroller simulation in the same environment. It also includes a tool for printed circuit board design. *Advanced Circuit Simulation Using Multisim Workbench* is a companion book to *Circuit Analysis Using Multisim*, published by Morgan & Claypool in 2011. This new book covers advanced analyses and the creation of models and subcircuits. It also includes coverage of transmission lines, the special elements which are used to connect components in PCBs and integrated circuits. Finally, it includes a description of Ultiboard, the tool for PCB creation from a circuit description in Multisim. Both books completely cover most of the important features available for a successful circuit simulation with Multisim. Table of Contents: Models and Subcircuits / Transmission Lines / Other Types of Analyses / Simulating Microcontrollers / PCB Design With Ultiboard **Digital Systems From Logic Gates to Processors** Springer This textbook for a one-semester course in Digital Systems Design describes the basic methods used to develop

“traditional” Digital Systems, based on the use of logic gates and flip flops, as well as more advanced techniques that enable the design of very large circuits, based on Hardware Description Languages and Synthesis tools. It was originally designed to accompany a MOOC (Massive Open Online Course) created at the Autonomous University of Barcelona (UAB), currently available on the Coursera platform. Readers will learn what a digital system is and how it can be developed, preparing them for steps toward other technical disciplines, such as Computer Architecture, Robotics, Bionics, Avionics and others. In particular, students will learn to design digital systems of medium complexity, describe digital systems using high level hardware description languages, and understand the operation of computers at their most basic level. All concepts introduced are reinforced by plentiful illustrations, examples, exercises, and applications. For example, as an applied example of the design techniques presented, the authors demonstrate the synthesis of a simple processor, leaving the student in a position to enter the world of Computer Architecture and Embedded Systems. **Fundamentals of Electronics Book 1 Electronic Devices and Circuit Applications** Springer Nature This book, *Electronic Devices and Circuit Application*, is the first of four books of a larger work, *Fundamentals of Electronics*. It is comprised of four chapters describing the basic operation of each of the four fundamental building blocks of modern electronics: operational amplifiers, semiconductor diodes, bipolar junction transistors, and field effect transistors. Attention is focused on the reader obtaining a clear understanding of each of the devices when it is operated in equilibrium. Ideas fundamental to the study of electronic circuits are also developed in the book at a basic level to lessen the possibility of misunderstandings at a higher level. The difference between linear and non-linear operation is explored through the use of a variety of circuit examples including amplifiers constructed with operational amplifiers as the fundamental component and elementary digital logic gates constructed with various transistor types. *Fundamentals of Electronics* has been designed primarily for use in an upper division course in electronics for electrical engineering students. Typically such a course spans a full academic year consisting of two semesters or three quarters. As such, *Electronic Devices and Circuit Applications*, and the following two books, *Amplifiers: Analysis and Design* and *Active Filters and Amplifier Frequency Response*, form an appropriate body of material for such a course. Secondary applications include the use in a one-semester electronics course for engineers or as a reference for practicing engineers. **Fundamentals of Electronics Book 3 Active Filters and Amplifier Frequency Response** Springer Nature This book, *Active Filters and Amplifier Frequency Response*, is the third of four books of a larger work, *Fundamentals of Electronics*. It is comprised of three chapters that describe the frequency dependent response of electronic circuits. This book begins with an extensive tutorial on creating and using Bode Diagrams that leads to the modeling and design of active filters using operational amplifiers. The second chapter starts by focusing on bypass and coupling capacitors and, after introducing high-frequency modeling of bipolar and field-effect transistors, extensively develops the high- and low-frequency response of a variety of common electronic amplifiers. The final chapter expands the frequency-dependent discussion to feedback amplifiers, the possibility of instabilities, and remedies for good amplifier design. *Fundamentals of Electronics* has been designed primarily for use in an upper division course in electronics for electrical engineering students and for working professionals. Typically such a course spans a full academic year consisting of two semesters or three quarters. As such, *Active Filters and Amplifier Frequency Response*, and the first two books in the series, *Electronic Devices and Circuit Applications*, and *Amplifiers: Analysis and Design*, form an appropriate body of material for such a course. **Index Generation Functions** Morgan & Claypool Publishers Index generation functions are binary-input integer valued functions. They represent functions of content addressable memories (CAMs). 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